CALL tasks with enhanced input: can this type of computer instruction help elementary ESL students learn science, a content area?

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CALL tasks with enhanced input: Can this type of computer instruction help elementary ESL students learn science, a content area?

by

Amy Kathryn Middlebrooks

A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

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Program of Study Committee:
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Ames, Iowa
2006

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Graduate College
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This is to certify that the master’s thesis of

Amy Kathryn Middlebrooks

has met the thesis requirements of Iowa State University

Signatures have been redacted for privacy
For my parents
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ABSTRACT

This study investigates how two elementary ESL learners utilized Computer-Assisted Language Learning (CALL) tasks with enhanced input to help them learn science in school. The CALL tasks were designed for this study because these tasks needed to include enhanced input and needed to be specific to what the participants were studying in their science class. The tasks which incorporated enhanced input consisted of study pages and readings on the solar system, their science unit. In addition, the tasks provided quizzes to help the participants review the input that had been presented to them. To understand the participants' progress, the participants were given a vocabulary pre and post-test, and were observed while working on the tasks and while learning in their regular science classroom. Moreover, Snapz Pro (Ambrosia Inc, 1996-2006, [computer software]) was used to record the participants' online activities, and finally, the participants were interviewed to discover how they thought the online tutorial helped them learn.

The results of this study suggest that the online assistance did facilitate the performance of the participants as they had vocabulary gains from pre-test to post-test. Further analysis of these tests showed that the participants had conceptualized the meanings of some words, while other words were still a working concept and others were still unknown to the participants.

The participants, themselves, said that the computer helped them learn. They said that the audio helped them learn to read and indicated that the pictures helped them understand the vocabulary words. The participants also indicated that the computer helped them understand the concepts that they did not comprehend in their science class. Not only do a pre and post-test and participant evaluations insinuate learning and improvement, but
observations and recordings suggest that these two participants used the enhanced input to help them conceptualize the meaning of the vocabulary. They used the audio to help them gain access to the L2 readings and textual glosses, and they used the audio to help them with their reading skills. Furthermore, they used images to give them recognize the picture-lexical item correspondence, and they used the textual glosses to help them internalize the meanings of the words. Finally, the participants used the salience and repetition to their advantage. They not only listened to the passages and textual glosses repeated times, but they even used the back buttons on the quizzes to find the answers to questions.

The findings from this study suggest that CALL tasks with enhanced input would be a useful tool in the ESL classroom at the elementary level. The tasks could provide comprehensible input to the ESL student and provide an alternative means of instruction for the ESL and content area teacher. The findings also have implications for material developers, suggesting that this is a possible need in the ESL and content area classroom as it could help ESL students gain access to academic language and could help them develop cognitive academic language proficiency (Cummins, 1984).
CHAPTER 1. INTRODUCTION

In the 2000-2001 school year, more than 4.5 million English language learners (ELL) attended public schools in the United States. This number reflects an increase of 32 percent over the 1997-1998 school year. As the population increases, new demands from the legislative have been placed on teachers and English as Second Language (ESL) students. According to Title III of the No Child Left Behind (NCLB) Act, states and districts must meet the needs of limited English proficient (LEP) children. LEP students, as required by the US Department of Education in February 2003, need to obtain English proficiency, develop academic competence, and meet the same academic content standards that are required of all children. Consequently, states, districts, and schools, are subject to show that certain subpopulations such as ESL students meet AYP (Adequate Yearly Progress). If the subpopulation fails to meet AYP, the school is deemed as needing improvement (Miller, 2003).

Since some ESL students lack prior formal schooling, it is imperative that they learn the academic language that their peers have already encountered in earlier grades. To ensure that they receive this assistance, regular classroom teachers and ESL teachers must provide instruction that is “comprehensible.” This instruction should come in the form of picture definitions, graphic organizers, or through highlighting key words and phrases (North Carolina State Department of Public Instruction, 2000). It has been my experience, however, that many elementary school teachers do not know how to modify academic lessons for children of other languages in the content area subjects.

In Georgia, where I was an ESL teacher for three years, many of the mainstream teachers did not know how to modify lessons for their ESL students. They frequently asked
me, the ESL teacher, how to modify their science, social studies, and even spelling lessons; however, I did not always have the answer. For this reason, I came to graduate school and began studying ESL and Computer Assisted Language Learning (CALL). In my studies, I discovered how ESL students could study a second language from the computer, and I wanted to know if computer-based modifications would help mainstream classroom teachers adjust content area material for ESL students. Therefore, I decided to conduct a study that involved Computer Assisted Language Learning (CALL) and elementary children to see how they could be aided through the use of an online tutorial that employed computer-based modifications also known as enhanced input.

Enhanced input, according to Smith (1993), helps language learners become aware of certain features in the linguistic input. This input can affect the learner’s knowledge and performance and possibly convert that input into a potential language lesson (p. 176). Two types of enhanced input are used in this study. The first is termed salience whereby a grammatical form or lexical phrase stands out through repetition or marking on the computer screen. The second type is termed “Input Modification”, which according to Chapelle and Jameison (2002), is a choice given to the reader that allows him or her to request the meaning of a text that he or she is trying to comprehend. In fact, the input modifications of audio, image, and textual glosses allow the student to access different representations of the L2 item (Chapelle, 2003).

Research has shown that enhanced input, specifically salience and input modifications, has been effective with adults (Chun and Plass, 1996; Plass, Chun, Mayer, and Leutner, 1998; Hegelheimer, 1998). However, this area of study does not seem to be prevalent at the elementary level though this type of research in technology and language
education in the K-12 setting could have important implications for schools in the U.S. The implications from this type of study could suggest ways that elementary teachers could possibly modify texts and provide support to their ESL students in the content areas. It could help lift extra weight off of the elementary teacher with little time and ESL training. In fact, the 1999 National Center for Education Statistics reported that teachers typically did not feel “very well prepared” to address the needs of limited English and culturally diverse students. One school even reported that only 27 percent of teachers in their school felt “very well prepared” to teach Limited English proficient and culturally diverse students though they had over a 50 percent minority population (U.S. Department of Education, p. 48).

In addition to the challenges presented by teachers’ lack of confidence, likely due to insufficient training in TESL, part of the challenge for the teachers and students alike is the science and social studies textbooks. The linguistic constructions of these upper elementary textbooks are often confusing even for native-speaking students (Reppen, 1994). Moreover, the technical vocabulary of science and social studies texts places a demand on students (native and non-native speakers) to have a wide vocabulary or the ability to comprehend new vocabulary (Reppen, 1995). As a result, Reppen (1994) proposes that teachers need to help students understand the information and the linguistic forms that are in the texts. If these texts are complicated for native speakers, then they are going to be even more complicated for non-native speakers and teachers must know how to modify the texts for the ESL students to make the input more comprehensible. In fact, learners can understand language and language structures they are not familiar with if they are provided pictures and a context (Krashen, 1991).
Enhanced input, which has the potential to provide a context for the vocabulary and subject being studied, could prove to be beneficial at the elementary level. It could not only help them with the complicated linguistic structures, but it could help an ESL student develop the academic vocabulary that typically takes an immigrant six or seven years to master (Cummins, 1982). However, little has been reported on the effectiveness of technology in language education in grades K-12.

In an article called, “Recent Developments in Technology and Language Learning: A Literature Review and Meta-analysis”, Zhao (2003) pointed out that the setting in which research was conducted was restricted to higher education and adult learners. Thus, research conducted with children in this area of study has been limited. There is still little known on how salience along with input modifications could help or hinder an elementary student who is trying to master a subject area with difficult linguistic constructions. Therefore, more studies need to be conducted to know how ESL students would use enhanced input in a CALL activity and specifically, whether the CALL activity would help an elementary ESL student learn new vocabulary in science. If we knew, through research, that enhanced input in CALL was helpful to the population of ESL learners at the elementary level, this could benefit both teachers and students. It could assist, not replace, that untrained classroom teacher, and it could support these ESL students now hindered by a language barrier and challenging textbooks.

To know if enhanced input in a CALL application could assist the teacher in teaching ESL students, we need to know whether or not it would aid a child in learning not just English in general, but the register of English in science textbooks. Therefore, the purpose of this study is to find out whether the use of CALL activities with enhanced input could be
effective in helping upper elementary ESL students build vocabulary, comprehend, and understand concepts in the content area of science. To gain this understanding, it is important to discover how they use the enhanced input to help them learn and it is important to realize the value of learning from this type of CALL activity based on the participants’ testimony of their own experiences. Moreover, it will be helpful to see what vocabulary gains are made throughout participants’ science unit on space and the solar system.

The topic of science was chosen because the participants, discussed in the next section, participated in the mainstream science classroom. To make the language more comprehensible, the ESL teacher always previewed the science vocabulary to help build background knowledge, which according to Krashen (1991) can help a learner understand the partially acquired target language. Therefore, since the participants needed to preview the vocabulary in science, this subject proved to be ideal for this study as the vocabulary could easily be illustrated on the internet with pictures and other modifications.

The two ESL elementary students who participated in this study were in fourth grade but were around the age of 12. They were cousins from the southern part of Sudan, and they spoke Dinka as their native language. Because of their lack of formal schooling, neither participant had any reading skills in his native language nor did they possess the same level of background knowledge in science as their peers in the fourth grade. Five months before this study was conducted [August 2004], they entered the United States with the little English that their uncle had taught them and some reading skills in Swahili they had learned in Kenya, understanding some concepts of print (K., Cantonwine, personal communication, January 9, 2005). However, they could not read English, and they still needed to learn
academic English and improve their Basic Interpersonal Communication Skills (BICS) (Cummins, 1991).

Because both participants were still in the early stages of learning English, had little background knowledge in science among other subject areas, and needed extra help, they proved to be ideal participants for this study. Their participation allows us to understand how enhanced input could help or hinder learning outcomes of an ESL student in the content area of science. These participants will help us realize how the use of enhanced input in an online tutorial can improve the academic language of an ESL learner.

This topic is important because it not only allows teachers and researchers to know if a CALL tutorial that employs enhanced input is a worthwhile tool in the elementary classroom, but this research may also have important implications for material developers in suggesting that this is a possible need in elementary schools. Through my research, I hope to understand if potential language learning could be achieved through the use of an online tutorial with enhanced input and to know if it would be a possible classroom tool that teachers could use. Furthermore, I hope to give teachers an alternate way to provide assistance to their ESL students. To explore this topic in depth and gain understanding of elementary students’ use of enhanced input, the following research questions were addressed.

1) Based on pre and post test scores, did the participants’ overall vocabulary knowledge improve after they interacted with the enhanced input in CALL, suggesting potential language learning? If improvement took place, in which way?

2) What were the perceptions of the participants: What benefits did they see from using the online tutorial with enhanced input?

3) How did the participants use the enhanced input (textual glosses, images, audio, and salience) in the CALL application to help them conceptualize the concepts and the meaning of the vocabulary?
Organization of the Study

The remaining chapters include a second chapter reviewing the research literature on ESL instruction in U.S. Schools, learning theories in second language acquisition in CALL, enhanced input, and computer instruction for ESL learners in public education. The third chapter, methodology, includes the theoretical perspective of the study, the setting, the participant selection, the background of the participants, the task design, the actual experimental procedure, the role of the researcher, and the method of analysis. Chapter 4 explains in detail the results of my study. Chapter 5 offers ideas for further research and discusses the implications this research has for elementary school teachers and material developers alike.
CHAPTER 2. LITERATURE REVIEW

This chapter provides an overview of four major areas to ground this study in related literature on adults and CALL. By understanding the implications of how CALL activities with input modifications have helped adults, we can ask similar questions with regard to children to widen the focus that CALL research has embraced over the years. While this literature review cannot reveal all of the research applicable to this study, I will attempt to review the most pertinent information that may offer suggestions on how input modifications may be effective for children. Specifically, I look at 1) ESL instruction in the U.S. Schools, 2) learning theory and second language acquisition in CALL, 3) enhanced Input, and 4) computer instruction for ESL learners in public education. By providing background knowledge on elementary schools and previous research in CALL, I show the need for research in CALL at the K-12 level and thus reveal the gap of limited research with CALL, enhanced input, and elementary students.

ESL instruction in the U.S. Schools

There is a need to better understand ESL instruction in the U.S. Fitzgerald (1995) explains that there are three ways that children are currently being taught in the U.S. One is transitional-bilingual education programs where both languages are used in the classroom, and subjects are transitioned from their native language to English. The second is ESL pullout programs where subjects are taught English by a trained teacher for one hour a day. The third is a two-way bilingual education programs. This type of program aids fluency in the students' native and second language. Fitzgerald (1995) goes on to state that many of these programs do not require an active learning environment. The subjects are expected to absorb the information they hear and simply recall it at a later date. Then again, many ESL
students do not even receive the added help they need to make academic progress in an English-speaking environment (Fitzgerald, 1995).

Most teachers do not realize that it takes longer for an ESL student to learn academic English than non-academic English. Such teachers assume that because students can communicate on an interpersonal level that they can also perform at the academic level. This assumption usually slows the ESL student’s progress and sometimes students are thought to have learning problems when in fact their learning problems are the direct reflection of instruction they have received in school. The judgment imposed on these ESL learners forces them out of the ESL program and into either the mainstream classroom and/or the special education program. In any of these cases, teachers may look for ways to help the struggling ESL student (Cummins, 1991; 1984). However, these teachers, as mentioned in chapter one, do not feel “very well prepared” to address the needs of limited English and culturally diverse students as described by the National Center for Education Statistics (U.S. Department of Education, 1999). If our teachers and school systems do not know how to help an ESL child in the mainstream classroom, then teachers and curriculum directors need to look at educating themselves in second language acquisition. Gass & Selinker (2001) suggest that one has to know more about language learning in order to develop teaching skills or methodologies.

Cummins (1984) made a distinction in second language acquisition that is particularly useful to the elementary school teachers and curriculum directors. He identified the difference between Basic Interpersonal Communicative (BICS) and Cognitive Academic Language Proficiency (CALP). The former characterizes the language used in everyday conversation where communication is supplemented with gestures and other context clues.
The latter characterizes academic situations that do not provide a context for the language. In order to understand the academic tasks, one has to understand the language involved and cannot rely on outside contexts. Because, typically, there is not an outside context, it takes a longer time period, typically 5 to 7 years, for immigrants to perform as well as native students in academic tasks. On the other hand, it only takes about 2 years for students to acquire basic interpersonal skills (Cummins, 1991).

Cummins (1984) expands on this distinction to provide a theoretical framework that involves two continuums to explain language proficiency, which also has value for school teachers. As seen in Figure 1, context-embedded communication and context-reduced communication rest in the first continuum. With context-embedded communication ESL students can rely on cues and negotiate meaning, which is typical of our everyday world (pg. 138, 139). In contrast, context-reduced communication refers to tasks such as maneuvering texts, tasks that students are asked to do on a regular basis in the classroom. These texts are linguistically hard for native and non-native students (Reppen, 1994; 1995) and the understanding of these texts relies on prior lexical knowledge (Cummins, 1984).
Figure 1

Cognitively Undemanding

\[ \begin{array}{c}
A \\
\hline \\
\text{Context Embedded} \\
\hline \\
B \\
\hline \\
\text{Cognitively Demanding} \\
\hline \\
C \\
\hline \\
\text{Context Reduced} \\
\hline \\
D 
\end{array} \]

Range of Contextual Support and Degree of Cognitive Involvement in Communicative Activities (Cummins, 1984, pg. 139).

The upper half of the vertical continuum, also referred to as A and C, are the tasks that are not cognitively demanding; they usually require skills that have been "mastered" or "automatized" (Cummins, 1984, pg. 139). The lower end of the continuum, B and D respectively, are cognitively demanding and require verbal skills that have not been automatized. Examples of cognitively demanding skills are writing an essay or persuading an individual about a point of view (Cummins, 1984, pg. 139).

In the L1, children usually learn language that is at first context-embedded. They are provided with cues from the people around them. Parents even offer context in the form of
Motherese, usually by talking slower and pointing at relevant objects. They also praise correct use of language, causing the child to modify language used incorrectly. Children learn a second language in much the same way: They mostly listen at first and then they try out linguistic forms, which are eventually modified to sound like a native speaker. They are also able to function at a higher cognitive level when there is an embedded context (Cummins 1981, 1984).

Krashen’s input hypothesis describes a theory in second language acquisition that discusses understanding knowledge beyond our current understanding. He uses the expression i +1 to capture his idea. He states that if provided “comprehensible input” through genuine communication, second language learners will be able to understand the language beyond their understanding because a context will be provided through “extra-linguistic information” (Krashen, 1991, pg. 58). This contextual information is provided in the form of visuals or familiar topics (Krashen, 1991, pg. 58).

