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Development and Validation of a Systematically Designed Unit for Online Information Literacy and its Effect on Student Performance for Internet Search Training

by

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy
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Keywords: content-centered instruction, learner-centered instruction, constructivist, behaviorist, Gagnè

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Dedication

I dedicate this work to my husband Rick, my son, Alex, my best friend, editor, and mentor, Susan Zucker. To James Carey whose dedication went beyond the call of duty and who worked with me to ensure my success. To my colleagues and students at Chamblee Middle School in Atlanta, GA for their patience and enthusiasm for this work, I dedicate this study.
Acknowledgments

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Development and Validation of a Systematically Designed Unit for Online Information Literacy and its Effect on Student Performance for Internet Search Training

Emily K. Dunsker

ABSTRACT

As online learning increases and classroom use of print textbooks are gradually replaced by web-based instruction, what features of online instruction prove beneficial to student learning? The present study has three purposes; (1) To examine the effects of conversion of textbook content to web-based instruction for an extant Internet search course. The researcher examined performance differences of an online textbook to web tutorial compared to a second version that included interactive features found in classroom instruction. (2) To investigate students’ perceptions of material that afforded high levels of learner control and compared responses to a more structured instructional module. (3) To document the design process used to convert textbook material to web-based instruction.

Gagné’s Events of Instruction (1985) differentiated features for comparison and treatment online modules; one featured content-centered, the other learner-centered instructional strategies. The treatment module incorporated interactive features from the Texas Information Literacy Tutorial (TILT) with content modifications appropriate to Internet training modules.

A pretest-treatment-posttest experimental design was used to assess student achievement within and between two groups of 41 high achievement eighth graders. Scores for comprehension and performance tests (scavenger hunt) assessed students’ retention and performance. Carey’s (1994) Academic Motivation Profile (AMP) instrument was used to study...
student perceptions of material on; attention, relevance, confidence, and satisfaction.

No differences between comparison and treatment groups occurred on comprehension. Mean scores across both groups increased from $\bar{X} = 58.97$ to $72.63$ ($N=41$). A repeated measures ANOVA revealed a main effect $F(1,39)= 40.233$, $p<.000$. Both groups excelled on the scavenger hunt with a $\bar{X} = 92\%$ ($N = 41$). The AMP revealed no significant differences between groups on attention, relevance, confidence, or satisfaction. The research confirmed previous findings by Schnackenberg (1998) that provision of high learner control to high ability students proved sufficient for mastery of course content. When practitioners convert print materials for online delivery, considerations such as learner characteristics, validity of testing instruments, navigation, elaboration, and practical considerations are important to the success of the product. Replication using a heterogeneous audience would assist practitioners in their efforts to make decisions regarding strategies for students of different ability levels.
Chapter One

Introduction

Information Literacy is defined as the ability to access, use, evaluate, and generate information effectively (AASL, 1998). Converting print materials to digital formats is increasingly popular and requires that students know how to search automated catalogs, proprietary database sources, and Internet information. Users must be able to convert natural language to language that is compatible with electronic databases to conduct effective searches. Effective searches require: (1) refining research questions, (2) identifying keywords and their synonyms, (3) becoming familiar with terms that pertain to a research topic, and (4) differentiating useful electronic resources from those that are not.

Internet access is now mandated within public and academic libraries and is used to conduct research. Lubans (1998), Deputy University Librarian from Duke University, reported that over 85% of the 235 college freshmen surveyed preferred searching the Internet over traditional library research. The state of Georgia states that students need instruction on how to use the Internet effectively and requires all students to use Internet resources to support research projects throughout middle and high school (Georgia’s Quality Core Curriculum, 2004).

It is not clear that these skills are being taught nor is it known if students possess them. Broch’s (2000) summary of works by Neuman (1995, 1997), Bilal (1998), and others reported research on novices’ Internet search behaviors. Neuman (1995, 1997) studied high school students as they used databases to find information. She noted that students failed to apply language rules for database searches and did not understand the concept of controlled
vocabulary. Neuman also found that when students lacked sufficient background information about research topics, they had difficulty choosing appropriate subjects and keywords for their searches. Bilal (1998) examined seventh graders who attempted search tasks with Yahooligans, a simplified subject directory for elementary and middle school students. The middle school students demonstrated poorly developed search skills when using keyword queries as evidenced by misspellings and absence of Boolean logic. Boolean logic is the inclusion of conjunctions “and”, “or”, and “not” alongside search terms in order to narrow or broaden search results. Students ultimately resorted to use of natural language for search fields.

Fidel and colleagues (1999) studied eight eleventh and twelfth grade students’ use of resources in a high school media center. Students had access to Internet search engines and subject directories but received only cursory training on their use, no training on how to use an Internet browser, and little assistance from the media specialist or their instructor while conducting research. Summarizing qualitative data, Fidel concluded that students demonstrated impulsive search behavior, selected the default search tool associated with the Internet browser, input single words for search terms, and chose the first of many results without critically assessing the information. Students expressed general satisfaction with their search results even though they neglected to analyze research assignments, use Boolean logic, or identify key phrases. Students handled their frustration with a search engine by returning to familiar sites. The researchers concluded that students possessed only primitive search skills and failed to use web search tools effectively.

Pitts (1994) identified determinants for decision-making for 26 high school researchers. She observed and interviewed students over the course of nine weeks to ascertain students' mental models of how the resource-rich environment of the media center
could be used to accomplish their research task. Students were asked to research information from online databases to create a script for a videography project on marine science. Pitts learned that students had poorly developed information-seeking skills and demonstrated ignorance of using electronic tools for finding resources. Pitts argued that, “These students were not overwhelmed by too much information. Instead they were floating in a sea of information but did not know how to access more than a few useful drops.” (p.11).

It is evident from this brief review of literature that adolescent searchers require instruction on how best to use Internet information resources. Media specialists have an imperative to provide students with this instruction but are confronted with a critical shortage of technical and human resources. Limited resources often mean that media specialists scan textbooks to convert content to websites in an effort to promote information literacy. Challenges to providing effective training include: (1) lack of technical skill, (2) limited access to students, (3) limited access to computer teaching labs, (4) scarcity of validated instructional materials to teach Internet search skills, (5) paucity of faculty members proficient in Internet searching, and (6) unreasonable expectations of media specialists; in schools with populations of over 1,000 one or two media specialists may service the entire student body.

Questions arise as to how web tutorials can be designed and used most effectively. In an article entitled, Beyond the Digital Fun-Factor, Glendinning (2002) acknowledges the “sexy appeal” (p.90) of computers and multimedia resources for teaching. He continues, “While computers are now a mainstay of everyday life, teaching with them remains largely the domain of a few self-educated mavericks.” Glendinning transfers text-based material for Internet access, but argues that it is alarmingly tedious to convert print material to web
delivery. He writes, “… a month of steady work last summer didn’t even cover three weeks of my curriculum!” (p.94).

Rarely does an instructor rely solely on textbooks to meet curricular objectives. The trend is to use the textbook as a reference for student investigation; the teacher’s role is to facilitate inquiry-based learning. A Best Practices high school in suburban Chicago (Daniels and Zemelman, 2003) illustrated how students and teachers use contemporary magazines and web-based articles to examine in-depth questions while using textbooks as reference material. Inquiry learning was promoted through interchanges between (1) students and peers, (2) students and material, and (3) students and teacher. The success or failure of this learning experience depended on resources, on the level of student engagement, and interaction with their instructor. Teachers used textbooks to guide and manage student learning experiences.

Typically, textbook material is enhanced with hyperlinks and some graphics, but little program-controlled interaction is created. An online textbook includes content presentation and may include end-of-chapter exercises to encourage learner exploration and illustrate constructs. The text is essentially linear, but students can choose a non-linear path to determine the pacing of the instruction. Feedback results as a natural consequence of the student’s exploration. Like problem-based learning, a high degree of learner self-regulation is required to derive full benefit. The success or failure of web-based textbooks may largely depend on the learner’s prior familiarity with the subject matter as well as their metacognitive abilities and motivation (Meyer, 2003).

**Statement of the Problem**

This study investigated the problems that often arise for learners as a result of instructors’ lack of skills and the instructional design when instruction is delivered via the
web. When instructors place content on the web and convert face-to-face instruction to distance learning, interactions within the learning environment radically change.

Problems can occur for the learner depending on the instructor and characteristics of the learner. Should the instructor lack skills to provide program control of guided practice and feedback, the degree of practice is often shaped through the experience of the individual learner. If the learner is self-directed, one may likely anticipate that he/she will experiment independently and take advantage of hyperlinks within the instruction. The degree of the learner’s maturity and self-regulation is an important factor for consideration when designing elements for guided practice and feedback. Should the learner lack prior experience, knowledge of concepts, or the ability to self-regulate, a constructivist approach in which the guided practice and feedback results from the learner’s own ability to experiment and develop his/her own strategies to master the material may prove insufficient (Meyer, 2003).

Two fundamental design questions emerge when media specialists attempt to implement web-based designs for information literacy training: (1) Will media specialists focus on delivery of content and follow cognitive principles of learning, or (2) Will the instructor emphasize a learner-centered approach whereby the materials set the stage for the learner to invent his/her instructional strategy via exploration or experimentation?

Specifically, the study compares content-centered instruction with learner-centered instruction delivered on the web and its effects on student performance and perceptions about the instruction received. A content-centered approach implies that learning takes place via transmission of information and/or presentation of constructs with examples and non-examples. The learner is guided through exercises, interacts with material, receives immediate feedback, and includes a summation of the material as it relates to previously learned content. The designer prescribes learner strategies through delivery of the content and
practice-feedback sessions throughout the learning module. Often, navigation and elicitation of performance and feedback is program controlled and not left to the discretion of the learner. The content model resembles a school of thought best illustrated by Gagnè (1985).

The learner-centered model embraces a constructivist model. Constructivists believe that learning takes place as a series of interactions or experiences presented by the designer intended to facilitate the process of construction of meaning from experience. In contrast to a content-centered focus, the learner maintains control of his/her learning objectives and strategies for acquisition of content. Feedback is not dependent on the instructional program or teacher, rather it results as a natural consequence of the learner’s experimentation with the constructs presented through authentic experience.

Research is needed to determine what strategies influence performance outcomes for learners engaged in e-learning for information literacy (Hirumi, 2002). Therefore, the researcher examined the effects of web-based instruction on student performance and perception.

Purpose of the Study

The purpose of the present study is threefold. The first purpose is to examine students’ performance on two forms of Internet search skills instruction for web-based delivery from a textbook. The second purpose is to examine effects on students’ academic motivation of two forms of web-based instruction that afford higher or lower levels of learner control. The third purpose is to document the design process used to convert textbook material to web-based instruction.

The two instructional strategies were designed to examine performance differences between two forms of converted online text for an extant Internet search training course.
The strategies are: (1) A content-centered form of instruction which features a high degree of program control. The instructor chooses the sequence, pace, and amount of practice to ensure the student masters the skills intended. This form includes features found in classroom instruction such as gaining attention, guided practice, corrective and reinforcement feedback, embedded quizzes that inform the learner of his/her progress, and summary screens that relate new content to previously learned material. (2) A learner-centered form which features a high degree of learner control. The student chooses the sequence, pace, and amount of practice. This form is typical of web-based instruction, includes a menu structure, suggested practice exercises, and is less prescriptive. The students choose the instructional strategy to master the course objectives.

The second purpose was addressed by examining the perceptions of high ability students towards the presented material. This was done to discern whether students’ perceptions differed between the two forms of online instruction. The online instruction is based on Keller’s (1987) ARCS theory: attention, relevance, confidence, and satisfaction. A self-report instrument developed by Carey (1994), the Academic Motivation Profile (AMP) is modified for the present research to measure attitudinal scores on each of the four factors.

Documenting the design process used to convert textbook material to web-based instruction addressed the third purpose of the study. The researcher considers whether additional time and effort to incorporate the features found in classroom instruction mentioned above are warranted based on performance and perception outcomes.

*Dependent Variables*

This study examined the effect two instructional design strategies had on two performance assessments and student perception. The performance assessments consist of a comprehension test and an Internet scavenger hunt. A pretest-treatment-posttest
Experimental design was used to assess within and between group differences on the comprehension test on knowledge of Internet search strategies. Following instruction, students took a second performance test in the form of an Internet scavenger hunt. Scores between groups on the scavenger hunt were compared to determine whether the instructional strategy proved to be a benefit or a detriment to the students. Further, investigation of students’ perception of the instruction was compared using a modified form of Carey’s (1994) Academic Motivation Profile (AMP).

**Independent Variables**

Two instructional design strategies are compared: (1) A content-centered form of instruction which features a high degree of program control. (2) A learner-centered form of instruction which features a high degree of learner control.

The researcher used content from an extant course on Introductory Library Research and Internet Skills by Frederick and Smith (2000) and converted the material to an online format. Reigeluth’s (1996) Elaboration Theory model and formative research informed the researcher’s decisions concerning the two instructional strategies. Reigeluth concluded:

- Elements should be sequenced from simple to complex,
- A precise overview of theoretical and/or procedural information should be provided in the form of an epitome, defined by Reigeluth (1995), as overview screens that provide context for the exercises that follow.
- Sequential steps for procedural knowledge should be compared and contrasted during exercises with reference to previous material,
- Problem based instruction should include differentiation between extraneous information and required information for task performance.
The two instructional designs differ in terms of navigation and extent of learner control versus program control for guided practice and feedback. Differentiation between treatment and comparison groups was based on Schnackenberg and Sullivan’s (1998) research findings. Schnackenberg found that when comparing the effects of two forms of computer-based instruction on competency-based education that students assigned to full program controlled software (treatment group) performed better than those students assigned to the lean version (comparison group). The full version controlled the sequence and practice the students received during training, while the lean program condition provided learners choice of extent of practice following examples.

The researcher also divided participants into ability levels and found that overall, high ability students performed better than those of less ability in both treatment conditions. Schnackenberg’s (1998) research indicated that greater reliance on Internet resources for classroom instruction afforded students greater learner control over the pace and extent of practice. She recommended that the issue of learner control versus program control navigation, guided practice, and feedback needs to be revisited.

Common Features of Two Instructional Modules

- Vertical menu structure with visual prompts to alert learners of their progress throughout the module.
- Graphical organizers and illustrations throughout the narration provide visual models of the content.
- Overview screens provide context for the exercises that follow.
- Clear definitions with pop-up hyperlinks within the narratives provide assistance.
• Reference to previously learned material for retention and transfer of knowledge is contained in each of the narratives.

Differences Between the Two Instructional Strategies

• Flash screens intended to gain the learner’s attention were used in the treatment condition but were absent in the comparison module.

• Guided practice and feedback in the comparison condition were accomplished through hyperlinks and suggested exercises. The treatment module controlled student navigation through several illustrative exercises and provided program-controlled feedback throughout the practice.

• The treatment included review screens and interval quizzes to provide feedback on the learner’s progress. These screens were absent in the comparison condition.

• A final game adapted from the University of Texas’ Texas Information Literacy Tutorial (TILT) called Library Squares was added to the treatment condition. Its intention was to reinforce transfer and retention of information prior to final testing.

Research Questions

The main purposes of this study were to examine the effects two online instructional strategies have on student performance; to examine students’ perceptions of the two forms of online instruction; and to document the design process used to convert textbook material to web-based instruction.

The three research questions driving this study are:

1. What effect do two online instructional design strategies for Internet training, characterized by their content-centeredness or learner-centeredness, have on student performance measures?
2. How do students’ perceptions based on self-reports differ on attention, relevance, confidence, and satisfaction between two instructional strategies characterized by their content-centeredness or learner-centeredness?

3. Is the additional time and effort needed to include the treatment module features found in classroom instruction; gaining attention, guided practice, corrective and reinforcement feedback, embedded quizzes, and summary screens, efficacious given the performance and perception results of this study?
Definitions:

- Ability levels – refer to the random assignment of students in this study using match pairs to physically control the covariate, which was the students’ pretest score.

- Boolean logic - the inclusion of conjunctions “and”, “or”, and “not” used to narrow or broaden search results.

- Computer-Assisted Instruction (CAI) - refers to drill-and-practice, tutorial, or simulation activities offered by themselves or as supplements to traditional, teacher-directed instruction.

- Constructivism - refers to the idea that learners construct knowledge or meaning for themselves learning takes place.

- Digital formats – delivery of information using various standards expressed in numerical form especially for use by a computer.

- Electronic resources – digital web resources used to conduct research.

- Epitomes – named by Reigeluth (1996), are overview screens which provide context for instructional exercises that follow.

- Hyperlink – element in an electronic document that links to another place in the same document or to an entirely different document. Hyperlinks are the most essential ingredient of hypertext systems, including the World Wide Web.

- HyperMedia - An extension to hypertext that supports linking graphics, sound, and video elements in addition to text elements. The World Wide Web is a partial hypermedia system since it supports graphical hyperlinks and links to sound and video files.
• Internet-based instruction - (IBI) instruction delivered via the web. The IBI research that has been done thus far has focused on three general categories: a method of instructional delivery; human behavior based on educational theory, such as motivation theory, instructional design theory, and more; and technology in teacher education.

• Information literacy – ability to effectively access, use, evaluate, and generate information.

• Instructional strategy - how one applies the methods the student will encounter to acquire the course objective.

• Internet browser – software application used for displaying HTML documents and other WWW documents. The two most popular are Netscape and Internet Explorer.

• Inquiry-based learning - implies involvement that leads to understanding. Involvement in learning implies possessing skills and attitudes that permit you to seek resolutions to questions and issues while you construct new knowledge.

• Metacognition - broadly defined, is the study of how humans think about and control their own thought processes.

• Multimedia - is the use of several different media to convey information (text, audio, graphics, animation, video, and interactivity); often refers to computer media.

• Natural language - human language; for example: English and Chinese are natural languages. Computer languages, such as FORTRAN and C, are not.

• Online databases – collections of information organized so that a computer can quickly access requested data. Like a traditional file cabinet, databases are organized by fields, records, and files.
• Print materials – materials distributed on paper.

• Problem-based learning – (PBL) is widely thought of as both a curriculum and a process. The curriculum consists of designed problems that demand that learners acquire knowledge, problem solve proficiently, self-direct their learning, and participate in teams to develop skills. The process replicates those encountered in life.

• Search engines - programs that search documents for specified keywords and returns a list of the documents from where the keywords were found. Search engines enable users to search for documents on the World Wide Web and USENET newsgroups.

• Variables identified in this study:
  - Dependent – consist of a measure of student perceptions and two student performance measures: knowledge assessment and an Internet scavenger hunt.
  - Independent – consist of two instructional designs: a content-centered form of instruction and a learner-centered form of instruction.

• World Wide Web - (WWW) system of Internet servers that support documents formatted in a markup language called HTML.

• Yahooligans – a digital subject directory simplified for elementary and middle school students.

**Limitations**

Limitations of this study include threats to internal and external validity. Internal validity threats include: (1) history or replication of the pretest following posttest without ample time allowed between administration of the instruments; (2) testing where the pretest
alters posttest responses and potentially negates the treatment; (3) instrumentation error due to low reliability or content validity of the tests and potential order effect resulting when pre and posttests follow the same order of questions.

Threats to external validity included interaction between selection of the sample and treatment. Characteristics of the high ability students include self-regulation and a desire to achieve knowledge and skills. The students were attracted to the instruction in both conditions. One cannot generalize beyond the local site because the researcher’s relationship with the selected sample may have influenced students’ receptiveness to the treatment.

Statistical limitations include the low reliability scores for both the comprehension and performance instruments, thus resulting in high standard error. Sample size was relatively small (N = 41) given that alpha was set at $p < .05$. Replication of the study with larger numbers would increase power and the researcher could have computed sample size based on an effect size of .80 and alpha at .05. For this study, the two groups should have been comprised of 30 students per group to have attained the correct effect size. The fact that both comparison and treatment groups excelled and the sample comprised high achieving middle school students may be attributed to learner characteristics being correlated to the sought outcomes of the dependent variable.

Conclusion

The appeal of web-based instruction is that it offers a convenient vehicle with which to teach large numbers of students with limited instructor resources. Problematic, however, is that web-based interactive modules are not easily created. Time resources and technical skills are not readily available at school sites. Consequently, an expedient means of producing textbook/training material to large numbers of classes without intensive effort on the part of media specialists is to convert text material to web via straightforward text-based websites.
Merely placing web instruction in a format conveniently available to large numbers of students does not insure that the instruction is necessarily effective. Success with web-based learning may depend on the characteristics of the learner. Meyer (2003) contends that a student’s prior knowledge as well as his or her learning style on a continuum of initiative and passivity may predict the success or failure of web-based learning. A self-directed learner may require different instructional strategies than a student with low self-regulatory learning skills.
Chapter Two

Review of Literature

Introduction

The topics chosen for this review of literature are intended to give the reader background and insight into educational issues concerning web-based instruction (WBI). The discussion is presented in three main sections that outline broad-based issues and then addresses issues from a narrower focus. Specific topics include: features associated with sound instructional design for online training environments, issues faced by educators when textbook material is converted to an Internet format, a theoretical analysis of instructional components necessary for successful online learning, and perceptual issues that influence a learner’s receptivity to instructional material.

Educational technology as information technology is clearly developmental in nature. The proliferation of micro-processing technology and convergence of telecommunications and computing have led to the digitization of information in all arenas, including education. The Information Age features a shift from linear to interactive media, a broadening concept of literacy, a merging of information processing, the regulation of new technologies, and the relationship between available information and its effective use (Saettler, 1990).

Empirical studies on the impact WBI has on learners, teachers and curricula are few because WBI is still in its infancy. Indeed, there is a paucity of empirical research that identifies features of online instruction that influence performance outcomes. In this study, content-centered versus learner-centered designs and the relationship of learner control versus program control are examined for their effect on student performance.
The WBI research that has been done thus far has focused on three general categories: First is a method of instructional delivery; i.e., online distance learning. Second is human behavior based on educational theory, such as motivation theory, instructional design theory, and others. Third is technology in teacher education. This study explores instructional delivery, design methods, and the behavioral aspect of educational theory denoted by performance and perception measures (Zucker, 1998).

The Internet is a new frontier in which computers are considered tools to learn about, to learn and to teach with. Technologists and educators work to improve instructional outcomes, design, and aesthetics to produce optimal learning.

*Instructional Design Models for Online Tutorial Development*

Many researchers contributed to the body of literature dealing with the first research question, “What effect do the two online instructional design strategies for Internet training have on performance measures?” The researchers featured in this study include: Alessi and Trollip (2001), Schnackenberg and Sullivan (1998), Chung and Reigeluth (1992), Hirumi (2002), Northrup and Rasmussen (2001), Carlson and Repman (1999), Biggs (1996), Bowden and Marton (1998), Laurillard (1993), and Williams (2002).

Well designed tutorials feature well written performance objectives, reference to prior learning, frequency of interaction following or prior to presentation of information, variety of question types to assist with maintaining learner's attention, feedback, response prompts, clear organization of information presentation, and well designed navigation (Alessi and Trollip, 2001). Alessi and Trollip write that good tutorials require succinct clearly written performance objectives to guide and motivate the learner through the sequence of activity described above. Tutorials that are well designed stimulate the learner's recall of prior
knowledge through narratives and use of metaphors, analogies, and reference directly to prior learning. Tutorials that incorporate numerous well placed questions and require the learner to provide input/action prove to be more effective than a more passive learning environment. They maintain that questions sustain the learner's attention, facilitate internal processing and reflection, and provide the learner self-assessed feedback on her/his progress (Alessi and Trollip, 2001, p.94). Response prompts and well-placed cues assist the learner in navigating and processing the material. The tutorial in this study includes graphical prompts for navigation, directions for interactions, and provides ample corrective feedback and positive reinforcement.

Tutorial navigation can be either linear or branching. Linear designs are the most simple and direct. They follow one of two sequences of presentation. One is hierarchical in the presentation of skill sets and builds on prior learning from one module to the next. The other is presented from simple to complex. Branching tutorials permit the learner decision points in the navigation, can provide remedial information if a student commits errors within a practice session, or permits the learner to exit and return later to the program. Branching permits the learner to skip sections of material and return to various sections via menus or forward and back navigation buttons.

Instructional tutorials for Internet search training require the learner to apply rules and principles for searching. Alessi and Trollip (2001) site two methods of conveying this information: (1) Rule-Example, or the (2) Example-Rule. Rule-example provides the learner information about a search strategy followed by an example. The program elicits a response and guides the learner through an exercise providing corrective or reinforcement feedback. The second method, example-rule shows the learner an example and prompts the student to infer the rule from a series of practice-feedback exercises. The latter method is more
representative of a learner-centered approach while the rule-example describes a content-centered design. The example-rule method relies on the learner's intuitive and analytical abilities to infer the rule from experience. Arguments can be made to favor either rule-example or example-rule methods but most educators prefer rule-example in that it requires less from the instructional designer and economizes the learning process (Alessi and Trollip, 2001, p.123).

They further state that successful multimedia designs include four phases: (1) presenting or modeling information, (2) guiding the learner through initiation of material, (3) encouraging the learner to practice concepts presented to increase learning retention, (4) conducting learning assessment. Information is presented and the learner is informed of the objectives and purpose of the instruction. Following elaboration of information (presentation of examples and non-examples), the learner performs some kind of interaction, the click of a button, answering a question, choosing a path for more information, etc. The program provides the learner feedback aimed to correct, inform, or praise the student and to reinforce or correct comprehension and/or performance. More information may be presented followed by learner interaction, feedback, and additional information until the program ends with a summary of what has been learned.

The present study documents conversion from print instruction to web presentation. A lean-plus design is featured affording learners non-linear movement to various topics in the program. The learner’s degree of choice has an impact on motivation and the ability to sustain attention (Alessi and Trollip, 2001, p.126). This study examines the effects on performance when students are allowed to choose the sequence and practice from modules on Internet training topics from a table of contents. The tutorials follow the rule-example protocol in both treatment and comparison conditions. Each topic within the table of
Development and Validation

contents presents an overview or rule, followed by practice under learner control in the comparison condition and programmed controlled for the treatment condition. The treatment condition controls the guided practice following a rule statement and does not permit the learner to return to the main menu until completion of an exercise and a summary screen. The navigational design and instructional strategy, whether program controlled or learner centered may have an impact on sustaining attention and motivation throughout the learning process. The latter issue is addressed in the second research question.

**Learner control versus program control and achievement.** Learner control is defined as the learner’s ability to control learning events (Schnackenberg, 1998). Allowing learners to control the pace, sequence, and navigation within an instructional program is founded on the idea that learners are able to best evaluate their instructional needs and devise their own strategies to fulfill their needs. Learners respond favorably to instruction that affords learner control of the pace, sequence, and depth of instruction. There is an assumption that when given free reign, the learner will demonstrate stronger motivation towards the material and thereby produce higher outcomes. However, Chung and Reigeluth (1992) contend that granting learner control produces “inconclusive and …more frequently negative” outcomes, however with the advent of the World Wide Web, there exist gaps in the literature concerning the issue of control in a hypertext environment. They suggest that research on learner control and achievement is equivocal and is more often negative when learners are given greater control of the instruction. The researchers assert the reason that greater learner control may lead to lower achievement is due to learner characteristics. Lower achieving students lack the ability to make decisions on pacing, sequence, and amount of practice afforded them.
Reigeluth (1996) defined a set of learner control strategies based on the Conditions-Methods-Outcome model. Three variables influence the designer regarding learner control; (1) instructional outcomes, (2) instructional conditions, and (3) instructional methods. Four factors that influence outcomes; (1) accuracy sometimes referred to as error rate, (2) speed as it relates to efficiency of learning, (3) ability to transfer information, and (4) the ability to retain information over time. Instructional conditions refer to learner characteristics, objectives or domains of learning, and learning systems such as computer-assisted instruction (CAI) and multimedia environments. Instructional methods encompass decisions based on sequence and selection of examples and non-examples, content summarization, and the learner’s synthesis of the material. Chung and Reigeluth (1992) provide a prescriptive model for learner control based on content, sequence, and pace. Learner control may be granted under the following circumstances:

1. Students have previous content knowledge of the material.
2. Students have high ability learner characteristics.
3. The probability of success is high regardless of whether one affords control to the learner or restricts control.
4. When higher-order skills are being taught compared to verbal information level (rote memorization, drill and practice) and when students are familiar with content (Hannafin and Peck, 1988).
5. One should NOT afford learner control when mastery of the material is dependent on a sequence of hierarchical skills.

