EFFECTS OF TWO MULTIMEDIA COMPUTER-ASSISTED LANGUAGE LEARNING PROGRAMS ON VOCABULARY ACQUISITION OF INTERMEDIATE LEVEL ESL STUDENTS

by

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(ABSTRACT)

Computer-assisted language learning (CALL) programs developed earlier for vocabulary acquisition employed mainly word-list pedagogy and could not present information in a real world context. Advancement in computer technology has triggered the development of multimedia CALL programs which can present information in different formats using graphics, sound, text, and video with links to other chunks of information.

The purpose of this study was to examine the effects of two multimedia CALL programs on vocabulary acquisition. Participants were 86 intermediate level English as a second language (ESL) students. They were randomly assigned to one of two treatment groups. Students in group one viewed a program with Motion Graphics and text. Students in group two viewed a program that had Still Graphics and text. Their task was to study ten names of hand and power tools. Both groups took the pretest, viewed the video of the tools, had an immediate posttest and a two-week delayed posttest.

The results yielded no treatment effects. Further analysis revealed time effects but no interaction between treatment and time. Students who learned through Motion Graphics performed significantly better on the recall tests than those who learned through Still Graphics. Further research in this area involving the use of various graphic formats in a CALL environment is needed.

DEDICATION

To my father,
Chief John Iheanacho Ogidi,
who died during my childhood
To my mother,
Lolo Anna Iheanacho,
And
My only sister,
Mrs. Maradie Eluchie,
whose untimely deaths occurred
while I was studying in USA.
May their souls rest in perfect peace.

To my lovely wife, Tina,
who never lost hope and patience,
but unselfishly sacrificed her time and pleasure
to support me spiritually, morally, and financially
throughout this journey.

Finally,
to my God given Children,
Vera, Michael, Kennedy, and Kingsley,
whose patience and understanding
inspired me to stay focused.

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CHAPTER ONE

Introduction

"Vocabulary ..... is an essential means of interchanging ideas and of acquiring new experiences... Man's growth in ideas has always been accompanied by a corresponding expansion of his vocabulary." (Gray 1939, p.1).

"When a pupil reads and learns the meaning of familiar words by context, there is reason to believe that the knowledge will be genuine and important." (Thorndike 1934, p.11).

*"**...**The commonest way and perhaps the best way to promote growth of content in words is to allow the child to infer the meaning from context" (Chambers 1904, p.50).*

Background of study

Vocabulary acquisition will be used interchangeably in this study with vocabulary learning. Researchers (Harley, 1996; Kolich, 1985; O'Rourke, 1974) point to vocabulary learning as a vital part of each student's life. According to O'Rourke (1974), it affects students' thoughts, actions, aspirations, and success, especially in academic achievement.

Studies noted that without an adequate knowledge of relevant vocabulary, students have difficulty performing the tasks required of them both in school and on the job (Harley, 1996; Kolich, 1985). Harley's study revealed a close connection between reading comprehension and vocabulary knowledge. According to Kolich, students who use a wide variety of words have little or no difficulty reading fluently, understanding the

author's intent, and expressing themselves correctly and concisely in both oral and written forms. Harley (1996) noted that vocabulary knowledge is fundamental to the development of second language proficiency. While many researchers accept the importance of vocabulary acquisition in language proficiency and academic achievement, their ideas about how vocabulary should be learned have varied widely. Mckeown & Curtis (1987) recognized two ways of learning vocabulary: word recognition and word meaning. This study will focus on a Contextualized vocabulary acquisition through word recognition in a computer-assisted language learning (CALL) environment. According to Mckeown & Curtis (1987), word recognition is mainly acquired through context.

Researchers in the field recognize the need for vocabulary acquisition especially at the intermediate level (Lessard-Clouston, 1996; Maylath, 1996; Prince, 1996; Siribodhi, 1995). One of the major concerns that both have is the need for developing effective pedagogical methods for the teaching of second language vocabulary. Traditional pedagogical methods for vocabulary acquisition include word-lists, dictionary use, workbooks, teacher-made materials, and group discussion. Yet developing effective pedagogical methods for vocabulary acquisition continues to demand attention and exploration.

One pedagogy which interests many researchers is computer-assisted language learning (CALL). Computer-assisted language learning programs have been found to be effective in many language learning studies (Asoodeh, 1993; Kolich, 1985; Siribodhi, 1995). The results of the studies showed that students who used CALL programs performed better than those who used traditional programs. Additionally, CALL

programs can enhance learning. They can provide individualized instructions and allow students to work at their own pace.

Discouragingly, many existing CALL studies concentrate on listening, reading, writing, and speaking, with very few exploring vocabulary acquisition (Ianacone, 1993; Jakobsdoffin & Hooper, 1995; Siribodhi, 1995). Furthermore, most of the available CALL programs for vocabulary acquisition employed the word-list pedagogical method. Word-list pedagogy is not an effective way of teaching vocabulary (Ianacone, 1993; Fitzgerald, 1995). According to Trump, Trechter & Holisky (1992), Ianacone (1993), Shrum & Glisan (1994), word list pedagogy does not introduce new words to be learned within their meaningful contexts.

Establishing contextualized vocabulary instruction within the CALL environment has not been well explored. Studies (Pusack & Otto, 1990; Shrum & Glisan, 1994; Pellow, 1995; Ciccone, 1995) suggest that video can be used to provide contextualized vocabulary instruction. The new words to be learned can be recorded in the form of video clips or quicktime movies and then incorporated into CALL programs. According to Ciccone (1995), "authentic video materials stimulate language acquisition and are thus an excellent source of comprehensible input" (p. 206).

Early CALL developers confronted limitations in the use of video, movies, and graphics (Siribodhi, 1995). It has been possible to develop interactive multimedia CALL because of the advancement in computer technology. According to Kalmbach (1994) and Siribodhi (1995), interactive multimedia CALL combines graphics, sound, video, and text to enhance learning. Furthermore, using graphics together with sound and text in CALL

to teach vocabulary is considered a vocabulary-remembering strategy (Kenning & Kenning, 1990). Graphics can be used to gain and direct the attention of learners. Additionally, graphics are effective in creating mental images that help to improve recall, retention, and imagination of information being learned (Rieber 1994; Ciccone, 1995).

It is not clear whether multimedia CALL with video, motion graphics format, or still graphics format would represent a better method of learning vocabulary for English as a second language (ESL) students. Research in this area is still developing because the use of multimedia CALL in vocabulary acquisition is still new. Investigation of the effectiveness of different graphic formats in a multimedia CALL environment is needed. The purpose is to investigate which of the graphic formats would represent a better pedagogical method of learning vocabulary by the intermediate level ESL students. The investigation can provide a better understanding of how Multimedia CALL programs should be improved with graphics to enhance vocabulary instruction.

Intermediate level English as a second language (ESL)

English as a second language (ESL) is the term often used by practitioners to refer to English taught to non-English speakers in situations like the United States, where English is the primary language of communication. Regrettably, Maylath (1996) pointed out that "vocabulary has been overlooked as an area of research at the intermediate ESL level" (p. 220). Earlier, Gaskill (1979) had pointed out the characteristics of the intermediate level ESL student. According to Gaskill,

> the intermediate level student has completed one basic course similar in content to a college level, first-year foreign language course and has at least been exposed to most of the basic grammar. The student has learned to read in the second language, but probably has read very short or simplified selections. Although the student makes many mistakes and has real difficulty in participating in native English conversation, the student is able to make himself/herself understood in the classroom, but generally unable to consistently produce a well-organized English paragraph (p.144).

Currently, the characteristics of intermediate level language learners have been summarized under speaking, listening, reading, and writing guidelines. According to American Council on the Teaching of Foreign Languages (ACTFL) Proficiency Guidelines (1990),

> the intermediate level in speaking is characterized by the speaker's ability to:
>
> > create the language by combining and recombining learned elements, though primarily in a reactive mode; initiate, minimally sustain, and close in a simple way basic communicative tasks; ask and answer questions; and use basic grammar with limited control (p. 237).
>
> In listening, the intermediate level is characterized by an ability to
>
> > understand main ideas and some facts from interactive exchanges and simple connected aural texts (p. 242).

In reading, the intermediate level is characterized by the ability to:

> understand main ideas and some facts from simple connected texts (p. 245).

In writing, intermediate level is characterized by an ability to meet

> practical writing needs by communicating simple facts and ideas in a loose collection of sentences with a limited control of basic grammar (p. 249).

Students at the intermediate level of ESL learning need to increase their vocabulary and to develop strategies for coping with unfamiliar words (Gaskill, 1979; Trump, Trechter, and Holisky, 1992; Harley, 1996). Gaskill (1979) conducted a study based on Stafford's (1976) research in tutoring ESL students in reading, and in using Goodman and Burk's (1972) reading miscue inventory. He found intermediate level ESL students in need of strategies to enhance their vocabulary. Gaskill recognized that vocabulary needs continued growth and development for both native and non-native speakers long after grammar and pronunciation are under control.

A majority of the intermediate level ESL students are adults who moved to the United States from various non-English speaking countries. Limited English proficiency can delay their success and cause social and economic problems. According to Trump et al. (1992), students who learn English as a second language need rapid and continual increase in vocabulary. Increase in vocabulary can enhance their language development and increase their chances of succeeding in this country. Furthermore, they can contribute to the economic growth and social well being of the nation.

Details of English vocabulary and language problems that confront ESL students in general and intermediate level ESL students in particular can be found in a body of earlier as well as recent literature (Mackey, 1973; August & Garcia, 1988; Barker, 1989; Fitzgerald, 1995; Ovando & Collier, 1995). The problems include poor academic achievement, high dropout rates, lack of communication skills, inadequate cultural orientation, lack of certified ESL personnel, and poverty. The Federal government officially recognized as far back as October 1964, that there were thousands of pupils in the United States whose mother tongue was not English. Those pupils needed special instruction in English if they were to understand and participate in the American cultural, social, and economic way of life (August & Garcia, 1988).

The study conducted by Fitzgerald (1995) showed that about 2.3 million students in the United States have been identified as having Limited English Proficiency (LEP). In California alone, about 50% of all students speak a language other than English as their primary or only language. The number is expected to increase by 70 percent by the year 2030 (Fitzgerald, 1995). The educational achievement, including reading achievement of language minorities has not kept pace with that of English-speaking students. A reading test given in 1983 and 1984 by the National Assessment of Educational Progress showed that language minority students were considerably below the national average at grades 4, 8, and 11. Among the language minorities, for example, there was a 40% high school dropout rate, a 35% grade retention rate, and a two to four grade level achievement gap (Steinberg, Blinde and Chan, 1984; August and Garcia, 1988).

There is great need for research on vocabulary learning strategies utilized by language learners of different proficiency levels and ages (Celce-Murcia & Rosensweig, 1979; Fitzgerald, 1995; Maylath, 1996). Since multimedia CALL can enhance language learning (Najjar, 1996), its various pedagogical methods for vocabulary acquisition can help ESL students to increase their vocabulary. But the effectiveness of the various pedagogies for vocabulary acquisition using multimedia CALL needs to be studied. Such study can serve as a guide toward the more effective teaching of vocabulary.