This type of contextual information is necessary for second language minority students to be successful. If schools often want students to understand context-reduced information, they need to provide context-embedded lessons that build prior knowledge and use visual cues. According to Cummins (1984), context-embedded lessons that make the input comprehensible will help L2 learners understand context-reduced information. If comprehensible input is not provided then language minority students will fall behind and will have educational difficulties. It is suggested that the dimensions as seen in Figure 1, context-embedded/context reduced and cognitively undemanding/cognitively demanding, are “directly relevant to the relationships between language proficiency and educational achievement” (Cummins, 1984, pg. 142).
Since academic language takes so long to learn and the L2 learners have a difficult time learning through the usual context-reduced instruction, it is easy to see why language minority children often have deficits in the content areas. However, the lack of proficiency in context-reduced and academic language is not the only barrier that slows a child's progress in school. Other variables such as motivation, socioeconomic status, and various economic backgrounds could also affect students' learning (Fitzgerald, 1995), and L2 students in general may require more review and repetition of the material than the L1 student (Celce-Murcia, 2001).

Sudanese refugees, with whom I conducted this study, often times, fall at the bottom of the social and economic status upon their entrance into the United States. Usually their families have undergone psychological stress due to cultural shock and familial loss. Though children and adolescents from this region may adapt quickly to their surroundings, they are now expected to attend formal school, to learn English as their second language, and learn literacy skills in the second language even though they may not possess reading skills in their first language (Singleton, 2001).

If these elementary ESL students, restricted by their native languages, cultures, and socioeconomic backgrounds, need repetition and context-embedded instruction in their educational diet, then how can teachers provide this need for language minority students? The best way to provide adequate support, of course, is through good teaching and context-embedded models so that the student can function when it comes to context-reduced information. But perhaps also, a teacher could use CALL tasks to supplement this context-embedded model of instruction. Conversely, if teachers are untrained, CALL tasks with enhanced input would be a way to support the ESL student and provide adequate learning
tools to make the context-reduced lessons and texts more context-embedded. To explore this topic in full it will be necessary to first provide background knowledge on how learning takes place with a CALL activity and then explore CALL activities that make the input comprehensible through modifications that make the context-reduced material more context-embedded.

Learning theory in second language acquisition and CALL

Ellis (1999) describes three theories that explain how interaction “contributes” to second language learning (pg. 1), and Chapelle (2003) explains how these theories shed light on CALL activities and computer-learner interaction. These theories include the interaction hypothesis (IH), socio-cultural theory, and the in depth-processing theory.

Interaction, itself, can occur on an interpersonal and intrapersonal level. Interaction can be seen as face-to-face communication, but “it can also refer to the intrapersonal activity involved in mental processing” (Ellis 1999, pg. 3). In effect, intrapersonal and interpersonal activities are closely connected in our acquisition of language: one can influence the other. Intrapersonal interaction is needed for interpersonal interaction and interpersonal interaction is needed to facilitate intrapersonal processes (Ellis 1999).

The interaction hypothesis (IH) seeks to explain how one can learn through interacting and thus learn from “breakdowns in communication” (Ellis 1999, pg. 3). The interaction hypothesis suggests the importance of a process known as negotiation of meaning – when a speaker attempts to clarify a misunderstanding. Sometimes speakers change the “structure of a conversation to accommodate potential or actual problems of understanding” (Ellis 1999, pg. 4). This is known as interactional modification (Ellis 1999, pg. 4).
Similar to the interaction hypothesis, is the socio-cultural theory. This theory attempts to explain how one person helps another through social interaction to “make meaning” (Chapelle 2003, pg. 55). However, it can also include the “internal dialogue” of the intrapersonal, which accommodates learning (Chapelle 2003, pg. 55). This theory highlights Vygotsky’s zone of proximal development (ZPD), which theorizes that there are activities that one can achieve by themselves, activities in which one needs assistance, and activities that one cannot accomplish on their own. ZPD involves the activities in which one needs assistance. This assistance, through social interaction, allows learners to “transform skills” situated in the ZPD (Ellis 1999, pg. 20). Thus this interaction employs scaffolding—“how an ‘expert’ assists a ‘novice’ to perform a difficult task” (Ellis 1999, pg. 19).

Interaction also facilitates in-depth processing or “the kind of mental activity required for new material to be stored in long-term memory” (Ellis 1999, pg. 26). Chapelle (2003, pg. 55) also describes it as the level at which one processes information when learning. In effect, retention occurs when connections are made between prior knowledge and current input (Ellis 1999, pg 27).

Chapelle (2003) states that interaction can be face-to-face communication, but it can also be applied to a CALL task or drill in which the learner interacts with the computer. Chapelle (2003) explains how the three theories, Interaction Hypothesis, socio-cultural theory, and in depth processing can be applied to computer-learner interaction. She states that these three theories state the value of interaction if it can 1) facilitate negotiation of meaning, 2) co-construct meaning, and 3) promote attention to learning. However, in a CALL task interaction can be “a means for getting better input, for receiving assistance needed to advance knowledge and understanding, and for activating deep processing input”
(Chapelle 2003, pg. 56). Often in computer programs, learners can request the meaning of the text through hyperlinks. This interaction provides learners with modified input and opportunities for modified interaction (Chapelle 2003). However, in a CALL task, learning depends on the “quality” of the modified input and the extent to which learners “engage in the interactions” provided (Chapelle 2003, pg. 59).

**Enhanced Input**

“Modification” in CALL, according to Chapelle and Jamesion (2002), is a choice given to the reader that allows him or her to temporarily request the meaning of a text that he or she is trying to comprehend. Input modification allows subjects to access a different version of the L2 (second language) input (Chapelle 2003) and is one form of enhanced input or input that helps L2 learners become aware of certain linguistic features in the linguistic input (Smith, 1993, pg. 176). Another type of enhanced input is salience, whereby a grammatical form or lexical phrase stands out through repetition or marking on the computer screen. Three types of input modifications in CALL along with salience or repetition have been shown to be beneficial with adults and may also prove to be beneficial with children in this study. The 3 types of input modifications images, audio, and textual glosses can coincide with salience or repetition.

*Images.* It has been suggested that words are more easily recalled when they are presented alongside an image. This is especially true when someone is learning a second language (Chun and Plass, 1996). In fact Chun and Plass (1996) conducted a study with 160 German university subjects who read German texts with vocabulary that was annotated with text, pictures, and videos in English. As a result, they found that higher scores were received for words associated with text + picture than the words associated with video + text or text
only. Plass, Chun, Mayer, and Leutner, (1998) conducted another study with German students. This study allowed students to click on vocabulary words and choose the type of annotation they wanted to access. The choices given to learners were visual plus verbal information, visual information, or verbal information. These researchers conclusively found that subjects had the best scores on a posttest when they chose to click on hypermedia text that was glossed with visual and verbal information as opposed to those that just chose glosses with visual or verbal information. If it has been shown that more than one gloss is effective when students are learning new vocabulary in a foreign language, then one can see how repetition comes into play in a CALL activity.

Repetition. Chapelle (2003, p. 42-45) describes 3 possible ways that repetition can be applied to a CALL activity: 1) the input can be annotated with a form of the target language multiple times; 2) one can give the students the opportunity to hear or see the input as many times as they wish, 3) one can ask a learner to look back at the input by providing a task (such as comprehension questions) at the end of the assignment. Chapelle (2003) gives an example in which the learner is provided with a text. The learner is then asked to read the text, listen to the text, and then answer questions about the text.

Textual and audio glosses. The effects of textual glosses and sentence-level audio glosses on on-line reading comprehension and vocabulary recall has been studied by Hegelheimer (1998). He conducted this study with 115 subjects who received three treatments: 1) one treatment in which the text did not have textual glosses 2) a second treatment in which the student had textual glosses 3) the third treatment had sentence level audio glosses and textual glosses. After each treatment the subjects answered 9 comprehension questions. Hegelheimer (1998) found that textual glosses helped a student
acquire the target language when subjects accessed the gloss on 2 or more occasions. No specific results were reported regarding the effects of the audio glosses.

Moreover, other studies have been run to see what kind of textual gloss is most helpful to the learner. Watanabe (1997, pg. 287) studied the effects of text modifications on acquiring foreign language vocabulary when reading. His study tested to see which kind of text modifications aided students the most. The text was annotated with appositives, multiple choice marginal glosses, and straightforward glosses. He found that straightforward glosses were most helpful to students. Though his study was done on paper and not the computer, it still has important implications for CALL. It suggests that texts annotated with vocabulary glosses are more likely to help students learn foreign words than text without these modifications.

While CALL has been researched with adults, there seems to be a lack of research with children, CALL, and enhanced input in CALL. However, the next section will reveal some idea of what has been done and what gaps still exist in the research.

**Computer instruction for ESL learners in public education**

There has been some attempt to study the effects of computer-assisted instruction with children. Saracho’s (1982) study investigated the effects of computer-aided instruction (CAI) on basic skills achievement with children learning a second language. In her study, there were two groups of 3rd-6th graders. One group participated in CAI, and the other was a control group. The CAI that Saracho (1982) describes consisted of drill and practice, a tutorial, and a dialogue. The drill and practice provided students with feedback and was meant to serve as a supplement to the lessons taught in class. In addition, the dialogue offered extensive interaction between the computer and the student. As a result of using and
studying the effects of a program that offered extensive practice and interaction for basic
skills achievement, Saracho (1982) found that children who used CAI did better than their
counterparts who did not.

Since the 1980's, there has been a call for effective software and online learning
resources in the schools. In 1997, one of the four goals for education, as stated by the White
House, was to have technology learning resources in every school’s curriculum by the year
2000 (Kongrith & Maddux, 2005, pg. 99). Now online learning is available and expanding
into classrooms, including ESL classrooms. Kongrith & Maddux (2005) suggest that online
learning is more versatile in its ability to allow the learner to interact and be creative,
whereas the computer aided instruction such as the one described in the previous paragraph
only promotes traditional learning, teaching, and rote tasks. Kongrith and Maddux (2003, pg.
97) state that “online learning can be an effective tool in second language acquisition (SLA)
because it can be an efficient and convenient way to provide accurate, understandable
material to second-language learners.”

While it has been a goal in the United States to provide these effective and efficient
tools, there seems to be a lack of research with K-12 students, particularly in the areas of
SLA and CALL. When searching for research articles for this study, none of the articles that
were found attempted to explore the interactions of elementary students on the computer
when input modifications are involved. Also, none of the articles found unearthed how these
interactions might help an elementary ESL student learn.

As a result, this study attempts to find answers where research is lacking. How would
enhanced input help elementary students conceptualize the vocabulary words and concepts in
science? How would the computer program help them gain knowledge about the subject
being studied? Would it be a feasible alternative to provide assistance to that unprepared teacher and to that ESL student that is still learning Cognitive Academic Language?

To uncover this information, this study will look at the interactions of two elementary students as they explore their science unit online. The number of each type of interaction with the modified input will be counted and analyzed to see how these two students use the computer to assist them with the learning process. The next chapter will describe the process of data collection and material development, the selection and description of participants, the role of the researcher, and the specific methods of analysis for this study.
CHAPTER 3. METHODOLOGY

Background

This chapter will uncover the methods used in this research project, whereby two fourth graders learning English were studied through qualitative research to understand how they would engage in a webpage that employed enhanced input to learn cognitive academic language in science. To help explain this study, I will describe my theoretical perspective followed by the role of the ESL teacher, a description of the participants as well as the setting, the CALL activities, the task design, and the procedures. Finally, I will describe my own role as the researcher to help the reader develop an understanding of what transpired during the data collection, and I will include the methods of analysis.

Theoretical perspective

This is a qualitative case study, whereby I, the researcher, am the primary instrument of data collection and analysis. In this case study, I selected as the case, or unit of analysis, two elementary students in an elementary ESL program because of their low level of English and because little has been done to study elementary students and their interactions with enhanced input in a CALL application (Merriam, 2002, p. 178-179). These learners presented an opportunity for study because their teacher wanted them to get help with their academic English.

This case study takes an interpretive approach, which provides a context for the methodology (Crotty, 2003, p. 3). The focus of an interpretative approach is interpretation and interaction. Thus, the question is how would the students interact with the enhanced input to “make meaning” of the material presented to them (Merriam, 2002, p. 6)? Through the process of triangulation, I hope to answer such questions in this study.
The ESL teacher

While the ESL teacher was not a participant in this study, she played an important role. She first helped me gain access to the ESL students and the science teacher at her elementary school. Then the science teacher and ESL teacher decided the best time and the unit in which I would conduct my research. Once it was decided that I would conduct my research during their solar system unit, the ESL teacher sat down with me and helped me decide what I should include in my online unit. Also, through a series of discussions, the ESL teacher told me about the background of her students from Sudan, my participants in this study. In addition, we would often have conversations after school where she would offer her insight. She would often comment on the 2 boys’ progress, and how she thought my online tutorial was probably helping them. In general, the ESL teacher was excited about the research I was doing, and she liked the online activities that were created. She was willing to do anything to help.

Participant Selection

The participants in this study were found through word of mouth. The ESL teacher at Central Elementary was interested in finding a graduate student with a concentration in Computer Assisted Language Learning to help two boys use the computer as a language learning tool since their English proficiency was limited and they had limited formal schooling. Therefore, I helped the students with the computer and in turn, I was allowed conduct my study in this ESL classroom. The study was conducted with the cooperation of the Ames Community Schools, the participants’ ESL teacher, the participants’ science teacher, the cooperation of participants’ legal guardians, and with the assent of the
participants’ themselves.

**Participants’ Background**

As mentioned in chapter 1, Alex and Michael, pseudonyms for the two participants in this study, were from the southern part of Sudan and spoke Dinka, but did not read or write in their native language. They were cousins about 12 years of age, but were placed in the 4th grade due to their lack of formal schooling. Not only had these children had little formal schooling, but they had experienced war and before the age of 5, and they had lost their parents in an invasion. Because of the violence that arose in their country, they left Sudan and fled to Kenya. In Kenya, they gained some concepts of print as they studied Swahili and for the first time they had formal schooling. After being in school for only two years in Kenya, they came to Ames, Iowa in August 2004 and began school here two days after their arrival. They could speak some English when they entered the Ames public school system, but they could not read English and the basic knowledge one would expect of a 4th grader was lacking. Michael improved the most in the first 5 months of the 2004-2005 school year according to the ESL teacher, but of course lacked several years of formal schooling compared to his classmates. Alex on the other hand, is deaf in one of his ears. Some of the bones in his ear deteriorated and though they tried to do surgery, his hearing did not recover in that ear. He, therefore, has a few more difficulties than Michael. In fact, while both boys scored Non-English Proficient on the ITELL (Iowa Test of English Language Learners), Micheal’s scores were almost double that of Alex (K, Cantonwine, personal communication, February 21, 2006).
SETTING: ESL program in Ames Community Schools

This study was conducted in the Ames Community Schools, specifically Central Elementary, in Ames, Iowa. To accomplish academic goals in the educational setting provided, the Ames school system believes in an individualistic, holistic approach to teaching. The goal of the ESL program, specifically, is to increase proficiency so that students can operate independently in the school’s educational program. Therefore, students need to use English to communicate in social settings, to achieve academically in all content areas, and to function at a pragmatic level both socially and culturally (Jackson, C., Cantonwine, K., Hoepner, G., Evans, W., Santiago, S., & Kern, A.M., May 2006).

Students are usually recognized as needing services when their English abilities are identified through assessment as Non-English Speaking (NES), Limited English Speaking (LES), Non-English Reader/Writer or Limited English Reader/Writer. Ultimately after testing, students are categorized as Non-English Proficient (NEP), Limited English Proficient (LEP), or Fluent English Proficient (FEP).

If a student is identified as LEP or NEP in the Ames Community Schools, they meet with an ESL teacher in the setting of a pullout program usually for half an hour a day. In correspondence with the ESL teacher, the classroom teacher, by law, has to provide modifications to the curriculum and assignments for the ESL child. Students in ESL can remain in the program until the student is able to achieve and function successfully in the educational setting provided by the Ames community schools. This can take from 1 to 10 years depending on the prior education of the student, and the success of the ESL student is determined by a standardized test given at the end of the year. At the time when the study
was conducted in 2005, the ITELL (Iowa Test of English Language Learners) was the standardized test that was used (Jackson, C., et al., May 2006).

Science, ESL, and Central Elementary

At Central Elementary, students, grades K-6, learn in a supportive environment where family, child, and staff work together to achieve learning goals and potential (http://www.ames.k12.ia.us/webstar4/schools/sawyer/handbook.htm). In particular, ESL students in the fourth grade science classroom receive assistance from peers, volunteers, the ESL teacher, and the classroom teacher. Their assignments are modified to accommodate the individual needs of the ESL learner as they participate in a science class of about 25. Often in the science class, students are asked to work in groups and ESL students receive help from their peers or are invited to participate with the assistance of the ESL teacher or a volunteer. For instance, ESL students and English speaking students in the fourth grade science class are asked to look up information and write down information about the topic being studied, sometimes being asked to write a short story or make a PowerPoint. In this case, the ESL student’s project may be modified from a PowerPoint to a short book or from a short book to drawing pictures about the topic being studied. In these cases, the ESL students may receive help from the ESL teacher as she comes to their classroom during science or when they go to the ESL teacher later in the day. In fact, some ESL students at Central Elementary spend anywhere from 30 minutes up to 2 hours in an ESL class, depending on their needs and level of proficiency. Sometimes students need extra help with reading as well as the content areas.