Control of sequence may be afforded under the following conditions:

1. When presentation of instruction does not require any particular order.
2. Students are familiar with the content of the instruction and able to make choices over sequence of presentation.

3. Students of high ability and familiarity with subject matter may be granted greater learner control.

4. If the learning is problem-based, permitting students to select a sequence facilitates synthesis of the material (Gagné, 1985).

5. Prior knowledge of the content permits learners to control instructional sequences (Mager and Clark, 1963).

Learner control may be given over the pace of instruction when:

1. Materials need to be relevant to students’ needs. Granting depth of exploration and additional time spent on an area of interest to the learner increases attention and motivation.

2. If students believe that spending additional time will increase their achievement.

3. Individualized or self-paced instructional platforms require learner control.

4. Students benefit when additional time to integrate new information with already acquired material.

5. Coached practice may increase achievement and sustain attention thereby reducing instruction time (Campbell and Terry, 1963).

Special considerations for hypermedia and learner control:

1. Provide guidance and objectives for low-ability learners as well as a default sequence of information presentation for the content.

2. Provide graphical cues for navigation and a form of map to let the learner know where they are within the instructional program.
3. Use audit trails, a graphical cue to show where the learner has been previously within the program.

4. Set standards for screen design.

5. Permit learners to make conceptual links within the framework of personal information management systems.

6. Present information in an overview rather than depth for presentation systems.

7. Inform the end-user of his/her location within the program.

8. For navigation settings, make a standard means of conveying topics of information.

9. Permit the user to close windows without exit from the program.


11. Provide a continual help system (Kinzie and Berdel, 1990).

Schnackenberg (1998) made a distinction between learner control and aptitude vs. learner pre-instructional knowledge. The author limited her review to those studies where normative aptitude measures were used to assess the relationship between learner control and ability.

A lower-achieving student may not have domain knowledge and therefore has less ability to self-regulate. Chung and Reigeluth (1992) found that low achieving students were unable to self-regulate and diagnose their learning needs. They failed to generate effective learning strategies when they encountered material with a large range of learner control options. These low achieving students benefited from a more structured, less lenient program controlled form of instruction for computer-based learning applications.
Steinberg (1989) found the opposite to be the case for high achieving students in a literature review on learner versus program control and learner characteristics. Steinberg asserted that high ability students perceived rigid learner control as a hindrance. Perhaps a more apt question was whether the amount of support afforded learners depended on topic knowledge and familiarity and aptitude. Steinberg supported the notion that when learners were informed of their progression, the program acted similar to that of a coach and provided learner advisement. The high ability learner made cogent decisions about whether they should engage in practice, repeat a particular section, or consider the unit complete.

Schnackenberg’s and Sullivan’s (1998) research was based on a sample of 202 undergraduate teacher education students placed randomly into four groups based on aptitude scores on the SAT and ACT. Subject matter focused on competency-based educational practices. Four versions of a computer-based program were developed based on two levels of learner control, high learner control and full program control, and two levels of program presentation, lean and full. The instructional program converted text from Teaching for Competence (1983) by Sullivan and Higgins adapted for an interactive computer assisted program done in HyperCard for Macintosh computers.

Information, examples, reviews, and summaries were identical for all four versions of the instructional program. Practice items were written as multiple choice single correct answer responses. Program controlled versions forced the participant to move sequentially through all screens in their view while the learner control the first of four multiple choice with feedback practice items was mandatory and under program control while the learner could opt to continue or move to another topic. Following training students completed a 36 item multiple-choice paper and pencil test. Reliability statistics using a Kuder-Richardson formula resulted in a reliability statistic of .78 Results indicated that the full program scored
higher than a lean version and high ability students scored higher than those of lower ability. More time was spent viewing material in the full version of the program thus resulting in a greater number of practice exercises. Posttest achievement did not differ by type of control, either learner or program controlled instruction. A thirteen-item attitudinal test that used a Likert scale was used to assess learner preferences. No reliability data was reported in the study.

Students indicated that they preferred the full program to the lean because it “afforded them time to complete more practice exercises”. The fact that the subject matter, competency-based instruction, lent itself more to face-to-face instruction versus computer delivered came as little surprise. When students were asked if they preferred computer-based versus classroom training on the subject, 51% preferred classroom-based instruction. Seventy-seven percent of the participants responded they would prefer competency-based instruction or another subject without computer instruction in contrast to 23% who preferred to use computer-based instruction.

Schnackenberg & Sullivan (1998) found when they blocked ability, measured by a standardized aptitude instrument, they discovered no aptitude interaction effect. Lower achievement students performed no better or worse when provided high learner control versus low learner control. Achievement outcome measures indicated that students’ performance was essentially equivalent regardless of whether they experienced higher or lower learner control conditions. Schnackenberg concluded that there were strong effects for ability and achievement for high and low learner control. High ability students who were provided high learner control and students experiencing high program control outperformed their low achieving students given both full and lean versions of the software.
Greater reliance on web-based delivery systems that afford students high learner control regardless of ability level necessitates educators to revisit the question of ability and learner participation for WBI. Quantitative and qualitative research is needed to assess how students of high ability level perceive the instruction and perform when provided with differing levels of learner versus program control for web instruction. Schnackenberg (1998) suggested research is needed to gain insight into the thought processes present as students encounter learning decisions during WBI.

Elaboration Theory of Instruction (ETI) conceived by Reigeluth (1996), sought to show increases in comprehension and motivation as a result of providing learner control and sequencing instruction based on the type of learning; e.g., information skills, cognitive, or procedural knowledge. He draws a distinction between task and content knowledge. Content knowledge, based on conceptual learning, prescribes a sequence of principles called conceptual elaboration sequence. Theoretical elaboration sequence is a type of sequence aimed at task knowledge such as solving algebraic equations, creative writing, outlining, or note-taking and focus on process-based skills. To accomplish objectives for task knowledge, Reigeluth offers the Simplifying Conditions Method (SCM) based on two conditions; (1) procedural knowledge where the learner follows a prescribed strategy, or (2) a heuristic task where the learner uses causal knowledge, conditional statements such as if this condition exists, then I (the learner) should do … Two Simplifying Conditions Methods include the procedural SCM sequence and the causal SCM sequence.

Theoretical SCM Sequence moves from the most basic observable principles to most complex and detailed principles. The initial lesson, termed the “epitome” describes the most fundamental and generalizable principles taught at the concrete operations level but taught in the context of real world situations.
Procedural SCM Sequence, based on task or process-based knowledge or set of skills, assumes that complex cognitive tasks such as those that involve problem-solving are completed under different circumstances. Some of these procedures represent simpler tasks, are initially taught and build from simple to complex. The learner builds confidence as the desired competence is achieved. Both sequences use concrete real-world versions of tasks.

Reigeluth (1996) conducted a qualitative formative study, divided in two phases, to identify strategies to apply his sequence theory. The study involved a group of thirteen sophomores from Indiana State University enrolled in the Electronics and Computer Technology program. The instructional program converted text from the *Introductory Circuit Analysis* textbook by Boylestad (1990) to a computer-assisted program.

For the first phase Reigeluth conducted individual “talk aloud” interviews while the ten voluntary students completed a computer-based program on electronic circuit analysis. The students were designated by ability level based on GPA: three - high ability, three - average ability, and four - lower ability. Students were asked to comment on each screen of the HyperCard program and comments were recorded by tape recorder by the investigator. Stratified sampling was used to ascertain whether qualitative feedback differed according to ability level.

The programs used material from the textbook but differed on theoretical or procedural sequences. Additional comparisons were made for both procedural and causal sequences. The computer program used varied sequences to ascertain students’ reactions to different levels of elaboration on the units.

Two levels of Simplifying Conditions Methods were included for each of the three instructional units; a theoretical SCM and a procedural SCM. Six assessment instruments were included: (1) two pre-tests, (2) posttest, (3) set of impromptu questions during the
interactive phase, (4) set of questions for debriefing, and (5) an attitude survey. The pretests measured prior content and prerequisite knowledge. Students who scored 30% or below on content knowledge participated which ensured that only novice students participated in the study.

The post-test was administered with an affective survey following instruction so students could provide feedback on students’ attitude toward the instruction. The posttest also allowed objective evaluation of the modules’ effectiveness. The attitude survey asks participants to circle responses on an ordinal scale of 1-5 in response to the appeal of the instruction and student’s individual attitude toward the instruction.

The second phase used three students for a total of N=13. For Phase II, three students completed instructional material revised from comments from phase I without the presence of an investigator. Following instruction, during a debriefing, students were asked to describe the method he/she used to navigate the module. Typed responses taken from audio transcripts were presented to students the following day to verify their input or be able to modify their responses.

Reigeluth (1996) reported data from both phases of the research and used a prewritten set of debriefing questions to ensure consistency of the feedback. Data was coded according to lesson number and phase number and responses from low, average, and high sub-groups were divided within a matrix of responses. Students were asked to comment on (1) how distinctions in the modules were illustrated from one procedure to another, (2) how procedural steps were explained, (3) whether the numbers were easy to calculate, or (4) if the material induced uncertainty. The investigator reported mean scores of high average and low ability participants on the posttest measure. Score means were 95.0 for the high ability, 93.7 for average students, and 84.1 for low ability participants. Though not an empirical
study, Reigeluth (1996) examined scores previously for 189 students whose average was 77.3% on the criterion referenced posttest. Qualitative data supports use of the epitome, sequencing from simple to complex for all ability groups and both phases of the formative research. Reigeluth enumerated the following suggestions concerning sequencing and elaboration theory.

1. For procedural information, relate previous sequences to new ones and distinguish common elements.

2. Provide labels beside conditions so that students gain optimal learner control.
   Labeling allows students to identify and categorize problems.

3. If the knowledge is based on a problem-based situation, assist the learner to distinguish between extraneous information and information relevant to the solution.

4. Reiterate at the macro instructional level by presenting problems under the identical condition and sequence the amount of complexity.

5. Epitomes teach small numbers of ideas at the application level, help the learner gain an overview of the procedural and theoretical, and focus them on essential material.

**E-learning interactions.** Differences between instructional delivery in the classroom and the web are apparent. Classroom teachers provide non-verbal spontaneous reactions that elicit student-teacher and peer interaction (Hirumi, 2002). E-learning interactions require careful planning and a theoretical basis for sequence and presentation of learning opportunities. Hirumi (2002) describes four major categories of computer-mediated interactions: (1) communication, (2) purpose, (3) activities, (4) and tool based taxonomies.

The focus of this study is on learner-instructional interactions, those that engage learners in activity, with emphasis on student to management interactions (feedback), the last classification listed by Northrup and Rasmussen below. Carlson and Repman (1999) classify
e-learning interactions into the following categories: (1) questioning, (2) feedback and clarification, and (3) control of pace and sequence of presentation (p.142). Northrup and Rasmussen (2001) define four classes of interaction: (1) student to student, (2) student to instructor, (3) student to instructional materials, and (4) student to management (feedback) interactions (p.142).

The theoretical basis for design of management interactions is dependent on the perspective of the designer, whether one follows a content-centered (behavioral) or learner-centered approach. If an instructor believes that activity-based interactions inspire engagement with the material to foster critical thinking and reflective information sharing, he/she may design navigation with high learner control in mind. The designer may offer learner control over sequence and presentation of material. The opposite is true if one believes that learners require embedded practice and corrective and reinforcement feedback in order to develop higher level thinking skills.

Hirumi (2002) proposes three levels of E-learning interactivity. Level I interactions are those experienced personally within the learner coined as learner-self interactions. Level I interactivity supports a learner-centered model of interactivity in which the student is presented opportunities for exploration and experimentation. Level I includes cognitive operations and self-regulation or metacognitive processes. Characteristics of learners who take advantage of lenient navigation and sequence of material are those capable of self-initiated strategies and diagnosis of learning gaps. Typically these learners are self-initiators and highly self-regulated, a trait highly desirable for distance learners. Level II interactions take place between learner and instructor, learner to learner, and learner-content interactions. Level III interactions are defined as learner-instruction interaction and involve, “...a deliberate arrangement of events to promote learning and facilitate goal achievement.
Learner-instruction interactions are differentiated from Level II and Level I interactions to illustrate how theoretically grounded instructional strategies may help distance educators design and sequence planned e-Learning interactions.” (Hirumi, 2002, p.148). Hirumi asserts when instructors post classroom based materials or text in web form, they often overlook planning for e-learning interactions and fail to ground interactivity in pedagogical theory. Table 1 below provides a framework for grounded instructional strategies. Two of the frameworks are directly relevant to the materials developed for this study.

Table 1

*Grounded Interactive Strategies* (Hirumi, 2002, p.149)

<table>
<thead>
<tr>
<th>Nine Events of Instruction (Gagné, 1985)</th>
<th>Direct Instruction</th>
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</thead>
<tbody>
<tr>
<td>1. Gain Attention</td>
<td>1. Orientation</td>
</tr>
<tr>
<td>2. Inform Learner of Objective(s)</td>
<td>1.1. Establish Lesson Content</td>
</tr>
<tr>
<td>3. Stimulate Recall of Prior Knowledge</td>
<td>1.2. Review Previous Learning</td>
</tr>
<tr>
<td>4. Present Stimulus Materials</td>
<td>1.3. Establish Lesson Objectives</td>
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<tr>
<td>5. Provide Learning Guidance</td>
<td>1.4. Establish Lesson Procedures</td>
</tr>
<tr>
<td>6. Elicit Performance</td>
<td>2. Presentation</td>
</tr>
<tr>
<td>7. Provide Feedback</td>
<td>2.1. Explain new concept or skill</td>
</tr>
<tr>
<td>8. Assess Performance</td>
<td>2.2. Provide visual representation</td>
</tr>
<tr>
<td>9. Enhance Retention and Transfer</td>
<td>2.3. Check for understanding</td>
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<td></td>
<td>3. Structured Practice</td>
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<tr>
<td></td>
<td>3.1. Lead group through practice</td>
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<tr>
<td></td>
<td>3.2. Students respond</td>
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<tr>
<td></td>
<td>3.3. Provide corrective feedback</td>
</tr>
<tr>
<td>Nine Events of Instruction (Gagné, 1985)</td>
<td>Direct Instruction</td>
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<tr>
<td>4. Guided practice</td>
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<tr>
<td>4.1. Practice semi-independently</td>
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<tr>
<td>4.2. Circulate, monitor practice</td>
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<td>4.3. Provide feedback</td>
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<tr>
<td>5. Independent practice</td>
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<tr>
<td>5.1. Practice Independently</td>
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<tr>
<td>5.2. Provide delayed feedback</td>
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</table>

As part of England’s higher education initiative, the Courseware for History Implementation Consortium (CHIC, 1998 - 2001) examined the effect of including websites as supplements to traditional textbook and lecture formats on student performance in college courses. Two other instructional strategies were compared; (1) online seminars with cooperative learning groups and (2) integrated cooperative online learning with face-to-face instruction. An important insight emerged from Hall’s (2002) research. Mode of delivery was not at issue, rather the differences in curricular design and student participation with peers, instructors, and materials were key to successful web-based designs.

Biggs (Swartz, 1999, 11) described key features of effective interactivity. “Learning is the result of the constructive activity of the student. Teaching is effective when it supports those activities appropriate to understanding the curriculum objectives.” The activities enable learners to demonstrate their understanding and instructional strategies support the student’s ability to fulfill course objectives. Thus, the student perceives the process as relevant to their learning needs. One strategy is to promote harmony (Hall, 2002, 151), provide an overview of the entire process so the student may relate the information as
important for personal growth and knowledge. A designer promotes deep-level understanding of the material, when students are encouraged to be proactive. Instructional designs require pre-assessment of entry skills so that new information relates to what is already acquired. Additionally opportunities for peer and tutor support are essential for students to acquire a full understanding of the learning task. Learners may not be invested in the instruction, when content and activity is highly controlled through program constraints (program control).

Educators at all levels are making efforts to distribute instruction to mass audiences through web-based courses. These sites typically include features that promote open, learner-controlled forms of navigation de-emphasizing the importance of the teaching method (Bowden and Marton, 1999). The learner’s ability to make sense of disparate sources of information that are unrelated and feature no guidance predictably leads to learner confusion. If a logical course structure with high learner control and access to the instructor as facilitator is provided, students are more likely to demonstrate mastery of the material.

Current strategies that convert text to web run the risk of creating encyclopedic volumes of unrelated reference material. Information intended to supplement content-centered instruction without opportunity for exploration and feedback fails to promote communication and ultimately mastery of learning objectives. Text-based websites without interactivity omit important facets of the teaching process; discussion, interaction, adaptation, and reflection, all primary ingredients for successful technology integration (Laurillard, 1993).

According to Hall (2002), website development must meet learner needs and support learning objectives, teaching processes, and learner outcomes. Learner preferences and abilities influence whether a learner-centered versus program controlled design is used. The
role of feedback plays an integral role in designs that contrast constructivist and behaviorist approaches; one that emphasizes high learner control versus one that advocates high program control for WBI.

Four common components of Instructional Systems Design include (1) analysis, (2) design, (3) delivery, and (4) evaluation (Williams, 2002). The success or failure of any instructional program depends on the design. Several steps are necessary to create an instructional program regardless of whether a content- or learner-centered approach is chosen. These steps include (1) preparation of objectives, (2) determination of content, (3) instructional methods and strategies employed, (4) assessment and access to resources, (5) application of content, and (6) assessment both formative and summative. This study examines the underlying theories that form the basis for qualitatively different instructional strategies; i.e., learner centered (constructivist) or content centered (structured cognitive) approaches to acquisition of knowledge.

Behavioral and Constructivist Theories and their Relationship to Instructional Design

Behaviorism is associated with scientists such as, Pavlov and Skinner. Programmed instruction is linear and features a mechanical type of learning environment model. Invented by B.F. Skinner (1976), behaviorists held that learning takes place as a series of rewards and punishments and that the environment shapes the complexity of behavioral responses. Few educators use programmed instruction to facilitate higher order thinking despite the fact that Skinner is recognized for his contributions of shaping behaviors through reinforcement and immediate feedback. Interestingly, however, basic tenets of behaviorism impact current methods of instructional systems design (Ertmer and Newby, 1993). These include the use of:

1. Pre-assessment instruments to determine entry level knowledge or behavior
2. Sequence instruction from simple to increasingly complex levels
3. Reinforcement and feedback to shape behavioral responses, retain attention to the material, motivate, and correct performance
4. Practice and application of principles conveyed through narrative material or examples and non-examples of constructs
5. Observable, measurable, performance-based outcomes (Williams, 2002, 135)

Most web-based learning is based on constructivist theory contrasted with behaviorist theory. Constructivists believe that learning is subjective. Learners arrive at a learning experience with a personal history, belief system, prior interaction with concepts, and prior knowledge. Constructivists encourage participation and relate the material to the individual’s prior experience. Ertmer and Newby (1993) posit that learner participation is enhanced when tasks include real world problem situations, collaborative learner strategies, and when the teacher acts as facilitator. Participation is also increased when teachers encourage discussion and debate within the framework of a common experience. Features of constructivist design include:

1. Applying learning to meaningful contexts
2. Affording high learner control
3. Providing opportunities for learners to apply what they have learned
4. Presenting information in multiple modes
5. Revisiting concepts previously encountered in the instruction
6. Emphasizing problem-based learning
7. Developing alternate ways of presenting problems
8. Focusing on transfer and retention of knowledge and skills
9. Presenting problems worded differently from those presented in examples in practice sessions on assessments

Both constructivists and behaviorists recognize the importance of feedback and assessment (Williams, 2002). While control of the environment is a central value for behaviorists, constructivists concentrate on the learning process and how individuals acquire skills and knowledge.

Williams (2002) conducted a study to determine optimal design features for adult learners and WBI. Her study focused on adult learning, based on the assumption that adults are self-directed and bring prior knowledge and experience to the learning environment. Though aimed for adult learners, many of the findings relate to web-based design for any age group. Web-based trainers/designers from across the United States (N=25) were selected for input of design principles deemed relevant for adult education. Thirty-six features of WBI resulted from input from designers’ electronic interviews. This author selected the following principles applicable to WBI regardless of age.

1. Instructional objectives and goals must be relevant to the goals of the learner
2. Content should reflect the tastes and interests of the learners
3. Pre-assessment is necessary to assure relevance of the material to learner needs
4. Learning activities should be based on the learners’ prior experience and familiarity of language and context
5. The learner should receive help to relate new material to what is previously learned
6. Relevant examples and activities should be included to assist the learner to grasp the material
7. Instructional activities should correspond directly to both content and course objectives
8. Graphics, examples, cases, and analogies should be included to facilitate the learner’s comprehension

9. Feedback, both positive and negative should be integrated into learning activities

10. Feedback on objectives should be provided as part of the training

11. One idea should be presented at a time followed by frequent summaries to assist retention and recall of information

12. Instructional interactions should allow for learner to learner, instructor and learner, during instruction focusing on new knowledge integrated into existing schemata (Williams, 2002, pg. 139-140).

Research Question Two: Perceptual Theories

The second research question, “How do students’ perceptions based on self-reports differ between the two instructional strategies on attention, relevance, confidence, and satisfaction?”, focuses on learner receptivity to instructional strategies and designs. Keller (1987) provides the theoretical basis for analyses of student perception. Keller believes the role of motivation and instructional design cannot be separated. The best designs in terms of features of instruction will not override a learner’s motivation or attitude toward instructional material or the instructional environment. Song and Keller (2001) discuss a systematic process to ensure that designs address motivation in their distance learning courses. Keller, known for the ARCS Theory (1996), with Suzuki created a rubric to assess middle school students’ receptivity to instruction based on attention, relevance, confidence, and satisfaction.

Keller’s (1987) ARCS Theory, an acronym that represents attention, relevance, confidence, and satisfaction along with other systematic design principles, guide the development of the affective components of instruction and is used in tandem with Gagné’s
Events of Instruction. The website *Integrating Instructional Design in Distance Education* (IIDDE) (Carr, 2000 available: http://ide.ed.psu.edu/idde/default.htm) provides practical examples of how one coordinates Keller’s ARCS Model with Gagné’s (1985) Events of Instruction. The IIDDE site poses each of Gagné’s Events and shows how Keller’s ARCS Theory attends to gaining the user’s attention and sustains interest throughout the instructional process.

Designers can gain the attention of a learner by posing a question, having the learner generate a question, or introducing some surprise or novel event. Relevance corresponds to Gagné’s (1985) goals and objective statements combined with Keller’s mandate to express those objectives so that they relate to the learner’s internal motivation. Expressing learning objectives and including the purpose of the material in language that appeals to the learners’ needs increases the likelihood that the learner will engage in the instruction. Carr (2000) suggests using familiar examples or those previously experienced by the learner when presenting instructional content. To sustain learners’ engagement with the material designers should elicit participation from the learner, clearly state teacher expectancies, provide opportunities for guided exercises, give feedback, and allow the learner to select resources. Satisfaction, Keller’s last component is enhanced when learners apply newly acquired skills to authentic problem-based activities. Satisfaction is also increased when learners can assess their progress and are given feedback that reinforces desired behaviors.

Keller collaborated with Suzuki in 1996 on a Japanese middle school project to account for motivational characteristics of learners, content area to be taught, and in the hardware or software to be used. Teachers evaluated data derived from students and teachers from eight subject areas. They devised strategies to address areas of weakness regarding student interest or motivation toward the material. The culmination of Keller and
Suzuki’s work was a matrix coded with plus and minus signs that represented a positive or negative response to a motivational feature. The model, based on Keller’s (1987) ARCS theory, includes motivational elements that address attention, relevance, confidence, and satisfaction. Table 2 illustrates Keller’s model applied to an International e-mail training unit.
Keller (2001) asserted that student perceptual responses to instruction changed over time and condition. When students were motivated positively towards the material, they remained on task and did not respond well to additional motivating tactics. The converse was also true, when not highly motivated to learn the subject matter, the absence of

<table>
<thead>
<tr>
<th>Design Factors</th>
<th>ARCS Categories</th>
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<tbody>
<tr>
<td>Learner characteristics</td>
<td>Attention: Elective course, high interest (+)</td>
</tr>
<tr>
<td></td>
<td>Relevance: High commitment (+)</td>
</tr>
<tr>
<td></td>
<td>Confidence: Low skills in typing and in conversational English (-)</td>
</tr>
<tr>
<td></td>
<td>Satisfaction: Newly formed group of students (-) but familiar teacher (+)</td>
</tr>
<tr>
<td>Learning task (Learners’ attitudes toward)</td>
<td>Attention: New, attractive, adventurous (+)</td>
</tr>
<tr>
<td></td>
<td>Relevance: High public interest to the Internet (+)</td>
</tr>
<tr>
<td></td>
<td>Confidence: Seems difficult (-)</td>
</tr>
<tr>
<td></td>
<td>Satisfaction: High applicability of acquired skills (+)</td>
</tr>
<tr>
<td></td>
<td>Immediate feedback (+)</td>
</tr>
<tr>
<td>Medium: Computer in this lesson (Learners’ attitudes toward)</td>
<td>Attention: Interesting new use as a networking tool (+)</td>
</tr>
<tr>
<td></td>
<td>Relevance: Familiar as a stand-alone learning tool (+)</td>
</tr>
<tr>
<td></td>
<td>Confidence: Unstable network connection may make students worried (-)</td>
</tr>
<tr>
<td></td>
<td>Satisfaction: Immediate feedback (+)</td>
</tr>
<tr>
<td>Courseware characteristics (e-mail software)</td>
<td>Attention: English usage (-)</td>
</tr>
<tr>
<td></td>
<td>Relevance: Participatory for every student (+)</td>
</tr>
<tr>
<td>Motivational tactics for the lesson</td>
<td>Attention: Minimal tactics required: Emphasize opportunity to communicate worldwide Demonstrate how it extends one’s communication capabilities</td>
</tr>
<tr>
<td></td>
<td>Relevance: Necessary to build confidence: Set objectives cumulatively from low to high Team teaching with an assistant English teacher Use translation software</td>
</tr>
<tr>
<td></td>
<td>Relevance: Provide reinforcement by receiving messages from “network pals”</td>
</tr>
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</table>
motivational strategies decreased engagement in the material. Keller recommended an adaptive approach built into computer-based software. Based on a survey of attitudinal responses upon initiation of the software, the program would branch to accommodate a learner’s level of attitude towards the material. Keller concluded that motivation, if applied systematically, sustained and facilitated motivation.

The challenge to overcome motivational problems in distance learning courses is apparent from the level of attrition seen in many universities. Visser (1990), a French resident, used Keller’s (1987) motivational matrix for a distance learning study sponsored by a university in the United Kingdom. Her research focused on an instructional design course for training personnel delivered via distance learning in Mozambique. Subjects were 22 adults from the Department of Ministry and seven special students using a case study method. Research questions included the following: (1) How valid are motivational messages in distance learning courseware, (2) How do messaging feedback work and with whom, (3) How does a messaging system work over time? A second study was conducted three years later. When she analyzed student responses to the motivation matrix, she found that more attention was required for support systems than on instructional strategies. Once help systems were implemented, student motivation increased.

In a follow-up study, Visser (1990) examined the effect of motivational messages on student performance (retention of material). One set of motivational messages applied uniform feedback messages throughout the program placed at predictable points within the instruction, the other set incorporated personalized messages of encouragement in the form of electronic greeting cards. Results from her experiment were dramatic and demonstrated how the personalized messages increased retention from 70-80%.
The third purpose of the current research is to document the design process used to convert textbook material to WBI. A description of the development process is included in the Methods chapter. Discussion of the theoretical bases for development of the online modules is discussed in this final section of the literature review.