If effective pedagogy for vocabulary acquisition is not provided to ESL students, such students may constitute social and economic problems for the nation by depending more on social welfare. On the other hand, if effective pedagogy for vocabulary acquisition is provided to them, the chances of learning English can increase. Thus, the communication skills of ESL students can improve and their chances of being employed can increase. Consequently, they can contribute to the economic growth of the nation by becoming productive members of the society.

Statement of the Problem

A great number of people from non-English speaking countries migrates to the United States for various reasons. They cannot adjust socially, economically, and culturally if they cannot speak English. Delay in helping them to master vocabulary quickly can delay their ability to speak English. Ultimately, this can lead to more economic and social problems. The problem is that their inability to speak English can hinder the development of appropriate communication skills needed for gainful

employment, success in schools, and adapting to the new culture. Thus, their chances of succeeding in schools and being employed cannot be assured as a result of their communication problems.

Purpose of Study

This study examined the effects of two multimedia computer-assisted language learning (CALL) programs on vocabulary acquisition by the intermediate level ESL students. The first program consisted of Motion Graphics and Text. The second program consisted of Still Graphics and Text. The purpose was to investigate which of the programs would represent a better environment for learning vocabulary by intermediate level ESL students. The second purpose was to examine which of the programs would help the intermediate level ESL students retain vocabulary words longer. The result of this study will contribute to the body of knowledge relating to intermediate ESL students who learned from Motion Graphics and Still Graphics.

Research questions:

The following research questions were asked:

1. Will the multimedia CALL program with Motion Graphics and Text help intermediate level ESL students improve their vocabulary scores?

2. Will the multimedia CALL program with Still Graphics and Text help intermediate level ESL students improve their vocabulary scores?

3. Will the multimedia CALL program with Motion Graphics and Text help intermediate level ESL students recall vocabulary information after two weeks of vocabulary instruction?

4. Will the multimedia CALL program with Still Graphics and Text help intermediate level ESL students recall vocabulary information after two weeks of vocabulary instruction?

Hypotheses:

In order to answer the research questions, the following seven null hypotheses were generated:

1. There is no significant difference between Motion Graphics treatment and Still Graphics treatment (No treatment effects).
2. There is no significant difference in vocabulary scores across the three tests (Pretest - Posttest - Delayed posttest).
3. There is no interaction between Time and Treatments.
4. There is no significant difference between group Pretest (T1) and Posttest (P2) means. (No Time effect from T1 to T2).
5. There is no significant difference between group Posttest and Delayed posttest means.
6. There is no significant difference between Pretest and Posttest means and between Posttest and Delayed posttest means in the Motion Graphics treatment group.

7. There is no significant difference between Pretest and Posttest means and between Posttest and Delayed posttest means in the Still Graphics treatment group.

Delimitations

This study will examine the effects of two computer-assisted language learning programs on vocabulary acquisition of intermediate ESL students. One program will consist of motion graphics and text. The second program will consist of still graphics and text. It will not be concerned with any other instructional design that may involve computer languages, extensive learning theories, strategies, models, grammar structure, word processing, spreadsheet, French, Spanish, or other native language of the students except where these are specifically relevant and may be mentioned in transit.

This study will be limited to the examination of the effects of two multimedia computer-assisted language learning (CALL) programs on vocabulary acquisition of intermediate level ESL students. The sample population will be intermediate level ESL learners. The result of the study can be applied only to institutions such as schools, colleges, and universities that have intermediate level ESL students.

Definition of Terms

CAI: is the use of the computer to assist in instructional activities. It is commonly used to refer to tutor applications such as drill and practice, tutorials, simulations and games (Chimezie, 1987).

CALL:Computer Assisted Language Learning is defined as a means of using computer to present, reinforce and test particular language items (Jones and Fortescue 1987).

Graphic: Any visual representation that the authors use to highlight, clarify, illustrate, summarize, or complement their text (Mcgrath, 1995).

Interactive Multimedia: The use of the computer to present and combine text, graphics, audio and video with links and tools that let the user navigate, interact, create, and communicate (Hofstetter 1994).

Still visuals: Images, including text, displayed on a computer monitor without the illusion of movement in space (Rieber, 1990)

Motion Graphics: Images, including text, displayed on a computer monitor with the illusion of movement in space (Rieber, 1990)

CHAPTER TWO

Review of Literature

Introduction

In this chapter, the related literature on vocabulary acquisition will be presented. Literature on how information is processed will be reviewed. Furthermore, visual research, imagery and studies relating to multimedia CALL will be presented. Finally, the effects of Motion and Still Graphics on learning will be reviewed. Motion, dynamic, and animation have been used interchangeably in many studies to represent movement (Rieber, 1994; Asoodeh, 1993, Bricker,1991). Research findings or literature in which motion, dynamic or animation was used will be considered in this study.

Overview of vocabulary acquisition

This section provides an overview of the importance of vocabulary in language learning and reviews literature relating to pedagogical methods for vocabulary acquisition. The importance of vocabulary in language learning has been reported by many researchers (Harris, 1969; Evans, 1978; Pouwells, 1992; Bismonte, Foley & Petty, 1994; Pellow, 1995; Watts & Bucknam, 1996; Laufer, 1996). Yet little attention is paid to vocabulary learning (Cates & Swaffar, 1979; Prince 1996). Vocabulary can play an important part in the development of the four language skills: speaking, listening, reading and writing

(Harris, 1969; Siribodhi, 1995). Evans (1978) pointed out that vocabulary can provide clarity and can enable the speaker to diversify language. Evans further explained that wrong use of vocabulary can lead to misinterpretation, whereas correct use of vocabulary makes it easier for people to read and write better, understand the main ideas and speak correctly.

According to Harris (1969), two important components commonly shared by speaking, listening, reading and writing, are vocabulary and grammatical structure. The third component is phonology (sound system). Furthermore, vocabulary has a unique quality that other components (grammatical structure and phonology) do not have. Whereas grammatical structure and phonology are mastered early in the language learning experience, speakers continually add to their vocabulary store (Robinett, 1978). Robinett stressed that vocabulary helps speakers to continually improve in speaking, listening, reading and writing, irrespective of the levels of language learning.

Students point to lack of vocabulary as their primary problem in second language learning (Celce-Murcia & Rosensweig, 1979; Knight, 1994). According to Knight, vocabulary acquisition is considered by many to be the single most important aspect of second language learning. Additionally, a majority of students studying second languages and their teachers cite vocabulary as their number one priority (Knight, 1994). The recognition of the importance of vocabulary in language learning by many researchers has propelled the search for effective pedagogical methods of teaching new words. One pedagogical method that has gained the interest and attention of many researchers is introducing new words through a meaningful context and then teaching those new words

from that context. The argument is that the meaning of a word lies in its meaningful context (Gaskill, 1979; Celce-Murcia & Rosensweig, 1979; Trump, Trechter & Holisky, 1992; Knight, 1994; Shrum & Glisan, 1994; Pellow, 1995; Watts & Bucknam, 1996; Zimmerman, 1997).

Shrum and Glisan (1994) provided many pedagogical methods for foreign language learning. In developing vocabulary skills, they expressed the view that new vocabulary should be introduced in a context using familiar vocabulary and grammar. In order to learn new words more effectively, they recommended the use of visuals for introducing new vocabulary. However, they were not specific as to whether motion or still visual would be more effective in introducing new vocabulary. Furthermore, Trump, Trechter and Holisky (1992) believe that introducing and teaching vocabulary through concepts and word domains would lead to a rich variety of activities that appeal to students with different learning styles. Additionally, Trump et al. hold the premise that using charts to display the words would aid the students in visualizing the domains and remembering them.

One of the problems confronting most teachers is how to provide the context from which the new vocabulary can be taught. In discussing the techniques for teaching vocabulary in context (Gaskill, 1979; Celce-Murcia & Rosensweig, 1979; Pusack & Otto, 1990; Ianacone, 1993, Shrum and Glisan, 1994; Pellow, 1995) suggested that songs, games, field trips to Zoos, museums and parks would provide opportunities for teaching vocabulary in context. Furthermore, they contended that visuals and audiovisual

materials such as charts, video, television, filmstrips, slides and movies are other means through which contextualized vocabulary can be taught.

Research for effective methods of teaching and learning vocabulary is still on-going (Ianacone, 1993). Since the emergence of computers in education, the research scope has extended to the use of computers in the form of Computer-assisted instruction (CAI). Computer-assisted instruction, as its name implies, is the use of the computers to assist in instructional activities. It is commonly used to refer to tutoring applications such as drill and practice, tutorials, simulations, and games (Chimezie, 1987; Rieber, 1994). According to Chimezie, CAI is only a part of computerized instruction which is a global term describing the various applications of computers in instruction.

Within CAI, many researchers and educators have been interested in Computer-assisted language learning (CALL). A problem associated with CALL is that most of the available CALL programs for second language and vocabulary acquisition are text based and in most cases present words out of context (Ianacone, 1993; Fitzgerald, 1995; Jakobsdoffin & Hooper, 1995; Siribodhi, 1995; Gan, Low, & Yaakub, 1996). The majority of the programs are in reading, writing, speaking and listening, with limited programs relating to vocabulary acquisition. Furthermore, most of the CALL programs in vocabulary acquisition employ the word-list method (Ianacone, 1993). Ianacone described words studied through word lists as unemployed words that are out of any meaningful context. He holds the premise that until students are actively engaged in studying word meanings as they occur in full-context material, vocabulary study cannot be effective.

One of the problems confronting CALL designers centers on how to establish contextualized vocabulary instruction in CALL programs. The incorporation of video clips or quicktime movies into CALL programs can provide contextualized vocabulary instruction (Pusack & Otto, 1990; Pellow, 1995). Students can view the movie or the video of a concept to provide contextualized learning. Thus vocabulary activities can be created that develop the meanings of words within the context. The new words to be learned can then be recorded in the form of video clips or quicktime movies and incorporated into CALL programs. Pellow (1995) noted that videos can provide real world and relevant resource for students. According to Pellow, many descriptions of movies or videos promote problem solving skills. Anderson (1985) suggested that problem solving activities are fundamentally cognitive activities. Cognitive processing can be better understood through an information-processing model which explains how information is mentally processed. In other words, if descriptions of movie or video promote problem solving skills, it can be inferred that they promote mental processing of information.

Information Processing

Cognitive models can help us understand how people interact with and process graphic materials. According to Willows & Houghton (1987), graphic materials are seen as essential for developing effective prescriptive principles of visualized instruction. Finding scientific means for studying the mental processes and events involved in the

acquisition and application of knowledge has been the focus of cognitive researchers (Howard, 1983). Cognitive theorists assume that any complete theory of human cognition must include an analysis of the plans or strategies people use for thinking, remembering, understanding and producing language. Chomsky (1965) argued that traditional stimulus-response and behavioristic theories are in principle inadequate to account for the acquisition and use of human language. He further argued that since language plays such a central role in human thought and human affairs, a theoretical approach that cannot encompass language must, from necessity, be inadequate for understanding human cognition.