In the ESL pullout classroom at Central Elementary, students often work on the computer or with the teacher to improve basic skills such as reading and math. As previously mentioned, they may also work on content areas such as social studies or science. When
working on the computer, students usually work with programs that tutor them in reading or work with websites that would help them with math. With the teacher, ESL students often work on basic reading skills as they read books for their appropriate reading level and learn sight words from the Dolch sight word list: a list of 220 most frequently found words in children's books used to teach beginning readers (http://www.english-zone.com). They may also take modified science or social studies tests with the help of their ESL teacher who often helps the ESL students develop the appropriate vocabulary for the subject area and encourages them to study for their science or social studies test.

**Description of the CALL Activity**

To modify the science lessons for the participants in this study, I created online activities, titled “The Planetarium: Welcome to Space!” The goal of the activities was to teach the two participants essential vocabulary about the solar system so they could have an understanding of the material presented in their science class. The participants were asked to complete the activities in the school library for 30 minutes four days a week during their ESL class for approximately a month. The online activities consisted of images, words, and audio files. Since the participants could not read very well, they had the option of clicking on the audio files to listen to the passage or definition presented in an activity. All of the written communication and audio files were in English, the target language, and the participants were asked to listen and read each vocabulary item twice. However, while the participants were given instructions, the choice to click for an explanation of the vocabulary item or to have the audio file read to them was ultimately theirs. They had control over what they wanted to learn from the activities, but they did not have any influence in how the activities were structured. However, they were told which activity to work on during the 30 minutes
they were asked to use the computer to learn about the solar system. Most of the time the participants were asked by me, the researcher, to do an online page until they had some understanding of the concepts on that particular activity. Usually this meant that the participant completed each activity at least twice. Since these students did not have access to a computer at home, it was expected that they would have an interest in learning from the computer at school. Furthermore, these students seemed to like learning from the computer when I observed them during the first 5 months of the school year.

**Software and Hardware configuration**

Software and Hardware were needed to create the online activities, to use the online activities, and to record the actions of the participants as they completed the activities. To create the online activities, I used Macromedia Dreamweaver and Macromedia Fireworks to make the activity pages (Macromedia Studio MX 2004 [computer software]). In particular, Dreamweaver was used to create the web pages, and Fireworks was needed to modify the images to make the input more comprehensible. Additionally, HotPotatoes was used to create the quizzes in the online tutorial, to create interactivity between the learner and the assessment materials provided to them.

In order for the online activities to work, two computers in a quiet location were essential. Because the Explorer and Netscape browsers on the Macintosh computer would not support the JavaScript in the online activities, it was necessary to use the Safari browser. In addition, the Macromedia flash player and QuickTime were required to access the flash buttons and the audio files. Finally, a trial version of Snapz Pro (Ambrosia Software, inc, 1995-2006, [computer software]) was necessary to record the participants’ actions as they explored the online activity, which was downloaded from the internet.
Task Design

The motivation to create a task for this research project was fueled by two factors: 1) the online material presented needed to be specific to the participants' unit on planets. 2) the online material needed to include input modifications. Such a task, to my knowledge, did not already exist, so the online tasks for this research project were created with prior CALL research and literacy methods in mind.

CALL and Literacy research

The participants in this study participated in their science class and required language modifications so that the information presented in class would be comprehensible (Krashen, 1991). In the fourth grade, the science curriculum includes a unit on planets. Both the science teacher and the ESL teacher of the two participants thought this would be a good unit to modify with the computer because the unit would be presented later in the year when the participants would have obtained more literacy skills to complete the online activities. Therefore, the participants' unit on the solar system was modified on the computer to make the content presented in class more comprehensible or understandable to the learner. To modify the concepts and texts dealing with the solar system, different versions of the L2 input were presented on the computer. These different versions included images, textual and/or audio glosses. The use of images in creating these tasks was twofold: 1) they served as an input modification and 2) images, in literacy, are a concrete model of a real experience meant to build background knowledge of the content to be read (Peregoy and Boyle, 2001). In fact, when teaching an ESL learner, building background knowledge is important to help an ESL student comprehend a topic before they read about it; otherwise, misunderstandings and confusion could occur upon reading about an unfamiliar topic in the target language. In
fact, learners can understand language and language structures they are not familiar with by using context and our knowledge of the world, which is usually provided in the form of pictures or familiar topics (Krashen, 1991). In this unit, input modifications were made on the computer to allow participants to access different versions of the L2 (Chapelle, 2003). The next section describes the online tasks that incorporated input modifications and were presented to the participants in this study.

The Tasks

The tasks created were centered around the 4th grade science unit on the solar system. Before I developed the online tasks, I met with the participants’ ESL teacher, who then helped me choose unfamiliar vocabulary from the unit that the participants needed to know for their science class. With the ESL teacher’s help, the ideas and planning for the tasks came together. This planning resulted in online tasks were divided into two modules, “Explore” and “Learn”, which existed as two different buttons on the opening page titled, “Welcome to Space”. In addition to the first two buttons, a “Quizzes” button also existed so that the participants could take a quiz independently of the first two modules as seen in Figure 1.
The first module, "Explore" consisted of at least two activities that were meant to build background knowledge. Because the two participants, according to their ESL teacher, did not have any concept of outer space nor did they know the difference between a neighborhood and a city, I created the first activity so that it would focus on building an understanding of those concepts and terms. The activity was made with the layer function in Macromedia’s Dreamweaver. As shown in Figure 2, I developed it so that the smallest concept, a neighborhood, would be the first picture to be displayed and each picture after that one sat slightly off-centered to the one before it so that it appeared that each picture was growing out of the one before it.
The students, therefore, were to learn that a neighborhood was smaller than a city and that Earth was smaller than space and was inside the solar system to give them a relational understanding of themselves to earth, the solar system, and space. The activity employed the input modifications of audio, images and text to help the participant gain understanding prior to reading the passage on solar systems. Each participant was given instructions to click in order on each word for its picture and then click on the sound and listen to the audio twice. After working on the page, the participants had a choice of taking a quiz, playing a puzzle game, or going to the next exercise titled, “The Solar System”. The participants were also given a graphic organizer to work on after they had done the first activity several times, which went along with the webpage to help solidify and evaluate their understanding.

The second page of the explore tasks, “The Solar System”, was also a page that was meant to build background knowledge. The page consisted of nine circles created in
Macromedia Fireworks. To the left of the nine circles were a list of the planets, the word, "sun", and the phrase "Solar System." As shown in Figure 3, the page was created using the layer function in Dreamweaver so when the participants clicked on the word, sun, for instance, the image of a sun would appear in the center of the nine circles and when they clicked on Mercury, it would appear next to the sun.

Figure 3 — "The Solar System" web page

In addition to seeing an image when a word was clicked on, participants automatically heard the audio that explained the sun, the planets, or the phrase, "Solar System."

When interacting with this webpage, students were encouraged to click on the hyperlinks in order starting with the hyperlink, sun, and ending with the hyperlink, Solar System. They were also encouraged to click on the hyperlink twice so that the audio could be heard on more than one occasion and because the audio sometimes skipped the first time
the hyperlink was clicked on. After completing the page, students had a choice of returning
to the previous page or going to the next page. In order to go to the next page, students had
to click on the words, “next page” in order for the next page button to appear. This hyperlink
was created to encourage students to finish this page before going to the third activity.

The third activity in the “Explore” tasks is titled “Out in Space.” This activity
engaged the participants in a reading on space which employed text, audio, image and
involved repetition, otherwise known as enhanced input. Again, this internet page was
designed with Dreamweaver using the functions of framesets and layers. As seen in Figure
4, the reading appeared in the right frame and an image with the textual and audio gloss
appeared in the left frame when the participant clicked on a vocabulary word highlighted in
the reading.

![Figure 4 – “Out in Space” web page](image_url)

At the top of the main page or right frame an audio gloss was placed so that the participants
could choose to have the story read to them. The audio glosses were necessary because the
participants' were pre-literate and were learning to read. Consequently, the audio glosses gave them access to the target language.

"Learn"

The second module, "Learn", had one activity that served as a vocabulary study page, meant to build background knowledge and another reading activity that employed the vocabulary on the study page. In Figure 5, the vocabulary study page titled, "Space Words", consisted of seven vocabulary words that the participant could study before going to the reading activity.

Figure 5 — "Space Words" web page

The page was made with Macromedia Dreamweaver using frames and layers. Therefore, the participants could click on a word in the left frame and an image with a textual gloss would appear in the right frame as seen above. Furthermore, the participants could choose to listen to the audio for each word and listen to the textual gloss. They could also listen to the
directions for this particular activity which told them to click on each word, look at the picture for that word, and listen to the definition for that word. The directions also suggested that they could click on a word more than one time or even read the definition by themselves if they could. They then could move on to the reading activity when they were ready.

The reading activity titled, “How do Plants Move,” was similar to the “Out in Space” page in the “Explore” module. This activity also used enhanced input to help the participants gain understanding of the vocabulary words in context of a paragraph. The reading appeared in the right frame and when the participant clicked on a highlighted word, an image and a highlighted word would appear in the left frame as seen in Figure 6.

![Figure 6 — “How Do Planets Move” web page](image_url)

Like the “Out in Space” page, the activity was designed with Dreamweaver and an audio gloss was placed at the top of the main reading and with each vocabulary explanation and picture. Participants could then choose to have the audio read to them if the passage or
In addition to the "Explore" and "Learn" module, there was a "Quiz" module. The "Quiz" module consisted of three quizzes. The first quiz was a matching quiz and the second and third quizzes were multiple choice. The quizzes were to provide repetition, a form of salience, by having the reader read and listen to it in the passage and then in the question (Chapelle, 2003). In fact, if the participants did not know the answer to a question, they had the option of clicking the back button to look up the answer. Because the participants also had the option of taking the quiz at the end of the concurring activity, a button existed so that once students found the answer they could go back to the quiz.

**Quiz 1**

Quiz 1, as previously stated, was a matching quiz. It was created with HotPotatoes, and the quiz was interactive as it allowed the participant to click and drag the picture on the right to the correct word on the left. Once they had completed the quiz, they could check their answer by clicking on the check button. It would then give them a score in the form of a percentage (see Figure 7).
Five images and five words existed in the quiz; however, only three of the images and words could be seen on the page. Every time the participant accessed the quiz, a different combination of images and words appeared. For instance, the first time the participant took the quiz, a picture of the Earth, a neighborhood, and a continent with their corresponding words may appear. However, if the participant took the quiz a second time or clicked the refresh button, a picture of the Earth, the solar system, and the city with their corresponding words might appear. The quiz did have a back button so that the participant could look up an answer. When the participant went back to the quiz, the same image might or might not be there. Because the quiz was different each time, the participants were prone to take the quiz more than once, providing them with more repetition.

**Quiz 2**

The second quiz was a multiple choice quiz as shown in Figure 8. Also created with Hotpotatoes, the participants could also interact with the quiz. This quiz allowed the students
to choose whether they wanted to see every question at once or only one question at a time as seen in Figure 9.

**Figure 8 — Quiz 2**

![Figure 8 — Quiz 2](image)

**Figure 9 — Quiz 2 with back button**

![Figure 9 — Quiz 2 with back button](image)

However, the participants could only answer one question at a time before it gave the participants a score. This was not the intention of the researcher, the designer of the web
The intention was for the participants to be able to answer all of the questions before
the computer gave them a score. To counteract this computer problem, I, the researcher,
asked the participants to only point to the correct answer with the mouse, and then I told
them if they got the correct answer. If the students did not know the correct answer, they had
the option of going back to the previous page to find the correct answer by clicking on the
back button as shown in Figure 9. Then the participants could come back to the quiz to
answer the questions again. Once they were finished with this quiz, they could click on the
next button, go to the main page, and click to complete the next module, titled “Learn.”

**Quiz 3**

After completing both the “Explore” and “Learn” modules, the participants could take
Quiz 3. They could access it from the main page titled, “The Planetarium: Welcome to
Space” under the Quiz button or they could take the quiz after completing the “Space Words”
page or the “How Do Planets Move” activity under the “Learn” module.

Since there were computer problems with quiz 2, quiz 3 was made with frames and
layers instead of Hotpotatoes. The page, in fact, was divided into two frames. In the bottom
frame, all 5 questions were listed with their multiple choice answers. When the participants
clicked on an answer, they could look at the top frame to see if their answer was correct. If
they got the answer correct, the word “Yes!” appeared at the top, if they got the answer
wrong, they word “No” appeared at the top.

In addition to receiving feedback about their answers, participants could also click on
a back button to go to the “Space Words” page, the study page, to look up the answers and
then return to quiz 3 to answer the question. Unlike quiz 1 and quiz 2, there was a back
button next to every question to encourage the students to look up the answer (as seen in
Figure 10) instead of just guessing. They were also encouraged in the directions to use the back buttons provided. Once the participants took the quiz, they could click the button at the bottom to return to the “The Planetarium: Welcome to Space” page.

![Figure 10](http://www.public.iastate.edu/~kathryn/thesis/jour_stars_quest_ans.htm)

**Data Collection and Procedure**

To obtain the privilege to conduct my study at Central Elementary School using the previously described CALL activities, I began to volunteer with the ESL teacher, upon her request to have somebody work with her two students, Michael and Alex, from the Sudan, on the computer. I began helping Michael and Alex on the computer every Friday afternoon from September 2004 to the beginning of January 2005. This helped me develop trust and rapport with the ESL teacher and the two ESL students, which according to Esterberg (2002) is the “main task [in developing relationships]” when gaining access to an unfamiliar setting (pg. 69). In exchange for my volunteering, the ESL teacher agreed to let me conduct this study with these two students.
The procedures used to conduct this study with Michael and Alex involved collecting five types of data. I collected all the data.

1. A visual literacy questionnaire (not included in results)
2. A vocabulary pre and post test on science related words
3. Daily observations
4. Online recorded observations
5. Semi-structured interviews

The pre and post-test were needed to understand how the participants’ vocabulary improved after interacting with the enhanced input. In the second question, semi-structured interviews were needed to understand the perceptions of the participants. The third question relied heavily on the three types of observations, in class observations, observations of participants working on the computer, and on the Snapz Pro online recordings. In addition to the observations, this question was also answered using the semi-structured interviews.

The third question, in particular, used triangulation. Triangulation uses different types of evidence to look at one problem and allows a balance for the strengths and weaknesses of each kind of data collected (Esterberg, pg. 176. 2002). The process of triangulation helps the researcher know whether the findings are consistent or inconsistent and in turn it creates a more informed study (Merriam, 2002). By analyzing and examining the perceptions along with the participants’ improvement and use of enhanced input to conceptualize the vocabulary, this study takes an in-depth look at the phenomenon, how enhanced input helps an elementary student learn.

To look at this phenomenon in a comprehensive manner, I collected the data over a period of one month and a half. The first week, I administered the visual literacy
questionnaire and the vocabulary and comprehension pre-test. The second, third, fourth, and fifth weeks, the participants completed the online tasks, and the sixth week, they completed the post-test and participated in the semi-structured interviews. The long data collection period also helped to ensure the internal validity of this study as Merriam (2002) recommends that the researcher should be involved in the data collection process long enough to have a thorough understanding of the phenomenon (pg. 26).

**Visual Literacy questionnaire**

Though the visual literacy questionnaire is not discussed as part of the results, the questionnaire was important to the researcher since the online tasks relied heavily on photos. Therefore, the two participants were asked about a set of pictures to see if they were able to comprehend their meanings. The researcher wanted to confirm that these participants were visually literate in terms of American images since they came from a different culture where graphic images with American ties and meanings were not as prevalent. The questionnaire consisted of 19 pictures and asked the participants about the images and the meanings that existed within them (See Appendix A). The participants were asked questions like, “What do you see in the picture above?” and “What are the objects doing in the picture?” The participants were able to answer most of the questions correctly: Alex was able to answer 100% of the questions correctly, and Michael was able to answer 90% of the questions correctly. Some of the answers Michael got wrong, however, were due to a lack of English vocabulary. Therefore, the participants understanding of the visual images in the questionnaire led me, the researcher, to believe that the participants could understand and learn from the images in the online activities.
Pre and Post tests

In addition to the visual literacy questionnaire, the students were given a vocabulary pre and post test (See Appendix B & C). The vocabulary pre-test was given on January 24, 2005 and the post-test was given on March 8, 2005. The vocabulary pre and post tests consisted of 22 vocabulary words chosen from the science textbook, *The sun and Its family*, (Daniel, L.H., Hackett, J., Moyer, R.H., Baptise, p.H., Stryker, P. & Vasquez, M.Ed., 2000) with the help of the participants’ ESL teacher. Eighteen of those words were incorporated into the CALL activities, but 4 were not. When taking the vocabulary pre-test, participants were read the vocabulary word and asked what it meant. The participants were not given a multiple choice test because the researcher did not want them to guess and get the right answer. However, if they seemed to know what the word meant but were not able to verbalize its meaning, they were shown a series of pictures and asked to pick the correct one.

The post-test was a replica of the pre-test. Students were not told the correct answers after taking the pre-test, and therefore, the pre-test became the post-test. However, on the post-test the participants were not shown a series of pictures if they were not able to say its meaning since by this time they should have been able to verbalize what they had learned. Once the students finished the post-test, it was scored by only counting the 18 words that were incorporated into the CALL activities. However, the answers to the other four vocabulary words were analyzed to understand what students learned in the classroom without the computer.