“Database searching should be part of a formal research offering that covers the nature and processes of research, various tools, etc” (Neuman, 1997, p.2, p.3). Neuman proposed that Internet curricula be developed that addresses training in the context of a holistic research process and fosters refinement of critical thinking skills. Neuman (1997) contended that we know little about how to encourage critical thinking skills with traditional library instruction; the challenge is even greater with digital library resources. Online searching offers students opportunities to gain technical skills and, more importantly, experience making information-use decisions based on higher order thinking skills such as assessment of relevance, validity, and currency of information. Further, instruction must inform students on the structure of “how information is organized”. Components in electronic resource training programs must include the general meaning and nature of the search process and address issues such as evaluation of relevancy of sources, information organization, and the relationship of information use and student learning (Neuman, 1997, p.11). The educational theories proposed by Robert Gagné (1985) and instructional design methods proposed by Dick, Carey, and Carey's (2001) *Systematic Design of Instruction* explain how to accomplish these goals.

Gagné’s (1985) *Conditions of Learning* is considered a primary text used by instructional designers everywhere. His events of instruction are applicable whether the learning is cognitive, psychomotor, attitudinal, or verbal information. These events include: (1)
informing the learner of the objectives of the lesson, (2) presenting the stimulus material, (3) providing learner guidance, (4) eliciting learner performance, (5) providing learner feedback, (6) assessing performance, and (7) enhancing transfer and retention (Gagné 1985; Richey 1997).

Richey (1997) views Gagné’s contribution to micro-instructional design principles as relevant to both constructivist and behavioral schools of thought. Gagné’s influence is apparent in the work of Merrill and Jones’ (1992) Instructional Transaction Theory and Keller’s (1987) Motivation Model. Learning principles outlined in both the transaction theory and Keller’s motivation model include:

- New learning is dependent on past knowledge and concepts
- New learning is stimulated by external events
- Learning is facilitated by instruction that is adapted to the nature of the learning outcome
- Instructional strategies of whatever form provide motivation, direction, guidance and guided practice, feedback, and reinforcement (Richey 1997, p. 595).

Gagné (1985) has been criticized for overemphasis on lesson content and not enough on process orientation. The focus on learning content over transference of skills for problem-solving tasks draws into question whether instructional systems theory enables students to organize knowledge and develop individual metacognitive strategies. Hannafin and Peck (1988) suggest that systems theory works best when there are prescribed objective outcomes and organization of lesson content. Questions arise regarding the current emphasis on constructivist principles of learning in relation to the efficacy of Gagné’s events and instructional systems design. Researchers criticized Gagné for focusing on external conditions for learning and placing too little emphasis on the internal processes of the
learner's experience. While Gagné emphasized the sequence of the events of instruction, he did not discount the impact of the learner's internal processes as he/she interacted within a learning environment. Gagné's contribution is to make the designer aware of conditions that ultimately lead to optimal acquisition of intellectual skills. Gagné provides a framework for engagement in a variety of instructional strategies that focus on learner participation as central to the learning process. The designer can use Gagné's events as a guide to integrate constructivist strategies that require the learner to engage in practice and feedback for retention of learning concepts.

The overarching goals of constructivism are to foster metacognitive skills and promote independence of learning so that students become lifelong learners. Problem-based learning (PBL), a popular constructivist strategy, requires a high degree of metacognition on the part of learners. Metacognition is defined as the ability to reflect on one’s own thinking patterns and employ strategies with which one acquires new information or knowledge. Barrow (1988) suggested that metacognition involves the following: deliberating or pondering on a situation or problem; analyzing what is known and what information is missing and comparing it to similar problems or situations; creating hypotheses; deriving appropriate questions and observations; reviewing and questioning new information sources and what has been learned; and making decisions about future inquiries or actions. Savery and Duffy (1996) asserted that Problem Based Learning (PBL) facilitates students’ problem-solving and critical thinking skills. PBL begins with defining a problem, locating and accessing resources, employing strategies, analyzing information appropriate to the problem, and evaluating the solution, functions that directly apply to information literacy instruction.
What is instructional systems design? This refers to the systematic design of instruction as a procedural set of steps for course development based on a text by Dick, Carey, and Carey (2001). Systematic design of instruction refers to a sequence of steps predicated on the notion that if one performs the following steps: (1) needs assessment, (2) task, (3) audience, (4) and instructional analysis, (5) clearly written performance objectives, (6) assessment instruments, (7) selection of instructional strategies, (8) sequence and presentation of instructional materials, (9) formative analysis, (10) revision, and (11) summative analysis with the result targeted at improved learning.

The term systematic design is often associated with a behavioral learning model in that knowledge and skill sets can be analyzed, categorized, and sequenced according to a set of cognitive principles. The question arises about whether a designer abandons constructivism in favor of behaviorism when the instructional designer categorizes and builds a hierarchical model of skill sets for the learner to demonstrate a learning outcome. Creating a flowchart of interrelated knowledge and skills and identifying subordinate and super-ordinate relationships among skill sets is central to instructional systems design. An instructional strategy is how one applies the methods the student will encounter to acquire the course objective. Thus, a designer can specify a constructivist learning strategy and incorporate materials that enable the student to "construct meaning" from experience within a systematic design model. Constructivist principles are applied when Internet skills are built so that effective transference of objectives such as text structuring, truncation rules, and application of Boolean operators are applied to a problem-finding task such as a scavenger hunt activity. The learner must construct a problem-solving process or personal search strategy in order to obtain necessary information to meet the cognitive objectives of the design.
Designing effective problem-solving tasks in the context of a systematic design model that follows constructivist principles can be challenging. Problem-solving tasks by nature require a multi-stranded set of tools and include procedural, cognitive, subject matter, motor, and attitudinal skills (Carey, 1998). Successful search engine use requires a repertoire of skills including: subject matter knowledge, language skills, text structure (syntax), and ability to generate a problem-statement. Pre-planning strategies require that students identify key words within the research question and translate natural language into a text structure that can be searched within a database. Evaluation of search strategies requires students to monitor their thinking and evaluate both search outcomes and search processes used to generate search outcomes (Haycock, 2000).

Instructional designers successfully incorporate constructivist strategies within the context of a systematic design method for Internet training in various ways. Constructivist strategies include modules that enable students to demonstrate application of objective rule statements to a given situation, and provide exercises to facilitate concept formation of how to apply multiple strategies to a given problem set. Search skills would include question analysis, brainstorming for keywords or phrases, pre-planned use of Boolean operators, and evaluation and comparison of multiple search techniques and tools.

Table 3 below based on an article by Carey (1998), includes Gagné’s (1985) events and proposes a set of constructivist strategies that correspond to a systems approach to instructional design. A third column has been added to illustrate how this training program includes a set of strategies for both online Internet training modules (comparison and treatment).
Table 3  

_Constructivist Strategies and Internet Training_

<table>
<thead>
<tr>
<th>Gagné’s Events of Instruction, Objectivist Strategies</th>
<th>Constructivist Strategies</th>
<th>Present Internet Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain attention: provide motivational introduction, focus on content to be learned</td>
<td>Provide motivation via &quot;ownership&quot; of material, provide choice of content and methods for exploration.</td>
<td>Provide authentic experience as students explore in natural setting with access to computer labs, provide choice of content presentation based on student interest, if simulation, provide screen shots of real websites Animated graphics, highly graphically based examples, humor, and conversational tone</td>
</tr>
<tr>
<td>Problem scenarios focus on process vs. product, scenarios require reflection on part of learner (reflective observation and abstract relevancy to what will be learned)</td>
<td>Create hyperlinks to glossaries and objective statements early on in the instruction. Use graphical organizers to tie smaller units</td>
<td></td>
</tr>
<tr>
<td>Gagné’s Events of Instruction, Objectivist Strategies</td>
<td>Constructivist Strategies</td>
<td>Present Internet Module</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>--------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>learned (present stimulus)</td>
<td>conceptualization),</td>
<td>of instruction into a &quot;big picture&quot; of what the learner will be able to accomplish upon completion of the unit.</td>
</tr>
<tr>
<td></td>
<td>incorporate functional knowledge in constructing strategies to conceptualize knowledge</td>
<td>Build in examples in guidance and feedback modules that include multiple opportunities to reflect on rule application, present information in context of problem-based scenario followed by examples of how to apply search rule to situation, provide opportunities for guided practice</td>
</tr>
</tbody>
</table>

<p>| Presentation of content in way that will facilitate students to learn and recall successfully (provision) | Cooperative learning strategies, students negotiate meaning, high complexity problem scenarios require | Present authentic scenarios exemplary of student context based problems, provide problems that employ |</p>
<table>
<thead>
<tr>
<th>Gagné’s Events of Instruction, Objectivist Strategies</th>
<th>Constructivist Strategies</th>
<th>Present Internet Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>learner guidance) multiple knowledge and tool strategies and skills, encourage multiple perspectives, situate problem in authentic context</td>
<td>combination of rules for searching, comparison search strategy examples and guidance, encourage active experimentation to problem scenario generated from students</td>
<td></td>
</tr>
<tr>
<td>Provide opportunities for practice of new skills, (guided practice and feedback) Problem scenarios student generated rather than designer prescriptive, active investigation and acquisition, use group participation to try-out and experiment similar to Kolb's active experimentation phase of cycle</td>
<td>Use of student generated examples and &quot;think aloud&quot; processes to determine strategies for searching, setting up game sequence whereby students test and receive feedback to multiple scenarios</td>
<td></td>
</tr>
<tr>
<td>Provide students information assessing how well they are doing during feedback Use of coaching techniques so that students begin authentic self-assessment</td>
<td>Provision of feedback during practice exercises comes naturally as active</td>
<td></td>
</tr>
<tr>
<td>Gagné’s Events of Instruction, Objectivist Strategies</td>
<td>Constructivist Strategies</td>
<td>Present Internet Module</td>
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<tr>
<td>-----------------------------------------------------</td>
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<tr>
<td>session</td>
<td>during instruction, examples of strategies include modeling, scaffolding, coaching, and collaboration, ensure peer review and group interaction for feedback to practice</td>
<td>experimentation within a real environment takes place. Provide problem scenarios for student to solve and participation will provide authentic feedback from application of skill sets.</td>
</tr>
<tr>
<td>Provide review and relate new skills to previously learned skills and real-world applications</td>
<td>Provide multiple parallel problem scenarios and find new application of new scenario previously constructed</td>
<td>Provide practice tests whereby student applies knowledge to similarly constructed problem scenarios, provide performance based testing</td>
</tr>
</tbody>
</table>
Gagné’s Events of Instruction, Objectivist Strategies

<table>
<thead>
<tr>
<th>Constructivist Strategies</th>
<th>Present Internet Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide tests, performance checklists, rating scales, attitude scales, or other means of measurement and mastery of skills in authentic setting. Gagné called this step enhancing transfer and retention.</td>
<td>Suggest tools that are self-reporting to facilitate students' monitoring of their own progress and retention, standards of evaluation not absolute, referenced to students goal, construction of knowledge, and past achievement, ultimate measure is successful performance in new authentic environment</td>
</tr>
</tbody>
</table>

Derivation of Course Content

Frederick and Smith (2000) developed a three-credit course for undergraduate students at the University of South Florida (USF) entitled Library and Internet Research Skills: A Guide for College Students. The faculty members from the School of Library and Information Science intended that the course be used to orient users of USF’s library; to teach how to access Internet resources for academic research. The course is predicated on the concept of information literacy as a holistic process beginning with an overview of the research process.
The course treats Internet training as a subset of the research process and follows sequentially from problem definition, determination of appropriate resources, location and access to source material, evaluation of resources for relevance and efficacy, use of information, and citation of information sources. Given that library-based and Internet-based research are viewed as two specialized forms of the fundamental research process, the textbook developed for the course can be used to cover the rules of library-based research skills, Internet-based research skills, or both (Federick & Smith, 2000, p.v).

Objectives for the course are clearly stated in the preface and include:

- “Choose appropriate and feasible research topics for a given assignment
- Determine which types of information sources are most suitable and available depending on the assignment and their chosen topic
- Locate needed information regardless of location and format” (p.v).

The Internet modules are organized into four categories of research tools: virtual libraries, specialized databases, general directories, and search engines. Following the modules on each of these tools, the authors devote several pages to Boolean operators, examples and Venn diagrams to illustrate the effect of conjunctions on search results. Practice exercises following expository information provide the students with examples and the opportunity for “hands-on” exploration of the concept. After completion of computer lab practice sessions, students are given an Internet Hunt test, and answers are e-mailed directly to the instructors.

*Library and Internet Research Skills* has been offered for several years to date. Unfortunately, this researcher is unaware of efforts to monitor participants’ research skills post training other than the performance criteria established grade issuance. Course content is reviewed on an ongoing basis by experts from the School of Library and Information
Science and is modified to maintain currency of information. Critical thinking skills are emphasized in that students are asked to evaluate information sources guided by research questions and then match the best resources to their research problem. Students are tested on application of rules to problem-solving scenarios for Internet practice and complete final quizzes, so there is some evidence that training is effective since most students at least pass the course and do well on the final Internet scavenger hunt.

Frederick and Smith (2000) based their course development on systematic instructional design methods and matched course objectives to content and practice exercises. However, course presentation is left to the discretion and personal teaching philosophy of the instructor. Computer labs provide opportunities for active experimentation and application of course principles. The authors adopted student-based examples in order to teach conceptual information in the context of real life problems, a practice encouraged by researchers, (e.g., King and Fonseca, 2000) media specialists, and the American Library Association.

University of Texas’ Texas Information Literacy Tutorial (TILT)

The Texas Information Literacy Tutorial (TILT) was developed as an online, interactive, self-instructional tutorial for the University of Texas (UT) at Austin's Digital Information Literacy Office (DILO). Its basis is on cognitive principles established in Bloom's (1956) Taxonomy of Educational Objectives and its philosophy is the belief in active learning.

TILT’s purpose was to ensure that incoming undergraduate students received instruction on basic research skills necessary for effective navigation through UT's library system. DILO’s sixteen public service librarians for various subject specialties collaborated and created a set of fundamental skills in the form of first year proficiencies (Dupuis, 1999).
TILT research included surveys, reviews, and usability tests and three project managers who specialized in instructional design, web design, and curriculum and content writing were involved in the development process (Dupuis, 1999). TILT presents expository material, examples, practice exercises, games, and online quizzes.

A survey was administered to 400 incoming freshman to ascertain how students used the Internet for research and assess students’ knowledge levels, usage, and interest in the Internet. TILT impacted students’ ability to discuss and use more complex research and instructors could integrate research-based instruction specific to subject level applications for face-to-face sessions with classes. Active learning principles guided classroom instruction and reflected the interactive nature of the online tutorial (Fowler & Dupuis, 2000).

The TILT Tutorial is widely used for online information literacy instruction despite the fact that effectiveness of instruction and concomitant performance has not been assessed with larger numbers of students at UT or elsewhere. The researcher of this study remedied this flaw and built in performance assessment at the end of each unit.

TILT's designers did not directly use Gagné’s (1985) *Events of Instruction* to create an instructional strategy, but their assumption was that interactive designs would result in higher retention than one without these features. The researcher used some of TILT’s introductory material and some interactive exercises in converting the textbook material from the Frederick and Smith (2000) text to an online interactive tutorial Internet search tools.

Introductory material was presented using TILT’s Flash presentation on common misconceptions about the Internet and was designed to gain the learner’s attention. A brainstorming interactive exercise exemplifies how keywords are selected and refines research questions for electronic searching. A Library Squares game at the conclusion of
TILT was adapted for the material in the Frederick and Smith (2000) textbook. Graphics illustrating the brainstorming process, narrowing of search terms, and pop-up definitions from TILT were used in both conditions.

Conclusion

This study involved the development of an instructional website based on textbook content about information literacy training. Two web versions of the material were created: one featured learner-control, the other program-control. Instructional design for the two online modules was based on an analysis of features using Gagné’s (1985) *Events of Instruction* as a framework to convert a textbook for web delivery. A baseline comparison version of the material takes TILT tutorial narratives along with presentation of concepts and exercises from the Frederick and Smith text and converts it into a form appropriate for web instruction. TILT exemplifies many of the principles of sound instructional design enumerated earlier by Alessi and Trollip (2001).

Literature from the 1980’s and 1990’s addresses the issue of learner characteristics and program control. Schnackenberg (1998) reviewed evidence about learners’ abilities and their influence on program control strategies versus learner controlled strategies and found that the research is inconclusive. The question remains about whether designers should allow high learner control versus a more content-centered approach with program control when converting textbook material to WBI. Arguments are made in favor of both pedagogical approaches.

Chung and Reiguluth (1992) suggested that low-ability students, measured by standardized general aptitude tests, require high program-control designs because of lower motivation and self-regulation. Steinberg (1989) asserted that learner control should be
reserved for high-ability students. Later studies appeared to controvert findings from the aforementioned studies. When investigators blocked student ability as a possibly confounding factor in similar studies, researchers found no interaction between ability and performance (Schnackenberg & Sullivan, 1998).

Instructional strategies in any form provide motivation, direction, guidance and guided practice, feedback, and reinforcement (Richey 1996, p. 595). Depending on the designer’s pedagogical perspective; whether constructivist or behavioral or a combination of both, the instructor must choose how one engages learners in interactive practice and feedback. A constructivist approach may employ a more naturalistic approach to practice and feedback reliant on the abilities of students to generate conclusions from their experience. In contrast to an open-ended strategy for practice and feedback, a more content-centered instructional model relies on program controlled guided practice and immediate feedback.

Research is needed to determine what strategies influence performance outcomes for learners engaged in e-learning for information literacy (Hirumi, 2002). Therefore, this study examined the effects of conversion of textbook content to WBI and compared performance differences of a second version of a tutorial that includes some features found in classroom instruction.

While there are questions regarding learner control and performance, one does not know if attitudinal preferences exist between the two schools of thought; high program control versus high learner control given a population of high achieving learners. The current study assesses whether learner attitude toward online information literacy instruction is influenced by high program control or high learner control.
The most carefully devised features of instruction will not override a learner’s motivation and attitude toward instructional material or the instructional environment. Keller (2004) discusses a systematic process to ensure that designs address motivation in distance learning courses. Keller’s (1987) ARCS theory includes motivational elements that address attention, relevance, confidence, and satisfaction. He asserted that affect as well as presentation of content is equally important for acquisition of learning. Further he stated that in order for instructional designs to prove successful, a systematic approach to both is necessary to sustain young learners’ attention and acquire new skills/knowledge.

The development of WBI is a response to changes pervasive in education and the economy and is brought about by an information explosion, technological advances, and advances in education. The new prototype in web-based education involves every facet of sound instruction. Retraining teachers in pedagogical methods and informational technologies is necessary for successful delivery of online education.

Studies cited in this work indicate that as digital information resources grow, distance learning and conversion of previously classroom-based paradigms will be increasingly supported with WBI. Research is needed to determine how features of learner-centered compared to content-driven WBI fare in terms of achievement and learner perception. The researcher discussed sound instructional design strategies appropriate to WBI.

The traditional method of research, known as the research-to-support-theory model (Willis, 1993), depends on proving that an innovative instructional technology is effective if it is found to be better or as good as a traditional teaching method. The researcher proposes that the impact of two strategies, one that is learner centered, the other content focused be compared. The efficacy of WBI is not in question, rather the current research examines the impact of instructional strategies on achievement and learner perception specified by

The instructional design (ID) research model was used in this study and the researcher believes that WBI stands on its own merit. It is expected that future WBI research will concentrate on the interaction between learner characteristics and instructional strategies. Information derived from well-conceived research studies promises to support and further enhance the development of WBI, thereby meeting the needs of teachers and learners.
Chapter Three

Method

Purpose

The purpose of the present study is threefold. The first purpose is to examine students’ performance on two forms of Internet search skills instruction for web-based delivery from a textbook. The second purpose is to examine effects on students’ academic motivation of two forms of web-based instruction that afford higher or lower levels of learner control. The third purpose is to document the design process used to convert textbook material to web-based instruction.

Research Questions Restated

1. What effect do two online instructional design strategies for Internet training, characterized by their content-centeredness or learner-centeredness, have on student performance measures?

2. How do students’ perceptions based on self-reports differ on attention, relevance, confidence, and satisfaction between two instructional strategies characterized by their content-centeredness or learner-centeredness?

3. Is the additional time and effort needed to include the treatment module features found in classroom instruction; gaining attention, guided practice, corrective and reinforcement feedback, embedded quizzes, and summary screens, efficacious given the performance and perception results of this study?
Research Design Model

It is important that information technology research measure the impact features of instruction have on learners’ performance levels. The researcher followed the instructional design and research model rather than the more traditional research-to-support-theory model (RTST) so that the web-based instruction developed for this study would be evaluated based on its own merit and not in comparison with traditional instruction.

The RTST model is too limiting and cannot adequately assess the impact innovative technologies have on learning; typically, it is used to compare innovative instructional interventions with more traditional instructional methods (Willis, 1993). If the results of a study favor the innovative instructional intervention, it is said to be more effective than the traditional method of intervention. The innovative intervention is then viewed as being representative of all such innovations. This conclusion makes no sense. One well-designed program is not representative of all programs. Each one needs to be evaluated to determine the impact it has on learning. Moreover, it is not necessarily the intention of an instructional designer to create a learning instrument that is more effective than traditional methods. This study focused on product development according to the specifications of the instructional design model, not on proving which instructional delivery vehicle is more effective.

Context of the Study

This study took place at a suburban middle school in the state of Georgia. A change of location from undergraduates via distance learning from USF to the middle school was based on convenience and the eighth graders demonstrated comparable academic abilities as the undergraduates. The change also permitted the researcher physical control and supervised conditions for the research. The school is considered one of the highest ranked
academic middle schools in the area as demonstrated by students’ national rankings in SAT scores and admission requirements; students score within the 85% (composite score) or higher on the Iowa Test of Basic Skills (ITBS). Class sizes in all magnet core classes are limited to a maximum of 21 students.

The county where this middle school is located places great emphasis on information literacy and research skills appropriate for student achievement. The WBI material created for this study worked well with the curriculum requirements for both the county and the state of Georgia because information literacy is emphasized. Permission forms signed and dated by parents and students were received prior to implementation of the research. Parents proved quite cooperative and enthusiastic about the activity because they were eager for their children to gain the skills the instruction taught.

The language arts teacher who participated in the study worked collaboratively with the researcher, the library media specialist for the school. To minimize intrusions on routine class work, students took the pretest for knowledge of Internet search tools in the classroom under the supervision of the language arts teacher when it was convenient for the teacher. A lab time was scheduled in coordination with the teacher after pretest scores were compiled and ranked for each class.

There was a two-week interval between completion of the pretest and assigning the students to groups. Students were matched within pairs and randomly assigned to either the treatment or comparison group to ensure equity between groups. Students had almost two full periods to complete the tutorials. To minimize interruptions during the students’ classroom work, the posttest was administered in the classroom in paper and pencil form at the convenience and under the supervision of the language arts teacher. In order to mitigate
history for the pretest and posttest, the investigator waited a week post-instruction for the students to complete the posttest for comprehension. Students took the Internet Scavenger hunt in the computer lab and were granted access to their respective tutorials as a reference tool the following week.

Comprehension tests were administered in paper and pencil form while the performance test (Internet Scavenger Hunt) was conducted in the computer lab. Cards were made up with student names and group number for each participant to ensure that all students assigned to either comparison or treatment group were properly placed. The investigator and teacher assigned seats in the lab to ensure a more valid performance measure. Students had one-hour to complete the scavenger hunt. A digital timer measured the time taken to complete this instrument.

Population and Sample

Two large group pilots were conducted prior to the final implementation of the research. The first took place summer semester 2003 with undergraduate students from the University of South Florida. The summer university pilot used an experimental design with volunteers from three sections of library and education online classes. A second large group formative assessment took place December, 2003. The sample was changed from undergraduate college students to a middle school population sample of high ability eighth grade students.

The investigator changed the location and population sample to the researcher’s worksite. The change was made partially for the convenience of the investigator and because the high ability middle school students had similar academic abilities to undergraduates originally used for the large group distance learning pilot. Forty high ability eighth grade
language arts students participated in December’s administration. Prior to final implementation of the research in May 2004, the researcher modified the instructional modules to ensure the integrity of the two instructional conditions for final data collection. Forty one different eighth grade high ability language arts students participated in the final implementation in May.

The first large group formative administration of the materials during the summer semester 2003 at the University of South Florida (USF) was conducted via Blackboard (distance learning portal) to test the material without instructor presence. The summer USF pilot used an experimental pretest-treatment-posttest research design. The study began with 56 volunteers enrolled in several sections of an undergraduate Course for Library and Internet Research Skills and introductory computer education course for those wishing to enroll in the graduate department of education at USF. Only 41 participants out of 56 completed the study including pretest, treatment, posttest, and scavenger hunt. Forty-five participants completed the pretest, treatment, and posttest for comprehension. Students were informed that should they wish to participate, they would earn two points towards their final grade for completing the study and that non-participation would not negatively affect final grades. The extra points proved a weak incentive even to those who completed the research.

The researcher used distributed e-mail lists to inform participants of their respective groups. Pretest scores were calculated and scores were ranked and matched within pairs to either the treatment or comparison group. Once assigned to individual groups, the researcher emailed the volunteers to provide instructions on which tutorial to take. Participants signed on to their individual web portal sessions (Blackboard) and chose the assigned website link within the course materials to complete their assigned tutorial at their
own pace. The volunteers were asked to approximate the time taken to complete the instructional materials. Self-report time estimates ranged from half-an-hour to forty-five minutes with a few students who took an hour-fifteen minutes to complete the instruction. A week following training, participants took the posttest measure.

Mean pretest scores were $X = 55.92$ ($N = 56$) voluntary participants enrolled in the pilot. Twenty-eight participants were assigned to group one (treatment group) but only 25 completed the pretest-treatment-posttest. Twenty-eight participants were assigned to group two (comparison) but only 20 of those assigned to group two completed the pretest-treatment and posttest portions of the program. Across both groups, comparison and treatment, there were appreciable gains from a mean of $X = 55.92$, $N = 56$ on the pretest score to a mean of $X = 74.52$, $N = 45$. The treatment group ($N = 25$) demonstrated a gain from 57.01 to 73.47. The comparison group ($N = 20$) increased their scores from a pretest average of 56.81 to 74.69 on the posttest measure. Because there was an uneven distribution of participants for the two groups and the integrity of the data was in question, statistical comparison of these results are inconclusive. A repeated measures ANOVA was performed with 45 of the participants to determine if significant gains resulted across both groups from pretest to posttest. The ANOVA produced a main effect across both groups; $F(1,44) = 61.560$, $p < .01$. No interaction effect resulted from the large group pilot, $F(1,44) = .106$, $p < .746$.

Results from the distance-learning participants proved to be inconclusive. Attrition and lack of follow-through on completion of the module and posttests resulted in a drop from 56 students to 45 participants who completed pretest and posttest for comprehension. Given the voluntary nature of the pilot, only 43 students completed the scavenger hunt.
Cronbach alpha was performed with 43 participants were $\alpha = 0.72$. The mean score from the group was 7.48 ($N=43$).

Results from the pilot led the investigator to examine features associated with each of the instructional programs as well as changes to the testing instruments. Similarities between the comparison and treatment groups used for the large group formative analysis were not dissimilar enough to identify the independent variable i.e., instructional strategy. Design of the materials was revised so that the comparison and treatment modules appeared identical except the treatment module included additional exercises that were program controlled and interval quizzes were added as well as the library squares game. The comparison condition afforded greater learner control and the qualitative differences became apparent in the practice exercises to rely on learner initiative to perform the exercises. Changes to the comparison program afforded more liberal learner control for those assigned to this condition. Navigation for the treatment module ensured that learners would complete guided practice and feedback exercises, active links on the menu were eliminated until completion of the exercises, interval quizzes and a library squares game remained in the treatment condition.

Due to problems with physical control of the former pilot taking place via distance learning, the researcher chose a face-to-face administration of the study. A decision was made to change the target population to those of comparable ability to the undergraduates but administer the research locally at the researcher’s worksite under supervised conditions. A change from college students to high ability middle school eighth grade students was made.

