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Pilot study of a multimedia instructional program for teaching ESL grammar with embedded
tracking

by

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CHAPTER 1. INTRODUCTION

This study examines the use of a multimedia program for teaching ESL grammar. The design of this program is grounded in cognitive load theory (Sweller, 1998) and multimedia learning theory (Mayer, 2001). Also, the design is based on evidence-based principles for the design of multimedia instruction. In this pilot study, we test the effectiveness of the instructional decisions based on the above theories and principles. For this reason, this pilot study can be classified as the "basic research on applied problem"(Mayer, 2008).

In this chapter, the importance of the development of multimedia instructional programs for teaching foreign language grammar, the importance of high-quality instructional design for multimedia instructional programs, a brief overview of the research related to the design of multimedia instructional programs, the purpose of this research study, the target audiences, and the limitations of the study are described.

Developing a multimedia instructional program is a very complex process. It requires sophisticated decision-making. During a multimedia training development, "the learning mission must be kept in focus to avoid veering off-track into technology issues, at the expense of the project's true purpose" (Troupin, 2000). It is relatively easy to transfer raw content (approximately 30 million pages of material are available on the Internet) from paper to technology delivery. But it is much more challenging to put material into a format that helps people learn (Troupin, 2000).

Multi-criteria decisions need to be made by the designer about how to incorporate the findings from the literature review and design an effective teaching program. The data collected during this pilot study will be instrumental in testing the implemented instructional design decisions with the goal of improving the effectiveness of the program.

The data collected in the pilot study also contributes to "educational research that simultaneously applies the science of learning to an authentic practical problem and grounds the science of instruction in research-based theory" (Mayer, 2008).

Behavior tracking technology that the program under evaluation uses is instrumental in collecting objective data about how it is used by learners. It not only collects the data about student's performance, but also how different features in the program are used by learners. If some features in the program are not used as extensively as others, the judgments about the appropriateness of these features can be made, which will serve as foundation for revision of the program.

Behavior tracking will also cover the important dimensions of the program evaluation after the pilot study. After all the necessary changes determined by the findings from the pilot study are made, the next study about the effectiveness of the program will be conducted on a larger number of participants. It will rely heavily on the database data about students' performance and the use of the various features in the program. There will be no need to go the site and conduct informal observations and administer surveys and tests because the program collects objective data about its use.

Brief description of the findings from the literature review

Because instructional design is crucially important to the success of a multimedia instructional program, a literature review on the body of research in the fields related to the design of the target multimedia instructional program was done. The purpose of the literature review is to review current research and literature on multimedia instructional programs and to discuss findings as they relate to the design and development of multimedia instructional programs.

The following portion of research was identified as related to the design of the multimedia program under development:

- Existing theories and approaches for teaching grammar

- Theories that promote efficiency in learning and are related to the multimedia instructional design

- Evaluation studies comparing different approaches for teaching foreign language

  grammar

- Multimedia instructional programs for teaching grammar available on the market

- Evaluation studies comparing different features of multimedia instructional programs

The analysis of those research and evaluation studies shows that two approaches, namely inductive that emphasizes implicit teaching (Krashen, 1988) and deductive that is

focused on conscious learning (Chomsky, 1986) are prevailing. Practitioners around the world often use the mixed approach, namely modified deductive or modified inductive approach (Gollin, 1998).

To make a choice on a particular approach, I reviewed the research on theories that promote efficiency in learning. Taking into account the target audience (novice learners) of the multimedia instructional program under development, the choice was made in favor of guided instruction, modified deductive approach, and tutorial format that supports this teaching approach."The past half-century of empirical research on the minimally guided instruction provided overwhelming and unambiguous evidence that minimal guidance during instruction is significantly less effective and efficient than guidance specifically designed to support the cognitive processing necessary for learning" (Kirschner et al., 2006).

An analysis of the body of the reviewed research shows that the theories that promote efficiency in learning are the cognitive load theory and the multimedia learning theory. The basic premise of the cognitive load theory is that the focus of the instructional module must be the instruction itself. Instruction that effectively presents the problem to our working memory has an impact of our ability to store knowledge and skills in our long-term memory. The cognitive load theory provides a sound baseline to the design of effective web-based instruction.

The cognitive load theory has its modern origins in experiments conducted by Dr. John Sweller at the University of New South Wales, Australia, in the early 1980s. Cognitive load theory is based on dozens of experiments conducted over the past twenty five years by instructional scientists in Australia, Europe, and the United States. Today it has grown into

one of the most widely recognized sets of proven principles governing learning and

instruction in the training profession (Clark et al., 2006).

Statement of the problem

The pilot study of the program "that simultaneously applies the science of learning to

an authentic practical problem and grounds the science of instruction into the research-based

theory" (Mayer, 2008) will be a valuable contribution to the educational research.

Despite the abundance of multimedia instructional programs, the evaluation studies

about their effectiveness are not something that can be found easily. Moreover, the majority

of the multimedia instructional program evaluations are based on self-reported subjective

data. For this reason, there is a need for evaluations that contain objective data and research

that will inform the instructional designer about the effectiveness of the instructional

decisions that he/she implements. Because design of multimedia instructional program is

extremely complex, any sources of information that will inform the software designer not

only about the effectiveness of the program overall, but also about the use of separate

features of the program by students will be a great benefit. If the data collection instrument is

embedded in the program itself, the process of collecting such data will be simplified. The

analysis of the collected data will help redesign and improve the features of the program and

its overall efficiency. User-behavior tracking technologies imbedded in the computer-based

instructional program will assist the instructional designer in testing her instructional design

strategies and features of the program. The designer will be able to see the details of how

students construct their knowledge and what problems they experience during the navigation and knowledge acquisition. Although interviews, surveys and observations are also important instruments of data collection, the use of the data collection tracking technology within the program itself will simplify the data collection process. Also, the data collected through the program will be used by instructors. They will be able to easily generate the data base reports and track what their students do and what problems they experience during their acquisition process rather than just see students' scores. The multimedia instructional program that contains a user behavior tracking technology needs to be designed, produced, and evaluated.

To sum up, the review of the literature yields the above theories aimed at understanding how people learn and evidence-based research aimed at understanding how to present the material in ways that help students learn.

Purpose of the study

The goal of this study was to evaluate the multimedia instructional program designed for teaching students the grammar concept of present simple and past simple passive voice in affirmative sentences within the context of the geography of the USA. The findings from the evaluation provided information for researchers and developers about the changes to the program that needed to be made.

This study allowed collecting data on students' learning and how students use the program. Analysis of the collected data informed the designer about the features of the program that supported learning more efficiently than others and which features needed to be modified.

The user-behavior tracking technology (recording the data about students' activities and navigation patterns into the database) helped the researcher study process-product relationship, providing an understanding not only of a combination of factors on learning, but an understanding of the effects of individual factors on learner outcomes.

The research questions addressed in this study were:

- What is the impact of the intervention on students' ability to use present simple and past simple passive voice in affirmative sentences?
- How do users use the program?
    a. Do they have any problems navigating through the program?
    b. What are their navigation patterns?
    c. Which program aids do they use the most (the least)?
    d. Do they have problems understanding words and sentences?

Limitations of the multimedia instructional program under development

The level of interactivity (a feedback level) is limited to a pre-defined feedback on specific learners' actions (solution steps, questions, and answers). The level of interactivity is immediate and explanatory (principle-based explanations, word references, glossaries, and grammar help). The design and production of a program with a high level of interactivity is beyond the scope of this project because of the time and cost constraints. Also, the choice of this low level of interactivity is in tune with the philosophy of reducing extraneous cognitive load on novice learners caused by interactivity. "A common notion across most papers in this issue is that interactivity and learner control might help, but might also hinder learning. For example, direct guidance could be provided to low-prior knowledge learners at the appropriate time or on demand using various forms of feedback and hints" (Kalyuga, 2007).

Limitations of the pilot study

This case study involved a limited number of individuals from DMACC (a convenience sample). For this reason, this case study used a descriptive method, not an explanatory one. That's why conclusions about cause-and-effect relationship could not be drawn.

Target audiences

The target audiences for this program are ESL learners 12 years old and above. Level of English proficiency: intermediate

Because the program is open to the public on the Internet, the audiences that do not belong to particular classes can take it under the class code GENERAL. The audiences that belong to particular classes can take the training under particular class codes assigned by the administrator. The access is restricted by a particular class code. In this way, the data from the outsider users is stored in the database separately and not interfere with the data used in the study.

Summary

In Chapter 1, the rationale for developing the multimedia instructional program that is able to collect data within itself about how students use the program (user-behavior tracking) is provided. The purpose of the study is to use interview data and data on student learning for modifying the program and understand how students learn through the program. The limitations of the program such as generalizability of the results are presented, and the program under development is described.

CHAPTER 2. LITERATURE REVIEW

In this chapter, a review of the body of research related to the design of the multimedia instructional programs is presented. The topics include: the purpose of the literature review, methodology, existing theories and approaches for teaching grammar, evaluation studies that support the reviewed findings from the Cognitive Load Theory, a brief description of the multimedia programs for teaching grammar available on the market, the choice of general framework for the evaluation of instructional programs for teaching ESL grammar, evaluative studies describing the effectiveness of different features of multimedia instructional programs, the use of captions in the system-paced learning environment, the use of personalization effect, different formats of presenting information on the screen: learner-paced parts vs. system-paced parts in the program under development.

Purpose of the literature review

Because good instructional design is critical to the success of a multimedia-learning program, before starting the design process it is important to find out which particular design will fit the target audiences and promote learning and the ultimate success of the program under development. The user behavior tracking technology incorporated within the program under development will become one of the means of collecting the information that will facilitate the design and development processes. The program under development will be designed to teach ESL grammar, namely passive voice to intermediate ESL students who are not familiar with the use of the passive voice grammar concept.

Before designing a multimedia instructional program, it is important to get familiar with the body of research in the fields related to the design of the target multimedia instructional program. A substantial body of theoretical and empirical literature on designing and evaluating multimedia instructional programs has been produced within the last twenty years. With the rapid growth of the computer industry, the application of computers for teaching and learning foreign languages has expanded in a number of directions.

The purpose of this literature review is:

- To describe useful existing theories and approaches for teaching grammar
- To describe the theories that promote efficiency in learning.
- To describe evaluation studies of the multimedia instructional programs for teaching foreign language grammar
- To describe research studies that will help design the main features in the multimedia instructional program under development grounded in research-based theory
- To use the findings for defining the project goals and design space
- To apply the findings for determining the design strategies of the multimedia instructional program under development.

Because this area of research is relatively new and the rate of development in the field of multimedia is changing so rapidly, the majority of literature reviewed covers mainly the past 20 years (1988-2008). The body of research in the following fields is the target of the literature review.

- The existing approaches to teaching foreign language grammar

- Multimedia instructional programs for teaching foreign language grammar available on the market

- Cognitive approach to instructional design for multimedia learning

- Strategies to design effective multimedia programs for teaching foreign language grammar

Methodology

This literature review aims to inform the instructional design of the target multimedia program on the ways of developing learning interventions for the intended audiences in the manner that promotes effective and efficient learning of ESL. For this reason, the first step in conducting the literature review was to find out about existing theories that promote efficiency in learning, namely theories and approaches for teaching grammar that exist on the market and then narrow the search down to the theories and approaches that fit with the target audiences, intermediate ESL learners that don't have any background knowledge of passive voice. After describing the theories and approaches that promote effective learning in ESL classes, I identified the theories and approaches that will suit the target audience. Because efficiency in learning is supported by cognitive theories that take into consideration the mental processes involved in learning, I focused on the cognitive theories that are applicable to multimedia learning. The findings from this literature review helped me identify the two major cognitive theories that are directly linked to computer-based learning: the cognitive load theory and the multimedia learning theory.