Cleveland and McGill (1984) also advised that researchers should look for a model based on a scientific foundation for graphic presentation. According to Miller (1989), the information-processing model provides a process by which graphic representations are decoded and encoded. It focuses on how the human memory system acquires, transforms, compacts, elaborates, encodes, retrieves, and uses information (Miller & Burton 1994). The memory system explains the interrelationship among the three main storage structures of the brain: Sensory register, Short term memory (STM), and Long-term memory (LTM). The Sensory register is closely tied to sensory experience. It holds small and unanalyzed information that is retained for a short time. The information received at this stage is raw and unprocessed and is then transferred to a more flexible and useful storage called Short-term memory (STM).

According to Schwartz and Reisberg (1991), the STM provides a small storage repository where the information is repeated over and over through a maintenance rehearsal process. When a piece of information is repeated and rehearsed, the probability of retaining that information can increase. But the STM is limited in how much information it can hold. The maintenance rehearsal helps to transfer the excess information which is not yet needed to another storage called Long-Term Memory (LTM). LTM provides a storage place of great size containing information that is not immediately active so that the information can be retrieved when needed. According to Miller (1989), LTM helps people to recall events, solve problems and recognize patterns. It is the repository in which we carry out all that we know (Schwartz & Reisberg 1991).

The interrelationship between STM and LTM explains how visual information can enhance retention and recall. According to Posner (1969), visual information can persist in STM after the stimulus is diminished. Additionally, visual information can be activated and retrieved from the LTM. The information processing model can account for the effectiveness of visuals in learning.

Visual research

Several studies (Paivio, 1971, 1986, 1991; Dwyer, 1978; Hannafin, 1983; Kobayashi, 1986; Levie, 1987; Arnhein, 1994) give credence to the use of visuals, especially when visuals and words are both used in teaching and learning. Arnhein (1994) stressed that visual learning uniquely enhances students' cognitive understanding of

abstract concepts. His argument was that a student's perception of ideas such as causality can be enriched by a visual example. Thus visuals can lead to development of perceptual thinking.

The concept of a concrete-abstract continuum as proposed by Bruner (1973) supports the use of visuals and words in instructional delivery. Bruner proposed that instruction should proceed from direct experience to iconic representation of experience, such as pictures and films, and then to symbolic representation such as words. Heinich, Molenda and Russell (1993) agree that learning is facilitated when instruction follows a sequence from actual experience to iconic representation, and then to symbolic or abstract representation. Visuals make abstract information more concrete and are suited for analogical reasoning (Levie, 1987).

The use of graphics, charts and diagrams explains the relationship between pictures and words in a learning environment (Winn, 1987). Earlier researchers (Knowlton, 1966; Doblin, 1980; Dale, 1969) asserted that pictures resemble what they stand for and describe phenomena, while words name and explain them. According to Winn, presenting information or problems in graphic forms can encourage students to use mental skills that can be more effective than verbal skills. The abstract nature of words can make them appropriate to explain how processes work. Gagne (1985) expressed the view that oral or printed language is seldom employed by itself to accomplish all instructional functions. Carey and Hannafin (1981) reported increased recall of information in grade school students when pictures were used with prose. The Anglin (1986) study showed that graduate students who received the picture and prose treatment

performed better than those who received the prose-only treatment. Anglin and Stevens (1987) conducted another study to determine if there would be significant variation in the use of picture and prose. They found that college students who received the picture and prose treatment remembered significantly more data than those who received prose-only treatment.

Pictures and prose can be used to help both skilled and unskilled readers to enhance their reading skills (Holmes, 1987). Holmes studied the ability of 116 fifth and sixth grade students to answer inferential questions. Three groups were established. The first group used pictures, the second group used prints, and the third group used a combination of prints and pictures. His purpose was to examine skilled and unskilled readers to see if there would be a significant difference in their ability to answer questions in each approach. He found that pictures enabled both skilled and unskilled readers to answer inferential questions. Holmes therefore suggested using pictures to initially improve inferential reading, and then gradually advancing to using print only.

Markham (1993) conducted a study to show that visual support improves the comprehension of second language students. His objective was to find the effects of visual support from captioned video with undergraduate ESL students. The students viewed two instructional programs. His findings showed that students learned significantly more when visual support from captioned video was used than when it was not used.

Furthermore, Siribodhi (1995) used CALL containing Still Graphics, English text, Thai text, and sound to test their effects on vocabulary acquisition by elementary level

ESL students. Pictures of the human body along with ten vocabulary items were administered to three treatment groups. The first group used English text, Thai text, and sound treatment. The second group used English text, picture, and sound treatment. The third group used English text, Thai text, picture and sound treatment. Siribodhi found that the groups that used graphics, text and sound scored significantly higher in immediate and delayed posttests than the group that used English text, Thai text, and sound. The difference found in picture matching of the two posttests was insignificant. He concluded that pictures positively influenced students' recall.

Additionally, Koskinem, Markham, Knable, Jensema & Kane (1996) examined the effects of captioned television on the incidental vocabulary acquisition of seventy-two inmates of a Pennsylvania correctional facility. Participants viewed nine science information segments over a nine-week period. They were randomly assigned to one of the two groups. One group viewed the science video segments with captions, and the other viewed the video materials without captions. The test consisted of word recognition, sentence anomaly, and word meaning measures. The results showed no significant difference between the two groups on the word recognition and sentence anomaly posttests. Significant differences were found in the word-meaning test favoring the captioned television approach. Answers to the questionnaire administered after the treatments favored the captioned television approach. Koskinem et al. (1996) recommended the use of captions in the second language context.

When graphics and words are combined, the probability of recall is increased (Rieber and Kini, 1991). Graphics can provide a mental image of information. Imagery

studies attest that mental imagery can facilitate learning and recall of information (Paivio, 1971, Rieber, 1994). Computer graphics can give the learner a mental image that may be useful in vocabulary acquisition.

Imagery and vocabulary acquisition

The impact of imagery on long-term remembering, as noted by Schwartz and Reisberg (1991), can be shown by manipulating the to-be-remembered vocabulary rather than the instructions to learners**.** Imagery studies have long suggested that mental imagery facilitates memory. Studies (Paivio, 1969; Paivio, Yuille, & Madigan, 1968) supported imagery's positive effects on memory. In one such study, college students were given a list of nouns and asked to rank them on a scale of 1-7 for how readily the nouns evoked an image. The words to receive high ratings were "elephant" with an average rating of 6.83 and "church" with an average rating of 6.63. Words like "virtue" and "context" received 3.33 and 2.13 respectively. The study on this memory performance was repeated before the conclusion was drawn that high imagery words can enhance learning. A different group of subjects was asked to memorize lists of words using the same words for which imagery ratings had been taken (Paivio, 1969). Subjects learned more high-imagery words than low-imagery words. They learned word pairs best if both words in the pair were high-imagery words, at intermediate levels if one word in the pair was a high-imagery word and the other a low imagery word, and worst if both words were low-imagery words (Paivio, Smythe, & Yuille, 1968).

Furthermore, a study conducted by Paivio and his associates (1971) revealed that when learners are instructed to use images to commit a list of words to memory, recall is

facilitated dramatically. In the study, subjects were required to learn pairs of words by rehearsing each pair, by making up a sentence for each pair of words, and by forming a mental image for each pair of words, with the image combining the words. They found that subjects who learned through imagery performed better on a recall test.

In this light, McCuistion (1989) recommended the use of computer graphics to give the learner a mental image that may be useful in communicating the concepts. Many imagery studies support the use of graphics with words. According to Paivio (1971), graphics and words are coded in two independent and interrelated subsystems. They are called visual and verbal subsystems respectively. Studies on how the two subsystems work were conducted by Paivio and his associates in late 60s and early 70s. Their studies led to dual-coding theory, which explains how mental images are encoded and decoded. Dual-coding theory provides a better understanding of how the two subsystems work.

Dual-coding theory

Dual-coding theory came as a result of earlier studies conducted by Paivio and his associates (Paivio, Yuille, & Madigan, 1968; Paivio & Csapo, 1969; Paivio, 1969; Paivio, 1971). The findings of the studies led Paivio to propose a dual-coding theory which contends that pictures and words activate independent visual codes (imagens) and verbal codes (logogens). The verbal system is language-like and specializes in linguistic activities associated with words and sentences, whereas, the visual system is thought of as a code for images and other picture-like representations (Rieber, 1994; Rieber, 1992). Rieber further explains that both verbal and visual subsystems have unique properties. Whereas

logogens are stored in the verbal system as discrete elements, resembling words and sentences, imagens are stored as continuous units in the visual system.

According to (Paivio, 1986; Rieber, 1992; Rieber, 1994), dual coding theory assumes that three levels of processing can occur within the verbal and visual systems. These are: representational connections, associative structure, and referential connections.

Representational connections occur between incoming stimuli and either the verbal or visual system. Whereas verbal stimuli activate verbal memory codes, visual stimuli activate visual memory codes. For example, hearing the word "computer" activates the verbal system, but seeing the picture of a computer directly triggers the visual system. Referential connections are made between the verbal and visual systems. For example, reading or hearing the word "computer" stimulates the appropriate logogen in the verbal system and at the same time forms a mental image of a computer. This shows that the verbal system has activated the imagen in the visual system corresponding to a computer. Rieber (1994) explained that the important aspect of referential connections between the verbal and visual systems are not one to one, but can be one to many. For example, seeing a picture of a computer may invoke many verbal responses, such as an Apple computer, an IBM computer or a Laptop computer. This concept can be applied when using pictures to learn vocabulary.

Associative structures refer to activation or processing of information within any of the systems. The processing of information in the verbal system is assumed to be sequential or linear; whereas, processing of information in the visual system is believed to be parallel or synchronous. The separate coding systems, however, can aid each other so

that something coded in both picture and verbal forms can be easily remembered (Rieber, 1994). The difference between these two coding systems is that pictures are more easily remembered than words (Hannafin, 1983; Rieber, 1994). However, the probability of recall is increased due to the availability of two mental representations instead of one. If one memory trace is lost, the other is still available (Rieber & Kini, 1991). Rieber (1992) recommended dual-coding theory as a good theoretical foundation for the design of visual instruction. Information encoded in both verbal and visual forms, with strong and flexible links between the codes, should enhance retention, retrieval, and transfer (Rieber, 1994).

Multimedia CALL and vocabulary acquisition

Recent advancement in computer courseware design has made it possible to develop interactive multimedia CALL. Earlier, CALL programs were limited to text (Siribodhi, 1995). According to Hofstetter (1994), interactive multimedia is the use of computers to present and combine text, graphics, audio, and video with links and tools that let the user navigate, interact, create, and communicate. Hofstetter explained that interactive multimedia allows individual learners to set their own pace and branch into different options according to their interest. The interaction that the system offers increases attention, understanding, and retention of information being communicated and at the same time provides the opportunity to learn by doing (Kalmbach, 1994).