The second large group administration of the materials took place in December, 2003 with a total of 40 high ability language arts students representing a culturally diverse
population enrolled in a high achievement magnet program in a middle school in metropolitan Atlanta, Georgia. The researcher modified the materials and the pre/posttest. Results from this group administration showed an increase from pretest to posttest score across both groups from 49.28 on the pretest to 62.91 on the posttest (N=40). Scavenger hunt scores averaged 90% across both groups when provided access to the tutorial to apply their knowledge on the hunt.

Problems with middle school students who failed to follow verbal directions and sat at the wrong stations forced the researcher to replicate the study and refine the procedure. Students were verbally assigned to either group one (treatment) or group two (comparison) from matched pairs in rank order to either group. The middle school students despite verbal directions, failed to go to their assigned group. All students completed the pretest-treatment-posttest and scavenger hunt but the groups were not equivalent on the pretest measure.

The study was replicated May 2004 to better control assignment of the 41 high ability eighth grade students from two sections of language arts classes to their respective groups. The same procedure used in the pilot was followed for random assignment of matched pairs of students to the treatment and comparison conditions; however, instead of relying on verbal instruction for directing students to the treatment or comparison workstations, the researcher made up index cards with the name of the student and the group assignment. The researcher assigned students one-by-one to a particular workstation before students began their respective tutorial. The room was divided in half with the comparison group sitting on one side of the lab and the treatment seated on the other side to physically separate the comparison and treatment students. The researcher added a third instrument, a modified version of the Academic Motivation Profile, for the final study. The students’ language arts teacher also participated in the study.
Research Question One

What effect do two online instructional design strategies for Internet training, characterized by their content-centeredness or learner-centeredness, have on student performance measures?

To answer this question, two distinct instructional modules and two performance measures were created. One instructional module featured content-centered features associated with classroom instruction. The learner-centered module provided high learner control compared to the content-centered module that featured a high program control. The two performance measures created were a comprehension pretest-posttest and an Internet Scavenger Hunt.

To mitigate the possibility of prior knowledge acting as a confounding variable, a pretest measure was administered to assess pre-instructional knowledge of the material. The pretest also served as a measure to rank and assign students in matched pairs to either the comparison or treatment condition. The same questions were used for a posttest for comprehension following instruction. The order of the questions was altered and a time interval of three weeks following the pretest was set to factor the possibility that history would threaten internal validity. Large group formative data was collected on the posttest measure to determine statistical reliability of the instrument. A pretest-treatment-posttest design was used to assess change within and between groups on the pretest and posttest score following instruction. The Internet Scavenger Hunt was used to measure differences between groups to determine if either instructional strategy proved more efficacious.
Instruments

Pre-Test / Post-Test Development

The researcher used a systems approach to construct the test. A systematic approach required test items corresponded to various cognitive levels of knowledge as well as referenced objectives of the instructional program. Appendix A documents the corresponding performance objective of the instruction, the cognitive level of the objective according to Bloom’s (1956) Taxonomy of Educational Objectives, and the individual test item.

The researcher addressed face and content validity when constructing test items used in this study. Before conducting any of the large group pilots, the researcher conducted one-to-one sessions with faculty members self-identified as naïve Internet researchers. The one-to-one sessions were held to obtain feedback on the clarity of the comprehension test questions and the instructions for the test. “Talk aloud” sessions revealed how participants interpreted each multiple choice, multiple answer, and true/false item on the pretest for comprehension. Distracters from multiple choice options were discussed and modifications were made according to feedback from formative sessions. Some of this feedback included questions worded as follows: “Name two methods of searching general subject directories.” Options were originally as follows: a) hunt and peck, b) surf and turf, c) browse and search, d) subject and title. Overwhelmingly, individuals chose the correct answer based not on knowledge of the material, rather they used logic. A colleague suggested that the first two options were obviously incorrect which left one of two remaining choices. Since subject and title were more closely associated with a card catalog, five of five participants chose the remaining option “c” as a correct response even though they admitted they were making a
logical guess. The question now reads, “What method would you use to search for information in a general subject directory?” Options include: 1) domain and URL, 2) web address and date, 3) browse and search, 4) subject and keyword, and 5) title and author. (The correct response is number three.)

Based on formative feedback from students, the researcher modified test items for the comprehension pre and posttest. During the summer of 2003, statistical analysis with the 45 participants from the online administration resulted in a Cronbach $\alpha = 0.78$. The summer pilot relied heavily on the clarity and internal consistency of test items. A Cronbach analysis of the data for the posttest in December 2003 with the middle school students was not performed. The researcher assumed that replication of the study was needed because problems associated with lack of integrity of the data were evident. Analysis of the final study was conducted to determine the test’s internal reliability.

Analysis of the final administration of the posttest for knowledge of Internet search skills resulted in a Cronbach alpha of .6856 ($N = 41$). Two of the items from the first question on identification of strategies appropriate to refinement of research questions required a multiple answer response with a total of five options (a, b, c, d ,e). One of these items (item 1c) produced no variance with all students responding correctly to this item. A second multiple answer item (question 20) asked students to identify two of five strategies when searching a subject directory. All students responded correctly on item 20c, thus lowering the alpha coefficient due to lack of variance. Tables A-15 and A-16 in Appendix A affords the reader an item-by-item analysis of the posttest questions.

Internet Scavenger Hunt Performance Test Development

The researcher developed an Internet scavenger hunt to measure learners' abilities to find relevant information using the Internet tools. To create as authentic a setting as
possible, students used their tutorial as a reference tool while completing the Internet hunt. The hunt presented research scenarios that corresponded to one of the four tools presented in the instruction. The student must engage a research strategy to solve an information problem. Answers are supplied in multiple-choice format. Appendix D presents the test items and the corresponding objective covered in the tutorial.

In summer, 2003 students enrolled in three sections of an online library science and education course completed the Internet Scavenger Hunt. Cronbach alpha was performed with 43 participants. Results on the alpha test were 0.72; mean score was 7.48 ($N=43$).

In December 2003, forty high achieving eighth grade students from a high achievement magnet program middle school in Atlanta, Georgia piloted the study. When provided an opportunity to take the Internet Hunt following training for both comparison and treatment groups, the mean score for the test produced Mean=90% ($N=40$). No reliability statistics were compiled for the December 2003 administration. Due to procedural mistakes described earlier, the researcher knew that subsequent administration of the material was necessary at which time statistical analysis of the test would be computed.

During the development phase of the research, a committee member suggested the scavenger hunt produced a ceiling effect with middle school students from the high ability group. To bolster the validity of the scavenger test, a small group of similar magnet students ($N=4$) participated in the hunt without benefit of instruction. Students were asked to talk aloud their search tactics and the researcher took observational notes of how these gifted students approached the material. All four students were enthusiastic about the activity and readily engaged in the task. They were permitted discussion with each other as they began their separate tasks at adjacent workstations in the lab. A digital stopwatch measured time on
task while the students proceeded through the material. Several observations were noted concerning the pilot with the students who had not had benefited from the tutorial as a reference or training aid.

1. Without exception students went to familiar search sites such as Google, Yahoo, or Ask Jeeves and input natural language into the search fields.
2. Students used a trial and error approach as they selected search results from their natural language queries.
3. None of the students went to particular databases such as the Internet Movie Database or United States Post Office to find pertinent information.
4. Students reported that the activity itself was fun but also frustrating.
5. When asked if training prior to administration of the test would have been helpful, all concurred that instruction would have made the task easier.
6. None of the students completed the activity within a 35-minute time window. In fact, the maximum number of items found within more than a half hour was five, with at least one error on the multiple-choice test.
7. Time was added as a secondary dependent variable to assess the relationship between time and performance accuracy on the scavenger hunt.

A Cronbach alpha was computed on the final administration of the Scavenger hunt posttest May 2004 (N = 41). Three of the ten items on the instrument produced no variance, thus when one computed the alpha score, the score computed a test with only seven items. The final computation resulted in an alpha of .5647. A ceiling effect may have resulted with an average score within both groups of 9.24 of a possible ten points (N = 41).
Research Question Two

How do students’ perceptions based on self-reports differ on attention, relevance, confidence, and satisfaction between two instructional strategies characterized by their content-centeredness or learner-centeredness? To ascertain if learner perceptions of the two versions of the instructional material differed within the sample, the researcher used a modified version of the Academic Motivation Profile (AMP). A paired t-test was used to compute between-group differences on each of four factors: attention, relevance, confidence, and satisfaction.

Academic Motivation Profile

The researcher used the Academic Motivation Profile (AMP) (Carey, 1994) to analyze student perception of the material across and between both groups. The instrument is based on four factors based on Keller’s (1983) ARCS Theory; (1) attention, (2) relevance, (3) confidence, (4) satisfaction. Carey’s AMP consists of four subscales each related to Keller’s four factors listed above.

In the present study, the researcher used Keller’s ARCS model to determine if motivational differences emerged between two instructional strategies. The treatment group received an introduction to the module using MacroMedia flash screens designed to pose controversial questions about Internet misconceptions. Additionally students received immediate feedback following guided practice sessions. Objectives in both conditions stated the purpose of the instruction in terms that described what a learner would gain upon completion of the unit. While the focus of the present research does not intend to measure adaptive feedback or motivational messages, it poses an important question of whether instructional strategies have an effect on student perception of their learning experiences.
Participation in the study was neither mandatory nor did scores on the tests count for extra credit for the students enrolled in the language arts classes. The middle school sample chosen for this study demonstrated their ability to perform their best in the absence of an external reward. Learners expressed interest in the instruction in both conditions. Students demonstrated a willingness to participate because the focus of the instruction was relevant and because these students generally have the internal drive to perform well. A novelty effect due to change from the classroom-based instruction to the computer lab, may have enhanced learner motivation and willingness to participate in the research. While students did not have access to help systems, they were able to receive real-time support from their instructor and the primary researcher. Students were not engaged in use of the material within a cooperative learning environment, rather each worked alone to ensure that the research was limited to evaluation of the material itself. If as Keller (2001) asserts, motivation changes according to learners’ requirements and learning conditions, a follow-up study may be appropriate under different conditions and with more varied groups of learners.

To test the internal reliability and the degree to which items on the Academic Motivation Profile could be replicated with confidence in other courses, Carey conducted a series of three formative studies of her instrument with over 760 undergraduate pre-service teachers. The first factor, attention, measured how well the delivery vehicle caught the students’ attention i.e., the textbook, lectures, practice exercises, assignments. Students rated their attention on a four-point scale ranging from not the least bit curious to very curious. Relevance was associated with short and long-term goals using a sample of undergraduate pre-service teachers. The confidence subscale measured the degree to which undergraduate pre-service teachers felt about short-term goals such as successfully passing the teacher
certification exam, and long-term goals as obtaining a teaching position. The satisfaction measure was linked to students’ overall satisfaction to the course evaluation questions. Carey constructed four-point response scales to eliminate neutral responses to each of the factors. In total, the pilot studies on factor loadings and internal consistency of the instrument were conducted with over 760 undergraduate students at the conclusion of spring, summer, and fall semesters of 1990. Internal consistency measures using Cronbach alphas proved a high coefficient (.94). Subscale reliability also proved consistent for each of the factors in the first two trials; attention yielded .82 and .83, relevance at .92, confidence from .91 to .94, and satisfaction .85 to .87. To assess the relationship between totals on each of the four factors and student achievement, Carey performed a Pearson Product Moment Correlation and found that the relationship between achievement and overall AMP score was significant but low (r = .22, p = .001). The purpose of using the AMP is to determine if between-group differences emerge on any one or more factor that prove if students reacted more favorably to the comparison or the treatment instructional strategies.

The researcher received a copy of a modified version of the AMP from Dr. James Carey who used the instrument for a graduate course on preparation of instructional materials delivered to graduate students pursuing media specialist certification. The investigator retained the basic structure of the original AMP but modified items to reflect the goals and context of the graduate course. A copy of the instrument is included in Appendix F.

Reliability statistics were computed using the modified version of Carey’s AMP designed to measure the students’ perceptions. Cronbach alpha for the attention sub-scale resulted in a statistic $\alpha = .92$ (N = 40). The reliability of the relevance sub-scale proved
almost as high with an $\alpha = .898$ ($N = 40$). The confidence factor yielded an alpha of .8546 on eight items. Finally the sub-scale for satisfaction resulted in a Cronbach alpha $\alpha = .8724$ ($N = 40$).

Research Question Three

Is the additional time and effort needed to include the treatment module features found in classroom instruction; gaining attention, guided practice, corrective and reinforcement feedback, embedded quizzes, and summary screens, efficacious given the performance and perception results of this study? The development process for both tutorials follows.

The materials were modified several times prior to final administration. Creating both modules was time consuming in terms of navigational design, conversion of content to web format, inclusion of graphical organizers, and design of the testing instruments. The treatment module required extensive revision for the navigation and employment of a javascript programmer to provide feedback, and a Flash designer to modify the Library Squares game. Development of the treatment module took more than a year to pilot and ensure that the navigation, guided practice, feedback, interval quizzes, summary screens, and Flash modules all worked properly. The comparison module in contrast took far less time due to the nature of the exercises and absence of interactive features reliant on the individual learner characteristics of the students.

Development of Instructional Materials

The researcher began the development process of the material by scanning text from Frederick and Smith (2000) course workbook. It was assumed that the authors of the course performed initial: (a) needs assessment (b) instructional analysis (c) target audience analysis
(d) and performance objectives for the course. Consequently, the researcher made no modifications to the material for the high ability middle school audience given their high reading comprehension scores and demonstrated abilities to work with adult reference materials in their classes. The researcher, in collaboration with course instructors: (a) developed and validated assessment instruments (b) choose an instructional strategy (in part developed by the extant information literacy tutorial) (c) developed and selected instructional materials (instructional material was already developed in the Frederick and Smith textbook) (d) conducted a formative evaluation (e) revised materials (f) and conducted a summative evaluation.

The researcher analyzed steps in the design process to include and exclude features for two forms of the text to web conversion using Gagnè’s (1984) Events of Instruction. In the comparison version students had a high degree of control and text was organized into subtopics in a vertical menu table format. Exercises were scanned from the workbook and typical of most text to web conversions, students received few instructor-guided strategies for completion of the exercises. The amount of feedback students received was dependent on how many active links they explored and how engaged they were in the exercises. Therefore, students’ conclusions about their experience with the material depended on the learner’s processing abilities and individual experiences.

Treatment module. The researcher used Gagnè’s (1985) Events of Instruction to develop the WBI module; examining interactive exercises that mirrored those found in classroom delivered instruction of the textbook material. Instructors typically include motivational material to engage the learner’s attention. This is often omitted when classroom textbooks are scanned for web delivery. The University of Texas’ TILT program provided excellent motivational and informational material. Sample exercises provided program
control to the students in the form of input fields, hotspots, and corrective and reinforcement. Additionally, response review quizzes with immediate feedback and summary screens followed the virtual library, specialized databases, and introduction to Boolean operators. The review quizzes along with a *Library Squares* game patterned after a game show in the TILT tutorial assisted students assigned to the treatment condition to transfer and retain acquired information.

Inclusion of guided practice and feedback, motivational material, embedded quizzes and feedback, and simulated search exercises proved significantly more time intensive for development of the treatment module. The development of the treatment material required study of the original text and workbook exercises. The developer spent many hours performing screen captures, practicing exercises originally offered as examples in the textbook, developing instructional text, and finally engaging the services of a javascript programmer. Navigational program control ensured that a learner proceeded sequentially through a sub-module prior to return to the menu screen. The researcher performed months of planning and testing of navigational sequences, construction of the practice exercises, formative testing of the instructions and learner exercises. Selection of material from the TILT modules that fit with the Library and Internet Research Skills course also required the researcher to become familiar with the modules within the University of Texas program and integrate them into the Internet instruction treatment module.

*Comparison module.* The comparison version of the Internet search tools module typifies what happens when an instructor takes a textbook and converts the material to web delivered instruction. Compared to the treatment module, the efficiency of straight conversion of text to web instruction proved considerably easier. Based on the Frederick and Smith (2000) topics included in an online version of the workbook are: (1) location and
access, (2) objectives, (3) search strategies, (4) brainstorming, (5) virtual libraries followed by an optional exercise, (6) specialized databases followed by optional practice, (7) general directories followed by optional practice, (8) search engines followed by optional practice, (9) metasearch engines followed by optional practice, (10) Boolean searches broken down into sub-units for and, or and not, and nested search techniques (11) advanced search techniques to include search for images, wildcards, search by domain, and comparing results with multiple search engines.

The comparison program presents narrative screens on a sub-topic related to a unit objective. Students have the opportunity to accept or decline an invitation to practice concepts using authentic examples of research exercises. The number of practice items in the comparison condition provides students the opportunities to gain more practice and experience a greater range of examples compared to the treatment condition. Students are free to take notes, practice exercises or not, and are given no instructor assistance, except as it pertains to technical difficulties, as they proceed through the comparison tutorial.

Common Features Between Treatment and Comparison Modules

The following describe common features for both tutorials - comparison and treatment:

Menu structure. Both tutorials used a vertical menu structure set up as tables where topics lined up vertically on one side of the screen and content appeared in the right side of the table. Both groups had visual prompts (arrows) to inform the learner of the nature of the information or exercise he/she was reading. If the student moved vertically from top to bottom in the table of contents, she/he moved logically through the topics. In most cases the researcher observed the students moving sequentially through the material using the vertical menu bar.

Use of graphical organizers. Graphics used in both conditions were used to illustrate
principles presented in the text. For example, when the students studied about general subject directories in both conditions, a link to a graphic of an inverted triangle illustrated how the directory was organized from broad topics to specific within a subject area. Venn diagrams were used in both conditions to illustrate Boolean operators along with a pop-up screen and definition of the origin and definition of the term. Flash applets were used sparingly on overview screens in both conditions in order to sustain attention and illustrate learning principles within the text.

*Overview of the research process.* Both comparison and treatment modules included a unit on research strategies and refinement of research questions taken with permissions from the University of Texas’ TILT Tutorial. Both modules presented an outline of how one goes about refining a research question, brainstorming subject categories, selecting keywords, use of quotation marks around phrases, and use of wildcards for word variations. These strategies were presented as a technique prior to choice of specific Internet search tool.

*Overview screens preceding exercises.* Both introductory screens for the comparison and treatment groups contained tables with descriptions, comparisons, and live links to various categories of Internet search tools. Exercises followed the overview in both conditions and the exercises included in the treatment condition were derived from the exercises in the textbook. With the exception of screen captures versus open-ended practice exercises with the material, some of the treatment condition exercises guided students and provided corrective and reinforcement feedback were replicated in the comparison condition with the exception that students received feedback as a natural consequence of their exploration within the exercises. Because questions were closed-ended in most cases, it was possible for a learner to conclude if his/her strategy proved successful. If a student was motivated enough, he/she might gain more practice and gain experience with a greater range of
examples in the comparison condition over the treatment.

*Clear definitions of terms.* Narrative screens provided clear definitions readily understandable with these high ability students. Embedded glossary hypertext links were included in overview screens for both conditions.

*Reference to previous material for retention and transfer.* The narratives used in both conditions used a conversational tone. Concepts in virtual libraries and general subject directories for example, made reference to each other so the student (if reading carefully) could glean the similarities and differences between various Internet search tools. Inclusion of examples of various tools within a specific category allowed students to compare a range of sites within a category. They were able to recognize similarities and differences as they progressed through the material.

*Scavenger hunt as a performance task.* The performance hunt measure proved to be effective with students assigned within both instructional conditions. When the researcher performed a small group pilot with students who did not have benefit of the online modules or any formal prior Internet search training, it was reported that the activity was enjoyable but frustrating without training. The researcher noted that inclusion of a performance task that requires students to apply principles from instructional material and gives access to these resources may prove beneficial and engaging as a learning experience in itself.

**Different Features Between the Comparison and Treatment Module**

The comparison module represents a typical conversion of textbook to web delivery of instruction. Little attention is paid those features associated with classroom practice including creating a context to gain the learner’s attention, making the material appear relevant to the learner, instructor-learner and material-learner interactions with corrective
and reinforcement feedback, summary and review material to enhance retention and transfer of information, attention to sequence and presentation of the material to ensure that students engage with the learning material. In contrast with the comparison group that offers optional practice exercises, the treatment program requires that students practice concepts and reflect on information corresponding to Gagné’s (1985) opportunities for engagement and feedback. Following a narrative on a search tool, students engage in a series of practice-feedback exercises that simulate Internet search commands. Thus, the student profits from a concrete experience of searching the Internet. Two self-assessed review quizzes are included in the treatment group. To enhance comprehension of concepts, the designer built in corrective and reinforcement feedback for each student interaction. Appendix C contains a table that compares the conditions described in the preceding sections. Each of Gagné’s (1985) Events of Instruction describes features for the comparison and treatment conditions that will be tested during the evaluative phase of the study. The following table illustrates the commonalities and differences between the two versions of the instructional program.
### Table 4

**Comparison and Treatment Group Differences**

<table>
<thead>
<tr>
<th>Gagné’s Events of Instruction</th>
<th>Comparison Module</th>
<th>Treatment Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain attention</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comparison module introduces concepts covered and four types of Internet search tools learner will encounter.

Treatment condition offers same information as comparison but leads the learner to an introductory interactive flash presentation on myths about the Internet.

The screen above provides a context for the learning module with a definition of information literacy. A right arrow button take the learner to a series of flash screen on misconceptions about the Internet. Material is derived from the TILT Tutorial.

Learner clicks on a bubble and program provides animated information about that myth.
Gagné’s Events of Instruction

**Comparison Module**

Course objective screens are identical in both comparison and treatment versions of the program.

**Treatment Module**

Treatment menu removes live links within the table of contents. The arrow pointing left on the objectives screen takes the learner back to original menu with live links to wherever the learner chooses to go.

Inform students of learning objectives, what they will be learning, and relevancy to what will be learned

Presentation of content facilitate students to learn and recall successfully (provision learner guidance)

Provide opportunities for practice of new skills, (guided practice and feedback)

The practice screen provides a series of closed ended questions with a table of tools for the learner to find his/her answer to the exercises via active exploration.

At the end of the introduction the program returns the learner to the main menu shown below.

The learner begins with an exercise with screen captures, input fields, hotspots, and pull down menus for the learner to step through an exercise sequentially.
<table>
<thead>
<tr>
<th>Gagné’s Events of Instruction</th>
<th>Comparison Module</th>
<th>Treatment Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development and Validation</td>
<td>Visual cues on the screen captures assist the learner to provide the appropriate information in the input field.</td>
<td>If student fails to provide input, the program prompts the learner to provide such input. Above the learner receives reinforcement feedback on a correct practice item. It is only when the student presses OK that the program continues.</td>
</tr>
<tr>
<td></td>
<td>Provide students information assessing how well they are doing during feedback session. Following overview screens, the comparison program provides practice exercises and where possible, illustrations of the concept. Learner gets feedback from exploration with the live links and answering the practice questions.</td>
<td>The first interval quiz in the treatment program provides immediate feedback on a multiple selection quiz on virtual libraries and specialized databases.</td>
</tr>
<tr>
<td></td>
<td>Corrective and reinforcement feedback is provided throughout the treatment program for each exercise.</td>
<td></td>
</tr>
<tr>
<td>Gagné’s Events of Instruction</td>
<td>Comparison Module</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>Provide review and relate new skills to previously learned skills and real-world applications</td>
<td>Treatment Module</td>
<td></td>
</tr>
</tbody>
</table>

Treatment program provides summary screens following exercises and prior to returning the learner to the main menu.

Nested summary in treatment program comes before the learner is guided through an exercise using nested search statements.

Library Squares Flash game provides real search problem scenarios and learner must agree or disagree with one of the celebrity searchers.
<table>
<thead>
<tr>
<th>Gagné’s Events of Instruction</th>
<th>Comparison Module</th>
<th>Treatment Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide tests, performance checklists, rating scales, attitude scales, or other means of measurement and mastery of skills in authentic setting. Gagné called this step enhancing transfer and retention.</td>
<td>Both instructional groups take a posttest for comprehension and performance. An Academic Motivation Profile adapted for the instruction provides the learner opportunities for reflection on what is learned.</td>
<td>Interval quizzes such as the one shown above along with the Library Squares game provide additional learner feedback on progress.</td>
</tr>
</tbody>
</table>

**Research Design for Final Administration of the Study**

Two modules; one with highly structured program control to include features associated with classroom instruction was compared to a tutorial that afforded full learner control and scanned text from the textbook and exercises without benefit of instructor/program guidance and feedback. Dependent variables included posttest scores for comprehension, a performance test in the form of an Internet scavenger hunt, and data from the modified AMP. The final study proved a mixed experimental design, based on change.
measure from pretest to posttest, thus the students were tested twice. The design was factorial because two between group differences (treatment vs. comparison) were measured on posttest scores for comprehension. Additionally, the researcher analyzed between-group differences on the performance measure (Internet scavenger hunt) to identify features of instruction that proved more effective for learners when presented a problem-based task. Finally scores from an attitudinal survey, *Academic Motivation Profile* (Carey, 1994) modified to fit the context of the instruction was administered post-training and after completion of the comprehension and Internet scavenger hunt tests.

**Procedure**

The instructor informed students of the voluntary nature of the research. Consent forms were distributed and collected prior to introduction of the study and the pretest. Participants required a parent and student signature on the form given that the sample comprised students over the age of twelve. Once all the consent forms were collected with signatures, the researcher distributed the pretest on knowledge of Internet search tools.

The pretest instrument was hand scored, then ranked in descending order. Based on ranked pretest scores, the investigator assigned students randomly within matched pairs to either the treatment or comparison condition. Matched pair random assignment was used to ensure the equivalence of the groups based on prior knowledge measured by the pretest for knowledge of Internet search tools. The researcher used a six-sided die to randomly assign students within pairs to group one (even number on die) or group two (odd number on die). To avoid confusion from the December 2003 administration of the course materials, student names and group assignments were printed on individual index cards. The investigator divided the lab into two sections; on one side the researcher placed students assigned to the
treatment module while those assigned to that comparison group sat at the other side of the room. Students were called one person at a time to take a seat at a prepared workstation within the computer lab. The researcher loaded the modules locally to a public shared drive to avoid problems with Internet access from the County’s proxy server. A freeware software Internet stopwatch program was downloaded and launched on each station so that students could record their time on task individually within groups. Groups were physically separated on two sides of the room so that the researcher and classroom instructor could monitor that each student began the correctly assigned tutorial and accurately recorded the time indicated on their digital stopwatch.

To avoid any confounding influence from the students’ language arts teacher or the researcher and provide an authentic learning environment, students worked individually at stations in the lab. While permitted to engage in conversation and assist one another while proceeding through the tutorial, the room remained almost totally silent as students proceeded through the materials in both groups. The only assistance provided was when there was a request for guidance about where to proceed once students looked at an instructional unit. Both groups were informed about where to click on the vertical menu bar prior to beginning their tutorial. They were also told they were free to take notes or not, that there were no repercussions either way. The researcher and language arts teacher remained in the room throughout the instructional time without talking to students and only to provide navigational assistance and supervision of proper behavior in the lab.

Students were given the posttest for knowledge of Internet search tools a number of days after their computer lab experience. The knowledge posttest actually assessed the students on retention of the training material rather than comprehension.
A week after training in the computer lab, students returned to the computer labs, assigned in groups, for the Internet scavenger hunt. Again, the researcher called students individually, distributed the student’s index card, prepared the stopwatch on the desktop, and made ready the assigned tutorial before the students sat to complete the scavenger hunt. Once students sat at their assigned workstations, the researcher instructed them to open a second window outside the tutorial to perform the searches, click the start button on their timer and begin the scavenger hunt.

A week later, the AMP was distributed in paper and pencil form to students during their language arts period. The researcher asked students to sign their name at the top of the evaluation and emphasized that no answer would be perceived as incorrect. The media specialist told students to respond to questions in their most honest form, that no feelings would be hurt by any negative responses and their responses would be kept in the strictest confidence.