To determine how those theories support the efficiency in learning, I identified the evaluation studies that describe how the cognitive theories affect learning. The findings from the evaluation studies helped me identify the teaching approaches that will fit with the target audiences and at the same time will take into account the cognitive processes involved in multimedia learning. The decision regarding the teaching approach in the multimedia instructional program under development was made in favor of a hybrid teaching approach, the blend of deductive and inductive approaches because the target audience is intermediate users according to their language level, but beginning users according to their knowledge of passive voice.

The next step was to make a decision about the role of computer in the multimedia instructional program under development. "According to the dichotomy popularized by Levy (1995, 1997), computers may be used in language learning in either tutor or tool roles" (Hubbard, et al., 2004). Determining which of these roles will better suit the target audience was the key. The studies that compared the two approaches: using computer as a tool or as a tutor were identified. On the basis of the findings from those studies, the decision was made in favor of a computer role as a tutor, because it better serves the needs of the learners who are not familiar with the concept to be taught.

Once the teaching approach and the type of the target multimedia instructional program were determined, the tutor type programs available on the market that use the same teaching approach were identified and given close attention in order to identify the

instructional decisions used in those programs that can be potentially used in the target program.

The next step of the literature review was to identify the features in the target program that could be supported by the findings from the evaluation studies. Because the scope of the evaluation studies related to different features of multimedia programs is too big, it was important to come up with the choice of the general framework for the evaluation of instructional programs for teaching ESL grammar. After the general framework was identified, a number of studies providing insights on different features of multimedia programs that proved to be effective were selected and given close consideration.

On the basis of the findings from those evaluative studies, the features of the program under development were conceptualized. The evaluative studies regarding the three core instructional decisions that will be implemented in the target program were analyzed in detail. The findings from the literature review led me to a conclusion that those core features and the other features presented in Table 3 had the potential to increase the efficiency in learning if implemented in the target multimedia program.

Existing theories and approaches for teaching ESL grammar

After reviewing the current research, theoretical studies, case studies, and evaluations on the topic of teaching grammar in ESL classrooms, I learned that in the literature regarding teaching grammar there is a controversy on how to teach grammar to ESL students.

The "communication" alternative focuses the learner's attention on the content and information, rather than on how the language works. "In this way, immersion programs are intended to exploit the early-life interaction of children who are acquiring the first language. The underlying assumption is that these same dynamics can effect acquisition in the classroom for the immersion pupil without hampering L1 literacy skills" (Kirkwold, 2007). The focus is on implicit teaching and unconscious learning of the language (See Table 1).

"Acquisition requires meaningful interaction in the target language - natural communication - in which speakers are concerned not with the form of their utterances but with the messages they are conveying and understanding" (Krashen, 1988). "According to Krashen there are two independent systems of second language performance: 'the acquired system' and 'the learned system'. The 'acquired system' or '**acquisition**' is the product of a subconscious process very similar to the process children undergo when they acquire their first language. It requires meaningful interaction in the target language - natural communication - in which speakers are concentrated not in the form of their utterances, but in the communicative act. The 'learned system' or '**learning**' is the product of formal instruction and it comprises a conscious process that results in conscious knowledge 'about' the language, for example knowledge of grammar rules. According to Krashen 'learning' is less important than 'acquisition'" (Schutz, 2007).

The opposite view on teaching a foreign language is that "language can be studied analytically through descriptions of structure. The most typical application of this approach is formally studying grammar, vocabulary, and phonetics. The justification for this kind of study is made on cognitive grounds" (Kirkwold, 2007).

In addition, there is another alternative "… in favor of balanced method of teaching, combining communication and analysis – and against methods that rely exclusively on alleged 'unconscious acquisition'" (Lowe, 2005).

"Proponents of various methods have typically treated the explicit/implicit option dichotomously" (Lowe, 2005). The proponents of the balanced method note, "Communicative Language Learning that relies exclusively on communication tasks without language awareness is not effective. A method that concentrates on language analysis without communicative language practice and tasks is equally ineffective. An eclectic method that combines communication and language awareness study is consistent with what we know about the functioning of the brain and how human beings learn, and it is effective" (Lowe, 2005).

The eclectic method of teaching grammar

The practitioners around the world adopted the eclectic method as an effective method of teaching grammar. According to Gollin (1998), who has taught in Europe, Thailand, Japan, and New Zealand, "there is a range of techniques, commonly called 'discovery' or 'guided discovery' techniques in which explicit focus is combined with interference from examples" (Gollin, 1998). For example, the teacher might put two contrasting items on the board and elicit the difference in meaning between them, which is

called 'modified deductive' teaching. In this case, the rule is explicitly formulated before practice.

Several researchers, who claim that they can enhance not only perceptual learning, but also conceptual learning, support the findings about the effective use of appropriately arranged contrasts.

"Understanding when, where, and why to use new knowledge can be enhanced through the use of 'contrasting cases,' a concept from the field of perceptual learning (see, e.g., Gagné and Gibson, 1947; Garner, 1974; Gibson and Gibson, 1955). Appropriately arranged contrasts can help people notice new features that previously escaped their attention and learn which features are relevant or irrelevant to a particular concept. The benefits of appropriately arranged contrasting cases apply not only to perceptual learning, but also to conceptual learning" (Bransford et al., 1989; Schwartz et al., 1999).

Another technique of 'guided discovery' is "where the rule is explicitly formulated either by the teacher or the students, after the students have been guided to work it out through practice. This 'modified inductive' technique emphasizes the formulation of the rule explicitly compared to a purely inductive approach in which the rule is left implicit. The common denominator with this range of techniques is the fact that the students are actively engaged mentally, which is not only motivating, but is believed to lead to more thorough learning" (Gollin, 1998).

These findings from the reviewed literature led the author to the conclusion that the techniques for teaching ESL grammar may vary. The author decided to find out how these techniques should vary in order to accommodate the needs of different audiences of learners. The cognitive load theory provides a thorough explanation and justification grounded in research and evaluation studies of different teaching approaches used for different target audiences (Clark et al., 2006). The author considers the above book as a

credible source of information because the findings are based on research. Also, the
publisher of this book, Pfeiffer, serves the professional development needs. It provides
hands-on resources for human resource professionals.

Instructional environment: A cognitive load perspective

According to the cognitive load theory, the instructional environment should differ in
regard to the level of base knowledge of learners. "Novices need support from the
instructional environment to substitute for their lack of schemas" (Clark, 2006, p.40) (see
Table 1). "Experts in a domain have a rich repository of schemas in long-term memory that
allow them to use their working memory resources more efficiently" (Clark, 2006. p.40).

"If neither appropriate LTM, long term memory, knowledge base, no external
instructions are available to provide executive guidance in novel situations, then we use
general search strategies by default. Even though such strategies may be effective in
reaching the goal, they are cognitively inefficient and cause high levels of working memory
load" (Sweller, 1998).

"For novice learners, external guidance may be the only source of executive function
while, on the opposite side of the continuum, experts could have all the required knowledge
structures available. At intermediate levels, an optimal executive function should be
knowledge-based when dealing with familiar elements of information and externally based
when dealing with new elements of information" (Kalyuga, 2007).

The quotation above comes from a peer-reviewed descriptive paper by Kalyuga
published in Educational Psychology Review (2007). It summarizes the main points and

recommendations of the previous papers in this special issue within a conceptual framework of cognitive load theory. The descriptive paper by Kalyuga can be considered as a credible source and a landmark paper that addresses the cognitive architecture, sources of cognitive load, and instructional applications for interactive e-learning environments and analyzes methods for managing cognitive load and enhancing instructional efficiency of such environments.

On the basis of the above findings from the reviewed literature I made the conclusion that the choice of techniques to teach ESL grammar should accommodate the needs of the target audience. For example, the deductive approach with an abundance of external support from the teacher will better suit the needs of the novices. The inductive approach can be used with more experienced learners to avoid redundant guidance. With intermediate students the eclectic approach could be an effective means of teaching.

The cognitive approach for choosing a teaching method to address the needs of the target audience is supported by the evaluation studies that compare the effectiveness of different teaching approaches for teaching grammar to novice students.

Evaluation studies and the findings from cognitive load theory

There is an abundance of evaluation studies on the effect of technology-enhanced instruction on achievement. However, most of these studies have examined the use of only one kind of technology, either used as a tool or a tutor. The author has found only one study that reports the perceptions of students enrolled in basic Spanish classes on different kinds of technology enhanced language learning. For this reason the study was given close attention.

Another reason for selecting this study for analysis was because the data were obtained from novice learners, the students who don't have sufficient prior background in Spanish. The instruction in those TELL classes (Technology Enhanced Learning Environments) was focused not on drill and practice (e. g. structured environments such as tutorials), but on simulated real-life tasks as a part of Internet activities. It is a descriptive qualitative study with a number of participants, which adds to the reliability of the data. The total of 358 students from first and second semester Spanish classes from Florida State University participated in the study. The duration of the experiment was one semester, which also adds to the reliability of the obtained data. The data were obtained through questionnaires administered to the students. The questionnaire contained 45 statements regarding students' perceptions about the effects of the technology on the foreign language learning experiences. The main computer-assisted instructional components were as follows:

1) An interactive audio-visual CD-ROM

2) Internet activities that required students perform simulated real-life tasks

3) Threaded discussions among the classes

4) Electronic pen Pal communication with individuals from Hispanic cultures

The Internet activities were inherently more holistic and authentic than the CD-ROM. The Internet activities led the students through a planned sequence of whole language exercises. The CD-ROM provided many internal supports, resources, and traditional building block reinforcement activities (Stepp-Greany, 2002).

The findings from this study support the idea that holistic non-guided instruction, the use of pure inductive approach, is not beneficial for the beginning foreign language learners. Only 43% of the students reported that they had learned a significant amount from Internet

task-based activities. Fewer felt that they that they had learned a considerable amount from the threaded discussions and pen pal activities, (30.2% and 27%, respectively). "Although it seems that students would have attributed their reported gains in cultural knowledge to the Internet activities, they did not seem to see a relationship between the Internet activities' authentic cultural and linguistic material and their improvement in cultural knowledge or reading skills" (Stepp-Greany, 2002). On the contrary, "64% of the students found the CD-ROM to be enjoyable. Students attributed more learning value to the CD-ROM than to the other components" (Stepp-Greany, 2002).

Another study that involved two small-scale experiments tested a hypothesis regarding the learning of second language grammar within a particular theoretical and pedagogical framework. The two experiments were carried out in two secondary schools between novice and more advanced foreign language learners in England to investigate two different ways of teaching French grammar, PI (processing instruction) and EI (enriched impact). The findings of the study support the theory that while students hear and read sentences in a foreign language they are not paying attention to the grammar structure, but interpret the meaning of the sentence through the context, the meaning of words, unless a particular techniques to help students focus on language form are used. Those techniques were used with PI, and not used in EI interventions. In both experiments pre-tests, immediate post-tests, and delayed post-tests were administered. "In addition to achievement test scores, attitudinal data were collected from the teachers and pupils, using questionnaires, interviews and focus groups. Attitudinal data suggested that learners found both PI and EI activities new and enjoyable" (Marsden, 2007). The achievement test results among the learners who were in a very early stage of developing a particular grammar concept and who experienced

input PI activities (those PI activities forced them to interpret the grammar concept) resulted in statistically significant larger learning gains than EI in all four measures used, namely, listening, reading, writing and speaking. For more advance students the advantages of PI instruction were the case too, but less pronounced (Marsden, 2007).