It is not clear if interactive multimedia CALL using motion graphics or still graphics will be more effective for ESL students in learning vocabulary. Most of the

available CALL software for vocabulary acquisition could not employ graphics and videos, and relied on word-lists (Siribodhi, 1995). Barker (1989) suggested that multimedia computer-assisted techniques can be used to create a wide variety of different interactive learning environments. These environments, he continued, are usually designed in such a way that the learning processes are learner controlled, participative, and highly motivational. In using technology to enhance linguistic acquisition, Sharp, Bransford, Goldman, Risko, Kinzer, & Vye (1995) asserted that multimedia technology allows precise coordination of linguistic and visual information. According to them, multimedia technology can provide teachers with tools for enhancing literacy foundations in children, especially those who might be at risk for school failure.

Computer-assisted language learning can be used to enhance the English vocabulary skills of increasing numbers of students in this country and all over the world who have been identified as having limited English proficiency (Fitzgerald, 1995). Babbit (1993) reported that computer-assisted reading materials have been found to be effective as a supplement to teacher-directed instruction for low-achieving elementary students. Babbit added that interactive multimedia programs have been used successfully in high school social studies classes with remedial students and students with learning disabilities.

Additionally, the Chambless & Chambless (1994) study compared the effectiveness of computer-based instruction in grades K-2 to traditional instruction of second graders in reading and writing. Students of the same socioeconomic status, race, and sex were compared in reading and writing tests. The authors reported that students who used computer-based instruction performed significantly better than those who used

traditional instruction. In addition, the experimental group (i.e., the group that used computer-based instruction) performed significantly better on measures for writing than the control group. Computer-based instruction was also found to provide classroom teachers with a powerful instructional tool for teaching writing to K-2 students.

Holmes & Keffer (1995) used a computerized program over a six-week period to teach high school students to use Latin and Greek root words for deciphering English terms. The purpose was to increase their scores on the verbal portion of the Scholastic Aptitude Test (SAT). The computer program was based on the Apple Hypercard system. In the study, 115 subjects from the college-preparatory-level English classes at one high school participated. The Solomon four-group design was used in the study and subjects were randomly assigned to each of the groups. Group 1 took a pretest and a posttest, used the computer program to learn Latin and Greek root words, and learned how to use them to decode English words. Group 2 took the pretest and the posttest. Group 3 used the computer program and took the posttest. Group 4 took the posttest. Their findings showed that those who used the computer program performed better and also enjoyed their instruction more than those who did not use the computer program.

A study involving the use of computers to learn vocabulary was conducted by Gan, Low, & Yaakub (1996). The study was an attempt to model teaching of vocabulary with a computer-assisted approach in the Teaching of English as a Second Language (TESL) preservice teacher education program. Computer-assisted approach provides both the speed and the memory power to search whole texts for the multidimensional occurrence of words. Forty eight subjects in the TESL Matriculation Program were

randomly assigned to either an experimental or a control group. A two-stage pretest-posttest experimental design was used. The study was conducted in two stages, each lasting 5 weeks. In each stage, the subjects were involved in five 2-hour sessions of computer-assisted exercises. The subjects in the control group were taught vocabulary skills the conventional way. In stage 2, the groups were switched around to allow both groups to experience both methods of teaching vocabulary skills (conventional classroom instruction and computer-assisted instruction). The pretest and posttest were equivalent forms of the same test and included items of multiple-choice, filling in tables, and filling-in-the-blank formats. Questionnaires were administered at the end of stage 2 to solicit students' opinions pertaining to the choice of the instructional approach. The findings overall showed that the computer-assisted approach was more effective than the conventional classroom instructional approach for teaching vocabulary skills. Based upon the subjects' responses in the feedback questionnaire, the authors recommended that the computer-assisted approach be used as a complement to conventional classroom instruction in vocabulary skills. They added that the computer-assisted approach can enrich the multicontext vocabulary learning experience.

Researchers are showing interest in using multimedia programs to test various language learning outcomes. Raphan (1996) developed a multimedia CALL program used to conduct a pilot study to determine how adult ESL students would handle the multimedia screen with simultaneous audio, visual, and note taking. The result showed that students adapted to the multimedia information quickly. Additionally, students interacted positively with the system, practiced grammar and vocabulary in context and

commented on the usefulness of the individualized instruction. Furthermore, students' listening comprehension and vocabulary improved. There was also an improvement in their reading ability. Raphan (1996) admitted that learners learn best from presentations that most closely simulate reality. She recommended the use of multimedia CALL as a supplement to enhance ESL programs.

A similar study was conducted by Masters-Wicks, Postlewate & Lewental (1996). They developed an interactive multimedia software as a part of an on-going effort to integrate multimedia technology into language curriculum. Their main goal was to develop faculty awareness of the potentials of multimedia tools in language instruction. Learners were exposed to new vocabulary and language functions through the video segments of the lesson. The video segments provided the immediate real-life contexts that enhanced assimilation of the lesson materials. The result of the survey and interview conducted after the lesson showed that students unanimously expressed enthusiasm for the interactive multimedia program. The students also felt that their listening comprehension skills improved and that the program was challenging and entertaining.

Studies (Reid, 1996; Davis & Lyman-Hager, 1997; Zimmerman, 1997) showed the effectiveness of multimedia CALL on vocabulary learning in particular and language learning in general. Based upon this review, multimedia CALL programs that use motion pictures, still pictures, and text can help ESL students to improve their vocabulary skills. But it is not clear if a multimedia program with motion pictures or the one with still pictures will be more effective for intermediate level ESL students. More empirical studies to investigate the effectiveness of multimedia CALL with motion pictures and still

pictures on vocabulary acquisition of ESL students can lead to the development of more effective methods for vocabulary acquisition.

Motion graphics and still graphics

The application of computer technologies in education has grown, and will continue to grow at an ever-increasing rate (Yong, 1989). As these computer technologies continue to gain increasing prominence in schools, computer graphics will introduce new dimensions to the roles of illustration in education (Willows & Houghton, 1987). Many studies (Rieber & Kini 1991; Siribodhi, 1995; Rieber, 1990; Rieber, 1996) have shown that computer graphics are effective for gaining attention. Furthermore, computer graphics can encourage students to create mental images that in turn make it easier for them to learn certain types of information. However, little reliable information exists as to which of the various graphic formats are most effective in learning. In vocabulary acquisition for example, most of the computer assisted studies have been text-based or still pictures (Siribodhi, 1995). Static graphics dominated earlier instruction and studies using photographs, slides and filmstrips.

Many researchers have shown interest in the use of motion or still graphics to test various learning outcomes. The primary focus is to find which situation, motion or still graphics, will be more effective as a learning tool. The difference between motion graphics and still graphics is that motion creates the illusion of movement which helps to explain abstract concepts (Bricken, 1991; Rieber, 1994). Rieber (1990) expressed the view that the reason for using animation in instructional presentations is to gain attention. In his discussion, he gave examples of animation as special effects for transitions between

instructional frames or lesson parts; special screen washes; moving symbols or characters, cartoon or text; animated prompts such as arrows which direct attention to keywords, paragraphs, graphics, or other screen items.

Dynamic, interactive graphics on video screens allow learners to create and modify their own educational illustrations (Willows & Houghton 1987). Sharp, Bransford, Goldman, Risko, Kinzer, & Vye (1995) explored the hypothesis that a multimedia environment with animated visual support facilitates language comprehension when children listen to short stories. The results of their study suggested that dynamic visual support can provide a framework for understanding and remembering linguistic information. Asoodeh (1993) conducted a study in which subjects who used animated visuals were compared with those who used static visuals in the development of spatial visualization. The result showed that subjects who used animated visuals scored significantly higher on mental rotation tests than those who used static visuals. On the sectioning test, the subjects in the static group scored significantly higher than the dynamic group. Aldahmash (1995) compared the influence of animated visuals with static visuals upon students' understanding of organic reaction mechanisms in chemistry. The result showed that students who used animated visuals performed significantly better than those who used static visuals on both immediate and delayed tests.

In 1996, Rieber conducted a study to explore how users interact and learn during a computer-based simulation given graphical and textual forms of feedback. He found that subjects learned more when provided with animated graphical feedback than with textual feedback. Rieber hypothesized that interactive forms of multimedia, such as computer

simulations will promote different levels of processing depending on the type of representation used (e.g. text, graphics, motion and sound). In an earlier study, Rieber & Kini (1991) contended that in contrast to static graphics, animated graphics can provide users with additional information through two important visual attributes: motion and trajectory. They also added that animation can provide information about whether the object is moving or whether the object's motion changes over time. Still or static pictures, on the other hand, lack motion and are more abstract than motion pictures. Still pictures suggest motion whereas motion pictures show life in action, can be used to study specific elements, and can bring us close to the point of visual contact (Dale, 1969).

SUMMARY

The use of computer graphics to improve the study of vocabulary in second language learning has become vitally important. Several studies have shown that computer graphics can be used to facilitate learning. Computer-assisted instruction has been found in various CAI studies to be more beneficial to students of various groups and educational levels than traditional paper and pencil instruction. Computer graphics can also be used to gain and direct the attention of the learners (Smith, 1988; Rieber, 1992, 1994). But the question that needs clarification is: which form of graphics, motion or still, can help ESL students learn vocabulary?

Research shows that about 2.3 million language minority students have been identified as having limited English proficiency (Fitzgerald, 1995). It is therefore necessary to find effective means of using computer technology to improve vocabulary learning. Studies have also shown that efforts to improve second language learning with computer technology have been unsuccessful. The use of an effective computer graphics format in vocabulary acquisition can be helpful to ESL students.

Dual-coding theory as proposed by Paivio (1971) has explained how verbal and visual systems and combination of the systems can be used to facilitate language instruction. The probability of recall can increase due to the availability of two mental representations instead of one. The use of graphics and text can be effective in vocabulary acquisition.

CHAPTER THREE

Methodology

Introduction

This chapter presents the research questions, research hypotheses, participants, treatment instruments, equipment, research design and method of analyzing the data for this study. It is an experimental study that investigated the effects of two multimedia CALL programs on vocabulary acquisition by intermediate level ESL students. The first program consisted of Motion Graphics with text. The second program consisted of Still Graphics with text. Three tests were administered: Pretest (T1), Posttest (T2), Delayed posttest T3).

Research Questions

In order to investigate the effectiveness of the two Multimedia CALL programs with two different graphic formats for vocabulary acquisition, the following research questions were generated:

1. Will the multimedia CALL program with Motion Graphics and Text help intermediate level ESL students improve their vocabulary scores?

2. Will the multimedia CALL program with Still Graphics and Text help intermediate level ESL students improve their vocabulary scores?

3. Will the multimedia CALL program with Motion Graphics and Text help intermediate level ESL students recall vocabulary information after two weeks of vocabulary instruction?

4. Will the multimedia CALL program with Still Graphics and Text help intermediate level ESL students recall vocabulary information after two weeks of vocabulary instruction?