Data Analysis

The researcher examined gains in learning from pretest on comprehension to posttest on this same measure. To mitigate history and order effect from the study, three weeks delay from the pretest to posttest were scheduled. The order of the questions was also altered on the posttest comprehension instrument. Repeated measures ANOVA was used to determine if significant gains in learning occurred across both groups. A factorial ANOVA was used to identify an interaction effect between the comparison and treatment conditions for the comprehension score. To determine if differences between groups on performance score on the Internet scavenger hunt posttest, a paired T-test was conducted. To assess differences between groups on student perception of the material, each of the four factors
was averaged individually within groups. Means between groups was computed and compared using a paired T-test to determine if significant differences resulted between the treatment and comparison group on any or all factors of the AMP. The researcher ran a Pearson correlation coefficient to determine if any statistically significant relationship emerged between perception and achievement on the comprehension or scavenger hunt test.
Chapter Four

Results

Purpose of the Study

The purpose of the present study is threefold. The first purpose is to examine students’ performance on two forms of Internet search skills instruction for web-based delivery from a textbook. The second purpose is to examine effects on students’ academic motivation of two forms of web-based instruction that afford higher or lower levels of learner control. The third purpose is to document the design process used to convert textbook material to web-based instruction.

Typical learner-centered approaches to textbook conversion to web delivery begin with scanned text converted to code readable via web pages. Depending on textbook content, the instructor may insert live links and practice exercises following content presentation or simply present content via web page. In the current study, practice exercises were included in the text derived from Frederick and Smith’s (2000) *Introduction to Library and Internet Research Skills* course. Learner centered designs rely heavily on the self-regulatory, motivational, and work habits of the learner. In this case, high ability students were used as a sample population so that comparison of design differences due to instructional strategies could be compared. The researcher did not wish to study the interaction between learner characteristics and design features.

A second textbook conversion based on cognitive principles associated with Gagné’s (1985) *Events of Instruction* included features associated with classroom presentation. These included (1) motivational material to gain the learner’s attention, (2) navigational controls
within sub topics so that students were forced to complete practice exercises following content overviews, (3) summary material, (4) immediate program-controlled corrective and reinforcement feedback, (5) interval review quizzes to enhance transfer of information, and (6) a Library Squares game with immediate corrective and reinforcement feedback to enhance retention and transfer of information.

Dependent measures for the experiment included scores on a posttest for knowledge of Internet search tools and a posttest score on an Internet scavenger hunt. Independent variables were the two tutorials for Internet search training, the first an amended version that focused on features associated with a cognitive model described above, the second a learner-centered approach that simply converted textbook materials and exercises from the Frederick and Smith (2000) library and Internet research skills course.

Research Question One

What effects do two online instructional design strategies for Internet training characterized by their content-centeredness or learner-centeredness have on student performance measures? Content-centered features associated with classroom instruction include: gaining attention, guided practice, corrective and reinforcement feedback, embedded quizzes that inform the learner of his/her progress, and summary screens that relate new content to previously learned material.

Results from the study revealed that neither tutorial yielded significantly higher performance results on the posttest measure for comprehension. Using a repeated measures ANOVA, results indicated that both groups improved significantly from pretest score to posttest score, $F(1, 40) = 40.233, p < .000$. The researcher computed an effect size based on the difference between pre and posttest scores across both groups and divided by the
standard deviation of the pretest score. The effect size resulted in .96079, considered statistically substantial. The data revealed no advantage in terms of performance gains between both groups one and two. No significant interaction effect emerged between groups as can be seen in the tables below. Across both groups scores increased from 58.9732 points on the pretest to 72.6337 on the posttest, an increase of close to 13 points. Group one (treatment) increased from a pretest mean of $\overline{X} = 58.2595$ to $\overline{X} = 74.0314$ ($N = 21$) slightly higher gains compared to Group two (comparison) who scored 59.7225 on the pretest and 71.1660 on the posttest ($N = 20$). The repeated measures ANOVA found that the interaction effect between the groups was statistically insignificant; $F(1, 40) = 1.018, p = .319$

Mean score differences between groups on the Internet scavenger hunt also proved negligible. Mean scores from group one (treatment) yielded $\overline{X} = 9.2381$ compared to group two (comparison) that averaged $\overline{X} = 9.2500$. Average Internet hunt scores across both groups resulted in $\overline{X} = 9.2439$ out of a potential ten points. Given that both groups had access to their respective tutorials, results on time to complete the scavenger hunt revealed similarly small differences. Mean time to complete the activity for group one was 0:27:27 ($N=21$) while group two used 0:26:02 ($N=20$)

There were no corroborative observational data that indicated students found answers to the scavenger hunt as a result of using their respective tutorials. The investigator noted some students using Boolean operators, moving from the tutorial to their Internet tool, and adding quotation marks around phrases. However, no corroborative conclusions may be drawn without triangulation of these observations.
Table 5

Repeated Measures ANOVA for Pretest and Posttest Groups One and Two

<table>
<thead>
<tr>
<th>Tests Within Subjects</th>
<th>Type III Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor I: Pre and Posttest Gains</td>
<td>3,793.718</td>
<td>1</td>
<td>3,793.718</td>
<td>40.233</td>
<td>0.000</td>
</tr>
<tr>
<td>Pretest-Posttest Gains * Group</td>
<td>95.960</td>
<td>1</td>
<td>95.960</td>
<td>1.018</td>
<td>0.319</td>
</tr>
</tbody>
</table>

Tests Between Subjects

| Group | 10.074 | 1 | 10.074 | 0.041 | 0.842 |

Note: N= 41 and p-value set < .05 Group One (Treatment) n = 21 and Group Two (Comparison) n = 20
### Table 6

**Descriptive Statistics on Pretest, Posttest, Time on Task, Scavenger Hunt, and Time to Complete Scavenger Hunt**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>N</th>
<th>St. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pretest</strong></td>
<td>58.2595</td>
<td>21</td>
<td>12.12557</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>74.0314</td>
<td>21</td>
<td>14.18675</td>
</tr>
<tr>
<td><strong>Timetask</strong></td>
<td>0:49:30</td>
<td>21</td>
<td>0:18:06</td>
</tr>
<tr>
<td><strong>Scavenger</strong></td>
<td>9.2381</td>
<td>21</td>
<td>1.26114</td>
</tr>
<tr>
<td><strong>Timehunt</strong></td>
<td>0:27:27</td>
<td>21</td>
<td>0:07:35</td>
</tr>
<tr>
<td><strong>Group 1</strong> (Treatment)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pretest</strong></td>
<td>59.7225</td>
<td>20</td>
<td>11.30883</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>71.1660</td>
<td>20</td>
<td>14.46689</td>
</tr>
<tr>
<td><strong>Timetask</strong></td>
<td>0:58:12</td>
<td>20</td>
<td>0:20:02</td>
</tr>
<tr>
<td><strong>Scavenger</strong></td>
<td>9.2500</td>
<td>20</td>
<td>1.01955</td>
</tr>
<tr>
<td><strong>Timehunt</strong></td>
<td>0:26:02</td>
<td>20</td>
<td>0:07:35</td>
</tr>
<tr>
<td><strong>Group 2</strong> (Comparison)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pretest</strong></td>
<td>58.9732</td>
<td>41</td>
<td>11.61079</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>72.6337</td>
<td>41</td>
<td>14.21787</td>
</tr>
<tr>
<td><strong>Timetask</strong></td>
<td>0:53:45</td>
<td>41</td>
<td>0:19:20</td>
</tr>
<tr>
<td><strong>Scavenger</strong></td>
<td>9.2439</td>
<td>41</td>
<td>1.13535</td>
</tr>
<tr>
<td><strong>Timehunt</strong></td>
<td>0:26:46</td>
<td>41</td>
<td>0:07:31</td>
</tr>
<tr>
<td><strong>Total within both groups N=41</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pretest</strong></td>
<td>58.9732</td>
<td>41</td>
<td>11.61079</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>72.6337</td>
<td>41</td>
<td>14.21787</td>
</tr>
<tr>
<td><strong>Timetask</strong></td>
<td>0:53:45</td>
<td>41</td>
<td>0:19:20</td>
</tr>
<tr>
<td><strong>Scavenger</strong></td>
<td>9.2439</td>
<td>41</td>
<td>1.13535</td>
</tr>
<tr>
<td><strong>Timehunt</strong></td>
<td>0:26:46</td>
<td>41</td>
<td>0:07:31</td>
</tr>
</tbody>
</table>
Table 7

*Descriptive Statistics for Group 1 and 2 on Scavenger Hunt Data*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Standard Deviation</th>
<th>Standard Error of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paired:</td>
<td>9.200</td>
<td>20</td>
<td>1.28145</td>
<td>0.28654</td>
</tr>
<tr>
<td>Scavenger Hunt Group 1</td>
<td>9.2500</td>
<td>20</td>
<td>1.01955</td>
<td>0.22798</td>
</tr>
</tbody>
</table>

Table 8

*Paired T-Test Comparing Group 1 and Group 2 on the Scavenger Hunt*

<table>
<thead>
<tr>
<th>Paired Groups</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standard Error of Mean</th>
<th>T-statistic</th>
<th>DF</th>
<th>Significance (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paired:</td>
<td>-0.0500</td>
<td>1.76143</td>
<td>0.39387</td>
<td>-0.127</td>
<td>19</td>
<td>0.900</td>
</tr>
<tr>
<td>Scavenger Hunt Group 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scavenger Hunt Group 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: p-value set at .05 or 95% confidence interval. N= 21 but because paired statistic, data excluded one student’s score listwise

*Self-Reported Time on Instruction*

A potential threat to the validity of the study was time on task. Because of the nature of the treatment group guiding students through exercises, provision of interval quizzes and
summary screens, time on task potentially could have taken longer than the comparison group. Time estimates were recorded to confirm that both groups spent approximately equivalent learning time on task. The reader should note that time calculations were estimated using a digital stopwatch placed students’ desktops. Students started their stopwatches after receiving instruction at the beginning of the instruction phase. Students clicked the stop on the digital timer at the end of the training session. Students recorded their times measured in minutes and seconds on their index cards for assignment to a group and workstation. The statistics for time on task and time to complete the scavenger hunt are rough estimates. Using a paired T-test, the difference in time was minimal with an average for group one of 49.5 minutes compared to group two whose mean time was approximately 58 minutes ($t(1,19) = 1.254, p = .225$). The range of time for group one was between 45 minutes and an hour and 21 minutes. Group two’s range to complete the instruction was between 35 minutes and an hour 41 minutes.

Students appeared highly self-directed in both conditions. One or two students assigned to the comparison group asked if they were required to perform the exercises from the scanned textbook and the instructor suggested that they should follow the instructions on the exercise page of their tutorial. Both the students’ language arts instructor and the researcher noted that all students in both module conditions complied with the instructions and completed exercises in both treatment and comparison groups. To avoid undue researcher influence, the researcher did not interact with students other than to instruct students on how to start and stop digital stopwatches on the desktops, how to open multiple windows while performing the scavenger hunt, and preparing each station to ensure that the methodology was followed throughout the research project.
Research Question Two

How do students’ perceptions based on self-reports differ between two instructional strategies characterized by their content-centeredness or learner-centeredness on attention, relevance, confidence, and satisfaction? To answer this research question, students completed a modified Academic Motivation Profile (Carey, 1985) instrument that encompassed four interrelated factors; (1) attention, (2) relevance, (3) confidence, and (4) satisfaction. Each question within the factor groupings was presented as a statement to which the student responded on a four-point scale.

To analyze this data, each student’s responses were categorized according to factor and an average score computed for both groups within each factor. The researcher analyzed data with a Windows version of SPSS (version 11.0). Data was input into SPSS within assigned pairs in each of the two periods engaged in the study. The researcher chose a paired T-test because students per group were assigned in matched pairs to ensure equality of group means. Due to uneven cells or pairs (originally N=41), SPSS automatically eliminated a data point without a paired data set for analysis of the paired T-test. The elimination of one of the data points forced the data to conform to N = 40 with 20 students assigned to groups one and two respectively. To compare responses between groups for each of the factors, the researcher performed a paired T-test (paired means) setting $\alpha = .05$. None of the data revealed significant differences between groups.
Table 9

*Descriptive Statistics Groups One and Two Assigned in Matched Pairs*

<table>
<thead>
<tr>
<th>Pair</th>
<th>Category</th>
<th>Group 1 Mean</th>
<th>Group 1 N</th>
<th>Group 1 Std. Deviation</th>
<th>Group 1 Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>Attention</td>
<td>2.5480</td>
<td>20</td>
<td>.64140</td>
<td>.14342</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attention</td>
<td>2.1820</td>
<td>20</td>
<td>.63331</td>
<td>.14161</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 2</td>
<td>Relevance</td>
<td>2.5570</td>
<td>20</td>
<td>.65785</td>
<td>.14710</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relevance</td>
<td>2.7400</td>
<td>20</td>
<td>.70068</td>
<td>.15668</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 3</td>
<td>Confidence</td>
<td>2.8135</td>
<td>20</td>
<td>.64541</td>
<td>.14432</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confidence</td>
<td>2.6650</td>
<td>20</td>
<td>.60478</td>
<td>.13523</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 4</td>
<td>Satisfaction</td>
<td>2.6325</td>
<td>20</td>
<td>.73142</td>
<td>.16355</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Satisfaction</td>
<td>2.6160</td>
<td>20</td>
<td>.76651</td>
<td>.17140</td>
</tr>
</tbody>
</table>
Table 10

Paired T-Test AMP

<table>
<thead>
<tr>
<th>Pair and Factor</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Mean</th>
<th>Lower</th>
<th>Upper</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attention</td>
<td>.3660</td>
<td>.95254</td>
<td>.21300</td>
<td>-.0798</td>
<td>.8118</td>
<td>1.718</td>
<td>19</td>
<td>.102</td>
</tr>
<tr>
<td>Relevance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confidence</td>
<td>.1485</td>
<td>.76757</td>
<td>.17163</td>
<td>-.2107</td>
<td>.5077</td>
<td>.865</td>
<td>19</td>
<td>.398</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>.0165</td>
<td>.94177</td>
<td>.21059</td>
<td>-.4243</td>
<td>.4573</td>
<td>.078</td>
<td>19</td>
<td>.938</td>
</tr>
</tbody>
</table>

Note: p-value set at p<.05

To further examine the strength of relationship between motivation and achievement, the researcher analyzed data by running Pearson Correlation Coefficients on the results of each of the factors across both groups and scavenger hunt scores and posttest.
scores. Results appear in the table below.

**Table 11**

*Correlations Between AMP Factors and Achievement*

<table>
<thead>
<tr>
<th></th>
<th>Posttest</th>
<th>Scavenger</th>
<th>Attention</th>
<th>Relevance</th>
<th>Confidence</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Posttest</strong></td>
<td>Pearson Correlation</td>
<td>.016</td>
<td>.124</td>
<td>.196</td>
<td>.233</td>
<td>-.090</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.920</td>
<td>.446</td>
<td>.226</td>
<td>.148</td>
<td>.579</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>41</td>
<td>41</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Scavenger</strong></td>
<td>Pearson Correlation</td>
<td>.016</td>
<td>1</td>
<td>-.029</td>
<td>.021</td>
<td>-.070</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.920</td>
<td>.858</td>
<td>.898</td>
<td>.726</td>
<td>.670</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>41</td>
<td>41</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Attention</strong></td>
<td>Pearson Correlation</td>
<td>.124</td>
<td>-.029</td>
<td>1</td>
<td>.736(**)</td>
<td>.605(**)</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.446</td>
<td>.858</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Relevance</strong></td>
<td>Pearson Correlation</td>
<td>.196</td>
<td>.021</td>
<td>.736(**)</td>
<td>1</td>
<td>.535(**)</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.226</td>
<td>.898</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td></td>
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<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Confidence</strong></td>
<td>Pearson Correlation</td>
<td>.233</td>
<td>.057</td>
<td>.605(**)</td>
<td>.535(**)</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.148</td>
<td>.726</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
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<td>N</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td>Pearson Correlation</td>
<td>-.090</td>
<td>-.070</td>
<td>.673(**)</td>
<td>.657(**)</td>
<td>.526(**)</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.579</td>
<td>.670</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
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<td>N</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
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<td>40</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

The table above indicates no significant correlations between the posttest scores and performance on the scavenger hunt indicating that these two performance measures targeted
different skill sets. As expected, significant relationships emerged between factors of attention, relevance, confidence, and satisfaction. Significant inter-correlations between all four sub-scores on the AMP could be an indicator of response generalization across all factors of the AMP instrument. The lack of significance between these affective measures and performance measures may lead to the question of the influence of affect and performance with high ability students compared to those less able to self-regulate and follow instructions.

Research Question Three

Is the additional time and effort needed to include the treatment module features found in classroom instruction; gaining attention, guided practice, corrective and reinforcement feedback, embedded quizzes, and summary screens, efficacious given the performance and perception results of this study? The process of creating an online module that includes these features is assessed to determine its efficaciousness. The researcher incurred time and monetary expenses for the features included in the treatment module that far exceeded those of the comparison condition.

Design considerations include the following:

1. Availability of software to include HTML editor, screen capture software, Flash software (MacroMedia)

2. Permissions granted to reuse animated graphics or Flash software from another source (in the present case from the TILT developers)

3. Technical abilities of the designer or access to programmer for javascript in the treatment module. No scripting was necessary in the comparison condition

4. Space considerations for upload of the software; 27.3 MB were used for the treatment module and 13.1 MB for the comparison module
An examination of performance and AMP results suggest that the cost outweighed the benefits with the sample chosen for this research.

Table 12

*Time and Resource Costs for Comparison and Treatment Module*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Software/Hardware Used to Create the Condition</th>
<th>Personnel or Technical Requirements Needed to Create the Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment (Content-Centered)</td>
<td>HTML Editing Software</td>
<td>1. Javascript programmer to provide feedback on learner input fields</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Researcher familiar with basic HTML and how to construct tables for web delivery and construct the navigational interface</td>
</tr>
<tr>
<td></td>
<td>Flash Software</td>
<td>3. OCR software along with a flat-bed scanner to get text into a format easily imported into an HTML editor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Derived from TILT tutorial, modification of practice Brainstorm</td>
</tr>
<tr>
<td>Condition</td>
<td>Software/Hardware Used to Create the Condition</td>
<td>Personnel or Technical Requirements Needed to Create the Condition</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>exercise completed with a programmer</td>
<td>2. Graphic artist and programmer used to modify the Library Squares Game to fit the content of the module</td>
</tr>
<tr>
<td></td>
<td>3. Researcher used SnagIt software from TechSmith</td>
<td>Simulation software for simulations for practice exercises</td>
</tr>
<tr>
<td>Comparison (Learner-Centered)</td>
<td>Software included HTML editor, no Flash programming or modifications to existing material from TILT, no need for javascript programming, only use of HTML tags</td>
<td>No programming assistance needed as the researcher used extant animated graphics from TILT, no modifications of Flash, no programming needed to control sequence or navigation</td>
</tr>
</tbody>
</table>
Summary of Results

The data indicate there were no apparent differences found between posttest scores in either the treatment or comparison module, however common features of both modules proved effective. A main effect resulted with an increase of scores from pretest to posttest $F(1, 39) = 40.233, p < .05$. Perhaps more importantly, students demonstrated both proficiency and efficiency in search skills overall as demonstrated by the Internet Scavenger hunt. Mean scores from the hunt (N=41) resulted in $\bar{X} = 9.2439$ of ten points.

Examination of the second question focused on whether student perception based on Keller’s (1992) ARCS model revealed no significant differences between groups on any of AMP’s four factors. Using a paired T-test to determine if significant differences emerged on attention, relevance, confidence, and satisfaction, none proved statistically significant within the two paired groups with $\alpha = .05$. A paired t-test resulted in no statistical difference on attention ($T = 1.718, p = .102$), relevance ($T = .997, p = .331$), confidence ($T = .865, p = .398$), or satisfaction ($T = .078, p = .938$). Correlations between factors on the AMP and achievement proved insignificant in terms of achievement but between factors of attention, relevance, confidence and satisfaction were significant at the $p < .001$.

The third research focus was on the efficaciousness of expending the increased effort and time to create the treatment WBI module. Results were based on performance and perceptual scores and they suggest that expending the resources needed to include the additional features for the treatment condition may be called into question. Given that the sample chosen for this particular research includes high ability students who demonstrate characteristics such as self-initiation, internal self-regulation, focus, and the ability to monitor choice of instructional strategy, the ability to generalize finding from the data to a less able group remains to be seen. Further, there was variance in student responses based on interest
in the subject matter regardless of assignment to any one instructional condition. From the data alone on the performance scores and perceptual feedback, it appears that one needs to focus on those features found common to both conditions given no significant differences between the two conditions on any of the performance or perceptual measures. Thus, upon first inspection, one could conclude that addition of the aforementioned features may prove unnecessary to obtain similar results with a population of high ability students.
Chapter Five
Discussion

Introduction

The researcher assessed the effectiveness of two online Internet training modules, one that used instructional strategies associated with learner-centeredness, the other based on content-centered instruction. Previous studies found that learners of high ability are able to self-initiate and regulate when provided with learner-centered instruction (Schnackenberg and Sullivan, 1998; Chung and Reigeluth, 1992; Steinberg, 1989). The investigator revisited the question of learner-centered versus content-centered instructional features and their effect on performance and perceptual measures identified as high ability middle school students.

Purpose of the Study

The purpose of the present study is threefold. The first purpose is to examine students’ performance on two forms of Internet search skills instruction for web-based delivery from a textbook. The second purpose is to examine effects on students’ academic motivation of two forms of web-based instruction that afford higher or lower levels of learner control. The third purpose is to document the design process used to convert textbook material to web-based instruction.

Referencing the first purpose…when textbook content is converted to HTML format for web delivery two schools of educational philosophy must be addressed. One
school of thought focuses on content-centered delivery, the other on learner-centered delivery. Specifically, this study focused on the effects content-centered versus learner-centered design has on performance scores for high ability learners.

The quality of the web-delivered material depends on instructors’ abilities to manage these resources, the receptivity of the target audience to the instructional content, and the quality of the textbook content. The researcher posed the question whether high ability learners would perform differently assigned to a content-centered or learner-centered module. Features associated with a content-centered approach included greater program control, immediate feedback and guidance, review, and intermittent quizzes.

In reference to the second purpose, the researcher wished to ascertain whether student preference differed between the two online modules (Keller, 1987). Student responses were analyzed based on a modified Academic Motivation Profile (Carey, 1994). The researcher analyzed whether high ability students favored an online module that included classroom instructional features over a skeletal version of the textbook material followed by practice exercises. Results proved inconclusive. Verbal feedback from the students indicated that the amended version of the material sustained student attention and increased confidence. Statistical analysis, however, did not support this finding.

The third purpose addressed the cost-benefit analysis for development of online instruction with features associated with classroom instruction. These features included gaining attention, guided practice, corrective and reinforcement feedback, embedded quizzes, and summary screens. Design strategies used to develop the treatment module were discussed in the Methods chapter. The researcher paid careful attention to test development to ensure content validity and course objectives corresponded with test items. One-on-one trials and small and large group pilots necessitated revisions throughout the design process.
Statistical analysis was performed to determine the reliability of the test items on the comprehension pre- and post-test. A final discussion concerning the efficaciousness of time and professional resources necessary for development of the treatment module follows in this chapter.

Implications of the Results

No apparent statistical advantage was seen in favor of either of the two strategies; learner-centered or content-centered instruction. Both groups, treatment and comparison, did equally well on the comprehension and performance measures. Results from the current study support Schnackenberg and Sullivan’s (1998) research. Those of high ability performed better than those of lower ability provided a lean and full version of software. Contradictory to Schnackenberg’s research, there was no difference on performance or attitude between the learner-centered (lean design) versus the content-centered (full version) software for high ability students. Perhaps content familiarity, students’ sense of relevance of the material, and the general novelty effect of online instruction influenced performance outcomes exhibited in the present study. While the research does shed light on the efficacy of learner-centered online materials for those of high ability, it cannot be assumed these results will be obtained with average or low ability learners.

The researcher found that when textbook content is converted for WBI, issues arose associated with learner characteristics, perceptions, and receptivity to instructional material. Apart from a statistically insignificant relationship between factors on the modified AMP in favor of either learner-centered or content-centered instruction, anecdotal evidence suggested that the AMP may not be sensitive enough to detect middle school student responses to the instrument. The relationship between attention, relevance, confidence,
satisfaction and achievement may be of greater importance for students with less developed metacognitive and self-regulatory abilities than those selected for the present study.

Performance and affective feedback indicate that additional time and cost to produce the content-centered module may not produce sufficient return.

**Research Question One**

What effect do two online instructional design strategies for Internet training, characterized by their content-centeredness or learner-centeredness, have on student performance measures?

Findings from this study found no difference between students in the treatment condition from those assigned to the comparison group for either the retention posttest or the scavenger hunt performance test. On first inspection, the results appeared to confirm the notion that a “lean-plus” design defined by Alessi and Trollip (2001) proved sufficient. A “lean-plus” design is exemplified by the learner-centered module. Students had opportunities to explore features of a non-linear computer-based tutorial without being compelled by the WBI program to complete interactive exercises. The addition of review quizzes and a simulation game where the student received feedback on her/his mastery of the material did not substantially benefit performance outcomes on the posttest.

The literature indicated that students of high ability may not require program control or directly prescribed strategies in practice exercises in order to acquire content-centered instruction. Learner characteristics may play a role in negating the treatment interaction effect of content-centered instruction. The degree of self-regulation and initiative of these students may enable them to engage in less structured instructional approaches. Schnackenberg and Sullivan’s (1998) research found when high ability students control the
pace, sequence, and navigation within an instructional program they are able to evaluate their instructional needs and devise effective learning strategies.

Meyer (2003) contended that success within non-linear web-based instruction was dependent on an individual’s self-regulatory abilities. Individual differences in terms of level of self-regulation across both groups may account for the “no significant difference” outcome between the two groups. Meyer asserted that a student’s prior knowledge, learning style on a continuum of initiative and passivity, may determine the success or failure of web-based learning. Chances are good that students will perform successfully if they have: (1) high motivation towards the subject matter, (2) greater self-regulating learning behaviors, and (3) the belief that they will learn in an online environment. Students who depend on external learning conditions and who do not possess the ability to self-regulate may not perform as well in online environments. The sample of high ability middle school students confirmed Meyer’s conclusions evidenced by the test outcomes across both groups.

The effect of features associated with classroom interactions or content-centered instruction failed to produce statistical differences between the treatment and comparison groups. Results from the present research required the investigator to identify successful common features for both tutorials. Both groups had a vertical menu structure set up in tables where topics lined up on one side of the screen and content appeared on the other. Both groups had visual prompts (arrows) to inform the student where they were within the module. If students moved vertically from top to bottom of the table of contents, they moved logically through the topics. In most cases the researcher observed the students moving sequentially through the material using the vertical menu bar.

Graphics used in both conditions were used to illustrate principles presented in the text. For example, when the students studied general subject directories in both conditions, a
link to a graphic of an inverted triangle illustrated how the directory was organized from broad topics to specific within a subject area. Venn diagrams were used in both conditions to illustrate Boolean operators along with a pop-up screen and definition of the origin and definition of the term “Boolean”. Flash applets were used sparingly on overview screens in both conditions in order to sustain attention and illustrate learning principles within the text.

Both comparison and treatment modules included instruction on research strategies and refinement of research questions taken with permissions from the University of Texas’ TILT Tutorial. Both modules presented an outline of how one refines a research question, brainstorms subject categories, selects keywords, and uses quotation marks around phrases and wildcards for word variations. These strategies were presented as a technique before introduction of any particular Internet search tool.

Overview screens for the comparison and treatment groups contained tables with descriptions, comparisons, and live links to various categories of Internet search tools. Students in both conditions took advantage of the opportunity to explore links. Exercises followed the overview in both conditions and the exercises included in the treatment condition were derived from those in the textbook. With the exception of screen captures versus open-ended practice exercises with the material, treatment condition exercises guided students and provided corrective and reinforcement feedback with examples found in the textbook. Students assigned to the comparison group experimented with exercises and derived feedback as a natural consequence of their exploration. Because questions were closed-ended, it was possible for students to conclude if their strategy proved successful.