Despite the small scale of the study, its credibility can be supported by the fact that it is peer-reviewed and it relies on the set of data that are not self-reporting. In addition, precautions against sampling and teacher bias were taken.

The effectiveness of more traditional structure focused on grammar among these beginning students is consistent with a study by Conrad (1999) who found that first semester students in regular foreign language classes favored repetition and more structured instruction compared to fourth semester students.

The rationale for conducting the qualitative research by Conrad was to find out the most effective way of teaching a foreign language to college students, namely, if structural approach, focus on accurate productivity or communicative approach should be used. The data presented in this study come from a large cross-sectional, cross-linguistic study. In this study, "the data were gathered from March to May to give the first-semester level students enough time to form opinions on their experience. A survey was distributed to students in first- and fourth-semester classes of French, German, Italian, and Spanish. "Of 791 surveys distributed, 480 were returned, and of these 454 were deemed usable" (Conrad, 1999).

Although both groups favored the accuracy of language production, the means among 1st semester students were higher than the means among 4th semester students (5. 375 vs. 5.198, where the 6 in the likert scale correlated with the strongly agree response). Also, the first semester students favored the more structured activities such as doing exercises in a

workbook (the means 4.239 vs. 3.468) and repetition of words and phrases (the means 4.812 vs. 4.245) when compared to the fourth semester students.

At the same time both 1st semester and 4th semester students responded negatively to the statement that the instruction should be only limited to the structured activities. "Classroom tasks should consist of a blend of activities, sometimes focusing on language accuracy, and at other times focusing on expressivity" (Conrad, 1999).

"The picture that emerges from the data suggests a blend of two leading considerations: using a structural approach involving corrective feedback and grammar, as well as a communicative approach where language is used for real communicative purpose" (Conrad, 1999). The findings from the above evaluation studies not only conform with the cognitive load theory that emphasizes more guided and structured instruction benefits for novice learners (Clark, 2006), but also show that learners place high value on activities to communicate information. For this reason, one of the major elements of the target program design is contextualized teaching of grammar and focus on an immediate use of the mastered grammar concept for communicating meaningful information.

Project goals and design space

On the grounds of the above findings, I concluded that the multimedia instructional program under development for teaching intermediate ESL students the basic knowledge of passive voice should be designed in the format that emphasizes structured activities, repetition, and specific sequencing. The linear fashion of presentation of the material will also benefit the students because they do not have any background knowledge of passive

voice. At the same time, the activities in the program can be structured in a way so that they prime learners' inductive reasoning skills to help them incorporate new knowledge within the existing schemas in their cognitive architecture. The appropriate balance should be maintained, because the program is designed for the target audience who doesn't have any basic knowledge of the grammar structure to be taught, but has some basic knowledge of English language grammar. In addition, the target audience needs to have a way of implementing the learned grammar concept for communicating meaningful information, the factual information about the USA. To sum up, the tutorial-based multimedia instructional program that encourages students to formulate the grammar rule and provides sequenced and guided practice and, in addition, gives them a chance to apply the knowledge they will have learned through the program will best suit the needs of the target audience.

The target program compared to the other multimedia programs available on the market

The previous part of the literature review casts light on various ways of teaching grammar. Some of those approaches have been adapted for computer-assisted language learning (CALL). The example of "top-down or deductive model is perhaps best exemplified in CALL by Azar interactive (1999), which is basically Betty Azar's grammar book in CD-ROM format. The computer program presents a rule or rule and some examples, and then provides practice exercises" (Hanson-Smith, 1999). In this software grammatical points are put into "multimedia" to bring grammar to life.

"Another, more cognitive approach to grammar study is illustrated by The Grammar ROM (Freebairn &Parnell, 1996). In this software, the grammar rules are divided by grammar points, but they are also connected to specific examples rather than just fill in the blanks, which is a step ahead" (Hanson-Smith, 1999).

" In contrast to deductive, structuralist approach, in which rules are provided first, concordancers rely on inductive reasoning. A concordancer searches a text for words targeted by the user and then aligns the target word down the center of the screen with the surrounding line of text, usually around 10 words (Thompson, 1991). The students can then see what kinds of contexts are typical of the collocation. The students then generate a rule for using the structure that they can apply to their own writing"(Hanson-Smith, 1999).

"With more sophisticated tutors, a more complex algorithm is required that can perform error diagnosis, error correction, and the integration of the individualized learner feedback. The CALL software programs or systems that aim to accomplish this task are often referred as Intelligent Language Tutoring Systems (ILTS), or intelligent computer-assisted language learning (ICALL) programs. In addition, the systems implement natural language processing (NLP) techniques, which utilize theories of grammar to process learner input in order to generate feedback" (Levy et al., 2006) A typical example is *Banzai,* a Web-based learning application for mastering Japanese grammar. (Nagata, 2002)

Building an ILTS program is beyond the scope of the target project, although the author of this literature review admits that the user-behavior tracking, namely, recording the data about students' behavior, performance, and scores, is already implemented in the target program and could be used for generating intelligent feedback on the users' responses.

Taking into account the findings from the reviewed literature on the multimedia instructional programs similar to what the author is designing, the target program under development will be a hybrid tutoring system because it will best accommodate the needs of the target audience, who are intermediate students according to their general knowledge of English and novices, because they don't have basic knowledge of the grammar concept to be taught. The teaching method of 'guided discovery', where the rule will be explicitly formulated by the program, after the students have been guided to work it out through practice of contrasting cases, namely, comparing sentences in active voice vs. passive voice, is used in the target program. The program provides sequential presentation of the material by feeding the information piece by piece and drill and practice with the feedback. In addition, the teaching strategy focuses on contextualized teaching of a grammar concept. The grammar concept will be taught within the country-studying context. At the end of the program, as a final authentic assessment, the user will have to produce a written narrative (production of the language) that will make him/her actually implement all the skills that he/she learned through the program.

General framework for the evaluation of programs for teaching ESL grammar

Because the ultimate goal of this literature review is to inform the designer not only about the existing teaching approaches that will best suit the target audience, but also about the ways of putting material into a computer-based format that helps people learn, I looked for evaluation studies that provide an insight on the effectiveness of particular features of multimedia instructional programs available on the market, namely the features that keep the learning mission in focus. For this purpose, I needed to identify the framework for software evaluation that suits best with the goal of the project. I found out that the framework of different authors on "the quality called language-learning potential (LLP)" (Levy, 2006, p.75) depended on their language learning perspective.

"Chapelle (2001) prioritized focus on form, and held that this is the most likely condition to lead to learner acquisition of the target language structures. In accordance with this theoretical position, learning to manipulate the grammar of language in a meaningful context is regarded as the core goal of language learning" (Levy, 2006, p.76) In contrast, Hubbard's perspective on LLP is broader and is focused on teacher's fit as the most crucial component of software evaluation.

Chapelle's perspective is "directed on the language-learning task, as it is actually carried out in a particular learning setting" (Levy, 2006, p. 80). Chapell's perspective on the framework of the evaluation of a computer instructional program fits best with the evaluation of tutorial-type software. It would include, firstly, "consideration of the task, as presented the program per se (Level 1), the particular way the teacher planned and organized, the use of the

program in class or out of class, perhaps with pre or post-CALL activities (Level 2); and a careful consideration of what the students actually did when they used the program in context (Level 3)" (Levy, 2006, pp. 80-81)

In tool-type programs, in which tasks reside outside of the computer program, the more general framework offered by Habbard (1996) is more suitable for the evaluation of LLP.

The multimedia program under development is a tutorial-type. For this reason, the author narrows down the scope of the evaluation studies to be reviewed to those that use the Chapelle's framework, because it fits best with the tutorial-type software.

Evaluation studies describing the effectiveness of different features of multimedia instructional programs

Taking into account Chapelle's framework of evaluation for selecting evaluative studies, I identified several evaluative studies grounded in cognitive theories and correlated those studies with the potential features to be implemented in the target program.

These studies are instrumental for me, the designer, because they provide evidence of the effective use of features in multimedia instructional design. These features are supported by the cognitive theory of multimedia learning, an extension of the cognitive load theory. According to Richard Mayer and Roxana Moreno (1998), the cognitive theory of multimedia learning is "based on the assumption that conceptualizes multimedia learners as active learners who are separately processing and then integrating limited amounts of visual and auditory information. Their theory explicates three types of demands (essential processing,

incidental processing, and representational holding) that may overload a learner's cognitive system and interfere with transferable learning."

Given the focus and direction of the target program, particular features were identified and will be incorporated in the final version of the target multimedia program. The scope of this literature review does not allow identifying all the potential features of the target program that can be supported by the findings from the cognitive load theory (Sweller, 1998), multimedia learning theory (Mayer, 2001) and evaluation studies. The most important potential features of the program and the studies that can be used for justification of their implementation are listed in Table 2.

The three core features are examined in detail:

- Personalization
- Subtitles and control over the pacing of the presentation in the system-paced parts of the tutorial
- Learner-paced parts vs. system-paced parts of the target program: Different formats of presenting information on the screen
-

The use of captions in the system-paced learning environments

The first study explicates an idea of the use of captions for audios in the system-paced environments. It is an empirical study designed to provide evidence whether subtitles or transcripts are more effective in cases of comprehension breakdowns. It was published in a credible source of information *Language learning and Technology*, 2007. "A multimedia

listening activity containing a video of an academic lecture was designed to offer help in the form of target language subtitles (captions) and lecture transcripts in cases of comprehension breakdowns" (Grgurovic, et al., 2007). Eighteen intermediate ESL students enrolled in an academic listening class at a research university participated in the study. Two tests and questionnaires in addition to screen captions were used to analyze students' performance on the activity and their use of help option during multimedia instruction. The received data were triangulated.

"The research indicated that participants interacted with the subtitles more frequently and for longer period of time than with the transcript"(Grgurovic, M. et al., 2007). All the participants were from different countries, which allowed the researchers to control for nationality variable. The participants were assigned to 3 groups, those who used subtitles or transcript and those who didn't have those options. The subtitles group had the best recall test score. The weakest group overall was non-interaction group. The findings showed that subtitles pages were opened on average 6.88 times (SD =4.95) compared to transcript pages 2.17 times (SD=3.68).

Despite such limitation of the study as a small number of participants, 18 students, and a purposive sample, it supports the idea that listening with the presence of subtitles led to better understanding of the subtitled passage.

The findings from the cognitive load literature on the subject of subtitles are seemingly opposing. Huang and Eskey (1999) studied the effect of subtitles on intermediate

ESL learners and found that those listening with subtitles scored significantly better on both vocabulary acquisition and listening comprehension of the subtitled TV program.