Hypotheses:

In order to answer the research questions, the following seven null hypotheses were generated:

1. There is no significant difference between Motion Graphics treatment and Still Graphics treatment (No treatment effects).
2. There is no significant difference in vocabulary scores across the three tests (Pretest - Posttest - Delayed posttest).
3. There is no interaction between Time and Treatments.
4. There is no significant difference between group Pretest (T1) and Posttest (P2) means. (No Time effect from T1 to T2).
5. There is no significant difference between group Posttest and Delayed posttest means.
6. There is no significant difference between Pretest and Posttest means and between Posttest and Delayed posttest means in the Motion Graphics treatment group.

7. There is no significant difference between Pretest and Posttest means and between Posttest and Delayed posttest means in the Still Graphics treatment group.

Sample population

The population consisted of 102 intermediate level ESL students who enrolled in a large community college located in the southeastern United States. Participation was voluntary. Consent forms were given to students, (see Appendix A). The sample consisted of 86 students (44 females and 42 males) who read, signed, and returned the consent forms. Participants were randomly assigned to one of the two treatment groups. They were adults (aged 18 years or above) who came from various non-English speaking countries and were enrolled in an ESL program at the intermediate level. In addition, they had completed the beginning level ESL program and passed the survey selection test for placement at the intermediate level. The Vice President for Curriculum and Instruction of the college gave approval for their ESL students' participation in the study.

Setting

The experiment was conducted at the computer laboratory located at a technical community college in the southeastern United States. Participants used Macintosh computers for this study. The Vice President for Curriculum and Instruction of the college approved the use of their computer laboratory for this study.

Research Variables

The independent variables were the two instructional programs.

Program one had Motion Graphics and Text.

Program two had Still Graphics and Text.

Vocabulary acquisition assessment methods were:

(a) Picture-text matching test of ten items

(b) Multiple choice test of ten items

Assessment times were :

Time 1 (T1) Pretest

Time 2 (T2) immediate posttest

Time 3 (T3) a two-week delayed posttest

Dependent variable was:

Vocabulary scores

Selection of Vocabulary

Ten names of shop tools with their corresponding pictures were used for this study. The ten names and pictures were selected from a video tape which shows their uses in context. The intermediate level ESL teachers from a large community college in the southeastern United States who are the content experts confirmed that the selected words were suitable for the intermediate level ESL students.

Software development process

The software development followed three instructional design processes. These are: (a) needs assessment, (b) software design, and (c) evaluation and revision.

The researcher conducted needs assessment through various visits to the English as a Second Language Institute at a large research university and a community college in the southeastern United States. The purpose was to consult with the Directors and the ESL teachers who are the content experts. In addition, some foreign language experts as well as the researcher's dissertation committee members were often consulted.

During the design process, the researcher reviewed several CALL designs. Directors of an ESL Institute at a land grant university, including the vocabulary teachers for the intermediate ESL students were consulted. After the review, the design was chosen to meet the perceived needs of the ESL students. The researcher chose Hypercard authoring software for the design of the instruments for the following reasons: (a) it is affordable, (b) most Macintosh computers come with Hypercard player to run Hypercard programs, and (C) it is easy for students to run Hypercard programs. Additionally, the video tape that contains the tools was reviewed. A Fusion recorder was used to capture the pictures in motion. Photoshop software was used to copy the same pictures when they were not in motion for use in the development of a still picture program.

Instruments

The instruments used for the two treatment groups were the two multimedia CALL applications developed by the researcher. Hypercard authoring software was used to develop the instruments. The first instrument consisted of ten motion pictures of workshop tools and their corresponding names. The second instrument consisted of ten still pictures of workshop tools and their corresponding names. The instruments and contents were reviewed by the content experts to ensure that the contents are valid. In addition, four Professors with expertise in language learning, technology, and research reviewed the instruments. Corrections were made after the review of the instruments to ensure validity. The instruments were tested for reliability. See the pilot study, page 43.

Procedures

Pretest:

A pretest (T1) containing the actual test items was administered to the participants a day before treatment in order to determine how well the participants knew the contents before treatment.

Treatments:

Participants were randomly assigned to one of the two treatment groups. Group one received treatment from the program that had Motion Graphics and Text. Group two received treatment from the program that had Still Graphics and Text. Both groups first viewed the video tape of workshop tools where the tools are used in context. The

selected pictures and names of the tools for the treatment were the same as those viewed in the video.

Posttests.

There were two posttests, the immediate posttest (T2) and the delayed posttest (T3). The immediate posttest (T2) was administered immediately after treatment. The delayed posttest (T3) was administered after two weeks without further treatment. In both sections, the same test items used for pretest were administered. Picture-text matching and Multiple choice test formats were used in both sections. A breakdown of the time spent in data collecting activities is given below:

1. Instructions/ consent form	5 minutes
2. Pretest	20 minutes
3. Viewing of Video	20 minutes
4. Treatment	30 minutes
5. Immediate posttest	10 minutes
6. Delayed posttest	10 minutes
7. Demographic data form	2 minutes
Total	= 97 minutes

Research Design

This study used a Pretest-Posttest experimental group design. Two experimental groups were used. Participants were randomly assigned to one of the two experimental groups. Both groups received a pretest, treatment and posttest. A two-week delayed

posttest was administered without further treatment. The design is expressed as shown in Figure 1.

Pretest	Treatment	Posttest	Delayed Posttest
T1	X1	T2	T3
T1	X2	T2	T3

Figure 1.

In this design, the subscript **T1** represents the pretest scores, **X1** represents the Motion Graphics with Text treatment, while **X2** represents the Still Graphics with Text treatment. The subscript **T2** represents the immediate posttest scores, while the subscript **T3** represents the delayed posttest scores.

Data analysis:

First, descriptive statistics of the mean scores were computed for the two groups. Second, repeated measures analysis of variance (ANOVA) was used to determine whether the differences between mean scores are statistically significant. According to Howell (1992), ANOVA allows various mean variables to be measured, allows two or more independent variables to be analyzed simultaneously, and also allows for the measurement of the interactional effects.

Pilot Study

A pilot study was conducted in July 1997 at a large urban community college in the southeastern United States. The aim was to verify the design of the experiment and to evaluate the experimental arrangements. Eighteen international students enrolled at the intermediate level ESL program participated in the study. The participants were randomly assigned to one of the two experimental groups. Instructions about the study and signing of consent forms lasted for 5 minutes.

A pretest was administered to both groups a day before treatment. The pretest lasted for 20 minutes. Thereafter, both groups viewed the video of the workshop tools used in context for 15 minutes. Demographic data forms were completed after the pretest. Both groups were exposed to treatments the next day. Group one was exposed to the instrument that consists of motion graphics and text for 30 minutes. Group two was exposed to the instrument that consists of still graphics and text for 30 minutes. The immediate posttest was administered after each treatment. The intermediate ESL teacher helped to keep a group in the class when the other group was taking the treatment and test. Two weeks later, a delayed posttest was administered to each group. Descriptive statistics of the data for the two groups were computed using Minitab statistical package.

Reliability:

According to Bryman and Cramer (1990), instrument reliability "refers to its consistency" of measurement (p. 70). Kuder-Richardson formula 21 (KR-21) was used to calculate the reliability of the posttest instruments.

The reliability coefficient for the Motion Graphics instrument was .868 while the reliability coefficient for the Still Graphics instrument was .78

The KR-21 reliability formula has been used by several researchers such as Kolich (1985) and Paciorek (1995). According to Paciorek, the KR-21 formula for reliability estimate is as expressed below:

$$r \text{ total test} = \frac{(K)\,(SD \text{ squared}) - X\,(K-X)}{(SD \text{ squared})\,(K-1)}$$

Where r = the reliability of the posttest

K = number of test items

X = mean of the scores

SD = Standard deviation

Different reliability coefficients have been used in various studies. Nunnally (1978) noted that a reliability coefficient of .70 and above is desirable. Nunnally also pointed out that low reliability coefficients of .50 or .60 are tolerable in early stages of research. Balian (1988) added that reliability coefficient of .85 to .89 are very good. Based on these figures, the reliability coefficients of .868 and .78 are desirable.

CHAPTER FOUR

Data Analysis and Results

Introduction

In this chapter, the data for the two treatment groups (Motion Graphics and Still Graphics) are shown. The data involved two factors, Factor one and Factor two which are represented by Treatment and Time respectively. Treatment consisted of Motion Graphics and Still Graphics treatments. Time consisted of Pretest (T1), Posttest (T2), and Delayed posttest (T3). Repeated measures analysis of variance (ANOVA) using Procedure for General Linear Models (Proc GLM) in SAS version 6.12 was performed. Both multivariate and univariate test results were examined. Only the results of univariate tests are presented, as the multivariate tests led to the same conclusions where applicable. The demographic data were not included in the hypotheses but are presented.

Demographic Information

The sample consisted of 86 adults who enrolled in an ESL program at the intermediate level. They were randomly assigned to one of the two treatment groups (Motion Graphics and Still Graphics groups). Forty-three (43) participants in each treatment group formed 50% of the sample. Group one received Motion Graphics treatment whereas Group two received Still Graphics treatment. Forty four (44) of the

participants were female which accounted for 51.1% of the sample while forty two (42) were male which accounted for 48.9% of the sample. Table 1. shows the frequency distribution of gender by treatment conditions.

Table 1.

Frequency Distribution of Gender by treatment conditions

	Treatments	N	males	%	Females	%
1.	Motion graphics	43	22	25.6%	21	24.4%
2.	Still graphics	43	20	23.3%	23	26.7%
	Total	86	42	48.9%	44	51.1%

Age

Participants were at least 18 years old, with 59.3% (51) of the sample being 18 to 29 years old, 23.3% (20) being 30 to 39 years old, and 17.4% (15) being 40 years and above. The age distribution of the participants is shown on Table 2.

Table 2.

Frequency distribution of Age for the entire sample.

Ages	Participants	Percentages
18 - 29 years	51	59.3%
30 - 39 years	20	23.3%
40 years & above	15	17.4%

Race

Participants came from four different races. Asians ranked highest in the number of participants with a total of 47.7% (41) of the sample. Hispanics came second in number with 21.1% (19) of the sample. The number of the White race equaled that of the Black race, with 15% (13) each. Table 3 below represents the frequency distribution of the races for the entire sample.

Table 3.

Frequency distribution of Race for the entire sample.

Race	Participants	Percentages
Asian	41	47.7%
Black	13	15.1%
Hispanic	19	22.1%
White	13	15.1%

Educational levels of participants

The educational qualification of the participants varied widely. Participants with High school diplomas formed 70.9% (61) of the sample. While 10.5% (9) of the sample had an Associate's degree, 15.1% (13) had a Bachelor's degree and 3.5% (3) had a Master's degree. The frequency distribution of the educational level for the entire sample is shown in Table 4 below.

Table 4.

Frequency distribution of Education for the entire sample.

Education	Participants	Percentages
High School diploma	61	70.9%
Associate's degree	9	10.5%
Bachelor's degree	13	15.1%
Master's degree	3	3.5%

Native Languages

Participants originated from thirty one (31) non-English speaking countries that speak twenty-three (23) different native languages. Table 5. below shows the frequency distribution of various native languages spoken by the participants.