Observations

I not only gave the participants questionnaires and tests, but I observed them daily in their science classroom. Moreover, I worked with Michael and Alex in the afternoon during
their ESL class for 30 minutes each, excluding Wednesday afternoons. Observations in both
the science class and on their computer work gave me a broader viewpoint of how the two
participants were constructing knowledge within their social reality (Esterberg, 2002).

The overall purpose of observing these participants was to see if and how they would
use the enhanced input to make meaning while interacting with the computer. To better
quantify what the participants clicked on and to note the usefulness of the enhanced input, I
took manual notes in addition to recording the participants’ online interactions with Snapz-
Pro, a thirty day trial freeware used for a Macintosh and similar to that of Camtasia, a
software program used to record interactions on a PC.

As I observed these two participants, I asked them to complete five CALL activities
and three online quizzes on the subject of the solar system. I designed three of the five tasks
to help the students build background or prior knowledge on the solar system, and the other
two tasks I created were readings about the solar system. I divided these tasks into two
components. The first one titled “explore” and the other titled “learn.”

The “explore” component consisted of two activities designed to build background
knowledge and the third activity was a reading task. This component had two online quizzes
that the students were to complete during and after the completing the assigned online
activities. Because it took several weeks for me to create the second component, the
participants utilized and were observed by me, the researcher, on the “explore” component
for two and a half weeks before moving to the activities titled “learn.”

The “learn” component consisted of an activity that helped them discover new
vocabulary and contained a reading task that repeated this vocabulary in the context of a
reading passage. I observed the participants on this component for one and a half weeks. At
the end of this component, the participants utilized an online quiz where I asked them, for the purpose of repetition, to refer back to the vocabulary page if they did not know the answer to the question. I gave these instructions not only to provide the participants with repetition, but also to help them utilize the input modifications on more than one occasion. While interacting with the computer, participants were reading the passages in the right frame; when they did not understand a word, they could click on it and a picture with a textual gloss appeared in the left frame. I asked the participants to read the explanation and told them to ask me questions if they did not understand. In addition, the subjects could choose to have the text in the right and left frame read to them. In fact, I advised them to click on each hypertext and listen to each passage twice. In addition, I encouraged them to listen to the textual glosses on more than one occasion. Nonetheless, it was still their choice as to what words they clicked on and how many times they listened to or read the text in one sitting.

As the participants were completing these CALL tasks, I observed them daily and asked them questions before and after working on these online tasks. I also observed the students in their science class on a daily basis. I did this to understand what the students were learning from the computer versus what they were learning in the classroom during the course of the study. Additionally, I provided assistance when the participants seemed confused and also provided students with offline tasks to demonstrate what they had or had not learned.

Semi-structured interviews

After completing the online CALL tasks, I conducted an interview with the two participants and their ESL teacher. I interviewed the participants in this study so that the analysis was not based solely on my interpretation; thus, the interview itself was intended to
inform the study through the perspective of the participants themselves.

The semi-structured interview consisted of 16 questions and invited students to answer questions about the CALL activities (See Appendix D & E). The interviews were taped separately at on the afternoon of March 8, 2005 in a small conference room off of the library at Central Elementary. The room was distraction free and the students were given a break since the interviews and post-test were conducted consecutively.

During the interview, I asked the participants such questions as, “How do you think the computer helped you learn science?” and “How did the pictures help you understand the meaning of the word you clicked on?” In addition, I asked the participants to speak loud during the interview sessions to get an effective tape recording that could be easily understood upon transcription.

My role as the researcher

To gather information, I became the observer, a participant, the interviewer, and the evaluator. Besides authoring the website to be evaluated, I chose to create this website because the software for my study needed to be specific to my needs, as the researcher, and the needs of the participants. I wanted software that would coincide with their unit on space and planets for the study, and I needed the website to include enhanced input to understand if and how it would help the ESL learner.

Once I created the website, I attempted to incorporate it into the school curriculum and to observe its effects on the participants. Normally these two Sudanese students received 1 to 2 hours of ESL a day and then they received regular classroom instruction with their peers the remainder of the day. To include them in my study, I worked with each participant for 30 minutes during their ESL time at the end of the day. It was here that I not only
observed them, but also served as a tutor and thus became a participant observer. As I observed, I was also teaching them how to use the website. In addition, I asked them questions as they were going through the website to see if they understood the content displayed. This allowed me to understand where my website was lacking and it helped me to teach them the content that they did not understand and reinforce the content that they did understand.

Teaching them as they were participating in this online study clearly affected my results. I helped them because I felt I had a responsibility to them as learners. If they did not understand the material presented online, then I had a moral obligation to help them learn. I could not let them misunderstand just because I was looking for a certain outcome within this study. However, there were times when I let the participants be autonomous learners so that my interpretations of the data would be more objective. I did this once I felt they understood how to use the online program to help them learn.

I did not rely solely on my own observations and interpretations for this study; rather, I interviewed and recorded the two participants to find out how they thought the website helped them. When interviewing the participants, I asked them more questions than I had to because I was not sure what answer my questions would provoke. I was also not sure if they would understand the questions I had written. Not being able to hear the participants on the recorded tape was the other problem I encountered. I tried to control for this by repeating their answers in case they did not speak loud enough. However, there were times when I could not understand myself on the tape because of static background noise. I would have used an external microphone, but I did not want it to make my participants self-conscious, which would have also hindered my results.
Besides interviewing, being a participant observer, and authoring the website for this study, I also became the evaluator of the online program and thus the one who analyzed to see if the online activities were effective. In fact, when analyzing my results, it was my job to organize and examine the different types of data collected to understand if the online activities were helpful to the participants.

**DATA ANALYSIS**

In this qualitative study, I analyzed the field notes taken during the daily and online recorded observations, the number of times students accessed the enhanced input as discovered in the online recorded observations, the pre and post-test, and the semi-structured interviews. This next section will give a detailed overview of how the data was analyzed and how the questions and answers were addressed.

**Analysis**

I referred to the book, *Qualitative Methods in Social Research*, by Esterberg (2002) to begin analyzing my notes. To analyze qualitative data, she recommends that the researcher first organize and type the field notes, become familiar with the data, and then immerse him or herself in the data to make sense of it. Consequently, I started typing my field notes. As I was typing my notes, I wrote comments to the side concerning what happened, how it happened, and how the study was conducted. Then I highlighted the comments to myself in yellow.

While continuing to type my notes, I started watching the Snapz Pro videos, video that captured what students were doing online. For each movie, I wrote down what happened, and I recorded what they clicked on and what they listened to in an Excel spreadsheet. For example, I created a table in Excel for the “Out in Space” web page. This
table listed each type of input modification and the total number of times each input modification was used throughout the study on this particular page. Then another graph was created for this page that was more detailed. This graph told what kind of input modification was used for each word throughout the research project. Once the graph was made, I copied and pasted the graph into a Word document and wrote additional notes, documenting what I saw the participants doing with the enhanced input in the Snapz Pro video.

After working the Excel graphs, I began to copy and paste the Excel graphs and coinciding Snapz Pro notes into the chronological field notes. This helped me organize all my notes in chronological order as recommended by Esterberg (2002). As a result, I had the field notes from observing the science classroom and from observing the participants working on the computer along with the Snapz Pro notes all for the corresponding day in one document. This allowed me to “rely on more than one source of evidence” (Esterberg, 2002): I could see if my Snapz Pro notes matched what I observed when I conducted the study. It also allowed me to begin the process of coding and looking for themes in my data.

Before analyzing my data further, I finished organizing my notes by dividing them into sections. I divided them into 8 different sections, titling them analyzing_notes1, analyzing_notes2, and so forth. Once divided into sections, I inserted page numbers for each section. From here, I read through my notes and the transcriptions of the semi-structured interviews and began noting consistent themes that emerged from the data and looking for evidence of other themes that I had thought of prior to completing the study.

The themes that seemed to emerge from the data included 1) retaining and recalling information, 2) transferring knowledge, and 3) the participants’ use of the audio input as aid in helping them gain literacy skills. While some themes emerged from the data, I searched
for others. The themes in which I searched for evidence included repetition and salience; what participants did with the enhanced input; how participants used images; how they used the audio; feedback; how the input modifications were used to conceptualize the information; class versus the computer; how participants used the pedagogical suggestions. This step of noticing relevant phenomena in the data is a basic procedure of coding data in qualitative research. The second basic procedure in coding is collecting examples of the phenomena at hand (Esterberg, 2002, pg. 158). Therefore, I typed each theme on a separate Word document and saved the document. I then looked through my notes and in my transcriptions to find evidence for each theme. When I found corresponding evidence for a particular theme, I copied and pasted it into that document and wrote down what set of notes I took the information from along with its page number. As I continued to look for evidence, I also had one page titled, “other miscellaneous information.” It was here that I documented information that I found to be important, but didn’t fit under a particular theme.

Since qualitative research is typically inductive or takes shape as you understand what you are looking at (M. Bruning, Research and Evaluation 580 lecture, January 24, 2005), I considered the compiled data, the results of the post-tests, thought about the evidence that existed, and then formulated my questions. I had thought of questions before I did my research, but revised them after reflecting on the existing data. I then listed each question on a word document and pasted the information that supported the question. The next chapter, Chapter 4, will discuss that information and thus the answers to the questions formulated.
CHAPTER 4. RESULTS

Background

This study researches how two elementary Sudanese students used the enhanced input in an online tutorial to help them with their science lessons. To gather evidence, qualitative data was collected and analyzed, including observations, interviews, and pre and post-tests. All the information was collected in the spring of 2005 with both participant interviews taking place on the afternoon of March 9, 2005. This chapter will use these interviews and other collected data to answer the three research questions at hand to understand if and how the online tutorial was helpful to the participants. This chapter is divided into three major sections, one for each question, as well as a conclusion to review the results. The questions are as follows:

1) Based on pre and post test scores, did the participants' vocabulary knowledge improve after they interacted with the modified input or enhanced input in CALL, suggesting potential language learning? If improvement took place, in which way?

2) What were the perceptions of the participants: What benefits did they see from using the online tutorial with enhanced input?

3) How did the participants use the enhanced input (textual glosses, images, audio, and salience) in the CALL application to help them conceptualize the concepts and the meaning of the vocabulary?

Vocabulary Knowledge Gained

The first research question asked whether the participants' overall vocabulary knowledge improved, based on pre and post-test, after they interacted with the enhanced input in the online tutorial. To answer this question, the pre and post tests were given, asking students the meaning of 22 vocabulary words in an open-ended approach. Eighteen of the 22
vocabulary words were included in the CALL tasks. The following Table lists the 18 vocabulary included in the CALL tasks and the 4 that were not included.

<table>
<thead>
<tr>
<th>Vocabulary in CALL tasks</th>
<th>Vocabulary not in CALL tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighborhood</td>
<td>Equipment</td>
</tr>
<tr>
<td>City</td>
<td>Fuel</td>
</tr>
<tr>
<td>State</td>
<td>Telescope</td>
</tr>
<tr>
<td>Country</td>
<td>Atmosphere</td>
</tr>
<tr>
<td>Continent</td>
<td></td>
</tr>
<tr>
<td>Planet</td>
<td></td>
</tr>
<tr>
<td>Earth</td>
<td></td>
</tr>
<tr>
<td>Sun</td>
<td></td>
</tr>
<tr>
<td>Moon</td>
<td></td>
</tr>
<tr>
<td>Asteroid</td>
<td></td>
</tr>
<tr>
<td>Solar System</td>
<td></td>
</tr>
<tr>
<td>Star</td>
<td></td>
</tr>
<tr>
<td>Orbit</td>
<td></td>
</tr>
<tr>
<td>Satellite</td>
<td></td>
</tr>
<tr>
<td>seasons</td>
<td></td>
</tr>
<tr>
<td>Revolve</td>
<td></td>
</tr>
<tr>
<td>Rotate</td>
<td></td>
</tr>
</tbody>
</table>

All 22 vocabulary items were analyzed to determine vocabulary development, but only the 18 vocabulary words that were in the CALL tasks were used to calculate the participants’ vocabulary development from pre to post test. A statistical analysis was not performed, however, because of the research design. Consequently, both pre and post test were evaluated to determine the raw score and the percentage of correct answers. In fact, Table 2, shows that participants’ post-test scores are much higher than their pre-test scores.
Table 2 Pre and Post test scores

<table>
<thead>
<tr>
<th></th>
<th>Pre-vocabulary</th>
<th>Post-vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>4 out of 18</td>
<td>16 out of 18</td>
</tr>
<tr>
<td>Percent</td>
<td>22%</td>
<td>88.80%</td>
</tr>
<tr>
<td><strong>Michael</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>4 out of 18</td>
<td>15.5 out of 18</td>
</tr>
<tr>
<td>Percent</td>
<td>22%</td>
<td>86%</td>
</tr>
</tbody>
</table>

On the pre-test, both participants answered only 4 out of 18 vocabulary questions correctly (22%). Comparatively, the post-test shows their improvement: Alex got 16 out of 18 (88.8%) correct and Michael got 15.5 out of 18 (86%) correct. Thus, the participants’ vocabulary knowledge did show signs of improvement. Chapelle (2001) states, that the evidence for language learning potential in CALL materials is strong if the pre-tests indicate that the participants did not know the vocabulary taught in CALL before completing the tasks and they do know it afterwards. These findings provide some evidence that the CALL tasks potentially aided the participants’ language learning although other factors may have contributed to their vocabulary improvement.

**Vocabulary Improvement: Alex pre and post-test**

On the pre-test, Alex could only answer or provide a partially correct answer for the vocabulary words “city,” “country”, “sun”, and “moon”. Even with the vocabulary words “sun” and “moon”, he could not verbalize what they were but could only point them out when given a choice of pictures. However, on the post-test, he could not only verbalize what the moon was but could he could articulate its function. He said that the moon “go around the Earth” and that it is a “satellite.” He also had a better understanding of “sun” on the post-test. On the pre-test, when asked what the sun did, Alex said, “light.” On the post-test the
following dialogue was recorded, showing that he was not only able to recognize the sun, but he could articulate when and where you could see it, as shown in Example 1:

Example 1

<table>
<thead>
<tr>
<th>Researcher:</th>
<th>What is the sun?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex:</td>
<td>have big red light.</td>
</tr>
<tr>
<td>Researcher:</td>
<td>When do you see the sun?</td>
</tr>
<tr>
<td>Alex:</td>
<td>Outside.</td>
</tr>
<tr>
<td>Researcher:</td>
<td>Do you see it at day or night?</td>
</tr>
<tr>
<td>Alex:</td>
<td>Day, but not when it’s raining.</td>
</tr>
</tbody>
</table>

The post-test also demonstrates Alex’s understanding of the words “city” and “country.” Whereas he was only able to give examples of cities, such as Iowa City and New York, on the pre-test, on the post-test he understood the concept of a city saying that cities have lots and lots of schools and that a city was bigger than a neighborhood. With the vocabulary word, “country,” Alex gave an example of Sudan as a country on the pre-test, but he also listed Africa and Iowa as countries. On the post-test, however, he said that countries have a lot of neighborhoods, cities, and states.

In addition to country and city, “Orbit” is another vocabulary item which demonstrates Alex’s vocabulary development. While the word, orbit, was not a part of Alex’s schema when the pre-test was administered, he said on the post-test that “orbit” means “[to] go around” and even demonstrated the word “orbits” with his hands.

While the post-test does demonstrate some vocabulary development, it also highlights points of confusion or vocabulary still unknown to the participant. The following dialogue was recorded when discussing the word planet, as shown in Example 2.
Example 2

Researcher: Can you name some planets?
Alex: Earth, Solar System, Venus, Mercury.
Researcher: Is the solar system a planet?
Alex: No, solar system go around the sun? Is that right?
Researcher: the solar system is all the planets that go around the sun.

In addition to being confused about planets and the solar system, he did not recall the word “seasons” and had trouble with the word “asteroids” though these words were presented to Alex several times in the online tutorial, especially as he did most web pages more than once. In fact, he only knew the word “asteroid” after being given a choice between “planet”, “rock”, and “goes around.” Once given a choice, he chose “rock”.

While there were words presented on the computer that he was unable to recall, there were also words that were not modified or not made salient in the CALL tasks that Alex could not call to mind. For example, he missed “telescope” and partially missed “atmosphere” on the pre and post test as these words were not modified in the CALL tasks; rather, they were only made salient in classroom work and activities. He, therefore, did not give an answer for telescope on the post-test, even though Alex had discussed it with his tutor and the ESOL teacher. Moreover, though he had written and read the word “atmosphere” in a book he made, Alex only got “atmosphere” partially correct knowing that it has to do with how cold or how hot a planet gets but never saying that atmosphere is “a layer of gases.”

Michael pre and post-test

Similar to Alex, Michael could give a correct answer or partially correct answer for the words “sun”, “moon”, “star”, and “country.” While Michael could give a description of
these words on the pre-test, his description was more detailed on the post-test. For example, Michael described the sun on the pre-test saying, “When there is no cold there is sun. [The] sun is hot.” On the post-test the following dialogue took place, as shown in Example 3.