Based on cognitive load theory, the study by Yali Diao, Paul Chandler, and John Sweller (2007) investigated the effect of simultaneous written presentations on comprehension of spoken English as a foreign language. "Learners' language comprehension was compared while they used 3 instructional formats: listening with auditory materials only, listening with a full written script, and listening with simultaneous subtitled text. Listening with the presence of a script and subtitles led to better understanding of the scripted and subtitled passage but poorer performance on a subsequent auditory passage than listening with the auditory materials only" (Diao, et al.,2007)

The authors interpreted their findings with the redundancy effect and attributed the increase in comprehension not to a modality effect (two modalities increase comprehension), but to the fact that comprehension came entirely from reading, because the learners had to process the multiple forms of the same information and that imposed extraneous cognitive load.

Overall, the findings from the reviewed literature in regards to captions and scripts seem to be controversial and need further research on which modality supports student's comprehension of audios when captions or scripts are used. At the same time, all the findings support the benefit of subtitles; because they help ESL students comprehend audio information, regardless of the modality that students use. For this reason, the author decides to implement captions in the target program in the way that students can turn them on and off

at any moment of the system-paced presentation. Captions will provide help for students with limited English vocabulary to help them comprehend information. The students who will not need such help will be able to focus on listening by turning the captions off at any time. In addition, users will be in control of system-paced parts of the program and will be able to pause and replay any sentence. It will allow them to adjust the use of captions to their needs.

Personalization effect

The second peer-reviewed evaluation study by Mayer et al. (2004) provides the author with the insight on personalization effect in multimedia learning. "In previous set of studies, Moreno and Mayer (2000) found that students scored higher on transfer test after receiving a narrated animation about lightening formation in which the words were in conversational style (i.e., using first and second person as well as comment directed at the learner) rather than in formal style (i.e. using third person and no comments directed at the learner)" (Mayer et al., 2004). They also found that students scored higher on a transfer test after playing an educational science game containing narrated animation in which the words were in conversational style than when the words were in formal style.

The evaluation study (Mayer et al., 2004) that I am going to focus on to prove my instructional decision in regards to a personalized format (story format) of the tutorial under development is a quantitative study consisting of three experiments. This study targeted the effect of personalization and provided evidence for the theoretical explanation of this effect based on the cognitive theory of multimedia learning.

 "Using the self as a reference point increases the learner's interest, which in turn encourages the learner to use available cognitive capacity for active cognitive processing of the incoming information during learning. The deeper processing results in more meaningful learning as indicated by better transfer test performance" (Mayer et al., 2004).

Three experiments were conducted. One of the research questions in each of the three experiments was: does personalization affect transfer performance? Overall 121 people participated in three experiments.

In the first experiment participants were 62 college students recruited from the Psychology Subject Pool at the university of California, Santa Barbara. The nonprobabilty sampling procedure was used to select the participants, which is the limitation of this study. The designers of the experiment took measures to isolate the variables of gender, age, and previous experience with the target topic *Human Respiratory System.* "The mean age was 18.5 years for the personalized group and 18.9 years for the nonpersonalized group; the personalized group contained 38% men, and the nonpersonalized group contained 33% men; the mean score (on the 12-point scale) on a survey of participants' experience with the tested information was 6.0. In the three experiments, students who received the personalized version scored significantly higher on transfer tests but not on retention tests than did students who received the nonpersonalized version. The results are consistent with a cognitive theory of multimedia learning in which personalization causes students to actively process the incoming material" (Mayer et al., 2004).

The students received a personalized or nonpersonalized version of a narrated animation explaining how the human respiratory system works. The narration for the nonpersonalized version was in formal style, whereas the narration for the personalized version was in conversational style in which "the" was changed to "your" in 12 places. Participants were tested in groups of 1 to 4 and were randomly assigned to a treatment group. The designers performed the statistical analysis of the obtained data by calculating means, standard deviations, and running t-tests. The mean scores on the retentions tests for the two groups in each of the three experiments were not significantly different in the two groups. The mean scores on the transfer tests were significantly greater for the personalized groups than for the non-personalized groups. "The personalization effect was strong and consistent over three experiments" (Mayer et al., 2004).

The author of the target multimedia program uses the personalization principle in the design of the target multimedia program. The framework of the program is a story that is used for focusing students' attention to the problem that they may encounter to communicate the factual information about the country (the USA), stitching the instructional pieces together, and summarizing and additional clarifying of the rules and difficult points in the acquisition process by using conversational language vs. formal language (See Table 2).

Different formats of presenting information on the screen:

Learner-paced parts vs. system-paced parts in the target program

The third evaluation study by Huib K.Tabbers et al. was chosen to support the instructional decisions in the program under development regarding the format of presenting information on the screen.

According to cognitive load theory (Sweller, Van Merrienboer, &Paas, 1998) and Mayer's theory of multimedia learning (Mayer, 2001), replacing visual text with spoken text (the modality effect) and adding visual cues relating elements of a picture to the text (the cueing effect) both increase the effectiveness of multimedia instructions in terms of better learning results or less mental effort spent. "A number of experiments have demonstrated that replacing written or on-screen text with spoken instruction improved the learning process in different ways: lower mental effort during instruction and higher test scores, (Kaluga, Chandler, & Sweller, 1999, 2000; Tindall-Ford, Chandler, & Sweller, 1997), less time on subsequent problem solving (Jeung, Chandler, & Sweller, 1997; Mousavi, Low, & Sweller, 1995), and improved scores on retention, transfer and matching tests (Mayer & Moreno, 1998; Moreno and Mayer, 1999).

The quantitative study by Huib K.Tabbers et al. was chosen because it was to test the generalisability of the modality and cueing effect in an ecologically more valid classroom setting. In addition, it is the most recent publication on this topic and comes from ERIC database, a credible source for educators.

The instructions in this experiment were learner–paced compared to system-paced in previous experiments. To determine the effectiveness of the instructions retention and transfer tests were applied. In addition, to determine the efficiency of the different presentation modes, the self-report measure of mental effort and total time spent on the instructions were collected. The designers used a non-probability sampling for choosing participants, 111 second-year students from the Department of Education of the University of Gent in Belgium. The limitation of this study is that the number of males in the study was significantly smaller than the number of females, 16 and 95, which does not allow isolating the gender variable. The students were randomly divided over the 4 experimental groups: "30 students in the VN-group (visual text, no cues in diagram), 26 in the VC-group (visual text, cues in diagram), 27 in the AN-group (audio, no cues in diagram), and 28 in the AC-group (audio, cues in diagram)." The randomized division to the groups adds validity to the study. The participants studied a web-based multimedia lesson on instructional design for about one hour. Afterwards they completed retention and a transfer tests.

"The variables under analysis were training time, mental effort spent on instruction and on tests, retention score, and transfer score. All scores were analyzed with two-factor analyses of variance (ANOVAs), with modality (visual vs. spoken text) and cueing (no cues vs. cues in the diagram)" (Tabbers et al., 2004).

The obtained data proved that adding visual cues to the pictures resulted in higher retention scores, while replacing visual text with spoken text resulted in lower retention and transfer scores. Comparing the results with the results from previous studies the designers came to the conclusion that "a bimodal presentation is only advantageous when the system

sets the pace of the instructions, whereas visual-only instructions are the preferred format if the learner is in control" (Tabbers et al, 2004).

The findings from this study can be applied in the multimedia instructional project under development in two different ways. In the tutorial parts, where students are presented with contrasting sentences so that they can generate the rule, the presentation of the material will be text-based and supported neither by the audio nor by narration. In these parts of the tutorial, the intrinsic cognitive load is high, the mental work is imposed by the complexity of the content, and the user needs time and control to assimilate new content. In addition, some content on the screens may need to be referenced. For example, students may need to use performance aids integrated into the application.

Visuals combined with narration can be used in the parts of the program where getting the user's attention is important, for example, focus their attention on the nature of the problem to be solved, or on the instructions about how the user is expected to use the knowledge gained in the program for the authentic assessment. Visuals supported by narration can be also used to clarify possible difficult points in the topic. At the same time, the learner needs the tools to adjust the system-paced presentation to his/her own pace. The user may need to pause and replay a sentence, or the whole scene.

Conclusion

"The exponential growth in computer-based training will precipitate increasing demand for effective learning design in multimedia instruction. Rather than relying on flashy

special effects, it is important that instructional designers begin to work within an empirical framework of principles that are driven by the learner, rather than technology. Cognitive science provides a research-based foundation of theories that serve as a grounded starting point for this instruction, as well as further research" (Sorden, 2005). This literature review was done with the goal in mind that the multimedia instructional program under development would be developed in a cognitively sound manner.

Despite some controversy among the evaluation studies and theories on the topic of multimedia instructional programs for teaching ESL grammar, the major thread is noticeable. By beginning with a theory of how learners process multimedia information, the author will be able to apply some preliminary principles of multimedia design for designing an effective multimedia program for teaching grammar to ESL students.

To close the chapter, I would like to quote from the work of Kurt Kohn (2001). "Those who approach the future of technology-enhanced language learning (TELL) from within its human and pedagogic heart know only too well that what we are witnessing today is a dramatic process of diversification and complexification. The range of available learning and teaching options will be richer and they will (have to) be capable of seamless combination depending on needs, preferences, feasibility, and pedagogic wisdom".

This quotation emphasizes the need for a diversity of computer- based instructional programs and learning environments. Regardless of the complexity of programs and environments, those that support effective learning by taking into account structural

characteristics and processing limitations of human cognition will have a better chance to be implemented.

Summary

This chapter provided an overview of the research regarding design and evaluation of the multimedia instructional programs for teaching ESL grammar available on the market for the past 20 years.

The review of the literature regarding existing teaching approaches for teaching ESL grammar and cognitive approaches to instructional design for multimedia learning were also covered in this chapter. The findings from the literature review helped me identify particular strategies for designing an effective multimedia program for teaching ESL grammar.

Table 1. Approaches to teaching EFL/ESL grammar

Teaching Approach	Description	Supportive Theory	References
Inductive	Implicit teaching, Unconscious acquisition of the language, The grammar rule is left implicit	Krashen's theory, Communicative approach	1). Krashen, 1988 2). Schutz, 2007.
Deductive	Explicit teaching, Conscious learning, Focus on form and error correction	Chomsky's Transformational Generative Grammar	1). Chomsky, 1986 2). Takahashi, 2005
Modified Deductive	Guided discovery, Explicit formulation of a grammar rule before students work it out by themselves Contrasting sentences	Recommendations from practitioners grounded in cognitive psychology	1). Gollin, 1998 2). Widodo, 2006
Modified Inductive	Discovery, Problem-solving approach to new language Students are guided through practice to help them formulate the rule Explicit formulation of a grammar rule after practice	Recommendations from practitioners grounded in ive psychology	Gollin, 1998