Table 5.

Sample frequency distribution of Native languages

Native languages	Participants	Percentages
Arabic	5	5.8%
Battner	2	2.3%
Bosnian	2	2.3%
Cambodian	1	1.2%
Chinese	1	1.2%
Espaual	1	1.2%
Ewe	1	1.2%
French	3	3.5%
Hindi	1	1.2%
Japan	1	1.2%
Korea	2	2.3%
Lao	1	1.2%
Mina	1	1.2%
Napali	2	2.3%
Portuguese	1	1.2%
Russia	8	9.3%
Somali	1	1.2%
Spanish	18	20.9%
Swahili	2	2.3%
Thai	2	2.3%
Twi	1	1.2%
Vietnamese	28	32.6%
Wosli	1	1.2%

Finding

The results of the pretest, posttest, delayed posttest mean scores, and standard deviations for group 1 (Motion Graphics group) and Group 2 (Still Graphics group) were calculated and are presented in Table 6 below. As shown in Table 6, the means for Group 1 are: pretest ($\overline{X}$ = 6.3256), posttest ($\overline{X}$ = 18.3721) and delayed posttest ($\overline{X}$ = 18.0698). The means for Group 2 are: pretest ($\overline{X}$ = 6.4651), posttest ($\overline{X}$ = 18.7442) and delayed posttest ($\overline{X}$ = 17.4419).

Table 6.

Group Mean scores, Standard deviations , Minimum and Maximum scores

Group 1 (Motion Graphics)

Variable	N	Mean	Std Dev	Minimum	Maximum
Pretest	43	6.3256	3.0136 0	0.0000	11.0000
Posttest	43	18.3721	2.4978	12.0000	20.0000
Delayed posttest	43	18.0698	2.5856	10.0000	20.0000
Group 2 (Still Graphics)					
Pretest	43	6.4651	2.8229 0	0.0000	11.0000
Posttest	43	18.7442	1.9160	14.0000	20.0000
Delayed posttest	43	17.4419	2.5848	12.0000	20.0000

The graphical representation of the means can be seen on figure 2.

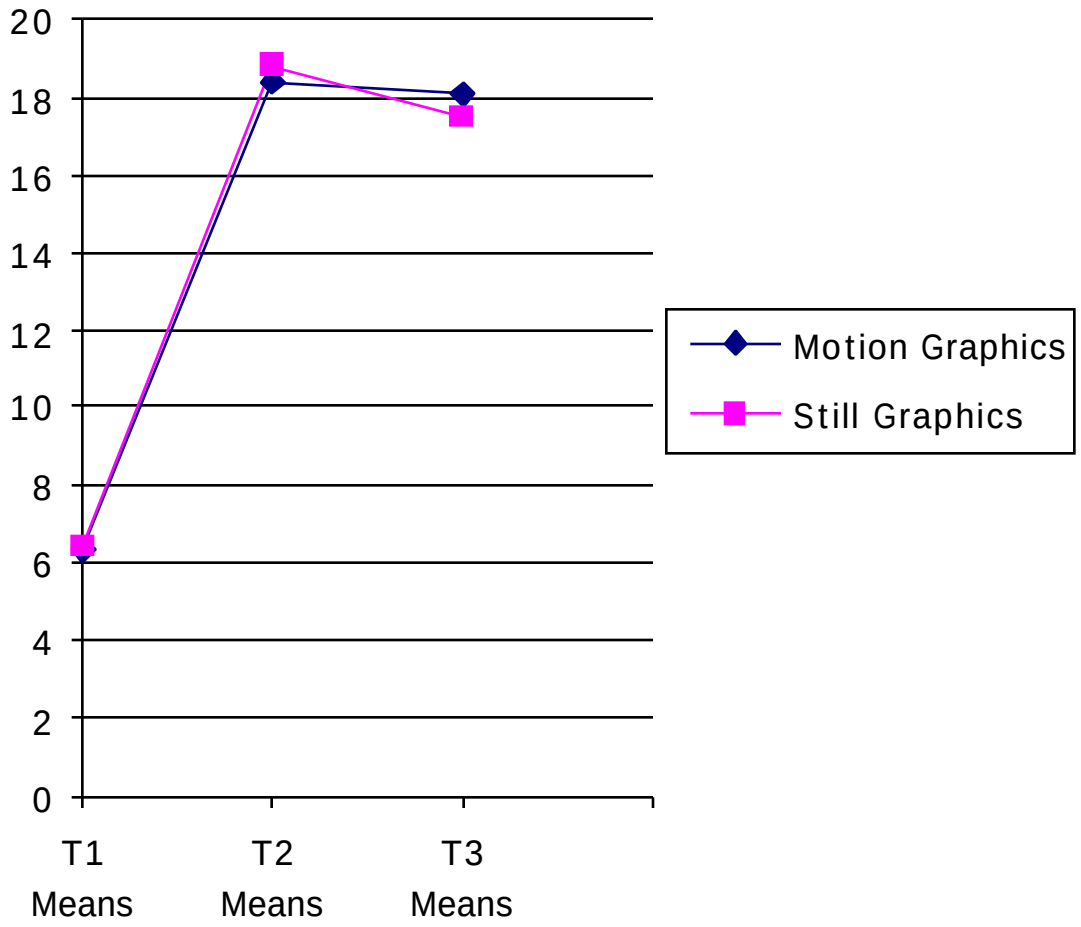

Figure 2.

Graphical representation of Group Pretest (T1), Posttest (T2) and Delayed Posttest (T3) means.

The repeated measures analysis of variance was performed to test for treatment effects. The result showed no treatment effects F (1,84) = 0.01, p >.05 (see Appendix E). This shows that both Motion Graphics and Still Graphics can have the same effects on vocabulary acquisition. A univariate test for WithinSubjects revealed significant Time effects. This means that significant differences occurred across pretest, posttest and delayed posttest mean scores. F = 752.91, p < .0001 (see Appendix F). There was no interaction between Treatment and Time (Appendix G) as revealed by the univariate test for interactional effects. F = 1.11, p > .05.

The result of univariate analysis of variance of contrast variables showed that significant differences existed between pretests and posttests in both groups in favor of posttests. The result revealed that learning occurred,

F = 1059.60, p < .0001. (see Appendix H).

As shown in Table 6 above, posttest and delayed posttest means in group 1 (Motion Graphics group) are $\overline{X}$ = 18.3721 and $\overline{X}$ = 18.0698, respectively. The posttest and delayed posttest means in group 2 (Still Graphics group) are $\overline{X}$ = 18.7442 and $\overline{X}$ = 17.4419, respectively. A decline in group 2 delayed posttest mean was observed. Differences in group posttest and delayed posttest means were tested for significance, using a univariate analysis of variance of contrast variables as shown in Appendix I. The result revealed significant difference between group posttest and delayed posttest means F = 8.58, p < .0044. It is difficult at this point to tell if this significant difference occurred in group 1 (Motion Graphics) or group 2 (Still Graphics).

Further analysis was performed on each group to investigate where the difference occurred. An analysis of difference of Least Square means was performed in group 1 (Motion Graphics) to test if differences occurred between pretest ($\overline{X}$ = 6.3256) and posttest ($\overline{X}$ = 18.3721), and also between posttest ($\overline{X}$ = 18.3721) and delayed posttest ($\overline{X}$ = 18.0698). The result as presented in Appendix J, shows that while the difference between pretest and posttest was significant,

t = -24.39, p < .0001, the difference between posttest and delayed posttest was not significant, t = 0.61, p > .05. The result indicates that learning occurred and that students retained what they learned over a period of time.

The same analysis of difference of Least Square means was performed in group 2 (Still Graphics) to test if differences occurred between pretest

($\overline{X}$ = 6.4651) and posttest ($\overline{X}$ = 18.7442), and also between posttest

($\overline{X}$ = 18.7442) and delayed posttest ($\overline{X}$ = 17.4419). The result, as shown in Appendix K, revealed a significant difference between pretest and posttest,

t = -24.77, p < .0001. A significant difference was also revealed between posttest and delayed posttest, t = 2.63, p < .0094. The result of this test showed that learning occurred; however, the students in this group could not retain what they learned over a period of time as much as those in the Motion Graphics group .

In summary, both Motion Graphics and Still Graphics were found effective in vocabulary acquisition in this study. Learning occurred significantly in both groups, but students in the Motion Graphics group performed significantly better than students in Still Graphics group in delayed posttest

CHAPTER FIVE

SUMMARY, DISCUSSION, AND RECOMMENDATION.

Summary

This study examined the effects of two multimedia computer-assisted language learning (CALL) programs on vocabulary acquisition of the intermediate level ESL students. The first program consisted of Motion Graphics and text. The second program consisted of Still Graphics and text. The purpose was to investigate which of the programs would represent a better method of learning vocabulary by the intermediate level ESL students. The second purpose was to examine which of the programs would help the intermediate level ESL students retain vocabulary words longer.

Vocabulary acquisition in the context of this study means the same as vocabulary learning**.** The study focused on contextualized vocabulary acquisition through word recognition in a CALL environment. Studies have shown that without adequate knowledge of vocabulary, students have difficulty performing the tasks required of them both in school and on the job (Harley, 1996; Kolich, 1985). According to Kolich, students who use a wide variety of vocabulary have little or no difficulty reading fluently, understanding the author's intent, and expressing themselves correctly and concisely in both oral and written forms. Regrettably, Maylath (1996) pointed out that "vocabulary has been overlooked as an area of research at the intermediate level English as a second language (ESL)" (p 220).

Many researchers in the field have recognized the need for vocabulary acquisition especially at the intermediate level (Lessard-Clouston, 1996; Maylath, 1996; Prince,

1996; Siribodhi, 1995). One of the major concerns that they emphasize is the need for developing effective methods for the teaching of second language vocabulary. Traditional pedagogical tools for vocabulary acquisition include word-lists, dictionary use, workbooks, teacher-made materials, and group discussion; yet developing effective pedagogical methods for vocabulary acquisition continues to demand attention and exploration.

One pedagogy in which many researchers have shown interest is computer-assisted language learning (CALL). Computer-assisted language learning programs have been found to be effective in many language learning studies (Asoodeh, 1993; Kolich, 1985; Siribodhi, 1995) The results of the studies showed that students who used CALL programs performed better than those who used traditional programs. Additionally, CALL programs can enhance learning, provide individualized instructions, and allow students to work at their own pace.

Problems:

Delay in helping ESL students master vocabulary quickly can delay their ability to speak English. Ultimately, this can lead to more economic and social problems. The problem is that their inability to speak English can hinder the development of appropriate communication skills needed for gainful employment, success in schools, and adaptation to the new culture. According to Trump et al. (1992), ESL students need rapid and continual increase in vocabulary. Increase in vocabulary can enhance their language development and increase their chances of succeeding in this country. Furthermore, they can contribute to the economic growth and social well being of the nation.