**Example 3**

Researcher: What is the sun?
Michael: is hot.
Researcher: What else does it do?
Michael: The sun is big and there are some planets that move around in the sun.
Researcher: What does the sun do?
Michael: The sun doesn’t move.
Researcher: When do you see the sun?
Michael: in day. When it is night time, you see the moon.

Thus, Michael gives a more complex explanation of the sun saying that “the sun doesn’t move” and that “there are some planets that move around sun”. Similar to the sun, Michael said on the pre-test that “when it is night, you can see a moon”, but on the post-test he said, “sometimes moon is a circle and sometimes it is like a [drew a picture of a crescent]...can see it at night...it is cold and white.”

Star is another word that verified Michael’s schema development. While Michael said on the pre-test that a star was “kind of like moon but different,” on the post-test, the following answer in Example 4 was recorded.

**Example 4**

Researcher: What are stars?
Michael: they are white - you can see them at night - there is big stars - another star I don’t know what it is but I think it is “Big Dog.” There are a lot of groups.
Researcher: Do you remember what those stars are called?
Michael: Constellations.
While Michael does give a more in-depth response to “What are stars?”, this knowledge about constellations did not originate from the enhanced input, but rather with the help of a class volunteer.

Similar to “sun”, “moon”, and “star”, Michael tried to give examples of countries on the pre-test, naming Africa and U.S. as countries. On the post-test, however, he could give a conceptualized portrayal of “country” saying that a country was smaller than a continent but bigger than a city, state, or neighborhood. Though Michael gave a better and more elaborated response on the post-test, he was still confused. The word “country” was still a working concept: he was able to explain it in relation to continents and neighborhoods, but was unable to point to a map and decipher which is a state, continent or country. In fact, he gave Sudan and New York as examples of countries on the post-test.

While some concepts seemed to be more solid and other vocabulary concepts were still developing after finishing the unit and the online tutorial, there were vocabulary words that Michael could not only conceptualize but explain on the post-test even though he had never heard of the word when asked for its definition on the pre-test. “Revolve”, “rotate”, and “seasons” were some of those words. In fact, Michael was able to say that “revolve” means “to move around the sun”, and he was able to name all the seasons and to tell me why the seasons change. Figure 1 shows an example of this input. Moreover, Example 5 reveals that he could also explain “rotate.”
Example 5

Researcher: What does rotate mean?
Michael: there is a little wire [axis] and the earth moves around like this [demonstrating with his hands that the Earth turns on its axis].

While there were still points of confusion after completing the online tutorial, both Alex and Michael showed signs of overall vocabulary improvement during the study, based on the pre and post-test. The enhanced input in the CALL materials aided this situation because it made the tasks more context-embedded by adding pictures and helping the participants to develop background knowledge (Cummins, 1984; Krashen, 1991).
The Participants’ Perspective of the Online Tutorial

The second research question addresses the perceptions of the participants: What benefits did they see from using the online tutorial with enhanced input? To answer this question, the two participants were interviewed. These interviews conveyed the participants’ fondness of the computer, commenting on the help functions. In general, when asked about the images, audio, and quizzes, the participants said that the enhanced input helped them learn.

The benefits

Audio, an input modification, is one help function that allowed these pre-literate participants to access the target language. Both participants stated that the audio help function facilitated their reading and Michael suggested that the audio aided him in the comprehension of the material presented. In fact, Alex even said that he liked reading from the computer because “somebody read it to you and then you read again and then the computer teach you.” When interviewing Michael the following dialogue occurred as shown in Example 6.

Example 6

Researcher: The other day you said that the computer helped you with reading. How did the computer help you with reading?
Michael: Because when you click it, it just reads it to you.
Researcher: Because what?
Michael: Because when you click it, and then it just read it to you.
Researcher: Because when you click it, it just reads it to you?
Michael: Yeah, and then it helps me.
Researcher: How did it help you? Did it help you unders...learn new words
Michael: yeah...
Researcher: learn how to read new words?
Michael: yeah
Michael: And then ..and then it help me picture of the pictures.
Researcher: Did it help you understand the pictures...Michael: Yeah
Researcher: when it read to you? Michael: Yeah
Researcher: And did you understand what that pictures meant most of the time?
Michael: yeah.
Researcher: yeah? What about the picture like..let’s see...how about...how about this picture...what does that mean?
Michael: It mean...orbit.
Researcher: Uh..uh... orbit...or... it could also mean?
Michael: ca...orbit and revolve.
Researcher: Good job! How did that picture help you understand orbit and revolve?
Michael: Because its...because its going around.
Researcher: Because its going around...it moves?
Michael: Yeah and then revolve mean it’s going around.
Researcher: uh-huh. Good job! Um..what about one that is not moving? What about this one?

The dialogue “it help me picture of the pictures,” suggests that it helped him gain access to the textual glosses which in turn helped him further understand the picture and the meaning of the word. We can even see that the participant was not just prompted by me, the researcher, but the participant was actually able to tell me the meaning of the word. In effect, the evidence suggests that the audio here functioned as an input modification because it served as a “provision of an accessible rendition of the L2 input” in this online tutorial (Chapelle 2003, 45).

After asking about the audio, the interview was turned toward images, asking both participants how the pictures helped them understand the meaning of the word they clicked on. Both participants indicated that the picture helped them realize the meaning of the vocabulary word at hand. In fact, the following conversation in Example 7 transpired with Alex.
Example 7

Researcher: How did the pictures help you understand the meaning of the word you clicked on?
Alex: Because you click...you click something and then it showed the picture... [the rest is undeterminable].
Researcher: it helps what?
Alex: it helps if you want to take out.
Researcher: What do you mean to take out?
Alex: when you..[undeterminable]...
Researcher: Does it help you understand the meaning of the word?
Alex: yeah
Researcher: Yeah? So when we showed...when it showed the picture of rotate...[Alex: uh-huh] on the ...[thing?] that helped you understand?
Alex: uh-huh...yeah, you don’t ...you can see the pictures..[undeterminable]
Alex: Which pictures do I remember?
Researcher: uh-huh
Alex: planets
Researcher: Does this picture help you understand the meaning of the word?
Alex: yeah
Researcher: why?
Alex: Because when you when you see the word, you don’t know what it is and then when you click on the other side, it have to show you the pictures.

When asked if the picture helped him understand the meaning of the word, Alex said, “Because when you...see the word, you don’t know what it is and then when you click on the other side, it have to show you the pictures...it helps you if you want to take out.” His, answer, though somewhat unclear, suggests that the images help him “take out” or comprehend the meaning of the word.

Michael, on the other hand, not only says that the pictures help him understand the word, but he reveals his comprehension of specific pictures and the related words. When asked how the picture of “spaceship” helped him understand the word, he said, “because I knew them as a word and then when we look at the pictures and then...we just said oh, I know this one. This picture is pictures for this one.” Thus he was able to grasp the picture-
lexical item correspondence. Further probing his answer, the participant was asked questions about other specific pictures as shown in Example 8.

Example 8

Researcher: And did you understand what that pictures meant most of the time?
Michael: yeah.
Researcher: yeah? What about the picture like...let’s see...how about...how about this picture...what does that mean?
Michael: It mean...orbit.
Researcher: Uh..huh... orbit...or... it could also mean?
Michael: ca...orbit and revolve.
Researcher: Good job! How did that picture help you understand orbit and revolve?
Michael: Because it’s...because it’s going around.
Researcher: Because it’s going around...it moves?
Michael: Yeah and then revolve mean it’s going around.
Researcher: uh-uh. Good job! Um..what about one that is not moving? What about this one?
Michael: The satellite.
Researcher: Uh...uh.
Michael: It doesn’t move.
Researcher: What doesn’t move?
Michael: It doesn’t move around the...
Researcher: The picture or the meaning of the word?
Michael: The pictures.
Researcher: The picture doesn’t move, right?
Michael: Yeah.
Researcher: It stays still, but did you still understand what it meant?
Michael: yes.
Researcher: What is a satellite?
Michael: Satellite..It’s ki...it’s kind of like little Researcher: uh-uh
Michael: and it's white Researcher: uh-huh
Michael: and then...and then it move around. Researcher: uh-huh
Michael: That’s all. Researcher: uh-uh.
Researcher: So maybe it’s a small object that moves around a bigger one.
Michael: yeah.

The interchange above demonstrates his understanding of the animated gif as well as the graphics that were stationary. In fact, when participants clicked on the words “rotate” and “orbit”, they saw an animated image of the Earth moving around the sun (Figure 2a).
When asked how the picture helped him understand “orbit” and “revolve”, Michael replied, “because it’s going around…it moves,” referring to the animated gif. On the other hand, Michael reveals that he understands the stationary images as well. He said that the satellite, a stationary image in the online tutorial (Figure 2b) “its kind of like little, and its white, and then…and then it move around.”

Figure 2a— animated gif of revolve and orbit

Figure 2b—stationary image of satellite

http://vortex.plymouth.edu/sun/sun3d.html

The next question the researcher asked the participants was, “Did the computer help you understand things you learned in science or things that your teacher talked about in science class? How?” Michael’s response was “because when I don’t understand what teacher said and then when I just click the place and then it just showed me.” Alex said, “The teacher teaches you something in science and then it show in the computer…yeah, when you don’t know, it shows you in the computer.” Michael’s response, “I just click the place and then it just showed me,” implies that the textual glosses and the images showed him or helped him understand the word or concept that he did not understand in class. Alex’s answer, “when you don’t know, it shows you in the computer,” suggests the same thing, though his answer is not as specific.

In addition to noting how the pictures, audio, and textual glosses helped the participants, Michael was asked if the quizzes on the computer helped him learn his science
and if so, how. He said, “cause when I just click it and then it start...and then it just show me...I just miss it and then just said its no and then when its right, and then its says yes.” Therefore the computer gave him feedback about his answers (Figure 3), serving as the expert helping the novice (Ellis, 1999). Besides providing feedback, the quizzes also provided him with repetition, salient input. In fact, one of the three quizzes gave him an easy option of clicking a back arrow to find the correct answer on the previous webpage, Space Words web page (Figures 3 & 4). Then once he found the answer, he could return to the quiz page and answer the question correctly (Figures 3 & 4).

**Figure 3- Quiz #3**
This allowed the participants to revisit the previous webpage, causing them to pay more attention to the input modifications that they may or may not have clicked on earlier (Figures 3 & 4). In fact, Michael indicates in Example 9 that this option helped him.

Example 9

**Researcher:** Okay, did you ever use the green buttons to go back and look at the answers

**Michael:** yeah

**Researcher:** Did that help you?

**Michael:** yeah

**Michael:** Because when I just ...when I just...when I don’t understand and then I just click that **Researcher:** you mean the buttons. **Michael:** and then it show you.

**Researcher:** like an example? **Michael:** Uh-huh

**Researcher:** and then you were able to get the answer right?

**Michael:** Yeah **Researcher:** instead of wrong. **Michael:** Yeah.

While Michael suggests that the quizzes helped, this question was mistakenly omitted in Alex’s interview though he did note that the computer helps him by telling him what is
right and what is wrong when asked if he would like to learn more of his science on the computer. In fact, based on the interview and on observation, it seems as if both participants liked working on the computer and that the participants found that the enhanced input aided them in learning, particularly the words glossed with audio and images.

**Participants’ use of enhanced input**

The third and final question addresses how the participants made use of the enhanced input to help them conceptualize the meaning of the vocabulary and the concepts in their space unit. For this question, “it seemed essential...to test what learners actually do, not what the researcher assumes instructions and task demands will lead learners to focus on” (Swain 1998). Therefore, the participants were observed in their science classroom and while using the online tutorial. Their actions were also recorded with Snapz Pro. In addition, the participants’ semi-structured interviews were used to help answer this question. Based on the triangulated data, this portion of chapter 4 will then discuss the enhanced input used by the students, and the observations and interviews will reveal how the use of the enhanced input aided their learning.

**Overall use of the online tutorial helped students**

Both Alex and Michael demonstrated that they were learning from the computer in general. Before they started talking about the solar system in their science class, I wanted to know what the participants already understood from their computer use. The following dialogues in Example 10 occurred on February 2, 2005 just before their science class on the solar system began.
Example 10

**Researcher:** What did you learn from the computer, yesterday?
**Michael:** Maps
**Researcher:** Yes, but what did you learn about the solar system? Remember the sun?
**Michael:** yeah
**Researcher:** What is around the sun?
**Michael:** Like the posters up there.
**Researcher:** What are they?
**Michael:** Planets
**Researcher:** What do planets do?
**Michael:** They move around and around.
**Researcher:** Remember talking about the solar system on the computer the other day?
**Alex:** yeah
**Researcher:** What did you learn from the computer?
**Alex:** about cities
**Researcher:** What was bigger than a continent?
**Alex:** I don’t know. Earth?
**Researcher:** What did those objects do?
**Alex:** Move around and around
**Researcher:** Remember the names of those objects
**Alex:** No

Because the participants only talked about the solar system briefly in class, these dialogues provide evidence that they were learning from the computer and were able to say that the planets or objects “move around and around.” This could be due to using a combination of the enhanced input.

**How participants made use of the input, audio**

There were 3 websites that contained audio files with coinciding text. The name of these 3 websites were “Out in Space”, “Space Words”, and “Planets_Move”. Tables 3a, 3b, and 3c, as shown below, display the number of times the participants clicked to have the audio read to them. Table 3a, specifically gives a ratio of the number of times the participant
accessed the audio over the # of times the webpage was completed. Table 3b presents a ratio of the number of times they accessed the audio over the number of opportunities (# opportunities = number of audio files per page multiplied by the number of times they did that page). Table 3c is a converts the ratio from table 3b to an average number of times they accessed the given audio files.

**Table 3a - Times participants used audio/number of times webpage was completed**

<table>
<thead>
<tr>
<th>Input modifications</th>
<th>explore/space_in</th>
<th>solar system</th>
<th>out in space</th>
<th>space words</th>
<th>Planets_move</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex</td>
<td>38/3</td>
<td>35/5</td>
<td>53/2</td>
<td>12/1</td>
<td>Not recorded</td>
<td>138/11</td>
</tr>
<tr>
<td>Michael</td>
<td>32/5</td>
<td>23/3</td>
<td>42/5</td>
<td>23/3</td>
<td>14/2</td>
<td>134/18</td>
</tr>
<tr>
<td>Rd text without audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex</td>
<td>NA</td>
<td>NA</td>
<td>½</td>
<td>0/1</td>
<td>Not recorded</td>
<td>1/3</td>
</tr>
<tr>
<td>Michael</td>
<td>NA</td>
<td>NA</td>
<td>21/5</td>
<td>1/3</td>
<td>0/2</td>
<td>22/10</td>
</tr>
</tbody>
</table>

**Table 3b - Ratio - Number of times participants accessed audio/number of opportunities**

<table>
<thead>
<tr>
<th>Input modifications</th>
<th>explore/space_in</th>
<th>solar system</th>
<th>out in space</th>
<th>space words</th>
<th>Planets_move</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex</td>
<td>38/24</td>
<td>35/55</td>
<td>53/34</td>
<td>12/7</td>
<td>not recorded</td>
<td>138/120</td>
</tr>
<tr>
<td>Michael</td>
<td>32/40</td>
<td>23/33</td>
<td>42/85</td>
<td>23/21</td>
<td>14/24</td>
<td>134/203</td>
</tr>
<tr>
<td>Rd text without audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex</td>
<td>NA</td>
<td>NA</td>
<td>1/34</td>
<td>0/1</td>
<td>Not recorded</td>
<td>1/35</td>
</tr>
<tr>
<td>Michael</td>
<td>NA</td>
<td>NA</td>
<td>21/85</td>
<td>1/21</td>
<td>0/2</td>
<td>22/106</td>
</tr>
</tbody>
</table>

**Table 3c - Average number of times participants accessed given audio files**

<table>
<thead>
<tr>
<th>Input modifications</th>
<th>explore/space_in</th>
<th>solar system</th>
<th>out in space</th>
<th>space words</th>
<th>Planets_move</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex</td>
<td>1.6</td>
<td>0.6</td>
<td>1.6</td>
<td>1.7</td>
<td>unrecorded</td>
<td>1.2</td>
</tr>
<tr>
<td>Michael</td>
<td>0.8</td>
<td>0.7</td>
<td>0.5</td>
<td>1.1</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Rd text without audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex</td>
<td>NA</td>
<td>NA</td>
<td>0.02</td>
<td>0</td>
<td>Not recorded</td>
<td>0.03</td>
</tr>
<tr>
<td>Michael</td>
<td>NA</td>
<td>NA</td>
<td>0.2</td>
<td>0.05</td>
<td>0/2</td>
<td>0.2</td>
</tr>
</tbody>
</table>
As previously stated, both pre-literate participants mentioned in their interviews that the computer helped them with reading. Of the three web pages with text and audio, Alex clicked to access the audio input on the “Out in Space” page an average of 1.6 times (Table 3c). On the “Space Words” page there were 7 audio files. Alex did the page once and chose to listen to 12 different audio files. He therefore accessed the audio an average of 1.7 times (Table 3c). The calculation is seen below in Calculation 1.