Narrative screens provided clear definitions readily understandable to high ability students. Embedded glossary hypertext links were included in overview screens for both conditions. The tone of the narratives in both conditions was conversational. Concepts in
virtual libraries and general subject directories for example, made reference to each other so the student could see the similarities and differences between various Internet search tools.

The performance hunt measure proved to be effective with students assigned to both instructional conditions. When the researcher performed a small group pilot with students who did not have benefit of the online modules or any formal prior Internet search training, it was reported that the activity was enjoyable but frustrating without training. When students were given access to their respective tutorial as a reference source, the students successfully applied principles from instructional materials to a performance task.

Research Question Two

How do students’ perceptions based on self-reports differ on attention, relevance, confidence, and satisfaction between two instructional strategies characterized by their content-centeredness or learner-centeredness?

Results revealed no significant differences between groups on factors of attention, relevance, confidence, or satisfaction. Though no statistical differences were found on paired T-tests on each of the four factors measured in the modified AMP, there may be anecdotal evidence that the treatment program may have been preferable to the comparison module. Carey’s (1994) AMP was originally designed for use with college students. “Typical means for undergraduate students on the four scales of the AMP are in the range from slightly above to slightly below 4.0 on a five-point scale after a full semester course experience” (Personal interview with L. Carey, 3/22/05).

The investigator modified the AMP to fit the context and content of the current study. Given discrepancies between student verbal responses to the instruction, the researcher questioned the sensitivity of the AMP for the middle school audience. Though
cognitively the students understood the verbiage of the instrument, conversational feedback indicated the students enjoyed their training experiences. Observational data and discussion with the students may not have corresponded to their written responses on the AMP instrument. A second factor, delay of more than a week’s time after training and administration of the performance tests may have posed a threat to the validity of responses from the students on the attitudinal instrument.

Upon replication of the study, the researcher suggests that administration of a perceptual instrument take place immediately following instruction. Only after the researcher has presented the questionnaire and dialoged with students would the instrument be given absent the presence of the researcher.

Design of the study was experimental using a matched pair assignment of students to either the comparison or treatment group. Mean scores on the four factors indicated that on a four point scale, students’ mean attention score was $\bar{X} = 2.39$, relevance $\bar{X} = 2.67$, confidence $\bar{X} = 2.67$, and satisfaction $\bar{X} = 2.65$. Mean responses to the instruction suggest students rated the instruction somewhere between slightly and moderately interested in the material. Both the researcher and the students’ language arts teacher noted that students appeared fully engaged in their work, very little talking took place, and students appeared to carefully “read” the software screens. Observational indicators suggest the AMP or timing for administration of the instrument may not yield accurate data.

A statistical issue related to power and effect size remains as only two classes were studied in total with students of very high ability. Calculation of statistical power and sample size is somewhat difficult for paired t-tests. Post hoc calculations were made via an online calculator for effect and sample size (Uitenbroek, 2005). For an alpha of .05, a minimum of
30 students/group were needed for an effect size of .6 for a double sided test. There is an error made in calculation of ES and Power when computing correlated “paired t-test value takes into account the correlation between the two scores the paired t-test will be larger than a between groups t-test.” (Becker, 2000) In the present study, the effect size was calculated using the difference Cohen’s \( d = M_1 - M_2 / s_{\text{pooled}} \) where \( s_{\text{pooled}} = \sqrt{\frac{(s_1^2 + s_2^2)}{2}} \) resulting in an inflated power estimate. Results using the online calculator, Cohen’s \( d \) resulted in a statistic of 0.574 for the attention factor between group one and two. On the factor of Relevance, the second group rated their experience higher than the first and resulted in a negative \( d = -0.269 \) Confidence power = .237 was in favor of group one (treatment). Satisfaction power analysis resulted in \( d = 0.0223 \). The researcher suggests that larger numbers are needed to assess between group differences on the four factors of attention, relevance, confidence, and satisfaction for replication of the study.

The timeframe for the research posed a possible threat to external validity. The research was conducted over a two-week interval. Students had recently completed standardized testing, schedules had been modified to accommodate five consecutive days of testing, and students may have been anticipating the end of year finals while they participated in the study. The time of year, the last three weeks of school prior to finals and summer break, may have affected the students’ full participation with the instructional online modules.

**Research Question Three**

Is the additional time and effort needed to include the treatment module features found in classroom instruction; gaining attention, guided practice, corrective and
reinforcement feedback, embedded quizzes, and summary screens, efficacious given the performance and perception results of this study?

Central to the question of how one converts textbook information literacy units to web-based instruction is consideration of cost-benefit analysis to the process of creating hypertext learning environments. The researcher incurred expense both in time and money given lack of javascript skills to create the feedback and reinforcement for the treatment condition. A graphical designer and programmer were hired by the researcher to adapt content for the Library Squares game from the original TILT Tutorial; javascript programming was needed to design guided practice and feedback simulations. Screen capture software was used to replicate the simulated exercises in the textbook in order to guide the students through the learning activities. The cost, measured in time and money, for media specialists or teachers without HTML or graphics skills would be higher.

A systematic design process was used for development for both treatment and comparison conditions. Modifications to the web-based format in the comparison condition included a analysis of skills, decision regarding entry level skills required for success within the course, clearly written objective statements in terms of performance expectations post-instruction, construction of criterion-based tests, choice of instructional strategy, sequence and presentation of the material (development and selection of instructional materials), formative trials with the software, revision of material, and summative evaluation of the instruction (Dick, Carey, & Carey 2001). The major difference between the two conditions resided in choice of instructional strategy. The treatment module contained program-controlled sequences for guided practice and feedback, program-controlled navigation within each of the sub-topics, motivational material at the start of the module, embedded quizzes for review and feedback, and simulated library squares game to provide assistance with
retention and transfer of learning. The treatment module required additional graphics (screen captures), programming to provide feedback during guided practice exercises, MacroMedia flash programming for the simulated library squares game and introduction to the unit, and javascripts for feedback loops.

In order to assess if participants gained skills post-instruction, much effort was placed in formative testing of the criterion-based testing instrument. This phase of the development process required careful analysis of objectives, examination of the instruction to ensure that learners were exposed to material that corresponded to the stated objective, and construction of test items that corresponded to performance objectives. Fortunately, much of this work was derived from previous iterations of the course from the authors and instructors from University of South Florida.

Additional effort and time was required to conduct one-on-one trials and interviews to determine the clarity of the questions for both the comprehension and scavenger hunt tests. Modifications were made to test items and subsequent delivery of the online modules and tests allowed the researcher to conduct statistical analyses of the internal reliability of the instruments.

The following steps were followed and proved successful for both conditions.

1. Gagnè’s (1985) Events of Instruction were used to determine differences in instructional strategy and to distinguish between the treatment and comparison conditions.

2. Clear statements of learning objectives and correspondence of objectives to narrative material, exercise examples, and test items were developed.
3. Narrative screens and presentation of content (from scanned material from the textbook) were featured and identical graphical organizers in both conditions taken from the TILT Tutorial were used.

4. Text content was edited to convey an informal conversational tone.

5. Menu structure was revised from a frames-based design originally adapted from the University of Texas’ TILT (1997-2004) website to a table format to avoid confusion and information overload for end-users. The changes made to the vertical menu format within a table proved easier for students to navigate and revisions were based on observations and direct feedback during formative trials.

6. One-on-one trials were conducted with the scavenger hunt and qualitative “talk aloud” feedback was received. This assisted the researcher in determining whether students were able to perform searches without benefit of instruction. Large trials of the scavenger hunt were conducted with undergraduate groups to determine the clarity of multiple-choice questions. Statistical analyses were conducted to determine internal reliability of this instrument.

The researcher concluded that the cost necessary to include features for the treatment condition may not be warranted for this population sample. Replication of the research is recommended to determine whether comparable results with larger numbers support these findings.

Limitations of Instructional Delivery and Online Learning Literature

In most circumstances the Internet modules would be used not as stand-alone material. Teachers would most likely present the material to a group and guide students throughout the instruction. Students would have opportunities for discussion, questions,
peer to peer interaction and the like. For the present research modifications of the online units were made so that the converted textbook material could be used as a stand-alone online resource. A look at distance learning literature may explain the results in performance outcomes between groups.

A consensus has been established regarding the benefits and difficulties encountered within web-based learning environments compared to traditional face-to-face classroom settings. Russell (1999) coined the phrase “no significant difference” between distance learning and classroom instruction; however Russell’s studies focused on high achievers enrolled in classroom and distance learning venues.

Three recurrent themes in the literature emerge that influence the success or failure of student performance within web-based learning environments. They are; (1) inclusion of peer interaction and cooperative learning opportunities within the design of online courseware, (2) awareness of the benefits and difficulties inherent in online environments, and (3) awareness of affective factors that will enhance or diminish student performance (Perez-Prado, & Thirunarayanan, 2002).

The current study failed to account for the first of the factors, peer interaction and cooperative learning opportunities. The study focused on design of instructional materials not controlling for peer interaction. The in-person delivery of the material in a computer lab neither encouraged nor discouraged peer interaction. Each student was assigned a station and while students sat at adjacent workstations (within assigned groups), there was little conversation or cooperative interaction between them. When students had a question, they raised their hands for assistance and the instructor or researcher responded individually to a question concerning navigation or use of the digital stopwatch.

Regarding awareness of the benefits and difficulties inherent to online learning, an
obvious benefit is that online information literacy instruction can be distributed to large numbers of students in a school setting. A disadvantage of delivery of the material absent an instructor is the risk of losing student engagement due to absence of “instructor presence”. Studies reveal that student satisfaction and participation are weakened absent perceptions of instructor or fellow students as “real” in distance learning classrooms (Sherry et al., 1998; Gunawardena & Zittle, 1997).

Factors that can enhance or diminish student affect towards instruction include: (1) difficulties due to lack of technical support, (2) increased demand on time for implementation for faculty members, and (3) higher demands for responsibility and self-initiative on the part of the learner. A qualitative study by Perez-Prado and Thirunarayanan (2002) found that students worried about their abilities to complete an online educational methods course independent of an instructor. Kling and Hara (2000) found that students relied on self-judgment to assess the meaning of educational interactions, contributing to some learners’ anxiety in distance learning courses. The presence and quality of learner-to-learner interaction and learner-to-instructor interaction can either alleviate or exacerbate learner confusion and anxiety (Gunawardena & Zittle, 1997).

The aforementioned difficulties were not apparent during administration of the instruction for the present study. Students appeared thoroughly engaged in both conditions, were afforded the opportunity to ask questions of the instructor and researcher. The design of the modules led to few navigational difficulties for groups, comparison and treatment. The students demonstrated internal self-regulation and derived benefit of the instruction without the need for instructor presence. When debriefed, when asked by the researcher if anyone experienced confusion about how to approach the material or use the tools in the tutorial to perform the scavenger hunt, all responded that the graphical cues and menu
format was easy to follow. Due to learner characteristics with high ability students, the same results may not result upon replication of the study with students of lower ability or self-regulation.

Conclusion

The reader should note that even under less than ideal conditions, the research demonstrated that a systematic approach for conversion of textbook to web for an information literacy unit proved effective. Student performance on a retention and applied search performance task demonstrated acquisition of knowledge and skills following instruction equally for both content-centered and learner-centered approaches to WBI. The study documents how: existing material is converted for online instruction, tests are constructed to measure course objectives, and how the educator has a responsibility to demonstrate the effectiveness of instruction. Mean statistics on the AMP between groups revealed that students responded equally to both content-centered and learner-centered instructional designs. Results demonstrated that learners grew in understanding of the material and were able to apply skills attained from the instruction.

Summary of Limitations

The researcher chose a pretest-treatment-posttest experimental design to measure gains in learning post instruction. To avoid sampling bias and ensure equivalency of groups for the comparison and treatment conditions, students were matched within pairs and within pairs assigned randomly to one of two conditions; treatment and comparison.

Threats to internal validity for the pretest-treatment-posttest design included the following: (1) history or replication of the pretest following posttest without ample time allowed between administration of the instruments; (2) testing where the pretest alters
posttest responses and potentially negates the treatment; (3) instrumentation error due to
low reliability or content validity of the tests and potential order effect resulting when pre
and posttests follow the same order of questions. This may occur especially when both
treatment and comparison groups are located within the same or approximate physical
space.

The researcher altered the order of questions between pretest and posttest
administration to mitigate an order effect on performance outcomes. A time period of three
weeks was allotted between pretest and treatment. The comprehension posttest was
administered within a week of training and the scavenger hunt a week after the training.
Cronbach alpha coefficients were computed for the summer 2003 administration of the
pretest-posttest and for the May 2004 final study. Cronbach alpha dropped from $\alpha = 0.78$
(N = 44) to .6856 (N = 41). The statistical decrease in alpha level threatened the internal
validity of the pre - post - test instrument. Replication of this research would include an
increased number of test items and include fill-in-the-blank questions. Items should be
clustered to correspond to specific objectives so that one could discern objectives
consistently missed by many of the students. The uniform responses to three of the
questions on the scavenger hunt resulted in a low alpha of .5647. The researcher concluded
that the three items may have been too easy and need modifications for future research. To
increase the reliability of the Internet hunt, one needs to add more test items including those
that ask for fill-in-the-blank responses.

Influence from instructor or researcher presence was eliminated in the procedure as
much as possible. The researcher prepared the environment i.e., launched the websites on
the students’ desktops, started the stopwatch, and told students one-by-one where to station
themselves. The language arts instructor was present as well as the primary researcher
throughout the training module. The researcher refrained from interaction with students while present in the lab while remaining “as invisible as possible”. Technical assistance only was provided when a student raised his or her hand for instructions. Students remained relatively silent during the procedure.

Threats to external validity included interaction between selection of the sample and treatment. As indicated in the discussion, the results cannot be generalized beyond the sample population. The research site represents a suburban magnet school for high achievement students. The school is an exemplary program and does not allow the researcher to generalize beyond the local middle school population.

Post hoc sample size estimates and power analysis indicated that larger numbers of students were needed to determine whether the features of the treatment condition warranted the extensive development. Further, the sample of highly self-motivated students may not be the best population for testing the effectiveness of the added features in the treatment condition. These students may benefit regardless of instructional strategy.

Statistical limitations included low reliability scores for the comprehension and performance instruments, thus resulting in high standard error. Sample size was relatively small ($N = 41$) given that alpha was set at $p < .05$. Replication of the study with larger numbers would increase power and the researcher could have computed sample size based on an effect size of .80 and alpha at .05 prior to implementation of the final research. The fact that both comparison and treatment groups excelled and the sample comprised high achieving middle school students may be attributed to learner characteristics being correlated with the sought outcomes of the dependent variable.
Summary of Implications

The previous discussion focused on characteristics of learners who successfully engage in WBI as well as those common features of instructions that proved fruitful for the sample of high ability learners for the present study. The objectives of the modules regardless of learner-centered or content-centered appealed to students. The characteristics of the learners were ideal for a learner-centered approach to the instruction. What remains unanswered is whether the findings can be generalized across other ability levels, perceptions towards learning modules with varied sample populations, and whether the additional expense can be justified with adoption of a content-centered approach to online instruction.

Study Informs Practice

The present study confirms the literature regarding design and high ability learners. If educators develop tutorial units for high achieving or advanced classes of students, it is likely the students will gain skills using a lean design, one that affords high learner control. Text materials need to be reorganized using overview of concepts screens, links for students to explore and experiment with concepts, practice screens, graphic organizers, and visual cues that inform the learner of her/his progression through the material. Designers would be well advised that prescriptions outlined by Chung and Reigeluth (1992) that describe a conditions – method- outcome model are supported by the current study.

The software for both comparison and treatment modules converts previous print material for WBI delivery; however both modules may be used as multimedia software viewed through a web browser. These modules may be used by future practitioners to teach Internet research skills. As practitioners design former print formats for WBI or computer-assisted-instruction, they would benefit from examination of Alessi and Trollip’s (2001)
Multimedia for learning: methods and development for features proven effective for tutorial development in the current study.

Recommendations for Future Research

A logical replication of the study would be to examine the effect of the two instructional conditions with varied levels of academic ability to determine if a treatment interaction effect would emerge between groups given lower achieving student sample. The high ability group showed no significant correlation between achievement and motivation score on the Academic Motivation Profile (Carey, 1994). This may not be the case given less academically gifted learners that represent a more generalized population of students.

The population sample consisted of high ability eighth grade students supervised in a computer laboratory setting. An earlier pilot in the Summer of 2003 with undergraduate students took place via distance learning. The higher score reports on posttests from students who received instruction under supervision indicates further research is recommended. Research is needed to determine whether performance results differ when high ability students are provided a distance learning venue with the same materials.

High ability middle school students absent an external incentive, such as additional points added to their grade, appeared eager to participate in the research and demonstrated high levels of concentration. Replication of the study would strengthen results with a different group of high ability students from a comparable school. Receptivity to the material measured by the modified AMP appeared consistent across both groups. Neither group statistically reported preference for a content-centered or learner-centered design, however anecdotal feedback indicated the treatment module sustained students’ attention and increased confidence. The implication of the AMP results calls for replication of the study.
with larger sample sizes.

The study addresses the question of cost-benefit use of a systematic online design process for the delivery of textbook content. Even in the comparison condition, it appears insufficient for instructional purposes to simply scan in text, insert hyperlinks, and provide performance tests to determine the effectiveness of the instruction. Attention must be paid to menu structure, navigation, presentation of examples and non-examples, tone and structure of the narrative content, instructional strategies for delivery of practice exercises, and technical skill of the instructor for conversion of the material formerly in paper format to digital delivery. Further, formative trials of the materials are optimal so that the instructor can gauge the usability of the converted web-based content with a wide variety of student groups. However, addition of features associated with classroom instruction to include program controlled sequence, guided practice and feedback, embedded review quizzes, and simulated searches may not be warranted for high ability students. The aforementioned features may be necessary for lower achieving students and calls for further investigation.

The relationship between student achievement and any of the factors of the AMP was statistically insignificant. Performance measures indicated the sample did not surpass those students assigned to the learner-centered module. Cost in terms of time and money to produce the content-centered approach was not justified given the results of this research. Results are inconclusive with respect to cost-benefit analysis of a content-centered versus learner-centered approach to WBI. Replication of the study may determine if the cost produces greater benefit for a wider audience of learners.

These results suggest that replication in whole or in part are appropriate; the new results can be used to support or extend the findings of this study. There are several issues that should be considered when replicating this study. First, modifications to the Internet
Scavenger Hunt to increase the internal reliability of the instrument include adding items, clustering the questions based on unit objectives, and inserting fill-in-the-blank answer formats. Parallel tests for the pre and comprehension posttests are needed to ensure that history does not threaten the internal or external validity of the research design. Timing for administration of the posttest for knowledge of Internet research tools suggest the test measured retention of verbal information, not necessarily measuring a learner’s ability to comprehend or apply the instruction to different contexts. Upon replication of the study, the researcher suggests that students take the test immediately following training. Further, students could use the tutorial as a reference aid to assess comprehension and application of rules regarding Internet research. Discrepancies between verbal feedback and scores on the modified AMP suggest that modifications in procedure and timing of administration of the instrument may be necessary. The delay in administration of the AMP posed a problem. The researcher suggests that narrative feedback immediately following training and distribution of the AMP at that time may yield more accurate responses.

The investigator recommends a two-by-two mixed factorial quasi-experimental design to determine if a content-centered versus learner-centered online module will benefit students of low achievement compared to high ability classes. Teacher training to familiarize the class instructor with both versions of the online modules would afford the students an opportunity to work with familiar classroom teachers and minimize the researcher’s influence. To create a more authentic teaching and learning environment, instructors serve as guides to assist students through the online modules. To mitigate the influences of students divided into two groups in the same computer lab, one low achievement and one high achievement class would be assigned as a whole group to either the treatment or comparison condition.
During the research, a digital stopwatch estimated time to complete the modules. A method to determine time on task less prone to human error is preferable for future research. Mean time on task estimates show an insignificant difference in time between the two groups assigned to either the treatment or comparison module, however these estimates are not reliable. Further time on task may reveal larger differences between low and high achieving students. A possible study entails replication of the materials with low achieving classes and use time as a dependent variable along with performance test scores.

Other questions worthy of investigation include the following: (1) How do students perform when presented a content-centered versus learner-centered online module when the instruction is facilitated by the classroom teacher? (2) Do low achieving students perform better when provided a content-centered versus learner-centered instructional design? (3) Will low achieving students prefer the content-centered treatment design over the learner-centered comparison design? (4) What is the relationship between students’ standardized reading scores and achievement on the Internet training module? (5) What is the relationship between students’ standardized scores on information skills based on the Iowa Test of Basic Skills (ITBS) and performance outcomes on the Internet training modules?

The questions form the basis for further research and are only a sample of how the data from the present study may be investigated in the future. The present research supports the use of a systematic design process used to convert traditional textbook content for WBI. Regardless of whether the designer supports a learner-centered approach to course development or content-centered approach, the process of converting text to Web-Based-Instruction is lengthy and requires forethought based on learner characteristics, educational philosophy, and practical considerations.
References


*Educational Technology, 32*(10), 14-20.


Repman, J., & Carlson, R. D. (1999). Feature - Surviving the Storm: Using Metasearch Engines Effectively - These experts offer explanations on the several different types
of metasearch tools and reveal the results of their study as to which ones work the best. *Computers in libraries, 19*(5), 50-57.


Appendices
Table A-13

Derivation of Test Questions for Pretest and Posttest Comprehension

<table>
<thead>
<tr>
<th>Performance Objective</th>
<th>Bloom’s Level of Objective</th>
<th>Parallel Test Item</th>
</tr>
</thead>
</table>
| Upon completion of the TILT Search Unit, the student will identify methods of selection for search terms, construct synonyms for key words, and phrases through brainstorming activities | Knowledge level: knowledge of terminology, ways or means of dealing with specifics, methodology. | Knowledge defined as remembering appropriate, previously learned information | Question: **Choose ALL ANSWERS that apply.** Of the following, choose those items that represent effective strategies for choosing search terms. Answers:  
- Write out your topic in a few sentences  
- Highlight the main terms and phrases  
- Brainstorm synonyms, broader terms, and narrower terms  
- List abbreviations and alternate spellings of words  
- Check a subject encyclopedia for ideas and concepts  
All answers are correct: multiple answer
Question: Choose TWO of the following choices. Which of the following are effective Web search strategies?

- Analyze which search engine is better for your topic than the others
- Make sure to search with broad terms and use OR with alternate spellings or meanings
- Check in virtual libraries, subject directories, and metasearch engines for all possible combinations of source material
- Pick only the first few results because they will be most relevant
- Construct your search using phrases and quotation marks and compare two or more search engines for results

Answer: Numbers 1 and 5

Knowledge level: knowledge

Question: Of the following examples, which is NOT a
<table>
<thead>
<tr>
<th>Performance Objective</th>
<th>Bloom's Level of Objective</th>
<th>Parallel Test Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student will identify the four major categories of Internet search tools as outlined in the Library and Internet Research Skills course.</td>
<td>of terminology, expressed as verbal information level</td>
<td>category of Internet research tool?</td>
</tr>
<tr>
<td>The student distinguishes the characteristics of a specialized database</td>
<td>Application level: use of previously learned information in new and concrete situations</td>
<td>Which of the following Internet sites is NOT an example of a specialized database:</td>
</tr>
<tr>
<td>Student will be able to identify the characteristics of each of the four categories of Internet tools: virtual libraries, specialized databases, general subject directories, and search engines.</td>
<td>Comprehension level: grasping the meaning of the instructional materials</td>
<td>Which statement about virtual libraries is NOT true?</td>
</tr>
</tbody>
</table>

- Usenet, Listserv, or Newsgroup
- Generalized subject directory
- Search Engine
- Specialized Database
- Virtual Library

Answer is number 1

Correct answer is b

- Mapquest.com
- Yahoo.com
- Homedepot.com
- Imdb.com

Correct answer is b

- Virtual libraries allow you to search within subject categories
- Virtual libraries all use sites reviewed by professionals in their field
- Virtual libraries select sources according to relevance and accuracy of information
<table>
<thead>
<tr>
<th>Performance Objective</th>
<th>Bloom's Level of Objective</th>
<th>Parallel Test Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student will be able to distinguish the characteristics among virtual libraries and demonstrate when to use a particular site when presented an information problem.</td>
<td>Application level: use of previously learned information given novel situation and Analysis - differentiates among search tools given an information problem.</td>
<td>Unlike general directories, virtual libraries link to thousands of websites not millions. Correct answer is number 2. You have to find examples of lessons on the Civil War for your high school sophomore American History class. Of the following virtual libraries, which is the best choice? 1. Internet Public Library 2. WWW Virtual Library 3. Infomine.</td>
</tr>
</tbody>
</table>

The student will be able to identify methods of searching general subject directories, virtual libraries, and specialized databases. | Comprehension level: grasping the meaning of informational materials | What method would you use to search for information in a general subject directory? 1. domain and URL 2. web address and date 3. browse and search 4. subject and keyword 5. title and author. Correct answer 3. |

The student will be able to differentiate use of a subject directory and use of a search directory and purpose of subject directory and search. | Analysis level: Student differentiates purpose of | Complete this analogy: A generalized subject directory is to search engine as: dictionary is to thesaurus. |
<table>
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<tr>
<th>Performance Objective</th>
<th>Bloom's Level of Objective</th>
<th>Parallel Test Item</th>
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</thead>
<tbody>
<tr>
<td>engine</td>
<td>engine</td>
<td>• movie schedule is to movie reviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• table of contents is to an index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• atlas is to street map</td>
</tr>
<tr>
<td>Correct answer is table of contents to index</td>
<td></td>
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</tr>
</tbody>
</table>

Student when presented an information problem will recognize the appropriateness of use of a search engine and when to use a subject directory is in order.

Application level: student determines the appropriateness of one tool over another regarding use of a subject directory and search engine.

Question: Imagine you are searching for Claude Monet's painting "The Sunflowers". Choose the best search strategy from each of the examples below.

1. In Yahoo, search under the heading Arts and Humanities, subcategory Visual Art, subcategory Painting, Artists, Masters, Claude Monet
2. Look in Google and search under images. Type the words "The Sunflowers" AND Monet in the search field.
3. Type "The Sunflowers" in Yahoo.