Table 2. Multimedia design decisions grounded in the findings from research

Instructional design decision	Part of the program where it will be used	Supportive evaluative and descriptive studies	Supportive findings from evaluative studies and cognitive theories
Contextualized teaching of grammar	The content of country studying (USA) is used in the whole program	1). Conrad, 1999 2). Marsden, 2007 3). Stepp-Greany, 2002	Students value a blend of structural approach involving corrective feedback and grammar, as well as communicative approach where language is used for communicative purposes, namely teaching grammar in context
The program makes the user generate grammar rules by the use of contrasting sentences and ideas	Tutorial parts	1). Gollin, 1998 2). Widodo, 2006	Practitioners use the hybrid approach in teaching grammar that proves to be effective, because it takes into account the cognitive architecture of human brain
Sequential presentation of the material with drill, practice, and feedback	Through the whole program	1). Conrad, 1999 2). Marsden, 2007 3). Stepp-Greany, 2002	Novice students in regular foreign language classes compared to more advanced students prefer repetition and more structured instruction
The use of hybrid (modified inductive) approach for teaching grammar and vocabulary in the program	Through the whole program	1). Conrad, 1999 2). Marsden, 2007 3). Stepp-Greany, 2002 4). Clark, 2006 5). Kalyuga, 2007	"Novices, need support from the instructional environments to substitute for their lack of schemas". (Clark, 2006, p.40) " At intermediate levels, an optimal executive function should be knowledge-based when dealing with familiar elements of information and externally based when dealing with new elements of information" (Kalyuga, 2007)
Two different formats of presentation of information on the screen	System-paced between tutorials and learner-paced within tutorials	1). Kaluga, Chandler, & Sweller, 1999 2). Tindall-Ford, Chandler, & Sweller, 1997 3) Tabbers et al., 2004	Modality effect takes place in system-paced but not in learner-paced formats of presentation of the information on the screen

Table 2. (continued)

Instructional design decision	Part of the program where it will be used	Supportive evaluative and descriptive studies	Supportive findings from evaluative studies and cognitive theories
The use of a story-telling format	It is used to personalize instruction and stitch together the tutorial parts of the instruction	Mayer et al., 2004	Personalized instruction leads to deeper processing of information and better students' performance on transfer tests
Subtitles and control over pacing of the presentation	In the system-paced parts of the program	1). Grgurovic, et al., 2007 2). Clark, 2006. 3). Huang & Eskey, 1999	It is a must to give learners control over pacing when there is mismatch in delivery and native language
The program is web-based	Through the whole program	Al-Jarf, 2005	ESL students score significantly better on listening comprehension if subtitles or scripts are provided Subtitles are preferable compared to scripts 24-hour independent access to the program Web-based grammar instruction integrated into in-class grammar instruction significantly improved EFL freshmen college students' achievement and attitudes
Students' performance and behavior is tracked by the database incorporated in the program	Through the whole program	1) Collentine, 2000 2) Hubbard, 2004	1) CALL containing user-behavior tracking technologies can provide important insights into the construction of grammatical knowledge and access if the program promotes grammatical development 2) If the software has tracking capabilities and reports on the students' activities, teachers may incorporate this feedback into follow-up activities in the next class

CHAPTER 3. METHODOLOGY

In this chapter, a description of the methods used in the pilot study is presented. The topics include: description of the multimedia instructional program under development, subjects, data collection, and data analysis.

Description of the multimedia instructional program under development

This multimedia program is designed to teach ESL students the concept of passive voice and its use in affirmative sentences. Students learn how to apply passive voice for the description of the geographical location, terrain, major rivers, and cities on the USA. The theory of cognitive loads and multimedia leaning theory stand behind this interactive multimedia program. The idea is to engage the target audience in meaningful project–based learning. The main character, an ESL learner, wants to write an email to her brother, who is learning English in Mexico, and attach some pictures with the description of the country. She wants to learn passive voice grammar structures to be able to describe the geography of the country in which she is living now, the USA, in this email. The users have to assist her every step on the way through the project. As the final assignment, the users will help her describe the pictures that she is going to attach to her email. The following features were implemented in the program:

1. Students can choose between deductive and inductive learning or use a combination of both. The deductive learning occurs when students use the series of Grammar Help aids

provided in the program to cope with the assignments. The inductive learning occurs when users try to figure out grammar rules by comparing and contrasting different grammar structures without the use of Grammar Help. In addition, students can test their hypotheses by using the Check Answer aids provided.

2. The implementation of the story format in the program allows the use of informal language in the dialogs between the main characters of the story. The dialogs are used to present problems, clarify difficult grammar points, and stitch together 7 units of the training. In contrast, the formal language is used in the Grammar Help aids.

3. Users can use a variety of tools and easily adjust them to their needs (captions on/off, replay sentence, pause, replay scene, pop–ups with images and maps, Grammar Help pop-ups, visual aids including animation, audio, glossary, and highlighted clickable words to hear and read the definition in a pop-up). Students with different learning styles (auditory, visual, and kinesthetic) can adjust the program to their needs by using different tools.

4. The embedded user-behavior tracking technology collects information about students' performance and navigation patterns. The collected data can be used for further research and provide data to help develop ideas about how the program can be improved.

The target multimedia program is designed as a story in order to improve the effectiveness of the learning process. Because of the story format of the program "personalization effect" (Mayer, 2001) occurs when students go through the training session. The story format allows personalized presentation of new information which facilitates deeper processing.

Also, the depth of processing the information that needs to be processed is increased by priming students' inductive reasoning skills. Through the combination of tutorials that are stitched together by the story line, the program makes the learner use his/her inductive reasoning skills to generate grammar rules.

The contextualized teaching of grammar is complemented by the authentic assessment to check students' ability to apply the knowledge acquired. At the end of the program users have to describe 12 images (production of the language), which makes users actually implement all the skills that they had learned through the program. In addition to the authentic assessment, 3 tests are embedded in the program. They are pre-test, post-test, and knowledge transfer test. (See Appendixes A,B,C.)

Subjects

The program was evaluated in at the Des Moines Community College with 15 adult learners in December 2008. The participants ranged from 22 to 60 years old and were not subject to any selection procedures. The level of their English language proficiency: intermediate and advanced. The level of familiarity with passive voice concept: beginners and intermediate. Participants were from a wide range of native languages, educational backgrounds, and computer experience. They had Chinese, Spanish, Slovak, Korean, Danka, Taiwanese, and Russian as their L1s. However, due to the lack of consistent attendance of 5 students only 10 received the treatment. Among the 10 students 4 have lived in the USA for

less than a year, 3 for less than 4 years, and 3 for 5 years or longer. The typing and computer

skills of the participants ranged from average to low.

Research questions and data collection instruments

Quantitative and qualitative instruments were used to collect data to address the

research questions (See Table3).

Research questions

1. What is the impact of the intervention on students' ability to use present and past simple passive voice in affirmative sentences for describing the USA?

2. What is the impact of the intervention on students' understanding of how to apply present simple and past simple passive voice forms in the contexts other than describing a country?

3. How do students use the program?

4. Are there any relationships between the users' learning outcomes and computer experience, their background knowledge of passive voice (pre-test) and performance on post-test and knowledge transfer test?

Data collection instruments

1. Background questionnaire to assess the users' familiarity with technology and collect their basic demographic information (Research Question 4)

2. Students' pre-test, post-test, and knowledge transfer test scores stored in the database (Research Question 2)

3. Students' writing assignments administered within the training episode and saved in the database (Research Question 1 and 4)

4. Likert-scale survey rating the effectiveness of different features of the program. (Research Question 3)

5. Debriefing (personal interviews with participants after the training episode about the users' experiences with the program) (Research Question 3)

6. A report from the program database about users' performance and their navigation patterns. (Research Question 4)

7. Informal observations of students using the program. (Research Question 3)

Data collection process

The participants received the instruction through the multimedia instructional program for 2-3 sessions for a total of 2-4 hours without any help from the teachers. Because the instruction could be done at the students' own pace, it took some students longer than others. During the first session, the concept of passiveness and the use of present tense passive voice were covered. During the second session, the participants learned how to use past tense passive voice, transformation of passive sentences to active, alternatives to passive voice, and suggestions on the choice and use of active and passive voice. One student, who neither was familiar with the geography of the country nor with the concept of passive voice used the third session to finish the training on the next day at her request. The participants did not receive any formal instruction on the concept of passive voice between the pre-test and knowledge transfer test.

The data from a background questionnaire, informal observations, personal interviews, likert survey, pre-tests, post-tests, and transfer tests were collected during the experiment (See Table 4).

The background questionnaire and the pre-test were administered on the first day (December 10). The learning occurred in two sessions: on the third and sixth days (December 12, 15). The writing test, the description of the 12 pictures, was part of the second session.

After completion of the second training session, the participants completed the likert survey in which they rated the effectiveness of different features of the program. During the

interviews conducted after the completion of the survey, the students shared their experiences of using the program. In addition, the informal observations were conducted during the training sessions to see how participants used the program. The data from the observations were triangulated with the data from the database report and survey.

Three days after the completion of the training (December, 19) the delayed post-test was administered to measure students' retention of the gained knowledge. Five days after the post-test (December 25), the knowledge transfer test was taken by the students. Both pre-test and post-test were designed using the context of geography of the USA. The knowledge transfer test used contexts other than geography of the USA.

Analysis of the data

Pre-test and post test students' scores and the writing assignments (description of the 12 pictures) stored in the database were the sources of data for determining the impact of the intervention on students' ability to use present and past simple passive voice in affirmative sentences for describing the USA.   I looked for the difference in the students' scores between the pre-test and the post-test. The students' scores reflected the knowledge gain on the 10 questions assessing declarative knowledge and the other 10 questions assessing procedural knowledge.

In students' writing assignments, I looked for patterns in the use of the grammar structures which were the desired learning outcome of the training, namely passive voice structures and alternatives to passive voice structures. Specifically, I looked for the use of the correct tense and form in passive voice structures. I also wanted to see if students chose the

appropriate vocabulary to describe the country and did not distort the factual information about the country. Another field of my interest was the use of prepositions to describe locations and articles with geographical names in students' writings. Also, I was open to other themes in the misuse of grammar structures which were in the way of communicating the factual information. I was looking for the effect that prior knowledge of passive voice had on their writings.

The pre-tests and knowledge transfer test scores stored in the database were the sources of information to determine the impact of the intervention on students' understanding of how to apply present simple and past simple passive voice forms in the contexts other than describing a country. The difference in students' scores between the pre-test was measured by counting the number of correct answers on the 10 questions assessing declarative and the other 10 assessing procedural knowledge.

A Likert-scale survey, debriefing, informal observations, and a report from the program database were used to determine how students use the program.

The Likert-scale survey was designed to determine which features students used and liked the most and which ones the least. The rating of different features in the program was ranked on a 5-point Likert scale. The items in the Likert scale were judged by 2 graduate students in terms of how favorable each item was with respect to the contrast of interest.

Debriefing was conducted after the completion of the survey. The students were asked to share their experiences of using the program. The tentative debriefing questions can be found in Appendix K. The follow up questions were driven by the participants' responses, if there was a need for additional clarification. I was looking for students' feedback on the following categories of information: visual design, complexity of the vocabulary, the

effectiveness of the implemented instructional strategies, the use of different tools and aids, and any possible unexpected themes that may arise during the interviews.

Two people were interviewing the participants. Each student was interviewed one on one. The interviewers were typing in students' responses in the forms with a list of questions prepared ahead of time. You can see the list of questions in Appendix K. The rest of the questions were the follow up questions driven by the students' responses. After the interviews the contents of the debriefing forms were analyzed for recurring themes. The recurring themes from the debriefing forms and informal observation forms were compared to double check the reliability of the obtained data.

The data base report was a source of data for tracking the frequency of the use of different aids in the program. The frequency of their use was counted and analyzed for recurring themes.