Sample

Eighty-six adult students from a large urban community college in the South Eastern United States who enrolled in ESL program at the intermediate level participated in the study. Forty-four participants (51.1%) were females and forty-two (48.9%) were males. Asians formed 47.7% of the sample, Blacks formed 15.1%, 22.1% were Hispanics and 15.1% were Whites. Among the participants, 70.9% completed high school, 10.5% have Associate's degree, 15.1% have a Bachelor's degree and 3.5% have a Master's degree. The participants originated from various 31 countries of the world within which 23 native languages are spoken.

Treatment

Participants were randomly assigned to one of the two treatment groups. Forty three participants (22 males, 21 females) in group one, received Motion Graphics and Text treatment and the other 43 participants (20 males, 23 females) in group two, received Still Graphics and Text treatment. Both groups first took the same pretest. The pretest consisted of twenty test items, a ten picture-word matching inventory and a ten item multiple choice inventory. They used paper and pencil in taking the test. After the pretest, both groups viewed a home improvement video that showed the use of ten workshop tools in context. A day later, both groups received treatments and immediate posttest. Two weeks after the immediate posttest, a delayed posttest was administered to both groups.

The following research questions were asked:

1. Will the multimedia CALL program with Motion Graphics and Text help intermediate level ESL students improve their vocabulary scores?

2. Will the multimedia CALL program with Still Graphics and Text help intermediate level ESL students improve their vocabulary scores?

3. Will the multimedia CALL program with Motion Graphics and Text help intermediate level ESL students recall vocabulary information after two weeks of vocabulary instruction?

4. Will the multimedia CALL program with Still Graphics and Text help intermediate level ESL students recall vocabulary information after two weeks of vocabulary instruction?

Discussion

The result of the univariate tests showed that the interaction between time and treatment was insignificant. Rieber, Boyce and Assah (1990) also could not find any significant difference in test scores based on the type of graphics used during instruction. Both Motion and Still graphics were effective in vocabulary learning, as significant differences occurred between Pretest and Posttest in both treatments in favor of posttests. There was no significant difference between posttest and delayed posttest

scores in the Motion Graphics group. Significant difference was found between posttest and delayed posttest in the Still Graphics group. This suggests that the participants in the Motion Graphics group had better retention from posttest to the delayed posttest than did the participants in the Still Graphics group. Future research involving the use of Motion Graphics and Still Graphics in vocabulary acquisition is needed to confirm this result. Participants in both groups indicated that the computer programs attracted their attention and that they enjoyed learning through the computer.

Recommendation

The results of this study showed the effectiveness of using multimedia computer-assisted language learning programs in learning vocabulary. The pretest and posttest scores indicated that both motion and still graphics can be effective in learning vocabulary. Based on the findings of this study, the following recommendations are made:

1. Multimedia CALL can be used to supplement or complement vocabulary instruction.

2. A replication of this study should be made to see if the results of this study will be repeated.

3. Multimedia CALL programs appear to be effective in teaching vocabulary, but there appears to be no difference between Motion and Still graphics when used in learning vocabulary.

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APPENDIX A

Informed Consent Form

INFORMED CONSENT FOR PARTICIPANTS IN THIS RESEARCH

Title: EFFECTS OF TWO MULTIMEDIA COMPUTER-ASSISTED LANGUAGE LEARNING PROGRAMS ON VOCABULARY ACQUISITION OF INTERMEDIATE LEVEL ESL STUDENTS.

Investigator(s): Clement C. Iheanacho

1. Purpose of this study

In this study, you will use Macintosh computers to study ten names and pictures of workshop tools. There will be a Motion Graphics program and Still Graphics program. Those of you who signed up will be randomly assigned to one of the two programs. The purpose is to find which of the programs will be more effective in learning vocabulary.

II. Procedure

You will first spend 15 minutes to complete an inventory that contains 20 test items. The test items are generated from ten names of workshop tools and their pictures. You will match the pictures with their correct names. After this, you will view a video of the tools for 20 minutes. After viewing the video, you will use Macintosh computers to learn the names and pictures of ten workshop tools selected from the video. You will spend 30 minutes learning the names and pictures of the selected tools. After learning, you will spend 10 minutes completing an inventory of 20 test items. The contents will be the same as the first one you completed. Two weeks later, you will complete the same inventory of 20 test items. The reason is to find whether motion pictures or still pictures helped you better in remembering what you learned. You will use the computer laboratory located at Guilford Technical Community College in Greensboro, North Carolina to learn the vocabulary words.

III. Risks

There will be no risk involved. The study is to find better ways of using computers to improve vocabulary instruction. You will use computers only to learn English vocabulary, just as it is done in the normal classroom.

IV. Benefits of this project

You will learn the basic use of computers and Hypercard programs. The result of the study can lead to a better understanding of using computer graphics in learning vocabulary.

V. Extent of confidentiality and anonymity.

You are not required to write your names and social security numbers throughout the study. Two coding systems will be used, with one code representing participants in each program. The coding will be used for data analysis.

VI. Compensation

There is no compensation for participating. Participation is voluntary.

VII. Freedom to withdraw

You are free to withdraw from this study at any time without penalty. You are also free not to answer any questions that you choose without penalty.

VIII. Approval of Research

This research has been approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University and by the Department of Teaching and Learning.

IX. Subject's Responsibilities

I voluntarily agree to participate in this study. I have the following responsibilities:
(List medical conditions to be reported, and staying in place for the specific length of time required for this study)

X. Subject's Permission

I have read and understand the Informed Consent and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project.

If I participate, I may withdraw at any time without penalty. I agree to abide by the rules of this project.

_____

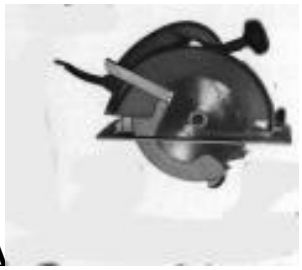
Signature Date

APPENDIX B

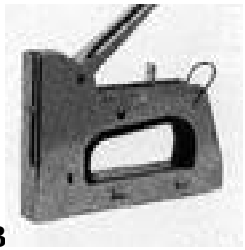
Picture Form (PF)
Vocabulary-Picture Matching Inventory (VPMI)
Multiple Choice Inventory (MCI)
Pictures and names of tools

PICTURE FORM
Code number (PF)

A

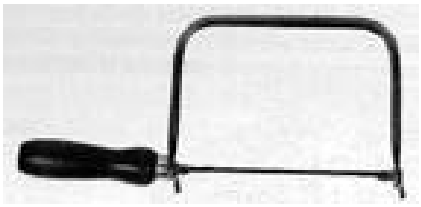


B



C

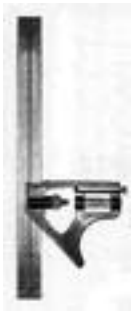
D



E

F

G



H

I

J

Vocabulary-picture matching inventory

Code Number: VPMI

Match the letter of each picture on the Picture Form (PF) to the corresponding name on the space provided below:

1. _____ Stapler
2. _____ Pliers
3. _____ Power planer
4. _____ Power drill
5. _____ Combination square
6. _____ Clamp
7. _____ Crosscut hand saw
8. _____ Circular saw
9. _____ Chisel
10. _____ Coping saw

Multiple Choice Inventory

Code Number: MCI

Instruction: Mark an X on the line beside the name that corresponds with the picture on Picture Form (PF).

Picture A is:

1. Stapler _____
2. Power drill _____
3. Circular saw _____
4. Screw driver _____

Picture B is:

1. Stapler _____
2. Power drill _____
3. Coping saw _____
4. Chisel _____

Picture C is:

1. Crosscut hand saw _____
2. Power drill _____
3. Circular saw _____
4. Combination square _____

Picture D is:

1. Clamp _____
2. Coping saw _____
3. Circular saw _____
4. Power planer _____

Picture E is:

1. Hammer _____
2. Pliers _____
3. Crosscut hand saw _____
4. Clamp _____

Picture F is:

1. Stapler _____
2. Crosscut hand saw ____
3. Framing square _____
4. Chisel _____

Picture G is:

1. Stapler _____
2. Hammer_____
3. Combination square_____
4. Circular saw _____

Picture H is:

1. Screw driver _____
2. Power drill _____
3. Pliers _____
4. Power planer _____

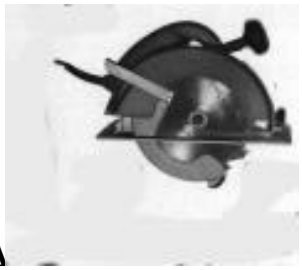
Picture I is:

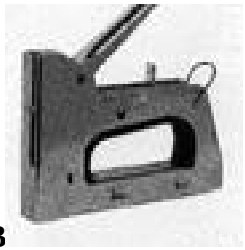
1. Stapler _____
2. Screw driver _____
3. Power drill _____
4. Combination square _____

Picture J is:

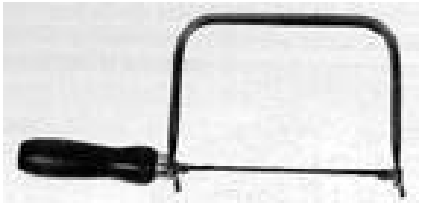
1. Screw driver _____
2. Power drill _____
3. Coping saw _____
4. Power planer _____

Pictures and Names of Tools
Code Number: PNST

A 
Circular saw

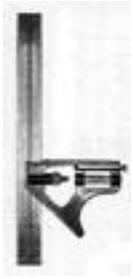
B 
Stapler

C 
Crosscut hand saw

D 
Coping saw

E 
Clamp

F 
Chisel

G 
Combination square

H 
Pliers


I Power drill

J 
Power planer

APPENDIX C

Demographic Data Form

Demographic Data FORM

Code number: DDF

Please complete this form as honestly as it applies to you. Do not write your name or social security number.

Gender: Male _____ Female _____

Country of origin: _____

Age: 18-29 years _____ 30-39 years _____ 40 years and above _____

Race: Hispanic _____ White____ Asian ____ Black _____ Other _____

Education obtained in home country: High School/GED__ Associate degree___ B.S.___ Other_____

How many languages do you speak ? _____

What is your native language? _____

Degree(s) or certificate(s) obtained in the United states: High school/GED _____

Associate degree_____ BS _____ Other _____

APPENDIX D

Instructional Model

INSTRUCTIONAL MODEL

A. Goal Statement:

At the end of this unit of instruction, learners will be able to identify ten pictures of hand and power tools with their corresponding names with 80% efficiency.

B. Unit of Instruction: Hand and Power Tools

C. Vocabulary Learning Task:

Power drill, Combination square, Coping saw, Crosscut hand saw, Power planer, Pliers, Clamp, Stapler, Chisel.

D. Instructional time: 1hour

E. Target Group:

Intermediate level English as a second language (ESL) teachers

F. Entry Behavior:

Use Picture Form (PF) and Vocabulary-Picture Matching Inventory (VPMI) to pretest the learners. (See Appendix B)

G. Instructional Materials And Equipment:

Home improvement video (hand and power tools), Tools manual, Multimedia Vocabulary learning Instrument (MVLI), Picture forms, Multiple choice inventory, Vocabulary matching inventory, Chalkboard, Computers, Television, Overhead projector,and Fliers.