**Calculation 1**

“Space Words” Web page

\[
\frac{\text{# of times}}{\text{# of audio files}} = \frac{12}{7} = 1.7 \text{ times}
\]

Though he did complete the “Planets_Move” page, Snapz Pro failed to record it. Snapz Pro did record Michael doing the “Planets_Move” page a total of 2 times giving him the opportunity to access audio files 24 times. Michael chose to listen to the audio 14 times or approximately half the time for an average of .6. He also accessed the audio on the “Out in Space” page an average of .5 and an average of 1.1 times on the “Space Words” web page (Table 3c).

Unlike Alex, Michael chose to read the text without the audio once he had listened to the audio files on each webpage. In fact, he read the text without the audio a total of 21 times on the “Out in Space” page. Since there were only 17 audio files to be accessed on that page, Michael read the equivalent of one page by himself, which is an exciting feat for someone who just began learning to read English a few months earlier. Meanwhile, Alex read the text without the audio 1 time out of the 2 times he did the “Out in Space” page, meaning he had
34 opportunities to read text without the added audio input, but only elected to read the text 1 out of 34 times. Calculation 2 shows how the average number of times the participant read without the help of the audio was calculated.

**Calculation 2**

"Out in Space" Web page

<table>
<thead>
<tr>
<th># of audio files</th>
<th>→</th>
<th>17 audio files</th>
</tr>
</thead>
<tbody>
<tr>
<td>× # of times the webpage was completed</td>
<td>→</td>
<td>× 2 times</td>
</tr>
<tr>
<td>= # of opportunities to read the text with audio</td>
<td>→</td>
<td>34 opportunities to read with audio</td>
</tr>
</tbody>
</table>

# of times read text without the audio = average # of times read text w/o audio
# of opportunities to read text with audio

Read text 1 time without audio = .02 average # of times read text w/o audio
34 opportunities to read text with audio

Participants also listened to the audio files on the other 2 web pages, "Explore/Space in" and "Solar System" that did not have additional text. Alex listened to the audio files for the "Explore/Space_in" page an overall 38 times out of the 3 times he did the web page (Table 3a). Because there were 8 audio files on that page, there were 24 audio files to be accessed (Table 3b). He clicked on these files an average of 1.6 times on the "Explore/Space_in" page and an average of .6 times on the "Solar System" page. Michael listened to the audio files 32 times out of the 40 opportunities given to him on the "Explore/Space_in" page for an average of .8 or a little over half the time. He accessed audio files and listened to the input on the “Solar System” page an average of .7. Calculation
3 shows how the average was determined for the “Explore/Space_in” page and gives an example of how the average was calculated for the “Solar System” page.

**Calculation 3**

**“Explore/Space_in” Web page**

\[
\begin{align*}
\text{# of audio files} & \rightarrow \text{8 audio files} \\
\times \# \text{ of times the webpage was completed} & \rightarrow \times 5 \text{ times} \\
\Rightarrow \text{# of opportunities to access audio} & \rightarrow 40 \text{ opportunities}
\end{align*}
\]

\[
\frac{\text{# of times audio was accessed}}{\text{# of opportunities to read text with audio}} = \text{average # of times accessed audio files}
\]

32 times the audio was accessed \(\frac{\text{accessed audio files an average of .8}}{40 \text{ opportunities to read text with audio}}\)

When the participants began using the online tutorial, they were instructed to try to listen to each audio file twice. However, the choice was ultimately theirs and there were times when the participants decided either to have the text read to them just once or twice or decided not to click on the audio file at all. This can be seen in Table 3b and Table 3c. As previously discussed regarding the “Out in Space” page, there were 17 opportunities to access the audio every time the participant completed the web page. Alex chose to access the audio 53 times, and since he did the page 3 times, he had a total of 34 possible times that he could have accessed the audio (Table 3b). Because he accessed the audio 53 times, he chose to click more than once on the same audio file for an average of 1.6 times (Table 3c).

However, Michael, who had 85 opportunities to access the audio files, only chose to listen to
them a total of 42 times for an average of .5 or half the time. Therefore, both participants did decide to access the audio to help them read the text, but it was their choice.

As seen in Table 3a, 3b, and 3c, Michael and Alex read the passage from the “Out in Space” page (Figure 5) without the audio input.

**Figure 5 — “Out in Space” web page**

Michael not only read the “Out in Space” page by himself, but he also read the definitions to the vocabulary words without having the computer read it to him. After reading each passage or definition, he then listened to the sound to make sure he read the words correctly, and then he would read it again by himself, pronouncing previously misread words correctly after listening again to the audio input.

Michael’s efforts to read without the audio were not only noted in the observations, but his online actions were recorded using Snapz Pro. As I watched his recorded online actions, I saw that Michael did not opt to have the textual gloss read to him. Instead he tried
to read the textual gloss to himself, pointing to each word as he read and possibly gaining confidence in his reading ability.

While Michael seemed to practice reading the text by himself and also to listen to the audio input, Alex chose to have the audio read him the “out in space” text 6 times consecutively on one occasion, using his mouse to point to each word as it was read to him. He also tried to read this passage by himself a day earlier upon the suggestion of the researcher. However, the passage seemed to be at his frustration level whereby he misread 6 or 7 words in the passage. Though Alex only tried once to read the passage by himself, listening to the same passage and words over and over again provided repetition. Therefore, not only providing him the opportunity to learn how to decode new words, but also allowing him to comprehend the meaning of the passage by giving him access to the L2 that he was unable to read autonomously. Therrien (2004, pg. 257) states that reading a passage repeatedly is a strategy proven effective in increasing comprehension and fluency skills.

Once the participants, both Alex and Michael, either listened to or could read the passage or definition by themselves, they were probably able to conceptualize the meaning of the picture. In turn this could have helped them understand the word that was clicked on and helped them comprehend the passage.

**How they used the images**

Both participants made use of the images. In fact, on the Solar System webpage (Figure 6), Alex, in one instance, clicked on each word once in chronological order. Every time he clicked on a word such as Mercury, it automatically gave an aural description of that planet. However, the second and third times he did this page he skipped around and clicked for different images, not really waiting for the audio to finish playing for that word.
As indicated in (Table 4a) on the next page, Alex seemed to like the images. Therefore, he clicked for the images a total of 42 times out of the 5 times (42/5) he was recorded doing the “Solar System” page with a total of 10 words to click on. Since there were 10 words that allowed the participants to access an image and Alex did the page 5 times, he had the opportunity to access an image for a total of 50 times (Table 4b). In fact, Alex chose to click for an image a total of 42 times out of the 50 opportunities given to him (Table 4b) for an average of .8 times on the solar system page (Table 4c). Out of the 5 web pages, he clicked for the images a total of 141 times and the total number of times he was recorded doing all of the web pages together was 11 (Table 4a). That means that he had a total of 117 opportunities to click for an image (Table 4b); he chose to click on some of them twice, accessing the images 141 times and an average of 1.2 times (Table 4c).
Michael accessed the images on all 5 web pages 159 times out of the 203 opportunities given to him to click on an image (Table 4b, total column). He chose to look at an image an average of .8 times together on all 5 web pages (Table 4c, total column).

Calculation 4 shows how the average # of times images were accessed on all 5 web pages was obtained.
Calculation 4

Total of all 5 web pages

\[
\text{# of times out of 5 web pages to access image} = \text{average # of times accessed image} \\
\text{# of opportunities to access image}
\]

\[
\text{accessed images 159 times on all 5 web pages} = \text{accessed image on average of .8} \\
\text{203 opportunities to access image}
\]

On the “Space Words” page, he clicked a total of 24 times for images out of the 3 times he was recorded doing the page (Table 4a). Since there were 7 words hypertexted with images and Michael did the page 3 times, there were 21 times that he could have clicked for an image. He clicked 24 times for an average of 1.1 (Table 4c), clicking at least once on each word. Calculation 5 shows how the average # of times images were accessed on the “Space Words” web page was determined.

Calculation 5

“Space Words” Web page

\[
\text{# of words hypertexted with images} \rightarrow 7 \text{ words with images}
\]

\[
\times \text{# of times the webpage was completed} \rightarrow \times 3 \text{ times}
\]

\[
= \text{# of words hypertexted with image} \rightarrow 21 \text{ words with images}
\]

\[
\text{# of times image was accessed} = \text{average # of times accessed images} \\
\text{# of words hypertexted with images}
\]

\[
\text{image was accessed 24 times} = \text{accessed images an average of 1.1} \\
21 \text{ words hypertexted with images}
\]
In one specific instance that his actions were recorded on the “Space Words” webpage (Figure 7), he clicked to access all the images on that page and read the text with the audio for each word and image. When asked what rotate meant in the interview, his description matches that of the animated gif (also shown below in Figure 7). Illustrating rotate without looking at the webpage, Michael said, “there is a little wire [axis] and the Earth moves around like this [demonstrating with his hands that the Earth turns on its axis].

Figure 7 – “Space Words” Web page

Since the image for the word rotates was an animated gif, the Earth looked like it was spinning on a stationary wire. Because rotate is a difficult word to explain or depict in a still photo, Michael’s answer suggests that the animated picture for rotate helped him to conceptualize the meaning of the word. Similarly, Alex thought the animated gif’s were
“cool” the first time he saw them. Perhaps, too, he was excited not only about the movement but also because he automatically understood what the word meant. In fact in the interview he states that “Because when you see the word, you don’t know what it is and then when you click...it have to show you the pictures.” Chapelle (2003, pg. 47) states that a word with a complex meaning can be hard or impossible to illustrate. It seems that rotate would have been one of these words had a still photo been used. However, the animated gif provided easy access to the meaning.

**How the participants used textual glosses**

In addition to making use of the audio and the images, it is apparent that students made use of the textual glosses. On the “Space Words” page, the participants could access the audio file independently of the image and textual gloss, which is why Table 5a, Table 5b, and Table 5c as seen below have 2 rows that list textual gloss with audio and textual gloss without audio.

**Table 5a- Number of times accessed the textual gloss/number of times web page was completed**

<table>
<thead>
<tr>
<th>Input modifications</th>
<th>Explore/space_in</th>
<th>solar system</th>
<th>out in space</th>
<th>Space Words</th>
<th>Planets move</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss with audio</td>
<td>NA</td>
<td>NA</td>
<td>46/2</td>
<td>12/1</td>
<td>0/0</td>
<td>58/3</td>
</tr>
<tr>
<td>read textual gloss without audio</td>
<td>NA</td>
<td>NA</td>
<td>0/2</td>
<td>0/1</td>
<td>0/0</td>
<td>0/3</td>
</tr>
<tr>
<td>Michael</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss with audio</td>
<td>NA</td>
<td>NA</td>
<td>35/5</td>
<td>22/3</td>
<td>11/2</td>
<td>68/10</td>
</tr>
<tr>
<td>read textual gloss without audio</td>
<td>NA</td>
<td>NA</td>
<td>18/5</td>
<td>1/3</td>
<td>0/2</td>
<td>19/10</td>
</tr>
</tbody>
</table>
Table 5b- Ratio of number of times textual gloss accessed/number of opportunities to access

<table>
<thead>
<tr>
<th>input modifications</th>
<th>explore/space_in</th>
<th>solar system</th>
<th>out in space</th>
<th>space words</th>
<th>planets_move</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEXTUAL GLOSS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss</td>
<td>NA</td>
<td>NA</td>
<td>46/34</td>
<td>12/7</td>
<td>not recorded</td>
<td>58/41</td>
</tr>
<tr>
<td>with audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss</td>
<td>NA</td>
<td>NA</td>
<td>0/34</td>
<td>0/7</td>
<td>not recorded</td>
<td>0/41</td>
</tr>
<tr>
<td>without audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michael</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss</td>
<td>NA</td>
<td>NA</td>
<td>35/85</td>
<td>22/21</td>
<td>11/24</td>
<td>68/130</td>
</tr>
<tr>
<td>with audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss</td>
<td>NA</td>
<td>NA</td>
<td>18/85</td>
<td>1/21</td>
<td>0/24</td>
<td>19/130</td>
</tr>
<tr>
<td>without audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5c -Average number of times textual gloss was accessed

<table>
<thead>
<tr>
<th>input modifications</th>
<th>explore/space_in</th>
<th>solar system</th>
<th>out in space</th>
<th>space words</th>
<th>planets_move</th>
<th>TOTAL average</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEXTUAL GLOSS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss</td>
<td>NA</td>
<td>NA</td>
<td>1.3</td>
<td>1.7</td>
<td>0/0</td>
<td>1.3</td>
</tr>
<tr>
<td>with audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss</td>
<td>NA</td>
<td>NA</td>
<td>0</td>
<td>0</td>
<td>0/0</td>
<td>0</td>
</tr>
<tr>
<td>without audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michael</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss</td>
<td>NA</td>
<td>NA</td>
<td>0.4</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>with audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read textual gloss</td>
<td>NA</td>
<td>NA</td>
<td>0.2</td>
<td>0.05</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>without audio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When Alex, clicked for the image and the textual gloss on the “Space Words” page, he listened twice to the definition for 5 out of the 7 vocabulary words on that page. He accessed the textual glosses on that page 12 times and on average 1.7 times. Calculation 6 demonstrates how the number 12 was determined to be the total number of times he accessed the textual glosses and how the average was calculated.
Calculation 6

"Space Words" Web page: Textual gloss

\[
\begin{align*}
\text{# of words hypertexted with textual glosses} & \rightarrow 7 \text{ words glossed} \\
- \text{# of times accessed gloss twice} & \rightarrow - 5 \text{ accessed twice} \\
= \text{# of textual glosses only accessed once} & \rightarrow = 2 \text{ glosses only accessed once} \\
\downarrow \\
(# \text{ of glosses accessed twice } \times 2) & \rightarrow (5 \times 2) = 10 \text{ glosses accessed twice} \\
+ \text{# of glosses accessed once} & \rightarrow + 2 \text{ glosses accessed once} \\
= \text{total # of times textual glosses were accessed} & \rightarrow 12 \text{ times text glosses accessed} \\
\downarrow \\
\text{# of times accessed textual gloss} & = \text{average # of times textual gloss accessed} \\
\text{# number of opportunities to access gloss} & \\
\text{12 times text gloss accessed} & = \text{accessed textual glosses 1.7 times on average} \\
\text{7 opportunities to access} &
\end{align*}
\]

On the "Out in Space" page and the "Space Vocabulary" page together, Alex clicked for the textual glosses on average of 1.3 times (Table 5c). Similarly, Michael either clicked to access the audio file or read the textual glosses to himself a total of 87 times out of the 10 total times he did all 3 web pages together. In particular, he had the audio read to him a total of 68 times, and he read the audio by himself a total of 19 times on all three web pages (Table 5a; Table 5b). After he listened and became familiar with the text, he tried to read the
audio himself a total of 19 times, 18 times on the “Out in Space” page and 1 time on the “Space Words” page (Table 5a; Table 5b). Calculation 7 demonstrates the addition that took place to determine the # of times Michael accessed the audio glosses altogether.

**Calculation 7**

**All web pages with textual glosses (Table 5a, 5b, 5c)**

\[
\begin{align*}
\text{TOTAL # of times read textual gloss with audio} & \rightarrow 68 \text{ times w/ audio} \\
+ \text{TOTAL # of times read textual gloss without audio} & \rightarrow +19 \text{ times w/o audio} \\
= \text{TOTAL number of times read textual gloss} & \rightarrow = 87 \text{ times read text gloss}
\end{align*}
\]

Michael accessed the textual glosses with and without the audio an average of .6 times, a little over half the time. Calculation 8 shows how the average was computated.

**Calculation 8**

\[
\begin{align*}
\# \text{ of times he read the textual gloss with and without the audio} & \rightarrow 87 \text{ total times} \\
\div \# \text{ total number of words hypertexted with a textual gloss} & \rightarrow \div 130 \text{ gessed words} \\
= \text{average number of times textual glosses accessed with and without audio} & \rightarrow \text{an average of .6}
\end{align*}
\]

Michael seemed to internalize some of the information from the textual glosses, which became apparent when he was reading a book in his science class with a spaceship on the cover. Upon being asked what was on the front cover, the following dialogue occurred.

**Example 5 – discussion on 2/08/05**

**Researcher:** “What is on the front cover of this book?”

**Michael:** A country.

**Researcher:** No, remember it flies.

**Michael:** Oh, I know it carries people, but I don’t remember the name of it.
This example shows that Michael remembered the definition of the word spaceship after giving the cue that a spaceship flies. He immediately connected that with the remaining part of the word's definition (as seen in Figure 8) saying that "it carries people", suggesting that the textual gloss gave him some kind of understanding about the image and the word.

**Figure 8**

How students made use of Repetition and Salience

"Enhancements of linguistic input are intended to transform the language that the learner reads or hears into a potential language learning lesson" (Chapelle 2003, pg. 40).