Informal observations (see Appendix J) were conducted with 5 of the participants with different levels of English language proficiency and familiarity with the concept of passive voice ranging from low-intermediate students unfamiliar with the concept to advanced students familiar with the concept of passive voice. The range of the observed participants contributed to understanding a broader picture of how the program suited the needs of different target audiences. The participants were encouraged to engage in a learning-focused dialogue about the use of the program. The feedback from the participants was analyzed for recurring themes about navigation system, visual design, and the language used in the Grammar help pop ups, instructions, and definitions of the highlighted words. In addition, the feedback on the appropriateness of various aids and sufficiency of the implemented instructional decisions was collected from the students. All the data obtained

from the observations were typed in the informal observation sheets during the observations.

The demographics survey, pre-test, post-test, and knowledge transfer test scores were the sources of data for determining the relationships between the users' learning outcomes and computer experience. Before the pre-test, the self-reported data about how comfortable students were with computers were collected in the demographics survey embedded in the program. Inferences about the relationships between the students' basic computer expertise and their learning outcomes were made.

The students' background knowledge of passive voice was determined from the pre-test scores. The correlations between the users' background knowledge of passive voice and performance on post-test and knowledge transfer test were examined.

The data from the tests, observations, surveys, and database report were triangulated to cross check the accuracy and reliability of the instruments and get a more rounded picture.

Summary

In this chapter, I described the research questions used in the pilot study. Then, I explained the data collection process by describing each data collection method in detail.

Data were collected through observations, surveys, writing assignments, tests, and a database report. All the data collection instruments were embedded in the program except for informal observations and personal interviews. The descriptive statistics and qualitative data analysis were used to analyze the data. The obtained data were used to inform the designer about how the program can be modified.

Table 3. Research questions and data collection instruments

#	Research Questions	Data Collection Instruments
1	What is the impact of the intervention on students' ability to use present and past simple passive voice in affirmative sentences for describing the USA?	1. Students' writing assignments administered within the training episode and saved in the database 2. Students' pre-test, post-test, scores stored in the database
2	What is the impact of the intervention on students' understanding of how to apply present simple and past simple passive voice forms in the contexts other than describing a country?	1. Students' pre-test and knowledge transfer test scores
3	How do students use the program?	1. Likert-scale survey 2. Debriefing 3. Navigation patterns from the database report 4. Informal observations of program use
4	Is there any relationships between students' learning outcomes and: • computer skills • prior knowledge of passive voice	1. Demographics survey 2. Pre-test 3. Post-test 4. Knowledge transfer test

Table 4. Data collection process

Time Schedule	Procedures
Day1 (Dec10)	• Collecting demographics (background questionnaire) • Pre-test (USA geography context)
Day3 (Dec12)	• Training episode: Unit1-4 • Informal observations
Day6 (Dec15)	• Training episode:Unit5-7 (picture description included) • Likert survey • Debriefing • Informal observations
Day10 (Dec 19)	• Delayed post-test (USA geography context)
Day 16 (Dec 25)	• Knowledge transfer test (context other than USA geography)

CHAPTER 4. RESULTS AND FINDINGS

In this chapter, the interpretation of the collected and triangulated data and the findings are presented. The topics include: descriptive statistics of the data from the tests and likert survey, analysis of the students' writings, and the data from the database report. The findings are reported in the sequence of the research questions.

Research question 1: What is the impact of the intervention on students' ability to use present and past simple passive voice in affirmative sentences for describing the USA?

An examination of the pre-test and delayed post-test scores revealed that the students' ability to use present and past simple passive voice in the context of geography of the USA on average increased by 3.6 points out of 20. All 3 tests, namely pre-test, post-test, and knowledge transfer test, consisted of 20 questions, the first 10 questions accessing students' declarative and the other 10 procedural knowledge. The scores (the number of questions answered correctly) by student on the pre-tests compared to the delayed post-test are presented in Table 4. The difference between the scores at the pretest and post-test showed the knowledge gain attributed to the training episode. It appeared that the highest gain was among the intermediate students who were unfamiliar or slightly familiar with the concept of passive voice and did not do well at the pre-test.

The examination of students' writing assignments and the description of 12 pictures, revealed that they were able to use passive voice structures and alternative active voice

structures for the description of the pictures and did not make mistakes in the use of passive voice with the verbs that were used the most in the program such as "is/ are located, is/are occupied, is/are known, and is/are composed". These verbs were used by students in various activities during the training. Students practiced with those verbs longer than with the other verbs.

Advanced students with high prior knowledge of passive voice were able to use correctly even those verbs which were not used in the program as often as the verbs mentioned above. The possible explanation for this fact is that the advanced students had prior knowledge of the meaning of the verbs which were not used very extensively in the program. Those users did not have to process both the meaning and the form of the verbs simultaneously as it was the case with the intermediate learners. The findings are in tune with the cognitive load theory by J. Sweller (1998). The major point of this theory is that our cognitive system is able to process only limited amount of information at a time. For this reason, the intermediate students needed more practice during the program with the unfamiliar verbs. The intermediate students needed more time (more practice) to internalize the information because the amount of information that they had to process at a time was bigger compared to the advanced students.

Three intermediate students made a mistake in the use of the verb "honor". For example, instead of making up a sentence "The Jefferson Memorial was built to honor the third American president." one of the students made up a sentence "Jefferson Memorial is honored the third American president". A possible explanation for this mistake is that intermediate students were not familiar with complex infinitive grammar structures such as "was built to honor."

All students used an alternative phrase to passive voice at least once in their writings and did not make any mistakes in the use of factual information. Interestingly, some of the participants made mistakes in the use of prepositions and articles in their writings, which showed the need in additional assignments to practice those skills in the program. For example, a low intermediate student who was neither familiar with the concept of passive voice (the data from pre-test analysis and observations) nor with the geography of the country, had problems remembering prepositions needed for the description of the country and excessively used the preposition "by" instead of other appropriate prepositions. Possible explanation for this fact is that the preposition "by" was the only one that was taught in the program. Students had an opportunity to use this preposition in different activities during the training.

The findings from the analysis of the writings are in tune with the findings from the debriefing and informal observations. All the intermediate students emphasized the fact that they needed more practice with prepositions and articles and they needed special exercises that would help them understand how to use prepositions and articles to describe the locations and places.

Although many students found the description of the pictures challenging, all of them unanimously emphasized the importance of this activity (the findings from observations, debriefing) because it helped them recall and retrieve the knowledge that they had gained.

Research question 2: What is the impact of the intervention on students' understanding of how to apply present simple and past simple passive voice forms in the contexts other than describing a country?

Comparing the scores of the participants on the pre-test and knowledge transfer test, we can see that the students were able to transfer their knowledge of present and past tense passive voice to the contexts other than geography of the USA because their ability to use passive voice increased on average by 3.2 points out of 20 or 16%.

The scores (the number of questions answered correctly) by student on the pre-tests compared to the knowledge transfer tests are presented in Table 6. The difference between the scores on the pretest and knowledge transfer test shows the knowledge gain attributed to the training.

Research question 3: How do students use the program?

A likert-scale survey, debriefing, informal observations, and a report from the program database were used to determine how students used the program.

In the survey, the participants ranked the effectiveness of different features in the program on a 5-point likert scale that ranged from strongly disagree to strongly agree. Students mean scores for all the features were favorable and ranged from 4.9 to 4.1 as listed in Table 7.

According to the likert scale ratings the participants found all the features in the program helpful. The most highly ranked features were feedback, images, and the

highlighted words that can be clicked to hear and see their definition, and extra practice.

These findings were in tune with the data from the database report. The frequency of the use of Grammar help popup ranged from 1 (advanced learner) to 21 times (intermediate learner) during the training episode. Nine out of ten students used the clickable highlighted words to hear and see their definitions. The frequency of the use of clickable words ranged from 10 to 29 times. All the students extensively used maps and images in the program (up to 34 times). Many students favored the option of listening to sentences during the training session (up to 33 times). Five of the students turned on and off captions at least 3 times. Six students used "Repeat the Scene" and "Play" and "Pause" tools.

According to the personal interviews, there was one person who was not happy with the quality of the sound and complained about the background noise. This person was the only one who used a headset with the sound coming in only one ear, which might have been a problem. The same person almost did not use the clickable words and ranked this feature as "disagree".

In addition, 9 out of 10 the students strongly agreed and 1 student agreed that the program helped them understand how to use passive voice. From the personal interviews we found that 2 participants recommended the program to their husbands, 1 person to her daughter, and 3 people asked after the transfer test for the URL of the program to go over it again and learn more about the geography of the USA.

Most participants found the program motivational, 9 of 10 liked the story telling format of the program, 2 students identified themselves with the main character, ESL learner, 1 of the students mentioned that he understood how technology can be used in education. All the students strongly valued the combination of verbal and visual representations of the

material, the fact that they could learn at their own pace and adjust the system-paced instruction to their needs.

Research Question 4: What are the relationships between students' learning outcomes, computer experience, background knowledge of passive voice, and performance of the tests?

Results of the pilot study made it clear that no relationships between computer experience and performance on the test was found. Students' background knowledge had an effect of students' knowledge gain. The gain was higher among the intermediate students whose familiarity with passive voice was limited, which was indicated by their low scores at the pre-test. For this reason, the difference between post- test and pre-test was bigger among intermediate students.

Summary

In this chapter, the impact of the intervention on students' ability to understand and use present and past simple passive voice grammar structures for describing the USA and to understand how to use it in other contexts was described. The analysis of students' writing assignments was presented and the obtained data were interpreted. Also, the data from the informal observations, database report, and debriefing were triangulated. The information about how students used the program was interpreted. The difference in the impact of the intervention on students with different levels of prior knowledge was described.

Table 5. Comparison of students' pre-test and post-test scores (number of the questions answered correctly)

# st-t	Pre-test Declarative Knowledge (out of 10)	Procedural Knowledge (out of 10)	Total (out of 20)	Post-test Declarative Knowledge (out of 10)	Procedural Knowledge (out of 10)	Total (out of 20)	Difference (out of 20)
1	7	3	10	9	9	18	8
2	7	4	11	9	8	17	6
3	7	6	13	10	8	18	5
4	9	4	13	9	7	16	3
5	9	8	17	10	10	20	3
6	8	6	14	10	9	17	3
7	8	7	15	10	8	18	3
8	10	7	17	10	9	19	2
9	7	9	16	9	9	18	2
10	9	9	18	10	10	19	1

Table 6. Comparison of students' pre-test and transfer test scores (number of the questions answered correctly)

# st-t	Pre-test Declarative Knowledge (out of 10)	Procedural Knowledge (out of 10)	Total (out of 20)	Transfer test Declarative Knowledge (out of 10)	Procedural Knowledge (out of 10)	Total (out of 20)	Difference (out of 20)
1	7	3	10	8	8	16	6
2	7	4	11	9	7	16	5
3	7	6	13	8	8	16	3
4	9	8	17	10	10	20	3
5	9	4	13	9	7	16	3
6	8	6	14	8	9	17	3
7	8	7	15	10	8	18	3
8	10	7	17	10	9	19	2
9	9	9	18	10	10	20	2
10	8	9	17	9	10	19	2

Table 7. Results of student survey (5 - strongly agree, 4 - agree, 3 - somewhat agree, 2 - disagree, 1 - strongly disagree)

#	Program Component	Rating	#	Program Component	Rating
1	This program helped me understand how to use passive voice	4.9	8	The material is presented in an interesting way	4.7
2	I like the sound in the program	4.2	9	The Grammar Help pop-ups are helpful	4.4
3	The pictures in the program are helpful	4.6	10	The Review Pages summarizing each unit are helpful	4.5
4	The clickable words highlighted yellow are helpful	4.5	11	The Extra Practice helped me understand passive voice	4.7
5	I can understand all sentences	4.3	12	The captions that can be turned on and off are helpful	4.4
6	The maps are helpful	4.7	13	The Stop and Replay Sentence tools are helpful	4.3
7	It is easy to navigate through the program	4.1	14	The feedback with explanation is helpful	4.7

CHAPTER 5. DISCUSSION AND RECOMMENDATIONS

In this chapter, the findings from the study are discussed and conclusions are made. The topics include: discussion and summary of the findings, limitations of the study, and recommendations for further improvement of the program.