Correct answer is number 2
<table>
<thead>
<tr>
<th>Performance Objective</th>
<th>Bloom's Level of Objective</th>
<th>Parallel Test Item</th>
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</thead>
<tbody>
<tr>
<td>Students will be able to combine search terms effectively.</td>
<td>Application level: Given a rule statement, students use prior knowledge of punctuation used around phrase searches to obtain information.</td>
<td>You need to find information on Lincoln's Gettysburg Address. What punctuation would you use to search for the phrase Gettysburg Address? 1. parentheses 2. apostrophe 3. commas 4. quotation marks The answer is number 4</td>
</tr>
<tr>
<td>Sub-objective: The student will use quotation marks around a phrase when searching for adjacent words in a specified order of appearance.</td>
<td>Application level: Student will identify the correct punctuation for a wildcard character.</td>
<td>You have an assignment that requires you to look up information on diabetes. You know that there are various methods to search for diabetes that include variant forms of the word: diabetes, diabetic, diabetics,</td>
</tr>
<tr>
<td>Students will be able to combine search terms effectively.</td>
<td>Application level: The student will use an asterisk as a wildcard character for words.</td>
<td></td>
</tr>
<tr>
<td>Performance Objective</td>
<td>Bloom's Level of Objective</td>
<td>Parallel Test Item</td>
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<tr>
<td>------------------------</td>
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</tr>
<tr>
<td>of alternate spelling.</td>
<td>Analysis level: breakdown of informational materials into component parts- keyword recognize or distinguish among statements</td>
<td>etc. Select the command that would retrieve all the variants of this term. 1. diab? 2. diabet* 3. diabetic&quot; 4. diabet! The answer is number 2</td>
</tr>
<tr>
<td>Student can correctly recognize use of a nested statement</td>
<td>Analysis level: student must break down or analyze component part – must be able to distinguish cause and effect</td>
<td>Of the following search commands, which is a correctly written nested statement? 1. &quot;rain OR snow&quot; OR sleet 2. (townhouse AND condominium) 3. &quot;hotel OR motel&quot; OR &quot;Holiday Inn&quot; 4. (townhouse OR timeshare) AND &quot;Orlando, FL&quot;</td>
</tr>
<tr>
<td>Student predicts the effect of the operator OR on search results when students are posed with a research question</td>
<td>Analysis level: student must break down or analyze component part – must be able to distinguish cause and effect</td>
<td>You are assigned a research paper on World War II and the Holocaust. From what you know about Boolean operators, use a search command that will retrieve the largest number of results. 1. WWII AND Holocaust 2. (&quot;World War II&quot; OR WWII) AND Holocaust</td>
</tr>
<tr>
<td>Performance Objective</td>
<td>Bloom's Level of Objective</td>
<td>Parallel Test Item</td>
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</tr>
<tr>
<td>Identify search statements with Boolean operators and match statements to expected results</td>
<td>Analysis level: keywords are identify and match, requires student to breakdown statements and match them to rule outcomes</td>
<td>Match the following search commands and the expected results.</td>
</tr>
<tr>
<td>Provided a search problem, student is able to compose a search statement that uses a NOT operator to exclude information from search results.</td>
<td>Synthesis level: keyword is compose and requirement of student’s verbal recall and ability to apply a rule to a given situation.</td>
<td>You are assigned a research paper on the Taj Mahal in India. How would you write a search statement that excludes information about a casino or Donald Trump in Las Vegas?</td>
</tr>
</tbody>
</table>

3. (“World War II” OR WWII) AND (Holocaust OR "concentration camp")

4. "World War II" AND Holocaust

Correct answer is number 3

Match to:

1. “Thomas Jefferson” OR “Benjamin Franklin”
2. “Bed and Breakfast” + “Savannah, Georgia”
3. China – dishes

Match to:

a. Expands search results
b. Eliminates particular results
c. Specifies search results (narrows)
<table>
<thead>
<tr>
<th>Performance Objective</th>
<th>Bloom's Level of Objective</th>
<th>Parallel Test Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provided a search problem, student is able to compose a search statement that uses an OR operator to increase search results.</td>
<td>Comprehension level: student grasps meaning and identifies the appropriate operator according to previous learning of a rule regarding an OR statement</td>
<td>&quot;Taj Mahal&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &quot;Donald Trump&quot; – casino</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &quot;Taj Mahal&quot; – &quot;Donald Trump&quot; + casino</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &quot;Taj Mahal&quot; + India - &quot;Donald Trump&quot; – casino</td>
</tr>
<tr>
<td>Correct answer is the 4th</td>
<td></td>
<td>You have a research assignment on former President Jimmy Carter. What operator would you use between “Jimmy Carter”, “President James E. Carter” to increase the number of search results?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ELSE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• OR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• AND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• NOT</td>
</tr>
<tr>
<td>The correct answer is OR</td>
<td></td>
<td>You're getting ready to buy a new dog. You can't decide if you want a miniature or a toy poodle so you seek breeders for both. Specifically, you want lists of breeders within the state of Florida who specialize in EITHER miniature OR toy</td>
</tr>
<tr>
<td>Performance Objective</td>
<td>Bloom's Level of Objective</td>
<td>Parallel Test Item</td>
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<tr>
<td>------------------------</td>
<td>-----------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Students can define the</td>
<td>Knowledge level – student</td>
<td>poodles. How would you write a</td>
</tr>
<tr>
<td>purpose and characteristics</td>
<td>can define the term metasearch engine</td>
<td>search statement that will find this</td>
</tr>
<tr>
<td>of a metasearch engine.</td>
<td>Knowledge level – metasearch engine</td>
<td>information?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Breeders AND Florida</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AND poodles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Poodles AND miniature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AND toy AND breeders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. (miniature OR toy)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AND poodles AND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Florida AND breeders</td>
</tr>
<tr>
<td>Correct answer is c.</td>
<td></td>
<td>An Internet tool that allows you</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to create one command for multiple databases is a…</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Virtual library</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Metasearch engine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Specialized database</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. General directory</td>
</tr>
<tr>
<td>Correct answer is b</td>
<td></td>
<td>What techniques (choose one of the following pairs) would you use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to search for information in a general subject directory?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Domain and URL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Web address and date</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Browse and search</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Subject and keyword</td>
</tr>
<tr>
<td>Performance Objective</td>
<td>Bloom's Level of Objective</td>
<td>Parallel Test Item</td>
</tr>
<tr>
<td>-----------------------</td>
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<td>--------------------</td>
</tr>
<tr>
<td>e. Title and author</td>
<td></td>
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</table>

Note: These question stems have been modified according to statistics and feedback performed after the pilot. Those questions having a $p$ value of less than 0.33 were modified for greater clarity.
Table A-14

Cronbach Alpha on Summer 2003 USF Students Posttest Scores

Reliability Analysis Scale (Alpha)

N of Cases = 44

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale Mean if Item is Deleted</th>
<th>Scale Variance if Item is Deleted</th>
<th>Corrected Item Total</th>
<th>Alpha if Item is Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1a</td>
<td>19.7955</td>
<td>16.6781</td>
<td>.4518</td>
<td>.7751</td>
</tr>
<tr>
<td>Q1b</td>
<td>19.6136</td>
<td>17.8705</td>
<td>.2555</td>
<td>.7854</td>
</tr>
<tr>
<td>Q1c</td>
<td>19.5682</td>
<td>18.2511</td>
<td>.1650</td>
<td>.7883</td>
</tr>
<tr>
<td>Q1d</td>
<td>19.6818</td>
<td>17.8499</td>
<td>.1759</td>
<td>.7883</td>
</tr>
<tr>
<td>Q1e</td>
<td>19.8409</td>
<td>17.4857</td>
<td>.2040</td>
<td>.7886</td>
</tr>
<tr>
<td>Q2c</td>
<td>19.6591</td>
<td>17.9508</td>
<td>.1589</td>
<td>.7888</td>
</tr>
<tr>
<td>Q2d</td>
<td>19.5682</td>
<td>18.5301</td>
<td>-.0513</td>
<td>.7921</td>
</tr>
<tr>
<td>Q3</td>
<td>19.8864</td>
<td>17.7775</td>
<td>.1184</td>
<td>.7937</td>
</tr>
<tr>
<td>Q4</td>
<td>19.6364</td>
<td>17.4461</td>
<td>.3934</td>
<td>.7804</td>
</tr>
<tr>
<td>Q5</td>
<td>19.7727</td>
<td>16.9239</td>
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<tr>
<td>Q6</td>
<td>20.0455</td>
<td>16.4165</td>
<td>.4426</td>
<td>.7749</td>
</tr>
<tr>
<td>Q7</td>
<td>19.8409</td>
<td>17.2997</td>
<td>.2536</td>
<td>.7859</td>
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<tr>
<td>Q8</td>
<td>19.7273</td>
<td>17.1332</td>
<td>.3718</td>
<td>.7797</td>
</tr>
<tr>
<td>Q9</td>
<td>20.1136</td>
<td>16.7077</td>
<td>.3729</td>
<td>.7793</td>
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## Development and Validation

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Reliability Coefficients  27 items

Alpha = .7891  Standardized item alpha = .7798
Table A-15

*Cronbach Alpha on Spring 2004 Chamblee Middle School 8th Grade Posttest Scores*

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Note: Q1C has zero variance  Q20C has zero variance

Reliability Coefficients 25 items
Alpha = .6563  Standardized item alpha = .6856
Appendix A Continued

Table A-16

*Frequency Distribution Test Items 2004 Chamblee Middle School 8th Grade Posttest Scores*

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Appendix A Continued

Pretest on your Knowledge of Internet Search Tools

Instructions: The quiz you are about to take is for research purposes only. Before you will begin your training in the computer lab, please take the following pretest. Once we have obtained a group of scores, we will assign you randomly to one of two tutorial groups. None of your scores will count against you. We are looking for gains in your score from pretest and after taking the tutorial, posttest on these same concepts. There is no risk to your grade for your participation. Here's a chance to gain some additional skills. At the conclusion of the research, you will be treated to a pizza party during your language arts class!

You have 30 minutes for the quiz. Take your time, and have fun and thanks for your participation!!

Question 1  Multiple Answer  5 points
Of the following, CHOOSE ALL ANSWERS THAT APPLY that represent good practices for choosing search terms?
   a)  Write out your topic in a few sentences
   b)  Highlight the main terms and phrases
   c)  Brainstorm synonyms, broader terms, and narrower terms
   d)  List abbreviations and alternate spellings of words
   e)  Check a subject encyclopedia for ideas and concepts

Question 2  Multiple Answer  5 points
CHOOSE TWO FROM THE FOLLOWING CHOICES. Which of the following are effective Web search strategies?
   a)  Search using all capital letters for more emphasis
   b)  Choose just one search engine and never leave it
   c)  Use phrases surrounded by quotation marks for more specific results
   d)  Scan a subject list and then search by keyword or phrase within the subject category for specific information
   e)  Look through every site you retrieve to choose the best ones

Question 3  Multiple Choice  5 points
The difference between a search engine and subject directory is….
   a)  One uses commands, the other does not
   b)  One contains driving directions, the other recipes
   c)  One gives phone numbers and addresses, the other gives zipcodes
   d)  One is organized into categories by subject, the other searches by word
Appendix A Continued

**Question 4** Multiple Choice 5 points
Of the following examples, which is **NOT** a category of Internet research tool?

a) Usenet, Listserv, or News group  

b) Generalized subject directory  

c) Search Engine  

d) Specialized database  

e) Virtual library

**Question 5** Multiple Choice 5 points  
An Internet tool that allows you to create one command for multiple databases is a...

a) virtual library  

b) metasearch engine  

c) specialized database  

d) general directory

**Question 6** Multiple Choice 5 points  
Which statement about virtual libraries is **true**?

a) Virtual libraries do not contain subject categories  

b) Most virtual libraries use reviewers to select sites within categories  

c) Virtual libraries link to millions of websites  

d) You cannot search by keyword within categories on virtual libraries

**Question 7** Multiple Choice 5 points  
Imagine you are searching for Claude Monet's painting "The Sunflowers". Choose the best search strategy from each of the examples below.

a) In Yahoo, search under the heading Arts and Humanities, subcategory Visual Art, subcategory Painting, Artists, Masters, Claude Monet  

b) Look in Google and search under images. Type the words "The Sunflowers" AND Monet in the search field.  

c) Type "The Sunflowers" in Yahoo.

**Question 8** Multiple Choice 5 points  
Which of the following Internet tools is **NOT** an example of a specialized database?

a) mapquest.com  

b) yahoo.com  

c) homedepot.com  

d) imdb.com

**Question 9** Multiple Choice 5 points  
What is an easy technique to search for information in a general subject directory?

a) Search for a URL  

b) Enter a WEB address  

c) browse the subject heading or search by keyword  

d) search by the author
Appendix A Continued

**Question 10** Multiple Choice 5 points
How much information can be access by Internet search engines?
- a) All of it
- b) More than half
- c) Less than half
- d) A small fraction

**Question 11** Multiple Choice 5 points
You need to find information on Lincoln's Gettysburg Address. What punctuation would you use to search for the phrase Gettysburg Address?
- a) parentheses
- b) apostrophe
- c) commas
- d) quotation marks

**Question 12** Multiple Choice 5 points
What kind of information could you find in a virtual library?
- a) A dictionary and thesaurus
- b) Driving directions
- c) Current weather forecast
- d) Recipes for your favorite dishes

**Question 13** Multiple Choice 5 points
You are assigned a research paper on World War II and the Holocaust. From what you know about this subject, select the search command that will bring you the **MOST NUMBER** of results.
- a) WWII AND Holocaust
- b) ("World War II" OR WWII) AND Holocaust
- c) ("World War II" OR WWII) AND (Holocaust OR "concentration camp")
- d) "World War II" AND Holocaust

**Question 14** Multiple Choice 5 points
You are assigned a research paper on the Taj Mahal in Asia. How would you write a search statement that excludes information about a casino or Donald Trump in Las Vegas?
- a) casino + "Donald Trump" - "Taj Mahal"
- b) "Donald Trump" - casino
- c) "Taj Mahal" - "Donald Trump" + casino
- d) "Taj Mahal" + India - "Donald Trump" - casino

**Question 15** Multiple Choice 5 points
Of the following search commands, which is a correctly written nested statement?
- a) rain OR snow OR sleet
- b) townhouse AND condominium
- c) hotel OR motel OR "Holiday Inn"
- d) (townhouse OR timeshare) AND "Orlando, FL"
Question 16  Multiple Choice  5 points
You have a research assignment on former President Jimmy Carter. Which of the following phrases will you want to include to increase the number of search results you wish to obtain?
   a) “Jimmy Carter” ELSE “President James E. Carter”
   b) “Jimmy Carter” OR “President James E. Carter”
   c) “Jimmy Carter” AND “President James E. Carter”
   d) “Jimmy Carter” NOT “President James E. Carter”

Question 17  Multiple Choice  5 points
You have an assignment that requires you to look up information on diabetes. You know that there are various methods to search for diabetes that include variant forms of the word: diabetes, diabetic, diabetics, etc. Select the command that would retrieve all the variants of the term.
   a) diab?
   b) diabet*
   c) diabetic"
   d) diabet!

Question 18  Multiple Choice  5 points
You're getting ready to buy a new dog. You can't decide if you want a miniature or a toy poodle so you seek breeders for both. Specifically, you want lists of breeders within the state of Florida who specialize in EITHER miniature OR toy poodles. How would you write a search statement that will find this information?
   a) breeders AND Florida AND poodles
   b) poodles AND miniature AND toy AND breeders
   c) (miniature OR toy) AND poodles AND Florida AND breeders

Question 19  Matching  5 points
Match the following search commands and the expected results.

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<th>Search Command</th>
<th>Expected Result</th>
</tr>
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<td>&quot;Thomas Jefferson&quot; OR &quot;Benjamin Franklin&quot;</td>
<td>a) expands search results: increases the number of results</td>
</tr>
<tr>
<td>&quot;Bed and Breakfast&quot; AND &quot;Savannah, Georgia&quot;</td>
<td>b) excludes possible results that are misleading</td>
</tr>
<tr>
<td>China NOT dishes</td>
<td>c) narrows a search: decreases number of results</td>
</tr>
</tbody>
</table>

Question 20  Multiple Choice  5 points
A subject directory organizes information into categories. Information within categories is organized from
   a) fat to thin
   b) specific to broad
   c) tall to short
   d) broad to specific
Posttest on your Knowledge of Internet Search Tools

Instructions: The quiz you are about to take is for research purposes only. There is no risk to your grade for your participation. Once you have completed the posttest, you will have an opportunity to take the Internet Scavenger Hunt. Neither of your scores will count against your grade in this class. When we conclude the research, look forward to a pizza party as a thank you for your participation.

Your Name: _____________________________________________
Group: One or Two (circle the appropriate choice)
Time to complete the Tutorial: _____________________________
(recorded from the digital stopwatch)

Question 1 Multiple Answer 5 points
Of the following, **CHOOSE ALL ANSWERS THAT APPLY** that represent good practices for choosing search terms.

- a) Write out your answer in a few sentences
- b) Highlight the main terms and phrases
- c) Brainstorm synonyms, broader terms, and narrower terms
- d) List abbreviations and alternate spellings of words
- e) Check a subject encyclopedia for ideas and concepts

Question 2 Multiple Choice 5 points
You have a research assignment on former President Jimmy Carter. Which of the following phrases will **increase** the number of search results you obtain?

- a) “Jimmy Carter ELSE “President James E. Carter”
- b) “Jimmy Carter OR “President James E. Carter”
- c) “Jimmy Carter AND “President James E. Carter”
- d) “Jimmy Carter NOT “President James E. Carter”

Question 3 Multiple Choice 5 points
You have an assignment that requires you to look up information on diabetes. You know that there are various methods to search for diabetes including the variant forms of the word: diabetes, diabetic, diabetics, etc. Select the command that would retrieve all the variants of the term.

- a) diab?
- b) diabet*
- c) diabetic”
- d) diabet!
Appendix A Continued

**Question 4**  Multiple Choice  
What kind of information could you find in a virtual library?
- a) A dictionary and thesaurus
- b) Driving directions
- c) Current weather forecast
- d) Recipes for your favorite dishes

**Question 5**  Multiple Choice  
You need to find information on Lincoln’s Gettysburg Address. What punctuation would you use to search for the phrase Gettysburg Address?
- a) parentheses
- b) apostrophe
- c) commas
- d) quotation marks

**Question 6**  Multiple Choice  
You’re getting ready to buy a new dog. You can’t decide if you want a miniature or a toy poodle so you seek breeders for both. Specifically you want lists of breeders within the state of Florida who specialize in EITHER miniature OR toy poodles. How would you write a search statement that will find this information?
- a) Breeders AND Florida AND poodles
- b) Poodles AND miniature AND toy AND breeders
- c) (miniature OR toy) AND poodles AND Florida AND breeders

**Question 7**  Matching  
Match the following search commands and the expected results

<table>
<thead>
<tr>
<th>Search Command</th>
<th>Expected Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Thomas Jefferson” OR “Benjamin Franklin” (choose a, b, or c)</td>
<td>a) expands search results: increases the number of results</td>
</tr>
<tr>
<td>“Bed and Breakfast” AND “Savannah, Georgia” (choose a, b, or c)</td>
<td>b) excludes possible results that are misleading</td>
</tr>
<tr>
<td>China NOT dishes (choose a, b, or c)</td>
<td>c) narrows a search: decreases number of results</td>
</tr>
</tbody>
</table>

**Question 8**  Multiple Choice  
You are assigned a research paper on World War II and the Holocaust. From what you know about this subject, select the search command that will bring you the MOST NUMBER of results.
- a) WWII AND Holocaust
- b) (“World War II” OR WWII) AND Holocaust
- c) (“World War II” OR WWII) AND (Holocaust OR “concentration camp”)
- d) “World War II” AND Holocaust
Appendix A Continued

**Question 9**  Multiple Choice  5 points
A subject directory organizes information into categories. Information within categories is organized from….
  a) fat to thin
  b) specific to broad
  c) tall to short
  d) broad to specific

**Question 10**  Multiple Choice  5 points
An Internet tool that allows you to create one command for multiple databases is a…
  a) virtual library
  b) metasearch engine
  c) specialized database
  d) general directory

**Question 11**  Multiple Choice  5 points
The difference between a search engine and subject directory is….
  a) One uses commands, the other does not
  b) One contains driving directions, the other recipes
  c) One gives phone numbers and addresses, the other gives zipcodes
  d) One is organized into categories by subject, the other searches by word

**Question 12**  Multiple Choice  5 points
Imagine you are searching for a picture of Claude Monet’s painting “The Sunflowers”. Choose the search strategy that will give you the correct answer most quickly.
  a) In Yahoo, search under the heading *Arts and Humanities*, sub-category *Visual Art*, sub-category *painting, Artists*, sub-category *Masters*, subject *Claude Monet*
  b) Look in Google and search under images. Type the words “The Sunflowers” AND Monet in the search field
  c) Type “The Sunflowers” in Yahoo

**Question 13**  Multiple Choice  5 points
Of the following examples, which is **NOT** a category of Internet research tool?
  a) Usenet, Listserv, or Newsgroups
  b) Generalized subject directory
  c) Search Engine
  d) Specialized Database
  e) Virtual Library

**Question 14**  Multiple Choice  5 points
Of the following search commands, which is a correctly written nested statement?
  a) rain OR snow OR sleet
  b) townhouse AND condominium
  c) hotel OR motel OR “Holiday Inn”
  d) (townhouse OR timeshare) AND “Orlando, Florida”
Appendix A Continued

**Question 15**  Multiple Choice  
What is an easy technique to search for information in a general subject directory?  
- a) search for a URL  
- b) enter a web address  
- c) browse the subject heading or search by keyword  
- d) search by the author

**Question 16**  Multiple Choice  
How much information can be accessed through the Internet search engines?  
- a) all of it  
- b) more than half  
- c) less than half  
- d) a small fraction

**Question 17**  Multiple Choice  
Which of the following tools is **NOT** an example of a specialized database?  
- a) mapquest.com  
- b) yahoo.com  
- c) homedepot.com  
- d) imdb.com

**Question 18**  Multiple Choice  
Which statement about virtual libraries is **true**?  
- a) Virtual libraries do not contain subject categories  
- b) Most virtual libraries use reviewers to select sites within categories  
- c) Virtual libraries link to millions of websites  
- d) You cannot search by keyword within categories on virtual libraries

**Question 19**  Multiple Choice  
You are assigned a research paper on the Taj Mahal in Asia. How would you write a search statement that **excludes** information about a casino or Donald Trump in Las Vegas?  
- a) Casino + “Donald Trump” – “Taj Mahal”  
- b) “Donald Trump” - casino  
- c) “Taj Mahal” – “Donald Trump” + casino  
- d) “Taj Mahal”+ India  – “Donald Trump” - casino

**Question 20**  Multiple Answer  
**CHOOSE TWO FROM THE FOLLOWING CHOICES.** Which of the following are effective web search strategies?  
- a) Search using all capital letters for greater emphasis  
- b) Choose just one search engine and never leave it  
- c) Use phrases surrounded by quotation marks for more specific results  
- d) Scan a subject list and then search by keyword or phrase within the subject category for specific information  
- e) Look through every site you retrieve to choose the best ones
Appendix A Continued

Note: The final revisions for the pre and posttest derived from p-values of Summer 2003 administration of the instrument. No Cronbach alpha computations performed on the Fall 2003 administration of the test with alternate group of 8th grade students from Chamblee Middle School.
Appendix B

Table B-17

*Conceptual Framework for Two Modules Comparison and Treatment*

<table>
<thead>
<tr>
<th>Features for each Gagne’s Events of Instruction</th>
<th>Conversion Frederick-Smith to web: high learner control</th>
<th>Structured guided practice-feedback: higher program control and content-centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gain attention:</td>
<td>Very little is included to gain the attention of the learner.</td>
<td>Opening screen with question posed…what is information literacy? Takes user to flash screen with bubbles about misconceptions of Internet.</td>
</tr>
<tr>
<td>Contextualize</td>
<td>The instructor may assume that by directly stating the objectives on a screen in terms of what the student will be able to do or grasp, the learner will be motivated to engage in the material.</td>
<td>Use of metaphors and graphics to stimulate recall of previously learned constructs in light of new information.</td>
</tr>
<tr>
<td>instruction to allow</td>
<td>that by directly stating the objectives on a screen in terms of what the student will be able to do or grasp, the learner will be motivated to engage in the material.</td>
<td></td>
</tr>
<tr>
<td>the learner to take</td>
<td>objectives on a screen in terms of what the student will be able to do or grasp, the learner will be motivated to engage in the material.</td>
<td></td>
</tr>
<tr>
<td>ownership of the lesson by providing a customized, meaningful learning experience.</td>
<td>Objectives of previously learned constructs are light of new information.</td>
<td></td>
</tr>
<tr>
<td>2. Inform students of learning objectives:</td>
<td>Statement of objectives follows the information provided in textbook stated in active terms.</td>
<td>Statement of importance of being able to discern what and what not is found on the Internet and promise of becoming a more savvy searcher. As</td>
</tr>
<tr>
<td>Informing learners of the outcomes, or objectives, will help them understand what they are to learn during the course</td>
<td>Statement of importance of being able to discern what and what not is found on the Internet and promise of becoming a more savvy searcher. As</td>
<td></td>
</tr>
<tr>
<td>provided in textbook stated in active terms. At the conclusion of this information you will be able to, no graphics or motivational material is included to suggest the relevance of the material to the student’s desire to learn.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Stimulate recall of Information may relate to</td>
<td>Relate new information to what they already</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Features for each Gagne’s Events of Instruction</th>
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</thead>
<tbody>
<tr>
<td>prior learning</td>
<td>what is previously covered in text, but generally no attention is paid to stimulate recall of prior learning</td>
<td>know. Use of conversational tone and introduction of metaphors and analogies to assist student to conceptualize and relate to new information- use of scaffolding in advanced organizer – good example is the brainstorming exercise in which learner relates prior knowledge to new situation in non-threatening environment</td>
</tr>
</tbody>
</table>

4. **Presentation of content to facilitate recall and successful performance**

- Table of contents presented as left frame (or table cell) but as learner navigates through sections, graphical indicator provides direction of where learner is throughout the program
- Use of graphics limited to illustrate concepts such as venn diagrams to illustrate Boolean operators, otherwise not graphic intensive, most text only
- Following overview of material, practice exercises offered to students but program control requires exercises.
- Sequence the instruction in a logical order. Learner has an option to move non-sequentially within the material from unit to unit but once engaged in a practice exercise,
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>students and learner chooses practice exercises.</td>
<td>student must complete the practice before moving to another point within the instruction</td>
<td></td>
</tr>
<tr>
<td>• Sequence of instruction in a logical order. Learner has an option to move non-sequentially within the material from unit to unit.</td>
<td>• Modular structure of material lends itself for greater retention of material.</td>
<td></td>
</tr>
<tr>
<td>• As in textbook, information is presented as small chunks to aid the learner on retention. Text is presented in separate modules but no attempt to summarize or tie in modules and their relationships to each other is made.</td>
<td>• Narrative screens serve as advanced organizers so that the learner can place the information into a structure that compares similarities and differences between Internet tools.</td>
<td></td>
</tr>
<tr>
<td>• Narrative screens serve as advanced organizers so that the learner can place the information into a structure that compares similarities and differences between Internet tool include live links to websites.</td>
<td>• High program control ensures learner is guided through practice material and receives immediate corrective and reinforcement feedback.</td>
<td></td>
</tr>
<tr>
<td>• Modular structure of material lends itself for greater retention of material.</td>
<td>• Call-outs on screen captures assist with navigation as well as point out additional information in graphical form.</td>
<td></td>
</tr>
<tr>
<td>• Within exercises, no back buttons are provided, learner moves forward as a function of interaction such as hot spot or text input screen.</td>
<td>• Within exercises, no back buttons are provided, learner moves forward as a function of interaction such as hot spot or text input screen.</td>
<td></td>
</tr>
<tr>
<td>• Narrative screens with definitions of specific Internet tool include live links to websites.</td>
<td>• Narrative screens with definitions of specific Internet tool include live links to websites.</td>
<td></td>
</tr>
</tbody>
</table>
Features for each Gagne’s Events of Instruction

Conversion Frederick-Smith to web: high learner control

Structured guided practice-feedback: higher program control and content-centered Internet tools.

- High learner control afforded for student to choose exercises.

  Feedback results from exploration of links.

  Student must formulate her/his own conclusions from exploration as no assistance is provided through the material.