H. Performance Objectives :

H-1. Given a list of five selected hand and power tools and their pictures, learners will be able to match four pictures with their corresponding names.

H-2. Given a Multimedia Vocabulary Learning Instrument (MVLI) containing pictures and names of five hand and power tools, learners will be able to describe their physical appearance with 80% accuracy.

H-3. Given a list of six hand and power tools, learners will be able to identify three hand tools and three power tools accurately.

I. Information Presentation

Time	Activity	Teacher's Input	Material	Students' Activity	Feedback
9-9:10	- Warm-up, - Entry behavior	- Introduce the lesson - Explain Objectives -Administer pretest	- Picture Form - Vocabulary - Matching inventory	- Pay attention - Ask questions - Take pretest	- Pretest scores
9:10 to 9:20	- Contextualized vocabulary instruction	- Show Video for home improvement	- Video tape - TV, VCR	- Watch video	- Questions on video viewed
9:20 to 9:30	- Objective H-1	- Display list of 5 tools - Display their pictures - Teach pronunciation - Match pictures with their names - distribute fliers to students - Guide students during guided practice.	- Picture Form - Vocabulary list - Flier	**Guided practice** - Go through the picture forms, fliers, under teacher's supervision **Independent practice** - Match pictures with their corresponding names	-Ask students to match pictures with their corresp-onding names
9:30 to 9:40	- Objective H-2	- Explain how MVLI is used - Tell students what they will learn	- MVLI - Computers	**Guided Practice** - Use MVLI under teacher's supervision **Independent practice** - Review with MVLI	Ask students to describe the five tools they learned.
9:40 to 9:50	- Objective H-3	- Show pictures and names of three power tools - Explain each power tools - Show pictures and names of three hand tool - Explain each power tools - Discuss the difference between power tool and hand tool	- Flier - Picture of tools	**Guided practice** Students learn the description of the selected tools on the flier under teacher's supervision **Independent practice**	- Display a flier of the learned tools on the board - Point at each tool - Ask students to pronounce the name of the tools pointed

		- Give fliers of the selected tools to students for guided practice		Learners write what they know about the six tools on the flier.	
9:50 to 9:59	- Closure	- Review - Answer students' questions	- Picture Forms - Fliers	- Ask questions	- Give vocabulary Matching Inventory - Ask a few questions on the lesson covered
	Follow-up	- Discuss plans for relevant field trip		- Reinforce what has been learned in context	

MVLI: = Multimedia Vocabulary Learning Instrument

Sources:

Shrum, J. L., & Glisan, E. W. (1994). Teacher's handbook: Contextualized instruction. Boston, Massachusetts. Heinle and Heinle Publishers.

Dick, W. & Carey, L. (1990). The systematic design of instruction. Glenview, Scott Foresman Publishers

APPENDIX E

Repeated Measures Analysis of Variance for BetweenSubjects Effects

APPENDIX E

Repeated Measures Analysis of Variance for BetweenSubjects Effects

General Linear Models Procedure
Repeated Measures Analysis of Variance
Test of hypotheses for BetweenSubjects Effects

Source	DF	Type III SS	Mean Square	F value	Pr > F
Treatment	1	0.096899	0.096899	0.01	0.9202
Error	84	805.81395	9.593023		

The result of this analysis shows no treatment effect.
F = .01, *P value = .9202*

APPENDIX F

Repeated Measures Analysis of Variance for WithinSubject Effects

APPENDIX F

Repeated Measures Analysis of Variance for WithinSubject Effects

General Linear Models Procedure
Repeated Measures Analysis of Variance
Univariate Tests of hypotheses for WithinSubjects Effects

Source	DF	SS	Mean square	F value	Pr > F
Time	2	7958.9379	3979.46899	752.91	.0001***

The univariate tests revealed time effects.

$F = 752.91$, $P < .0001$***

******* represents significant effect at level at .0001

APPENDIX G
Univariate Tests for Interactional Effects

Appendix G
Univariate Tests for Interactional Effects

Univariate Tests of hypotheses for Interactional Effects

Source	DF	SS	Mean square	F value	Pr > F
Time and Trt	2	11.77519	5.88759	1.11	.3307

The result of this univariate tests shows no interactional effect between Time and Treatment (Trt). *F* = 1.11, *P value = .3307*

APPENDIX H

Univariate Analysis for Variance of Contrast Variables
(Group Pretest Vs Group Posttest)

Appendix H
Univariate Analysis for Variance of Contrast Variables
(Group Pretest Vs Group Posttest)

General Linear Models Procedure
Repeated Measures Analysis of Variance
Univariate Analysis of variance of contrast variables

Contrast variable.Time 1. (Group Pretest Vs Group Posttest)

Source	DF	SS	Mean Square	F value	Pr > F
Mean	1	12722.27907	12722.27907	1059.60	0.0001***
Error	84	1008.55814	12.00664		

$F = 1059.60$, $p < .0001$***

*** = Significant difference at 0.0001

APPENDIX I

Univariate Analysis for Variance of Contrast Variables
(Group Posttest Vs Group Delayed Posttest)

APPENDIX I

Univariate Analysis for Variance of Contrast Variables
(Group Posttest Vs Group Delayed Posttest)

General Linear Models Procedure
Repeated Measures Analysis of Variance
Univariate Analysis of variance of contrast variables

Contrast variable.Time 2, Posttest Vs Delayed Posttest

Source	DF	SS	Mean Square	F value Pr > F	
Mean	1	55.36046	55.36046	8.58	0.0044**
Error	84	542.13954	6.454o4		

Univariate Analysis of variance of contrast variables revealed significant effect.
$F = 8.58$, $p < .0044$**

** = Significant at .0044

APPENDIX J

Difference of Least Square Means in Group 1 (Motion Graphics group)

Appendix J

Difference of Least Square Means in Group 1 (Motion Graphics group)

Difference of Least Square Means in Group 1

Variable	Diference	Std Error	DF	t	Pr > t
T1Vs T2	-12.0465	0.4958	168	-24.39	0.0001***
T2 Vs T3	0.3023	0.4958	168	0.61	0.5428

There is significant difference between Pretest and Posttest in Group 1.

t value = -24.39, *p* < .0001***

There is no significant difference between Posttest and Delayed Posttest in Group 1.

t value = 0.61, *p* = .5428

T1 = Pretest
T2 = Posttest
T3 = Delayed posttst
*** = Significant at .0001

APPENDIX K

Difference of Least Square Means in Group 2 (Still Graphics group)

Appendix K

Difference of Least Square Means in Group 2 (Motion Graphics group)

Difference of Least Square Means in Group 2

Variable	Diference	Std Error	DF	t	Pr > t
T1Vs T2	-12.2790	0.4958	168	-24.77	0.0001***
T2 Vs T3	1.3023	0.4958	168	2.63	0.0094*

There is significant difference between Pretest and Posttest in Group 2
t value = -24.77, *p* < .0001***
There is significant difference between Posttest and Delayed Posttest in Group 2.
t value = 2.63, *p* = .0094*

T1 = Pretest
T2 = Posttest
T3 = Delayed posttest

Significant at .0001***
Significant at 0.0094*

VITA

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EDUCATION:

Ph.D. Curriculum and Instructional Technology 1997
Management Science (cognate)
Virginia Polytechnic Institute and State University Blacksburg

MS.I.T. **Industrial Technology** (Manufacturing Systems Management) 1993
Technology Education (2nd Major)
North Carolina A&T State University Greensboro.

MS **Educational Administration and Supervision.** 1989

North Carolina A&T State University Greensboro.

BS **Industrial Education** (Electrical Industries). 1986.
North Carolina A&T State University Greensboro.

COMPUTER SKILLS:

Skillful in the following hardware and software: Microsoft Word, WordPerfect, Microsoft Works, SpreadSheet, Dbase, PowerPoint, Persuasion, Authorware, HyperCard, Eudora, HyperStudio, SuperCard, Astound, Desktop publishing with Pagemaker, Toolbook, Director, MasterCam, Photoshop, Netscape, Statistical software such as SPSS, Number Cruncher, Minitab; Internet Assistant, Fetch, Gopher, FTP, Acrobat Front page, HTML Homepage programming.

TEACHING AND RELATED WORK EXPERIENCES:

Web Master: Jan. 1996 - Aug. 1997, NC A&T State University Greensboro.
Web server Administrator, Developed Web sites, recommended and upgraded software and hardware, managed the Webteam, conducted several workshops on

homepage development, consulted with the Administrators, Faculty, and Staff on integrating Internet Web technology into the academic curriculum.

Assistant Professor: 1996. School of Education, NC A&T State University.
Taught Utilization of Educational Media

Graduate Teaching Assistant: 8/92 - 6/93. NC A&T State University Greensboro NC.
Assisted in teaching Manufacturing processes, CNC, & Principles of Robotics

Graduate Research Assistant: 1993-95. Virginia Polytechnic Institute and State University.
Scheduled computer laboratory activities, troubleshot computer problems, installed computer software and hardware.

Technology Education Instructor: 8/90-8/92, West Montgomery High School NC:
Taught introduction to technology and computer uses.

Senior Technical Instructor: 1980 - 1984., Teacher Training College, Imo State Nigeria.
Taught teaching methods, Psychological foundation of education, Principles of technology, advised and supervised student teachers.

Higher Technical Instructor: 1977 - 1979, Govt. Technical College Owerri, Nigeria.
Taught basic electricity and electronics, Principles of technology.

PUBLICATIONS, PROJECTS & CONFERENCES:

Iheanacho, C. C. (1997). Effects of motion graphics and still graphics on immediate and delayed recall of vocabulary information (In press).

DISSERTATION:

Iheanacho, C. C. (1997). Effects of two multimedia computer-assisted language learning programs on vocabulary acquisition of intermediate level ESL students. Blacksburg, VA: Virginia Polytechnic Institute and State University.

CONFERENCES:

Iheanacho, C. C., Ali, N. B. (1996). Teaching style and learning style with reference to left and right hemisphere: A paper presented at the 19th annual conference of Eastern Education Research Association held in Boston.

Iheanacho, C. C. (1996). The use of multimedia in the classroom: problems and solutions. A paper presented at the annual conference of Virginia Society for Technology in Education.

GRANT PROPOSAL:

Uzochukwu, G. A., Iheanacho, C. C., Lord, E., Walson, F. O., Johnson, M. (Under review). Use of Electronic Interactive Technologies to Enhance Technician Education Programs. Submitted to National Science Foundation.

MULTIMEDIA PROJECTS:

Iheanacho, C. C. (1995). Nigeria and Culture.
Iheanacho, C. C. (1997). Multimedia Vocabulary Learning Instrument.
Iheanacho, C. C. (1996). NC A&T Web site

PROFESSIONAL ASSOCIATION:

Association for Educational and Communication Technology.
Eastern Educational Research Association.
National Association for Industrial Technology