Discussion and conclusions

The participants seemed to learn the grammar some aspects concept and of the USA geography from the program and enjoyed their learning. They considered the contextualized learning of grammar as meaningful and engaging. The program appeared to be an effective way of teaching as reflected in the students' test scores, their picture descriptions, database reports, informal observations, and participants' perceptions a new grammar concept in a context of USA geography with the subsequent generalization to other different contexts. All the students were able successfully use the gained knowledge in different contexts at the knowledge transfer test even though the main part of the training was done in the context of USA geography. This was supported by their ratings of the program in the survey, their comments in the student interviews and the knowledge gain shown at the delayed post-test and knowledge transfer test.

The participants in this study were selected because they were available and readily accessible. For this reason, not all the participants represented the target population for this program, namely intermediate learners not familiar with passive voice. Because of that, the

biggest knowledge gain (6.3 out of 20) was among the students who were unfamiliar or slightly familiar with the concept of passive voice and received low scores at the pre-test.

The smallest gain (2.3 out of 20) was among those who were familiar with the concept and showed high pre-test scores. Interestingly, we found from the personal interviews, informal observations, and the survey that the students who were familiar with the concept of passive voice thought that they learned much through the program. They mentioned that they learned about the geography of the country, and practiced spelling of the geographical names. They also became confident in the use of prepositions for describing the geography of the country, alternatives for passive voice, and gained knowledge about when the use of passive voice is an appropriate choice and when it is better to use active voice instead. In addition, they gained confidence in conversion of passive voice sentences into active and vice versa.

The participants with low prior knowledge of passive voice were more focused on mastering the form of present and past simple passive voice. The findings are in tune with the cognitive load theory that explains that our cognitive system can only process a limited number of items at a time (Clark, et al., 2006). The analysis of the findings showed that even though the amount of information presented in the program was abundant, the students were able to adjust the instruction to their own needs. It seemed that their attention was focused on different aspects of the concept of passive voice.

This leads us to the conclusion that if the program is used in mixed groups, which is often the case in ESL classes, the assessment in the program needs to be more comprehensive

to show the knowledge gain of learners with different level of prior knowledge of passive voice.

As to the preference of a particular teaching approach (inductive or deductive), all of the participants used a combination of both. While some students were inclined to arrive at the rule using their inductive reasoning skills and used the Grammar Help option as the last resort, others preferred explicit instruction of grammar in the Grammar Help pop up before starting to practice a particular grammar skill. At the same time, the latter group admitted that the compare and contrast exercises helped them understand and memorize the grammar rules. It appeared that the program was able to address the different cognitive learning styles of the participants.

Other evidence of the ability of the program to teach students with different learning styles was the fact that different students used different features in the program more extensively than others. For example, some students preferred to listen to all sentences in the program and used the option to repeat the last sentence and the scene more often than other students. 3 students listened to the dialogues with captions first and then without captions, which may suggests that those students intended to train their listening and comprehension skills. Two students often did not want to listen to sentences and studied the maps and images longer than others (from the database report about the amount of time spent on the screen and comments during the debriefing stating that they are visual learners). The rest of the participants did not show any preference in the use of the program features.

All the learners regardless of their prior knowledge of passive voice, level of English proficiency, and learning style were able to learn new concepts through the program.

Overall, the instructional decisions implemented in the program which were grounded in the cognitive load theory by Sweller (Sweller,1998), multimedia learning theory by Mayer (Mayer, 2001), and evidence-based principles for the design of multimedia instruction (Mayer, 2008) proved to be effective.

Although the relationships between the users' learning outcomes and computer experience were not found, the participants with low typing skills spent more time going through the program than those who had average typing skills. It leads us to the conclusion that even students with low computer skills can use the program without special training, but if their typing skills are low, it will take them longer time.

As to the relationship between students' learning outcomes and performance on the pre-test, it was apparent that the knowledge gain among students with low prior knowledge of the concept was higher compared to those with higher prior knowledge of the concept (30% compared to 10%). Nevertheless we cannot claim that these findings lead us to the conclusion that learners with some prior knowledge of passive voice failed to learn through the program because of the findings from the debriefing suggest the opposite. Further research and addition of the items to the pre-test that will target learners with some prior knowledge of passive voice may cast light on this issue.

Recommendations

Despite the fact that overall the program appeared to be an effective teaching tool, some changes to the program need to be made. The findings from the pilot study suggest that

there is a need for additional assignments to practice alternatives to passive voice. Also some students would prefer to have more practice with past tense passive voice and comparison of present and past passive voice.

According to informal observations, debriefing, and answers to some of post and knowledge transfer test questions regarding the choice between present and past passive voice, some additional screens need to be added to the program. Such screens would help students with past vs. present time expressions and provide extra practice with past tense passive voice.

Also, the study revealed the limitations of the predetermined feedback, because in some cases the explanation in the feedback was not sufficient, especially for the advanced learners.

The analysis of writing assignments, the descriptions of the pictures, revealed the need for redesigning some screens and adding additional screens to the program. For instance, students seemed to need more exercises to practice the use of prepositions for the description of places and articles with geographical names.

In addition, the analysis of the advanced students' test scores revealed that the tests need to include extra items to target advanced learners to better show their knowledge gain, if the program is used in mixed groups that include advanced learners.

As to the navigation system in the program, some students would have liked a previous button so they could return to previous pages and review them.

Limitations of the study

One of the limitations of the study is the convenience sample used to test the program and the limited number of participants. Another limitation is the one-group pre-test/post-test design of this pilot study. Because of these limitations, the findings cannot be generalized to the general population. Further research is recommended to test the program on a larger sample to be able to apply the statistical analysis in the evaluation.

Summary

In this chapter, the description of the convenience sample of participants was presented. The affect that the difference in prior knowledge of the participants had on their learning outcomes was described.

The unexpected outcome of the study was that the program seemed to be comprehensive enough to be used in the mixed groups of students with both low and intermediate prior knowledge of passive voice. According to the findings from the informal observations and the debriefing, students with different level of expertise in passive voice learned different things during the training. For this reason, one of the recommendations for further research was to make the tests more comprehensive and include the items which would target advanced students with intermediate level of prior knowledge of passive voice.

Also, the findings from the study suggested that the program had a potential to address the needs of students with different learning styles. In addition, the data revealed the preliminary evidence of the effectiveness of the program.

The information collected during the pilot study was used for the program's modification. Further research was recommended to test the modified program on a larger group of participants for a statistical analysis of the data so that the findings could be generalized to broader audiences.

APPENDIX A. PRE-TEST

Choose the correct answer.

1. Thomas Jefferson_____ as an author of the Declaration of Independence.
   1) is known
   2) knows
   3) known
   4) are known
2. The Appalachian Mountains _____ by the Great Plains, the Atlantic Coastal Plain, and the Gulf Coastal Plain.
   1) is bound
   2) bounds
   3) are bounded
   4) is bounded
3. Niagara Falls _____ on the Niagara River.
   a) was located
   b) is located
   c) were located
   d) are located
4. Washington, D.C. _____ by the local government.
   a) was govern
   b) governed
   c) were governed
   d) is governed
5. The National Park Service _____ the Lincoln Memorial.
   a) is administered
   b) administers
   c) administered
   d) administer
6. The words of dedication _____ on the wall behind the statue of Lincoln.
   a) inscribed
   b) were inscribed
   c) inscribe
   d) is inscribed
7. The sculpture of Lincoln _____ by Daniel Chester French.
   a) was designed
   b) are designed
   c) designed
   d) designs
8. The President of the United States_____ the White House.
   a) occupy
   b) occupies
   c) is occupied

d) was occupied

9. The Washington Monument and the Jefferson Memorial _____ in Washington, D.C. to honor the two American presidents.
- a) were build
- b) were built
- c) built
- d) were builded

10. George Washington _____ the first American president in 1789.
- a) become
- b) is become
- c) was become
- d) became

Please, type the verb in the correct form in the box. You can use the Table of Irregular Verbs by clicking in the button at the bottom of the screen.

11. The USA _____ of fifty states. (compose)
12. Hawaii_____ for its tropical climate. (know)
13. The forty-eight states _____ the Lower 48 or contiguous United States. (call)
14. Thomas Jefferson _____ the Declaration of Independence. (compose)
15. The Lincoln Memorial _____ in the form of a Greek Doric Temple in 1922. (build)
16. The US Congress_____ the Capitol in Washington, D.C. (occupy)
17. The Rocky Mountains _____ into the series of ranges. (divide)
18. The Appalachian Mountains _____ between the Great Plains and the Atlantic Coastal Plain. (lie)
19. Henry Bacon_____ the Lincoln Memorial in the form of a Greek Doric Temple. (design)
20. The White House and the Capitol _____by Pennsylvania Avenue. (connect)

APPENDIX B. POST-TEST

Choose the correct answer.

1. Washington, D.C. _____ as a popular tourist destination.
   - a) is known
   - b) knows
   - c) know
   - d) are known

2. The White House and the Capitol _____ by Pennsylvania Avenue.
   - a) is connect
   - b) connects
   - c) are connected
   - d) is connected

3. The USA _____ into fifty states.
   - a) was divided
   - b) is divided
   - c) were divided
   - d) are divided

4. Washington, D.C. _____by the states of Virginia to the southeast and Maryland on the other sides.
   - a) was border
   - b) bordered
   - c) were bordered
   - d) is bordered

5. The US Congress _____ the Capitol in Washington, D.C.
   - a) is occupied
   - a) occupies
   - b) occupied
   - c) occupy

6. The five Great Lakes _____ in the north-central part of the US.
   - a) located
   - b) were located
   - c) are located
   - d) is located

7. The Lincoln Memorial _____in the form of a Greek Doric Temple.
   - a) was built
   - b) are built
   - c) was builded
   - d) built

8. Thomas Jefferson _____ the Declaration of independence.

a) was written
b) written
c) are written
d) wrote

9. Many speeches _____in front of the Lincoln Memorial.
a) were gaved
b) were given
c) gave
d) given

10. Henry Bacon _____the Lincoln Memorial in the form of a Greek Doric Temple.
a) is designed
b) was designed
c) were designed
d) designed

Please, type the verb in the correct form in the box. You can use the Table of Irregular Verbs by clicking in the button at the bottom of the screen .

11. America_____into fifty states. (divide)
12. The Appalachian Mountains _____ by the Great Plains, the Atlantic Coastal Plain, and the Gulf Coastal Plain. (bound)
13. The Grand Canyon _____ of a whole maze of canyons. (compose)
14. Niagara Falls _____ on the Niagara River. (locate)
15. Forty-nine states in the United States _____ on the North American continent. (lie)
16. The sculpture of Lincoln _____ by Daniel Chester French in the twentieth century. (design)
17. George Washington _____the first American President in 1789. (become)
18. The Washington Monument and the Jefferson Memorial _____ in Washington, D.C. to honor the two American presidents. (build)
19. The Rocky Mountains _____ into a series of ranges. (divide)
20. Washington, D.C. _____ by the local government. (govern)

APPENDIX C. KNOWLEDGE TRANSFER TEST

Choose the correct answer.