Salience is one type of enhancement whereby a grammatical form or lexical phrase is marked or repeated (Chapelle 2003, pg. 40). Input can be made salient through highlighting or through the repetition of the target linguistic forms. Desmarais, Duquette, Renie, & Laurier
(1998, pg. 17) imply that words are more likely to be acquired or learned when they occur frequently or are made salient in multimedia courseware. The web pages in this case study with the two Sudanese participants, Alex and Michael, highlighted vocabulary words through the use of hypertext and then repeated these words throughout the texts on the web pages. The online tutorial also had built-in quizzes where the learner would be tested on the salient vocabulary previously highlighted on prior web pages. The quizzes gave the participants the option of going back to the previous web pages to find the answer and then returning to the quiz to try and find the correct answer (Figure 9 & 10).

**Figure 9 — Quiz 3 with back button**

![Quiz 3 with back button](http://www.public.instate.edu/kathryn/than/login?start=quiz政府部门.htm)
The participants made use of the input and salience. Not only did they opt to listen to a text more than one time consecutively, they would do the same web pages multiple times. As previously mentioned, Alex listened to the input 6 times consecutively and most, if not all of the web pages were explored by both participants 2 or more times. In addition, when taking the online quizzes the participants would either answer the questions multiple times, using the yes/no feedback for guidance, do the quiz multiple times, or use the back button to look up the answer. On quiz 3 (Figure 9) Michael, for example, would click the back button while taking a quiz to find the correct answer and then he would go back to the quiz to find the correct answer for the given question. For quizzes 2 and 3, Michael, used the back buttons and then went back to the quiz and got the answer correct. When asked about revolves and orbits on quiz 3, Michael went back twice to find the correct answer. When he went to answer, he first clicked on revolve, then orbit, and then orbit and revolve until the
computer told him he got the correct answer. Likewise, Alex did quiz three also and instead of going back, he used the yes/no feedback to help him find the correct answer. He did the quiz until he got all of the answers correct on the first try. In fact, he did the quiz a total of six times. This is repetition.

Conclusion

The results of the study indicate that the online tutorial with the enhanced input helped students learn science vocabulary. It appears that the audio, images, textual glosses, and the salience and the repetitious nature of the online tutorial were all key in helping students acquire new language and concepts. Chapelle (2003, pg. 47) even suggests that the more kinds of modifications that exist in a CALL application the more likely the chance that the learner will retain what was presented in the application. In addition to the potential language learning, the audio had an unexpected gift: the data suggested that it helped them with their reading, possibly helping them to gain fluency and improving their comprehension of the L2 passage. The audio probably not only gave them access to the L2, but they were able listen to the passage as many times as they wanted to, focusing on the meaning of the passage instead of how to decode each word. Gettys, Imhof, and Kautz (2001, 93) suggest that computerized glosses aid a learner in reading a foreign language because it “relieves them [students] of cognitive overload” and allows them to focus on the meaning of the text.

To capitalize on these findings, the following chapter will summarize the results in more extensive manner, will evaluate the CALL tasks, suggest how these types of CALL tasks could be implemented in the classroom, and among other things reveal the limitations of the study, and give suggestions for further research.
CHAPTER 5. CONCLUSION

This chapter will take a comprehensive look at the whole study. It will review and summarize the results as presented in chapter 4, and it will take a closer look at the positives and negatives of the study. As a result, the chapter will evaluate the given CALL tasks, discuss how the computer can be implemented in the classroom, and explore how learning in the classroom and on the computer helped and hindered the study and the participants.

Finally, the limitations of the study will be revealed and suggestions for further research will be discussed. Consequently, the chapter will include 1) A Summary of results, 2) Evaluation of the CALL tasks, 3) Classroom implementation, 4) Learning in the classroom and on the computer, 5) Limitations of the study, and 6) Suggestions for further research.

Summary of Results

The sources of evidence suggest that the assistance provided through the online tutorial with enhanced input and the results of that assistance did in fact facilitate the performance of the participants, improving their vocabulary from the pre-test to the post-test. The analysis of the questions from the pre and post-test provided a further and more in depth understanding into how the students improved over the course of their involvement with the computer in this science unit. It showed that they had conceptualized some words, while other words were still a working concept, yet others were still unknown to the participant. The participants even admitted that the computer helped them to learn. They said that the audio helped them learn to read and indicated that the pictures helped them understand the vocabulary words. Michael, in particular, said that the picture for orbit and revolve helped him understand because the picture moved and “revolve mean it’s going around.” He even
described “rotate” without looking at the image when asked what it meant. Similarly, Alex said the picture helped him understand the meaning of the word “Because when you when you see the word, you don’t know what it is and then when you click on the other side, it have to show you the pictures.”

While participants stated that the images and audio helped them, they also indicated that the computer helped them with the things that they did not understand in science class, saying that “the teacher teaches you something and then it shows you on the computer” and “because when I don’t understand what teacher said and then when I just click the place and then it just showed me.” In addition to helping them understand what their teacher was talking about, the computer also gave them feedback when taking the quizzes. Michael even said, “cause when I just click it and then it start…and then it just show me…I just miss it and then just said its no and then when its right, and then its says yes.”

Not only do a pre and post-test and participant evaluations indicate learning and improvement, but observations and recordings show that these two participants did use the enhanced input to help them conceptualize the meaning of the vocabulary. The students were observed pointing to each word with their mouse as it was read to them or as they read it to themselves. They listened to the audio repeated times, helping them to gain fluency and comprehend the passage. They used the images, which gave them a picture-lexical item correspondence and the textual glosses helped to internalize some of the meanings of the words, especially after listening or reading the textual glosses on numerous occasions, again helping them to comprehend the meaning of the word. Thus, the participants did in fact use the salience and repetition to their advantage. They not only listened to the passages and textual glosses repeated times, they even used the back buttons on the quizzes to find the
answers to questions, forcing them to use the enhanced input, including the input modifications, relieving these readers of “cognitive overload” and allowing them to focus on the meaning of the text (Gettys, Imhof, and Kautz, 2001, 93).

Evaluation of Tasks

The tasks in this study included 3 web pages that were meant to build background knowledge and 2 web pages that included passages on the content, solar systems, meant to be learned by the participants for their science class. All the web pages included some type of enhanced input, particularly the 2 web pages that included passages. In addition to the 5 web pages previously mentioned, there were also 3 quizzes and one game meant to help students revisit the content and help them learn. While these tasks did prove beneficial in helping the students learn, there were also some negative characteristics about certain tasks that were not previously mentioned.

First, the web page (Figure 1) was meant to help the two participants in this study build background knowledge about space.
The idea of this webpage was to aid in the participants’ acquisition and understanding of outer space by providing a context. Based on the results of the pre-test, these two participants from the Sudan did not seem to have an understanding of outer space, and their knowledge about the world was limited as they only knew where Sudan and Iowa were on the map. Therefore, the web page, as seen in figure 1, was meant to help the participants learn the spatial relationship between where we live on Earth in relation to the solar system. The concepts on this page were hard for the students to grasp. In fact, they were given explanations from the researcher and asked to do additional worksheets and online games to help them grasp the concepts of neighborhood, city, states, etc. Though they may have had an understanding that countries were bigger than neighborhoods, cities, or states, they had a harder time understanding the concept of each individual word. For example, on the post-test they were still confused about the definition of a country. Alex said that Iowa and Africa
were countries and Michael said Sudan and New York were countries. Perhaps the web page did its job when it came to the spatial relationship of neighborhood to space, but it was not ideal for grasping the complete concept of words like country or continent since students could not give accurate examples.

The space webpage, as seen in Figure 2, was to help the students visualize the planets in order and when they clicked on a word such as sun or mercury, it showed a picture and gave an aural description of the word clicked on.

**Figure 2**

![Image of solar system]

This web page was beneficial in giving the participants facts about the planets; however, they had to sometimes click on the word twice to hear the aural description. The first time the word was clicked on, the sound would sometimes break up and the second time they clicked the word, the audio would recover so that it could be heard.
This web page in Figure 2 also had an unexpected outcome. When the participants were asked about a planet such as which planet is the biggest, they would answer with the number instead of the name of the planet. For example, if asked which planet is the biggest, the participants would often say #5 instead of saying the planet’s name, Jupiter.

In addition to the two web pages mentioned above, the second quiz had technical difficulty: if they answered any 1 of the 5 questions, it would say that they had 100% and not let them answer any of the 4 remaining questions. Therefore, I just had the participants point to the correct answer with the mouse, and then I told them if they got the answer correct or not. However, the other two quizzes seemed successful. The third quiz was especially successful in getting students to use the back button as there was a green back button next to every question. This quiz was self made using frames and layers instead of HotPotatoes.

The other web pages particularly the ones that included passages and the vocabulary study page (Figure 3) all seemed to be successful with few technical difficulties and these web pages seemed more profitable for autonomous learning.
When students clicked on the word in the Space Words webpage, it provided a pictorial example, an explanation, and the explanation could be heard if the participant chose to listen. The examples here were straightforward and some of the pictures were animated gifs, which seemed to help the participants understand a word’s meaning.

Classroom Implementation

Drawing on the results of this study, it seems that a tutorial with enhanced input does have some positive effects in the learning outcome of an elementary ESL student. That being the case, then how could this type of program be integrated into the elementary ESL and content area curriculum? One answer lies in the developer’s hands, as such a program would have to be developed by a book company and be made readily available to those interested in using a tutorial with enhanced input. Teachers themselves, even if they knew how to make
this type of web page, would not have the time to make it for every unit in their science or social studies book.

If online tutorials were made with enhanced input, both teachers and students would have to learn how to use these tutorials and ESL students should learn to use them autonomously. This could take some time upfront as I had to work with the participants in this study at first to use the tutorial effectively, teaching them how to click for the enhanced input and telling them that they should listen and click on everything twice. Eventually the participants were able to do the program by themselves and often they did choose to listen and click on the input consecutive times in a repetitive fashion. Consequently, they were not only able to use the program effectively, but they became more familiar with the computer and its functions, having to adhere to the visuals and attentively listen to the input. Using a computer, in general, probably helped them to click on things in other learning software programs.

A tutorial with enhanced input in the content classroom would most likely be utilized best as an added learning tool when ESL learners have free time or when they go to their ESL class. The participants’ ESL teacher perceived that the computer gives the participants help and picture-lexical item correspondence through the input modifications, textual glosses, audio, and images. She professed that this may provide them with an opportunity to name the unknown word or word known in the L1 and may help them comprehend the word in context. Next the computer provides reinforcement to the participant when the images with the vocabulary are made salient, providing the same words and images on different web pages. Further reinforcement presents itself when the salience is combined with the participants repeated actions, clicking on the input modifications more than one time. This
learning process and reinforcement helps them to filter out words that they hear in class, helping them to recognize these words and be active listeners in class. In turn, they may hear words in class and then those words may be reinforced on the computer through the enhanced input (K., Cantonwine, personal communication, March 23, 2005). The following flow-chart (Figure 4) was created by the researcher to explain the ESL teacher’s perceived notions of the computer tasks with her ESL students in this study.
Figure 4 – A graphic organizer that demonstrates the ESL teacher’s perceived notions of the computer tasks with her ESL students, the participants in this study.

- Images, textual/audio glosses on the computer
  - Gives immediate help through picture-lexical item correspondence relieving them of cognitive stress
    - Gives new name to a unknown word or word known in L1
    - Helps comprehend vocabulary word in context
  - Repetition and salience of the above
    - Provides reinforcement
    - Provides a filter
      - Helps them recognize words and be an active listener in class
      - Hear new words in class and then those words maybe reinforced on the computer.
The beginning of the flow chart starts with the input modifications (images, textual and audio glosses). Then the flow chart shows that input modifications give the students immediate help through picture-lexical item correspondence relieving them of cognitive stress. Next this immediate help gives the students a new name to an unknown word or word known in the L1 and also helps them comprehend the vocabulary word in context. Then the flow chart illustrates that repetition and salience of the input modifications provides reinforcement. Next the flow chart points to how this learning process helps them filter out words, recognize them, and become an active listener in class. Once they become an active listener in class, they may hear other new words, which then may be reinforced on the computer. The long line to the right points back to the beginning of the flow chart to explain that once students hear a new word in class it can be reinforced on the computer and the process can start all over again.

One day when Alex was watching a video in science class, he heard the word “satellite.” That day, as I observed him working on the computer, he saw a picture of the moon and said “this is a satellite,” suggesting that what he had heard in class was being reinforced as he was learning from the computer. As mentioned in the results section, both participants commented on how the computer helped them in class. Michael said “because when I don’t understand what teacher said and then when I just click the place and then it just showed me.” Alex said, “The teacher teaches you something in science and then it show in the computer...yeah, when you don’t know, it shows you in the computer.” Moreover, it suggests that computer-aid with enhanced input may be of better use when its assistance coincides with the classroom.
Learning in the Classroom and on the Computer

Though this study does not make it easy to separate out what students were learning on the computer versus what they were learning in class, the post vocabulary test does provide some clues, showing that the computer and the class were reinforcing each other. Alex got approximately 9 words correct that were presented on the computer and in class. However, there were words presented only on the computer that were still confusing Alex on the post-test. When analyzing Alex’s post-test, it seems that he was still a little confused about planets and the solar system and he did not recall the word “seasons.” He also had trouble with the word “asteroids” though these words were presented several if not numerous times in the online tutorial. In fact, he only knew the word asteroid after given a choice between “planet”, “rock”, and “goes around.” Once given a choice, he chose “rock”.

While there were words presented on the computer that he was unable to recall, there were also words that were presented to him only in class that he also missed. For example, he missed “telescope” even though he had discussed it with his tutor and he only got “atmosphere” partially correct knowing that it has to do with how cold or how hot a planet gets but never saying that atmosphere is “a layer of gases.” Similarly, Michael missed “in orbit” and part of “continent” and “country” that were words presented on the computer. Additionally, he missed “telescope” and “atmosphere” which were words presented in class. He got some words correct that were not presented in class like state and city, but then he got about 10 correct that were presented on the computer and in class. Again, this data also suggests that these types of CALL tasks may be best used when they coincide with the classroom.
Limitations of the study

Technical difficulty was the main limitation in this study. There were several technical difficulties with the web pages. I would design a web page that worked on a PC at Iowa State University, but when I would go to the elementary school, it would not work on their Macintosh computers. The functions of the web page would not only depend on the type of computer being used, but it would depend on the Internet browser being used. At the elementary school, I had to use the browser, Safari, for the web pages to work. Even then, quiz 2, would only let the participants answer 1 out of the 5 questions, so I told the participants to point to the correct answer. Then I told them whether their answer was wrong or right. The technical difficulties with my web pages also put my study on hold, not changing the outcomes of the study as written in chapter 4 of this thesis, but it did change some of procedures as I was supposed to start the study before they began the unit on the solar system in the 4th grade science class.

When collecting data, I encountered other technical difficulties. The Snapz Pro did not record several of the computer sessions with Alex and Michael as they worked on the computer. This affected the answer to question number three when I reported how many times participants clicked on the input modifications and the number of times they did certain web pages. Therefore, I had to base my answers on what had been recorded since I watched these videos and counted how many times they clicked on the input modifications to help answer question 3.

The third technical difficulty was the interview recording. Though the interviews were conducted in a quiet conference room, there was still background noise – possibly the air conditioner. Therefore, it was hard to hear certain things that the participants said.
Consequently, the transcripts say “undeterminable” in several places. Thus, important information may have been left out due to the quality of the interview tapes.

In addition to human subjects and technical difficulties, the page that explained neighborhood in relation to space was not self explanatory. It was here that a lot of explaining from me, the researcher, occurred to get the participants to understand not only the concepts behind each word, but also to help them understand that the solar system is inside or part of space and that the Earth was part of the solar system and thus forth.

While having to help the participants learn the material from one of the web pages was one limitation, doing this study while they were learning the same material in class could also be considered a limitation. In fact, sometimes they would discuss some of the solar system vocabulary in class and then they would see it again on the computer; then sometimes they would hear it on the computer first and then see it the same vocabulary again in class. Alex, for instance, heard the word satellite in a video they watched in science class and then when working on the computer, he pointed to Earth and said that it was a satellite. Since the participants were observed in their science class and on the computer, often times it was easy to know where they learned the information. However, because the classroom and the computer learning often coincided and the learning was intertwined, it is impossible to say that all the knowledge gained in this unit, as it was tested on the pre and post test, was solely learned from the enhanced input in the online tutorial. However, it is possible that the learning which took place in the class was reinforced by the computer and vice versa.

Suggestions for further research

This study only establishes a beginning into how enhanced input, repetition and salience with input modifications, could facilitate the elementary ESL learner and ultimately assist the
teacher in helping his or her ESL students understand the information and the linguistic forms that are in the texts. Therefore, further study does need to be conducted in this area. Consequently, a study, similar to this one, where students do a tutorial with enhanced input to help them with the content vocabulary before it is discussed in class could be organized to see if it would help the students build background knowledge. Sometimes ESL learners do not have the schemata that would help them understand the information being presented to them. The participants in this study, for instance, were preliterate with little formal schooling and had probably never heard of space even in their native language. Presenting the vocabulary and helping them understand what space was before they started on the unit would have built a framework. This framework would have facilitated a response and assisted them in learning the information presented in class. It would provide reinforcement, repetition, and possibly review instead of trying to learn a brand new concept (Cummins, 1984; Krashen, 1991).