1. This room _____ every day.
   - a) clean
   - b) is cleaned
   - c) cleaned
   - d) cleans

2. The two companies _____ highways around the country.
   - a) build
   - b) is built
   - c) builds
   - d) are built

3. All the flights _____ because of the bad weather.
   - a) cancelled
   - b) were cancelled
   - c) cancel
   - d) cancels

4. They _____ me two hours to make my decision.
   - a) are given
   - b) were given
   - c) is given
   - d) gave

5. The service _____in the bill.
   - a) was included
   - b) were included
   - c) are included
   - d) includes

6. The instructor _____ the material in an interesting way yesterday.
   - a) is explained
   - b) are explained
   - c) explained
   - d) was explained

7. Pete and Sue _____ their first baby soon.
   - a) are expect
   - b) are expected
   - c) is expected
   - d) expect

8. Students _____ to wear uniforms at all times.
   - a) is required
   - b) are required

c) was required
d) requires

9. I always _____ the window at night because it is cold.
   a) are closed
   b) am closed
   c) was closed
   d) close

10. Yellow Stone Park _____ as a popular tourist destination.
    a) Knows
    b) Is known
    c) Knew
    d) known

Please type the verb in the correct form in the box. You can use the Table of Irregular Verbs by clicking in the button at the bottom of the screen.

11. This book _____ by Mark Twain in the twentieth century. (write)

12. My sisters _____ a lot of dolls and other toys. (have)

13. The thief _____ my camera at the airport yesterday. (steal)

14. A lot of gifts _____ away at the presentation of a new product last Monday. (give)

15. When the wrong answer ____ in, the program does not give a point. (type)

16. The manager _____ a new job to him yesterday. (offer)

17. The pyramids ____ thousands of years ago. (build)

18. His job is a great because he _____ a lot of people. (meet)

19. This car _____ by electricity. (drive)

20. All the rooms in the hotel _____ with microwaves. (equip)

APPENDIX D. PRINT SCREEN FROM THE DATABASE REPORT ILLUSTRATING THE DESCRIPTION OF PICTURES BY PARTICIPANTS

APPENDIX E. DEMOGRAPHICS SURVEY EMBEDDED IN THE PROGRAM

APPENDIX F. DATA FROM THE DEMOGRAPHICS SURVEY STORED IN THE DATABASE

APPENDIX G. PRINT SCREEN FROM THE DATABASE REPORT ILLUSTRATING THE CLICKBLE WORD AIDS USED BY THE PARTICIPANTS

APPENDIX H. PRINT SCREEN FROM THE DATABASE REPORT ILLUSTRATING THE USE OF TOOLS TO ADJUST PACING OF INSTRUCTION

APPENDIX I

CONSENT FORM FOR: The Pilot Study of a Multimedia Instructional Program for Project-based Teaching of ESL Grammar with Embedded Tracking Technology.

This form describes a research project. It has information to help you decide whether or not you wish to participate. Research studies include only people who choose to take part—your participation is completely voluntary. Please discuss any questions you have about the study or about this form with the project staff before deciding to participate.

Who is conducting this study?

This study is being conducted by Natalya Koehler and Kajal Shah, graduate students in Curriculum and Instructional Technology at Iowa State University.

Why am I invited to participate in this study?

You are being asked to take part in this study because you are an adult ESL learner. You should not participate if you are under 18 years old.

What is the purpose of this study?

The purpose of this study is to determine whether a multi-media program for teaching ESL teaches the concept of passive voice and its use in present and past tense passive voice affirmative sentences and how students use the program.

What will I be asked to do?

If you agree to participate, you will be asked to fill in a demographics survey (5 minutes) and do a pretest (25 minutes) on the first day. On the next day you will take the training (1 hour) and fill in a survey (5 minutes).

After the training you will be invited to take part in the focus group interview. The focus group is expected to last approximately 20 minutes. You will be asked questions about your experiences with the program. Your individual responses will be treated confidentially. Statements made by other group members should also be treated confidentially and should not be shared outside of this group. Your participation is completely voluntary; although you have all shown interest in participating in this group, you are free to withdraw from the focus group at any time and can choose not to answer specific questions. In order to ensure the accuracy of statements made by

participants in this group, we will be recording the session on video tape. These tapes will not be marked with your names and will be securely stored. After 1 year, the tapes will be destroyed or erased.

Three days after the training you will be asked to do the posttest (15 minutes). A week after the training, you will take a knowledge transfer test (15 minutes).

What are the possible risks and benefits of my participation?

There are not any possible risks in this study.

You will benefit from the study because you will understand the concept of passive voice, learn how to apply it in present and past tense passive voice sentences. You will also learn some factual information about the USA and how to communicate that factual information using passive and active voice grammar structures. It will be possible because the instruction in the program is meaningful practice and the teaching of grammar is contextualized.

How will the information I provide be used?

The information you provide will be used for the following purposes: it will help us to evaluate the program and improve it.

What measures will be taken to ensure the confidentiality of the data or to protect my privacy?

Your name will not be recorded and the data will not be identified with you.

What are my rights as a human research participant?

Participating in this study is completely voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences. You can skip any questions that you do not wish to answer.

Whom can I call if I have questions or problems?

You are encouraged to ask questions at any time during this study.

For further information about the study contact Natalya Koehler at 515-233-2775.

The telephone of the major professor Ann Thompson: 515-294-5287

If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office of Research Assurances, 1138 Pearson Hall, Iowa State University, Ames, Iowa 50011.

Consent and Authorization Provisions

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant's Name (printed) _____

_____   _____

(Participant's Signature)   (Date)

Investigator Statement

I certify that the participant has been given adequate time to read and learn about the study and all of their questions have been answered. It is my opinion that the participant understands the purpose, risks, benefits and the procedures that will be followed in this study and has voluntarily agreed to participate.

_____   _____

(Signature of Person Obtaining Consent)   (Date)

APPENDIX J. INFORMAL OBSERVATIONS SHEET

 (Because of a confidentiality issue the real name of the participant is not disclosed and the pseudonym Amy is used).

Dates: December 10-15, 2008

Typing speed: low, uses two fingers.

Login-1min

Demographics survey-3min

Pretest: 15 min

Training

Unit1

Amy: I like these dialogues with captions and clickable words. They are very helpful. I like to listen. It helps me learn better.

Frame 997

She cannot understand the idea " acts" or "receives the action" .

Frame 998

She reads the explanation and looks like she is starting to understand.

Frame 999 (Summary page)

Amy: (talking to the program) OK. Now I understand what you mean .

Investigator: How do you like the idea of Review Lesson screen and Grammar Help pop up?

Amy: I do like it. It helps. I have a suggestion. I want to have a previous button to go to the previous screen and review the page that I had problem understanding.

Investigator: How about feedback?

Amy: feedback is important because it explains. It is not that it says that your answer is right or wrong, it explains to you why it is wrong or right.

Unit 2

Frame 1038.

She has problem understanding that you need to click on the Map button to see the map.
She prefers to use the Grammar Help pop up first and then do the exercises.
Amy: This table of irregular verbs pop up is great, very convenient.
Investigator: What would you prefer: to use the textbook to do the exercises or the program?

Amy: The program is better because I can click and type and there is audio to listen to. I also like to practice with the feedback, it helps. It is more interesting than the textbook. Emotionally more interesting.

Unit 3

Frames 1879-1880

She likes the idea of putting the words in sentences in the correct order. She also likes the idea of maps and that on the pop-up maps she can see her answer, the jumbled sentence, and the correct sentence, all of them in one place.

Amy: It takes long to type in the sentences. It would be nice just to click on a word and it jumps to the right place.

She likes the images. She thinks that they help learn new information better.

Investigator: How easy is it for you to work with the program?

Amy: Easy. It is because I can see an unfamiliar word in a sentence , read it, see the image, and listen to it. (very important to understand which preposition to use to describe the position of places)

Frames 2096 (Review Lesson 3 screen)

Amy: I like the review screen, it helps me review what I have learned.

Unit 4

She likes the animation about exceptions.

Frame 2595

Amy: I like the assignments with exceptions and alternative phrases. This is an important thing to know for ESL students. I have a suggestion. It would be nice to learn about which articles to use with geographical names.

Investigator: What do you think about the screens divided into two so that you can compare and contrast?

Amy: It is very helpful. I would like more programs with other tenses used in passive voice. I would like to continue learning in this way.

Amy's overall impressions:

- It is a good way of learning.

- It will be interesting for people who want to learn about geography and history of the country.

- It is an interesting way of presenting information, but sometimes too many dates and names.

- Learning in the context is very interesting and helps learn faster. Generalization through extra practice is also important.

- Colors are also important. They are not too bright, but texts are easy to read and important information is highlighted.

- Audio with text is very helpful.

- Jumbled sentences are a very good exercise. It helps learn word order in the sentences, prepositions, and articles.

- Contrast and compare concept is very important, because she can see the difference between grammar concepts and tenses.

- She likes the idea of the training online because it is easily accessible.

- She likes the characters in the program because one of them is an ESL learner who learns how to speak English and succeeds. She identifies herself with this character and it is very motivational for her.

- She asks for more programs for teaching advance grammar, vocabulary, and idioms. She is a busy person, raises two kids and works full time. She can learn from such programs when she has free time at her convenience, especially if she is not happy with the way these grammar concepts are taught in an ESL class or she does not have time to attend it. She thinks that the program is engaging enough to keep her going without supportive classroom atmosphere and, in addition, she can learn at her own pace.

APPENDIX K. DEBRIEFING AFTER THE POST-TEST

 (Because of a confidentiality issue the real name of the participant is not disclosed and the pseudonym John is used).

Date: December 19, 2008

Investigator: Were there any words or sentences in the program you did not like or found difficult?

John: No, because we can find the definitions of difficult words by clicking on them. They are usually highlighted yellow. It means that you can click on them and hear and see the definition.

Investigator: Were there any assignments that you did not like?

John: No, I liked the assignments from the program very much, especially those that taught the concepts that I have not known before.

Investigator: Were there any assignments that you found difficult?

John: Yes. Some of the assignments seem to be difficult especially verbs with prepositions in Unit 3. I would like more practice with prepositions.

Investigator: Did you learn anything new through the program? If yes, what did you learn?

John: Yes, I did. It was a very good experience for me. I learned new grammar concepts, some facts about geography of the country. I also learned how the software can be used for teaching and learning.

Investigator: How did you like the characters (people talking) in the program?

John: I liked them. It is a nice way to introduce the topic that I need to learn.

Investigator: Did the strategy of comparing and contrasting sentences work for you?

John: Yes, it did. It helps understand the grammar rules better s.

Investigator: What do you think about the feedback ?

John: I like it, it is very important because it answers your questions right away. In two cases it did not provide enough information but in other cases it worked fine.

Investigator: How do you like teaching passive voice in context?

John: I like this idea. It is meaningful and I can practice using it right away. It is interesting and you have to pay attention to what you are doing. It is good that technology can give you this opportunity.

Investigator: What do you think about the idea of generalizing the concept through exta practice exercises?

John: Very good, very important, works well for me.

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