Whether the study is carried out before the vocabulary is discussed in class or not, one could further investigate how an online tutorial with enhanced input is working to help these students in class. Does the enhanced input in an online tutorial reinforce what they are learning in class and vice versa? What types of enhanced input help the students with their classes the most? Are animated gifs more effective than still images? Can this type of modification be used for regular elementary students or elementary students with learning disabilities to help them in their content classes?

All of these questions could be refined and researched to help discover more about how enhanced input helps students including non-ESL students learn. In fact a researcher from the field of TESL and a researcher from the field of psychology or education could
collaborate to see how this type of input in an online tutorial affects the learning of elementary students in general. Moreover, a study that researched enhanced input online could be done with elementary students in English as a Foreign Language (EFL) setting, since the learning environment is different. A similar study could also be done with more participants for a broader understanding of how it helps or does not help elementary students in their content area classes. In addition, CALL tasks with enhanced input in the L1 and the L2 could be studied to understand if the L1 supported learning the academic language in the L2. The student could first do the CALL tasks in the L1 and then in the L2. Krashen (1991) states that if one has academic knowledge in their first language, this knowledge could aid second language acquisition when it comes to academic tasks.

If more is known about how enhanced input helps ESL students and even non-ESL students learn, then perhaps teachers and students alike will have an alternative way to overcome difficult linguistic constructions in textbooks. Thus, ultimately the elementary student would be relieved of cognitive stress and the elementary teacher would be excited to have an alternative approach to provide context-embedded instruction (Cummins, 1984).
APPENDIX A. VISUAL LITERACY QUESTIONNAIRE

1. a) What do you see in this picture above?
   b) Does it look like it is indoors or outdoors?

2. a) What do you see in this picture above?
   b) What is happening in this picture above?

3. a) What do you see in this picture above?
   b) Does the blue mean hot or cold?
   c) Does the red mean hot cold?
4. a) Do you think it is hot or cold in the picture above?

5. a) What do you see in the picture above?
b) Is it day or night?

6. a) What is in this picture above?
b) What is happening in the picture above?
7. a) What do you think that the red circle with the line through it means?

8. a) What is in this picture above?  
   b) What is it doing?

9. a) What color is this arrow?  
   b) Is the arrow pointing up or down?

10. a) What color is the arrow?  
    b) Is the arrow pointing up or down?
11.
   a) What color is the arrow?
   b) Is the arrow pointing up or down?

12.
   a) Do you know what is in the picture above?
   b) What other things do you notice?

13.
   a) What is the big object in this picture?
   b) Is it hot or cold?
   c) Where is the sun?
   d) What do you think is next to the sun?
14. a) Is it night or day?  
b) What do you see in this picture?

15. a) What is in the picture above?

16. a) What do you see above?  
b) What are those objects doing?  
c) Are they moving?  
d) Which way are they moving? Can you tell me by pointing to which direction they are going in?
17.  
a) What is in the picture above?  
b) What colors do you see?  
c) Do you think someone lives in the place above?  
d) What makes you think that?

18.  
a) Do you know what the object above is?

19.  
a) Is this a country or a city or a state?  
b) What do you think the blue part is?  
c) What do you think the different colored parts are?
APPENDIX B. PRE-TEST

Name: ____________

Pre-test Vocabulary Questions

Directions: I will read the words in the list. If I read a word and you know what it means, I want you to circle it. I may ask you to tell me what they mean, to draw me a picture of what they mean, or point to a picture that would tell me you understand the word. I am doing this because I want to see what words you know and what words you don’t know. If you do not know some of these words, it is okay.

1. neighborhood

2. city

3. state

4. country
5. continent
6. planet
7. earth
8. sun
9. moon
10. asteroid
11. equipment

12. fuel

13. telescope

14. solar system

15. star

16. orbit
17. atmosphere

18. satellite

19. seasons

20. revolve

21. rotate

22. in orbit
APPENDIX C. POST-TEST

Name: ____________

Post Vocabulary Questions

Directions: I will read the words in the list. If I read a word and you know what it means, I want you to circle it. I may ask you to tell me what they mean or to draw me a picture of what they mean. I am doing this because I want to see what words you know and what words you don’t know. If you do not know some of these words, it is okay.

1. neighborhood

2. city

3. state

4. country
5. continent

6. planet

7. earth

8. sun

9. moon

10. asteroid
11. equipment

12. fuel

13. telescope

14. solar system

15. star

16. orbit
17. atmosphere

18. satellite

19. seasons

20. revolve

21. rotate

22. in orbit
APPENDIX D. INTERVIEW QUESTIONS

Name:
Date:

Interview questions for the participants

1. How do you think the computer help you learn science?

2. Did you like learning from the computer? If so, what did you like best?

3. What did you not like about working on the computers? What made you feel this way?

4. Was it helpful to have me work with you at the computer? Would you have liked to work on the computer by yourself?

5. Did the pictures help you understand the meaning of the word that you clicked on?

6. Which pictures do you remember? Did this picture help you understand the word? Why?

7. Was it helpful to have the computer read to you? Why or How?

8. Did the quizzes on the computer help you learn the science? Which quiz did you like best?

9. How did working with the computer help you understand what your science teacher taught you in class? Did it help you?

10. What do you think you learned in class and what do you think you learned on the computer?

11. Would you like to work on the computer for other classes such as social studies? Why or why not?

12. Would you like to learn more of your science on the computer? Why or why not?
13. How do cities and neighborhoods relate to space? Or how do cities and neighborhoods compare to space? Or what did you learn about cities neighborhoods and space?

14. What did you learn about planets on the computer?

15. Can you name some space vocabulary that you learned on the computer?

16. Did you like the animated pictures better or the pictures that stayed still better? Why?

17. Did the animated pictures help you learn words such as revolve and rotate? How?

18. Did the still pictures help you learn words such as asteroid and seasons? How?
Interviewer: Researcher  
Interviewee: Alex  
Date: 3-8-05

**Researcher:** The first question is: How do you think the computer helped you learn science?  
**Alex:** Because something...computer [undeterminable]...something and it helped you- like I'm ..I mean I don't know something...the computer show you.  
**Researcher:** Like what...what's the something.  
**Alex:** Kind of like ....kind of like...learners  
**Researcher:** How does it show you?  
**Alex:** I don't know. Because computer.  
**Researcher:** How does the computer show you when you don't know something.  
**Alex:** [he is thinking]  
**Researcher:** How did the pictures help you understand the meaning of the word you clicked on?  
**Alex:** Because you click...you click something and then it showed the picture. [the rest is undeterminable].  
**Researcher:** it helps what?  
**Alex:** it helps if you want to take out.  
**Researcher:** What do you mean to take out?  
**Alex:** [undeterminable]  
**Researcher:** Does it help you understand the meaning of the word?  
**Alex:** yeah  
**Researcher:** Yeah? So when we showed...when it showed the picture of rotate...[Alex: uh-huh] on the ...[thing?] that helped you understand?  
**Alex:** uh-huh...yeah, you don't ..you can see the pictures.[undeterminable]  
**Researcher:** Which pictures do you remember?  
**Alex:** Which pictures do I remember?  
**Researcher:** uh-huh  
**Alex:** planets  
**Researcher:** Does this picture help you understand the meaning of the word?  
**Alex:** yeah  
**Researcher:** why?  
**Alex:** Because when you when you see the word, you don't know what it is and then when you click ...[undeterminable]...it have to show you the pictures.  
**Researcher:** Okay...that's a good answer. Do remember any other pictures?  
**Alex:** [undeterminable]  
**Researcher:** Can you think of any of the other ones that helped you understand?  
**Alex:** [undeterminable]  
**Researcher:** How did working on/with the computer help you with what your science teacher taught you in class? Did it help you?
Alex: The teacher teaches something in science and then it show in the computer.

Researcher: okay, the teacher teachers you something in science and then it shows you on the computer?
Alex: yeah, when you don’t know- it shows you in the computer.
Researcher: let me make sure I understand what you said-when the teacher teaches you something in science and you don’t know what it means [Alex: uh-huh]...then it shows you on the computer [Arrik: uh-huh]...Researcher: right? [Alex: uh-huh] Researcher: okay
Researcher: Would you like to learn more of your science on the computer?
Alex: yeah
Researcher: why?
Alex: cause computer will help me
Researcher: How will it help you?
Alex: what?
Researcher: How will it help you?
Alex: because …computer shows you what is wrong and what is not
Researcher: it shows you what is right and what is wrong?
Alex: uh-huh
Researcher: how does it do that?
Alex: I don’t know. Cause I don’t know anything.
Researcher: Cause you don’t know anything?
Alex: uh-huh
Interviewee: Michael  
Date: 3-08-05  
Interviewer: Researcher  
Location: Central Elementary at 1:30pm

Researcher: The other day you said that the computer helped you with reading. How did the computer help you with reading?  
Michael: Because when you click it, it just reads it to you.  
Researcher: Because what?  
Michael: Because when you click it, and then it just read it to you.  
Researcher: Because when you click it, it just reads it to you?  
Michael: Yeah, and then it helps me.

Researcher: How did it help you? Did it help you unders... learn new words?  
Michael: yeah...  
Researcher: learn how to read new words?  
Michael: yeah  

Michael: And then ..and then it help me picture of the pictures.  

Researcher: Did it help you understand the pictures...?  
Michael: Yeah  
Researcher: when it read to you?  
Michael: Yeah  

Researcher: un-kay. Um..Let’s see what else. Did the pictures help you understand the meaning of the word that you clicked on?  
Michael: Yeah.  
Researcher: Yeah?  
Michael: Yeah.  
Researcher: Which pictures do you remember?  
Researcher: Did these pictures help you understand the word?  
Michael: Yeah.

Researcher: So like, um...how did the picture of a spaceship help you understand the word?  
Michael: Because..because I knew them the as a word..and then when we look at the pictures.. and then..and then we just..and then we just said oh, I know this one. This picture is pictures for this one.  
Researcher: oh, okay.  
Michael: ...not understandable....

Researcher: And did you understand what that pictures meant most of the time?  
Michael: yeah.  
Researcher: yeah? What about the picture like..let’s see...how about...how about this picture...what does that mean?  
Michael: It mean...orbit.  
Researcher: Uh..uh... orbit...or... it could also mean?
Michael: ca...orbit and revolve.
Researcher: Good job! How did that picture help you understand orbit and revolve?
Michael: Because its...because its going around.
Researcher: Because its going around...it moves?
Michael: Yeah and then revolve mean it’s going around.
Researcher: uh-uh. Good job! Um..what about one that is not moving? What about this one?

Michael: The satellite. Researcher: Uh...uh. It doesn’t move.

Researcher: What doesn’t move?
Michael: It doesn’t move around the...
Researcher: The picture or the meaning of the word?
Michael: The pictures.
Researcher: The picture doesn’t move, right?
Michael: Yeah.
Researcher: It stays still, but did you still understand what it meant?
Michael: yes.

Researcher: What is a satellite?
Michael: Satellite..Its ki.. its kind of like little Researcher: uh-uh Michael: and its white
Researcher: uh-huh Michael: and then...and then it move around. Researcher: uh-huh
Michael: That’s all. Researcher: uh-uh.

Researcher: So maybe it’s a small object that moves around a bigger one. Michael: yeah.

Researcher: Do you think it’s always white?
Michael: No, I don’t think so.
Researcher: alright. Um...did the quizzes on the computer help you learn your science?
Michael: yeah.
Researcher: How?
Michael: cause when I just click it and then it start..and then it just show me and then its..and then its just reading to me.
Researcher: it reads to you?
Michael: yeah
Researcher: um the quizzes do? Remember the quizzes...this one [looking at the computer]...where you match?

Michael: and just like that and that...and just...and just...like that outside..and then I just miss it..and then just said its no and then when its right, and then it says yes.
Researcher: So it told you whether it was right or wrong?
Michael: Yes.
Researcher: okay. Which quiz did you like the best? Did you like the matching one, like this [looking at the computer]? Did you like the multiple choice one like this [looking at the computer]? Where you um...it gave you the picture and you had to find the word...or did you like the quiz that was multiple choice and it showed you the answer...it showed you yes or no at the top...then you could go back on this one, remember?

Michael: yeah, yeah.

Researcher: Which one did you like best?

Michael: [not understandable...something like “the picture”]

Researcher: All of them?

Michael: Yeah.

Researcher: Alright, is there something...did you like this one? Michael: Yeah.

Researcher: The one where it showed you yes or no at the top? Michael: Yeah.

Researcher: Why?

Michael: Because it shows the pictures here and then it goes in the top and then it just answer.

Researcher: Okay, did you ever use the green buttons to go Michael: Yeah Researcher: ...back and look at the answers Michael: yeah Researcher: Did that help you? Michael: yeah

Michael: Because when I just ..when I just...when I don’t understand and then I just click that Researcher: you mean the buttons. Michael: and then it show you. Researcher: like an example? Michael: Uh-huh Researcher: and then you were able to get the answer right? Michael: Yeah Researcher: instead of wrong. Michael: Yeah.

Researcher: Did the computer help you learn...did the computer help you understand things you learned in science or things that your teacher talked about in science class? Michael: Yes.

Researcher: How?

Michael: because when I don’t understand what teacher said and then when I just click the place and then it just showed me.

Researcher: It showed you?

Michael: Yeah. And then the teacher just stop and then I don’t remember what was that word and then it ....[this line was hard to hear...not sure if transcribed correctly]....

Researcher: because you learned it on the computer.

Michael: Yeah.

Researcher: So maybe if your teacher said rotate, you understood what it means.

Michael: Yeah.

Researcher: Can you think of any words where that happened?

Michael: undeterminable...
Researcher: Can you think of any words where you heard it in class and then you realized you knew it because you learned it on the computer?

Michael: Yeah

Researcher: Which word?

Michael: undeterminable at this time.

Researcher: What do you think you learned in class and what do you think you learned on the computer?
APPENDIX F. THESIS RESULTS VS. PILOT STUDY RESULTS

Before conducting this study with two Sudanese children, I conducted a similar pilot study with a third grader from Russia and a fourth grader from Malaysia. They too were asked to complete an online tutorial with enhanced input. Their online tutorial focused on social studies and geography. The social studies tutorial read the main passage to the participants, and showed a textual gloss and image for each vocabulary word with hypertext.

It is interesting to compare the perceptions of the participants in this study versus the perceptions of the participants in the pilot study. The participants in this study said that the audio helped them read. Alex said that “somebody read it to you and then you read again and then the computer teach you.” Michael said that “Because when you click it, and then it just read it to you….yeah, and then it just helps me.” Correspondingly, both participants in the pilot study said that listening to the story helped them also. Participant A said that it “tells me about it [what is happening]” and participant B said, “it helped me to say the correct words.” Therefore, 2 participants in one study and 2 participants in a similar but different study all admittedly said that the audio helped them to decode words or teach them after the computer read them the passage.

In addition to showing that the audio helped students in two different studies, both studies also revealed that the images helped the students to learn. In this study with the two Sudanese participants, Alex said, when asked if the images helped him, “Because when you see the word, you don’t know what it is and then when you click…it have to show you the pictures.” Likewise, Michael, said, “Because I knew them as a word and then when we look at the pictures and then…we just said oh, I know this one. This picture is pictures for this
one.” Equally, the participants from the pilot study suggested that the images helped them. Participant A said that the images and the sentence level definitions along with my explanation helped her understand the text while Participant B said that the images helped her understand the text most.

Since the input modifications of audio and images seemed to help participants in both studies, it seems that the feedback from the quizzes was also noticed by one participant from each study. When Michael was asked if the online quizzes helped him learn his science, he said, “cause when I just click it and then it start…and then it just show me…I just miss it and then just said its no and then when its right, and then its says yes.” In the pilot study, participant B said “it helped me to study and told me when answers were wrong.”

It is interesting to note the parallels between two similar studies that involved enhanced input in an online tutorial. It seems that the 2 participants from this study and the 2 participants from my pilot study agreed in similar ways that the web pages with enhanced input did help them learn the content area that they were studying.
REFERENCES


REFERENCES FOR WEBSITE


College of Liberal Arts and Sciences, Wayne State University. Retrieved November 27, 2004, from Department of Interdisciplinary Studies, College of Urban, Labor and Metropolitan affairs Web site:
http://www.is.wayne.edu/mnissani/a&s/Jupiter's%20moons.gif


http://vortex.plymouth.edu/sun/sun3d.html.

http://vortex.plymouth.edu/sun/sun3d.html.

Jones, P. School of Physics and Astronomy. Retrieved November 27, 2004, from School of Physics and Astronomy, Cardiff University Web site:
http://www.astro.cf.ac.uk/schools/talks/solar-system.jpg

http://www.synapses.co.uk/astro/tiltorbl.gif

http://scirealm.netfirms.com/gallery/planets_comets_asteroids/asteroids/Asteroids.jpg


http://www.geocities.com/rotempo/space-800.jpg.


http://www.lib.utexas.edu/maps/united_states/n.america.jpg.


http://nyfo.fws.gov/info/images/seasons.jpg


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