- Narrative screens with definitions of specific Internet tool include live links to websites

- Following narrative, hands-on practice of material guides students through illustrative examples but left to the discretion of the student

- Fewer graphics than with the controlled practice condition…graphical information provided by real-time exploration
<table>
<thead>
<tr>
<th>Features for each Gagne’s Events of Instruction</th>
<th>Conversion Frederick-Smith to web: high learner control</th>
<th>Structured guided practice-feedback: higher program control and content-centered within live websites.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. <strong>Provide learner guidance</strong></td>
<td>Learner guidance in high learner control condition affords learner optional practice exercises. Questions imbedded with live links pose an open-ended question OR a series of typical research questions for the learner to solve with the tools provided. Feedback results from learner’s authentic exploration of the sites presented in real-time.</td>
<td>Learner guidance is more structured. Examples for learner to interact provide high program control to assure that the learner engages with examples designed by instructor. Learner control is NOT afforded through instruction to ensure that learner is exposed to examples and non-examples and interacts with material and controlled feedback.</td>
</tr>
<tr>
<td>6. <strong>Elicit Performance:</strong></td>
<td>No planned e-Learning interactions, only opportunity to click live links embedded in learner activities to promote recall and conceptualization of the material</td>
<td>Program controls presentation of exemplary situations to illustrate constructs presented in the overview. Program control of guided practice and immediate corrective and reinforcement feedback ensures that student practices with content. Feedback is the result of student who</td>
</tr>
</tbody>
</table>
Features for each Gagne’s Events of Instruction

<table>
<thead>
<tr>
<th>Conversion Frederick-Smith to web: high learner control</th>
<th>Structured guided practice-feedback: higher program control and content-centered</th>
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</thead>
<tbody>
<tr>
<td>takes advantage of live links and is natural consequence of exploration. No enforced performance provided students. Students may choose to skip practice entirely or only practice those questions of their own choice.</td>
<td></td>
</tr>
</tbody>
</table>

7. Feedback: Provide No formal feedback for students to assess their information assessing how well they are doing via feedback on the student’s own exploration of the material. Feedback in high learner control condition dependent on the student’s own exploration of the material. Students receive no review tests or feedback on review questions. Immediate feedback is embedded in practice exercises and includes corrective, confirmatory, informative, and analytical. Practice-feedback with exercises is required following narrative screens. Review questions on material (unscored) provide feedback for correct and incorrect responses – Summary screens and review quizzes provide feedback for correct and incorrect responses. Students receive no review tests or feedback on review questions. Immediate feedback is embedded in practice exercises and includes corrective, confirmatory, informative, and analytical. Practice-feedback with exercises is required following narrative screens. Review questions on material (unscored) provide feedback for correct and incorrect responses – Summary screens and review quizzes provide feedback for correct and incorrect responses.

8. Review and relate Typically conversion of textbook material to web offers little or no review with authentic material or opportunities to practice what is learned and integrate new information into previously learned constructs or skills. Review screen following practice sessions summarize information and tie in what is previously learned with new information. Intermittent quizzes at midpoints of instruction provide immediate learner feedback. Embedded quizzes allow learner to become aware of her/his progress.
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>9. Assess Performance:</td>
<td>Both groups receive an objective retention test on the material in the form of multiple-choice comprehension pre and posttests. Additional assessment is an open-book Internet scavenger hunt designed to parallel the objectives of the tutorial</td>
<td></td>
</tr>
<tr>
<td>Pretest your objectives, embed questions, provide objective tests, and opportunities for performance tasks.</td>
<td>Both groups receive an objective retention test on the material in the form of multiple-choice comprehension pre and posttests. Additional assessment is an open-book Internet scavenger hunt designed to parallel the objectives of the tutorial</td>
<td></td>
</tr>
<tr>
<td>10. Enhance transfer and retention through performance assessments - checklists, rating scales, attitude, assess mastery in authentic setting</td>
<td>Open-book access to the tutorial and presentation of Internet Scavenger hunt provides accurate feedback to instructor as to student’s ability to apply principles presented within instruction to authentic research scenarios</td>
<td></td>
</tr>
<tr>
<td>Open-book access to the tutorial and presentation of Internet Scavenger hunt provides accurate feedback to instructor as to student’s ability to apply principles presented within instruction to authentic research scenarios</td>
<td>Open-book access to the tutorial and presentation of Internet Scavenger hunt provides accurate feedback to instructor as to student’s ability to apply principles presented within instruction to authentic research scenarios</td>
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</tbody>
</table>
Flowchart for Comparison Group
Flowchart for Comparison Group Continued
Flowchart for Comparison Group Continued
Flowchart for Comparison Group Continued
Flowchart for Treatment Group

1. Location and Access → What is Information Literacy? → Intro Screen in Flash about Internet misconceptions
2. Objective Statement
3. Search Strategies
4. Brainstorming
   - Brainstorming exercise with fields for analysis of research question
5. Virtual Library Overview
   - Live Links to Virtual Library Resources → Virtual Library Guided exercises with feedback
Appendix C Continued

Flowchart for Treatment Group Continued
Appendix C Continued

Flowchart for Treatment Group Continued

1. **Using Boolean Operators**
   - Hyperlink to George Boole page
   - Illustrated page of AND, OR, NOT

2. **Metasearch Engines Overview with examples and live links and descriptions**
   - OR Overview
   - Guided practice and feedback with OR exercise

3. **AND Overview**
   - Guided practice and feedback with AND exercise

Table of Contents allows free choice without constraints or forced navigation-Vertical menu
Appendix C Continued

Flowchart for Treatment Group Continued
Table D-18

*Derivation of Test Questions for Internet Hunt Posttest*

<table>
<thead>
<tr>
<th>Performance Objective</th>
<th>Bloom’s Level of Objective</th>
<th>Parallel Test Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upon completion of the TILT unit, the student will demonstrate use of a specialized database to find information appropriate to those databases</td>
<td>Application level: keyword is demonstrate, takes previously learned material and applies in new concrete setting</td>
<td>Name the 1964 movie that starred Richard Burton and Peter O’Toole about the demise of the Archbishop of Canterbury and King Henry II? Hint: look in specialized databases for an appropriate tool. 1. Virginia Wolfe 2. What's New Pussycat? 3. Becket 4. Camelot The answer is Becket</td>
</tr>
<tr>
<td>Upon completion of the TILT unit, the student will demonstrate use of a specialized database to find information appropriate to those databases</td>
<td>Application level: keyword is demonstrate, takes previously learned material and applies in new concrete setting</td>
<td>What year did Toyota Corporation begin its first sales operations in the United States? Here's a hint: Many companies contain information about their research and development, sales figures, history, and other important facts on</td>
</tr>
<tr>
<td>Performance Objective</td>
<td>Bloom's Level of Objective</td>
<td>Parallel Test Item</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>----------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>The student will use Boolean operators effectively within a search engine or subject directory to find information about aspartame using the OR operator</td>
<td>Application level: use of previously learned information in new and concrete situations</td>
<td>the correct answer is number 1. 1957. The student will use Boolean operators effectively within a search engine or subject directory to find information about aspartame using the OR operator. 1. 1957. 2. 1964. 3. 1954. 4. 1983. The correct answer is number 1.</td>
</tr>
<tr>
<td>The student will demonstrate proficiency with a virtual library source to find an American Heritage Dictionary site</td>
<td>Application level: use of previously learned information in new and concrete situations</td>
<td>Use a virtual library source: Infomine (<a href="http://infomine.ucr.edu/">http://infomine.ucr.edu/</a>), Argus Clearinghouse (<a href="http://www.clearinghouse.net/">http://www.clearinghouse.net/</a>), Internet Public Library (<a href="http://www.ipl.org/">http://www.ipl.org/</a>), Librarians' Guide to the Internet (<a href="http://lii.org/">http://lii.org/</a>) or the World Wide Web Virtual Library (<a href="http://www.vlib.org/">http://www.vlib.org/</a>).</td>
</tr>
</tbody>
</table>

At the 2003 Westminster Kennel Club show, what breed of dog was declared "Best in Show"? 1. Argent Big Bang, a collie 2. Malka Happy, a Pomeranian 3. Torums Scarf Michael, a kerry blue terrier 4. Winterwinds Glenn Plaid, a labrador retriever. The correct answer is number 3.
<table>
<thead>
<tr>
<th>Performance Objective</th>
<th>Bloom's Level of Objective</th>
<th>Parallel Test Item</th>
</tr>
</thead>
</table>
| The student will demonstrate proficiency accessing a reference source from a virtual library and defining the origin of a word using an Internet dictionary | Application level: use of previously learned information in new and concrete situations | What is the address (URL) for "The American Heritage Dictionary of the English Language."

Possible answers:

www.bartleby.com
www.dictionary.com
www.mirriamwebster.com
www.americanheritage.com

The correct answer is number 1

Using a WWW dictionary (hint: look under references from a virtual library), what is the meaning or origin of the word "scherzo"?

1. From the Italian, meaning joke
2. From the Spanish, meaning afraid
3. From the French for running fast
4. From English, meaning slightly crazy

Correct answer is number 1

The student will demonstrate the ability to effectively search for images from a previously learned information given novel

You need information about the date of Monet's "The Sunflowers". What year was this impressionist painting completed?
<table>
<thead>
<tr>
<th>Performance Objective</th>
<th>Bloom's Level of Objective</th>
<th>Parallel Test Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>search engine situation</td>
<td>1. 1908</td>
<td></td>
</tr>
<tr>
<td>2. 1890</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. 1881</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. 1900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct answer is number 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The student effectively combines search terms by using quotation marks surrounding phrases and can demonstrate use of AND operators.

Application level: Uses prior learning to apply search rules in new context.

Use HotBot's advanced search (hotbot.com) technique to find the name of the book by James Loewen, an American historian, about how schools are teaching history incorrectly.

1. Falsehoods in American History
2. Lies my Teacher Told Me
3. How Schools Lie About History
4. The Truth About America
Correct answer is number 2

Student will demonstrate the ability to apply Boolean operators with the preposition NOT to a search problem.

Application level: student uses previous knowledge to take on a problem within a new context.

Explore the Taj Mahal in Altavista's (altavista.com) advanced search mode. Who built the Taj Mahal in memory of his wife?

Hint: make sure to exclude "Las Vegas", and "Donald Trump" from your search.

1. Emperor Shah Jahan
2. Emperer Bahadur Shah Zafar
<table>
<thead>
<tr>
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<th>Parallel Test Item</th>
</tr>
</thead>
</table>
| The student will demonstrate the ability to effectively search for zipcodes from a specialized database | Application level: use of previously learned information given novel situation | 3. Emporer Napoleon Bonaparte  
4. Emporer Aurangzeb  
The correct answer is number 1  
What is the zipcode for Silver Springs, Florida? |
|                         |                            | 1. 30338  
2. 34488  
3. 30336  
4. 34650  
Correct answer is number 2 |
| The student will demonstrate the ability to apply advanced search techniques such as domain searching to find information. | Application level: taking previously learning information and applying it to a new problem-solving context | Look in Dogpile metasearch engine (www.dogpile.com). Find out when Jennifer Lopez and Ben Affleck announced their engagement publicly? Limit your information from the domain: eonline.com Hint: the command for domain limitation is domain:eonline.com |
|                         |                            | 1. November 2002  
2. December 2003  
3. October 2001  
4. January 2003  
Correct answer is number 1 |
These questions were changed from short-answer format to multiple-choice upon advice from the course instructor and from information gleaned from a formative small group evaluation. The multiple-choice format eliminates any possibility of ambiguity and provides an objective method for scoring each of the items. Each of the questions corresponds to one of the course objectives but also may be found through any number of search strategies. Students were granted open-tutorial access post-instruction and for timed administration of the Internet Scavenger Hunt.
Appendix D Continued

**Internet Scavenger Hunt**

**Instructions:** The quiz you are about to take is for research purposes only. There is no risk to your grade for your participation. Once you have completed the Internet Scavenger hunt, you can look forward to a pizza party as a thank you for your participation.

You will have 30 minutes for the quiz. Take your time, and have fun and thanks for your participation!!

Your name: _________________________________
Group: One or Two (circle the appropriate choice)
Approximate time taken to complete the tutorial: __________________

**Question 1** Multiple Answer 1 points
At the 2003 Westminster Kennel Club show, what breed of dog was declared "Best in Show"?
   a) Argent Big Bang, a collie
   b) Manka Happy, a pomeranian
   c) Torums Scarf Michael, a kerry blue terrier ✓
   d) Winterwinds Glenn Plaid, a labrador retriever

**Question 2** Multiple Choice 1 points
Explore the Taj Mahal in Altavista's (altavista.com) advanced search mode. Who built the Taj Mahal in memory of his wife? Hint: make sure to exclude "Las Vegas", and "Donald Trump" from your search.
   e) Emperor Shah Jahan ✓
   f) Emporer Bahadur Shah Zafar
   g) Emporer Napolean Bonaparte
   h) Emporer Aurangzeb

**Question 3** Multiple Choice 1 points
Look in Dogpile metasearch engine (www.dogpile.com). Find out when Jennifer Lopez and Ben Affleck announced their engagement publicly? Limit your information from the domain:eonline.com Hint: the command for domain limitation is domain:eonline.com
   e) November 2002 ✓
   f) December 2003
   g) October 2001
   h) January 2003

**Question 4** Multiple Choice 1 points
Name the 1964 movie that starred Richard Burton and Peter O'Toole about the demise of the Archbishop of Canterbury and King Henry II?
   a) Virginia Wolfe
   b) What's New Pussycat?
   c) Becket ✓
   d) Camelot
Appendix D Continued

**Question 5**  Multiple Choice  1 points
Use a virtual library source: Infomine (http://infomine.ucr.edu/), Argus Clearinghouse
(http://www.clearinghouse.net/), Internet Public Library (http://www.ipl.org/), Librarians' Guide
to the Internet(http://lii.org/) or the World Wide Web Virtual Library(http://www.vlib.org/). What
is the address (URL) for "The American Heritage Dictionary of the English Language."
   a)  www.bartleby.com ✓
   b)  www.dictionary.com
   c)  www.mirriamwebster.com
   d)  www.americanheritage.com

**Question 6**  Multiple Choice  1 points
Use HotBot's advanced search (hotbot.com) technique to find the name of the book by James
Loewen, an American historian, about how schools are teaching history incorrectly.
   d)  Falsehoods in American History ✓
   e)  Lies my Teacher Told Me
   f)  How Schools Lie About History
   g)  The Truth About America

**Question 7**  Multiple Choice  1 points
Using a WWW dictionary (hint: look under references from a virtual library), what is the meaning or
origin of the word "scherzo"?
   a)  From the Italian, meaning joke ✓
   b)  From the Spanish, meaning afraid
   c)  From the French for running fast
   d)  From English, meaning slightly crazy

**Question 8**  Multiple Choice  1 points
What is the zipcode for Silver Springs, Florida?
   e)  30338
   f)  34488 ✓
   g)  30336
   h)  34650

**Question 9**  Multiple Choice  1 points
What year did Toyota Corporation begin its first sales operations in the United States? Here's a hint:
Many companies contain information about their research and development, sales figures, history,
and other important facts on their business websites.
   e)  1957 ✓
   f)  1964
   g)  1954
   h)  1983

**Question 10**  Multiple Choice  1 points
You need information about the date of Monet's "The Sunflowers". What year was this impressionist
painting completed?
   e)  1908
   f)  1890
   g)  1881 ✓
   h)  1900
Table D-19

*Cronbach Alpha for Scavenger Hunt: Summer 2003 Students*

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale Mean if Item Deleted</th>
<th>Scale Variance if Item Deleted</th>
<th>Corrected Item Total Correlation</th>
<th>Squared Multiple Correlation</th>
<th>Alpha if Item Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>6.6279</td>
<td>4.7154</td>
<td>.2429</td>
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<td>.5277</td>
<td>.3320</td>
<td>.6786</td>
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<td>Q3</td>
<td>6.7907</td>
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<td>.2918</td>
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</tr>
<tr>
<td>Q4</td>
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<td>4.6346</td>
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<td>.7290</td>
<td>.5440</td>
</tr>
<tr>
<td>Q5</td>
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Note: p-value < .05; N of Cases = 43.0

Reliability Coefficient on 10 items
Alpha = .7241 Standardized item alpha = .7262
Table D-20

*Cronbach Alpha for Scavenger Hunt: Spring 2004 Middle School Students*

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale Mean if Item Deleted</th>
<th>Scale Variance if Item Deleted</th>
<th>Item Total Corrected</th>
<th>Scale Squared</th>
<th>Multiple Correlation</th>
<th>Alpha if Item Deleted</th>
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<tbody>
<tr>
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<td>.5555</td>
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Note: p-value < .05; N of Cases = 41.0

Questions 1, 2, and 6 produced no variability and were therefore omitted from the alpha statistic based on 7 items.

Reliability Coefficient on 7 items

Alpha = .5626  Standardized item alpha = .5647
### Table D-21

**Item Frequencies for Scavenger Hunt: Spring 2004 Middle School Students**

<table>
<thead>
<tr>
<th>Question</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>41 correct</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Q2</td>
<td>41 correct</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Q3</td>
<td>6 incorrect</td>
<td>14.6</td>
<td>14.6</td>
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<tr>
<td></td>
<td>35 correct</td>
<td>85.4</td>
<td>85.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Q4</td>
<td>2 incorrect</td>
<td>4.9</td>
<td>4.9</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>39 correct</td>
<td>95.1</td>
<td>95.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Q5</td>
<td>10 incorrect</td>
<td>24.4</td>
<td>24.4</td>
<td>24.4</td>
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<tr>
<td></td>
<td>31 correct</td>
<td>75.6</td>
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<td>100.0</td>
</tr>
<tr>
<td>Q6</td>
<td>41 correct</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Q7</td>
<td>1 incorrect</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>40 correct</td>
<td>97.6</td>
<td>97.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Q8</td>
<td>1 incorrect</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
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<td></td>
<td>40 correct</td>
<td>97.6</td>
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<tr>
<td></td>
<td>33 correct</td>
<td>80.5</td>
<td>80.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Q10</td>
<td>2 incorrect</td>
<td>4.9</td>
<td>4.9</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>39 correct</td>
<td>95.1</td>
<td>95.1</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Note: p-value < .05; N of Cases = 41.0
Appendix E

Table E-22

*Formative Evaluation Feedback from Pilot: Undergraduate Students (N=39)*

<table>
<thead>
<tr>
<th>Component</th>
<th>Instructor Observations and Participant Comments</th>
<th>Suggestions for Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-instructional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Initial motivation</td>
<td>No orientation on how to navigate the material was problematic. When the researcher asked if students had seen or used the navigation bar, students commented they had not noticed or accessed the glossary, map, or objectives screen. Because there were no repercussions for completing material, some reported they merely skimmed the tutorial and failed to check the links within pages.</td>
<td>Students requested instruction on how to navigate materials. Students did not know they could use the tool to review sections of the material. Suggested that student be informed that the tutorial covers required material for the course and that they take the instruction seriously.</td>
</tr>
<tr>
<td>Component</td>
<td>Instructor Observations and Participant Comments</td>
<td>Suggestions for Improvement</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td><strong>Presentation</strong></td>
<td>Some students reported that materials were helpful and feedback enabled them to acquire the concepts, others noted material was tiresome given that the program would control for correct input from the student. One student reported low motivation due to lack of challenge in practice exercises.</td>
<td>Students suggested that in future versions of the tutorial, more contemporary examples be included. Instead of using John Lennon’s Strawberry Fields, they suggested a more contemporary pop artist be chosen as well as current film examples for imdb.com</td>
</tr>
<tr>
<td>• Sequence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Examples</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Participation</strong></td>
<td>Those students who reportedly were assigned to the experimental condition reported positive feedback on the Hollywood Squares game. There was one complaint that the program did not respond to three answers diagonally but did work for those answers that were correct responses horizontally or vertically. One student commented that the feedback on the game was “campy” and “hoaky”</td>
<td>Change some of the feedback screens to more sophisticated level of feedback for Freshman undergraduates. Different responses were reported from small group formative run-throughs with adult students and middle school students. Another suggestion is to imitate the navigation much as in the extant program that calls for optional engagement with the exercises. When students were informed they could have used the tutorial as a</td>
</tr>
<tr>
<td>Component</td>
<td>Instructor Observations and Participant Comments</td>
<td>Suggestions for Improvement</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td>reference tool and move non-sequentially through the material through the “map” icon in the navigation bar, they reported they would have perceived and used the material differently. It appears that an overview or introduction on how to navigate the material is essential.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Instructor Observations and Participant Comments</th>
<th>Suggestions for Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>When informed on the first two items of the pre and posttest for comprehension that more than one answer was required, students registered confusion and misread the instruction on these items. Suggested that the researcher reword the item to emphasize that more than one item was required to answer the question. Students responded to a true/false question regarding the organization of general subject directories. When shown the link on the introductory page, none of the students indicated that they saw the link in the instructional material. Students were distressed about their low scores. The researcher explained that their feedback was essential and that the tests only measured gains in their performance scores.</td>
<td>Students suggested that scores not be posted to their final grade averages to eliminate confusion. Modifications to those items deemed confusing were changed to reflect both statistical low reliability and student feedback.</td>
</tr>
</tbody>
</table>
Appendix F

ACADEMIC MOTIVATION PROFILE
Modified for Use in an Introductory Management Course in Library Science (Master's Program)

ATTENTION: Various aspects of this course may or may not have gained and held your attention. For each of the course aspects listed below, rate your attention levels using the following responses:

During this course, I was: (responses)
1. Not the least bit interested and my attention always wandered during...
2. Slightly interested and my attention frequently wandered during...
3. Moderately interested and my attention occasionally wandered during...
4. Very interested and my attention rarely wandered during...

TEXTBOOK AND READING ASSIGNMENTS
4. Information and explanations in the textbook.
5. Examples (e.g., charts, graphs, illustrations, case studies) in the textbook.
6. Information, explanations, and examples in the readings.

LECTURES AND DISCUSSIONS
7. Lectures and explanations given by the professor.
8. Group discussion and professor’s feedback and commentary.
9. Informal interaction with classmates and the professor

PROJECT ASSIGNMENTS
10. Background work and research preparing for assignments.
11. Completion of assignments in final form to turn in.
12. Review of professor’s feedback and commentary.

RELEVANCE: You may perceive the information and skills covered in this course to be relevant (useful to you) or irrelevant for a variety of reasons. Rate the relevance of this course to you personally using the following responses:

This course was: (responses)
1. Not the least bit relevant (not useful to me) for helping me...
2. Slightly relevant for helping me....
3. Moderately relevant for helping me...
4. Very relevant for helping me...

DURING MY STUDIES AS A GRADUATE STUDENT
14. Learn necessary professional skills in Library Science.
Appendix F Continued

15. Perform professionally during other classes, site visits to libraries, and/or fieldwork assignments.

**DURING TRANSITION TO FIRST PROFESSIONAL POSITION IN A LIBRARY OR TRANSITION TO A NEW JOB ASSIGNMENT IN A LIBRARY**
16. Make career decisions about jobs in librarianship.
17. Interview successfully for first job as a librarian or for a new job assignment.
18. Demonstrate professionalism and skill during first job or new job assignment.

**AS A LIBRARIAN**
19. Analyze, plan, and evaluate library policies, programs, and procedures.
20. Manage the day-to-day programs and activities in a library.
21. Work effectively as a professional librarian with patrons, other librarians, and administrators.

**CONFIDENCE:** Related to your “internal feelings” of your own skill levels (as opposed to the grades you anticipate in this course), rate your level of confidence in performing each of the following course goals using the following responses:
1. I do not feel at all confident in my ability to...
2. I feel slightly confident in my ability to...
3. I feel moderately confident in my ability to...
4. I feel very confident in my ability to...

**PLANNING FOR LIBRARY OPERATIONS**
22. Analyze needs and plan mission, goals, and objectives.
23. Translate mission, goals, and objectives into library programs and activities.
24. Evaluate the effectiveness of programs and activities and prescribe improvements.

**MANAGING LIBRARY OPERATIONS**
25. Establish and manage day-to-day operating procedures and activities
26. Manage and evaluate library staff.
27. Manage facilities, equipment, and collections.

**MANAGING PROFESSIONAL ISSUES AND LIBRARY OUTREACH**
28. Plan and implement library policies in accord with accepted professional and ethical standards.
29. Identify the library’s community and plan for inclusion of stakeholders.
30. Publicize and promote the role of the library and the library’s programs in the community.
SATISFACTION: You may or may not have found this course personally rewarding or satisfying for a variety of reasons. Please rate your level of personal satisfaction with the course using the following responses.

During this course I was:
1. Not at all satisfied with...
2. Slightly satisfied with...
3. Moderately satisfied with...
4. Very satisfied with...

MY PARTICIPATION
31. The level of personal effort I expended.
32. My opportunities to discuss library management practices with other students.
33. My opportunities to discuss library management practices with my professor.

PERSONAL DEVELOPMENT
34. My feelings of personal accomplishment.
35. My personal gains in skills required for library management.
36. My personal attitudes and opinions about library management.

PROFESSIONAL AFFILIATION
37. My current perspectives on my role and responsibilities as a librarian.
38. What I now have to offer as a librarian to patrons and colleagues.
Appendix F Continued

ACADEMIC MOTIVATION PROFILE
Modified for Use in an Introductory Internet Search Module

**ATTENTION:** Various aspects of this course may or may not have gained and held your attention. For each of the course aspects listed below, *rate your attention levels* using the following responses:

During this course, I was: (responses)
1. Not the least bit interested and my attention always wandered during...
2. Slightly interested and my attention frequently wandered during...
3. Moderately interested and my attention occasionally wandered during...
4. Very interested and my attention rarely wandered during...

**ONLINE NARRATIVE TEXT**
1. Information and explanations in the online module.
2. Examples (e.g., charts, graphs, illustrations, case studies) in the online module.
3. Information, explanations, and examples in the online narrative overviews.

**INFORMATION SEQUENCE AND PRESENTATION**
4. Lectures and explanations presented in the tutorial
5. Feedback and commentary provided within the online module.
6. Interactivity with the online material (how much hands-on interaction with the software)
7. Summarized concepts and how they related Internet search skills

**PRACTICE EXERCISES**
8. Background work and research preparing for practice following overviews.
9. Completion of practice exercises
10. Adequate feedback following or during practice exercises.
11. Related new information to what I already knew

**RELEVANCE:** You may perceive the information and skills covered in this course to be relevant (useful to you) or irrelevant for a variety of reasons. *Rate the relevance of this course to you personally* using the following responses:

This course was: (responses)
1. Not the least bit relevant (not useful to me) for helping me...
2. Slightly relevant for helping me....
3. Moderately relevant for helping me...
4. Very relevant for helping me...

**DURING MY PARTICIPATION IN THE ONLINE MODULE STUDY**
12. Preparation for the comprehension posttest
13. Usefulness of the module for preparation with Internet Scavenger Hunt posttest
Appendix F Continued

14. Learn useful search skills for finding Internet-based information
15. Perform better on research assignments in school

USEFULNESS OF INFORMATION FOR RESEARCH IN FUTURE
16. Use skills for with other Internet databases such as Galileo
17. Ability to communicate with other students or adults skills learned from the online module

AS A RESEARCHER
18. Analyze, plan, and revise research questions
19. Construct more precise keyword and subject searches with directories and search engines
20. Demonstrate greater accuracy and efficiency with Internet searches
21. Know when to use particular Internet search tools such as virtual libraries, specialized databases, subject directories, and search engines

CONFIDENCE: Related to your “internal feelings” of your own skill levels (as opposed to the grades you anticipate in this course), rate your level of confidence in performing each of the following course goals using the following responses:

1. I do not feel at all confident in my ability to…
2. I feel slightly confident in my ability to…
3. I feel moderately confident in my ability to…
4. I feel very confident in my ability to…

PLANNING INTERNET SEARCHES
22. Analyze research questions and select effective strategies for searching the Internet
23. Use the most effective tool given a research question
24. Revise a strategy that results in more relevant information sources for your research question

USING INTERNET STRATEGIES
25. Use AND, OR, NOT to construct search statements
26. Use wildcard characters to find alternate word usage
27. Use parentheses to write nested search statements
28. Use domain limiters for searching
29. Distinguish among Internet tools and when to use them such as virtual libraries, specialized databases, general subject directories, and search engines
SATISFACTION: You may or may not have found this course personally rewarding or satisfying for a variety of reasons. Please rate your level of personal satisfaction with the course using the following responses.

During this course I was:
1. Not at all satisfied with...
2. Slightly satisfied with...
3. Moderately satisfied with...
4. Very satisfied with...

MY PARTICIPATION
30. The level of personal effort I expended.
31. My opportunities to discuss with fellow students.
32. My opportunities to discuss Internet search tools/strategies with my teachers.

PERSONAL DEVELOPMENT
33. My feelings of personal accomplishment.
34. My personal gains in skills required for Internet searches.
35. My personal attitudes and opinions about using Internet search tools.
Emily Dunsker at the time of publication, serves as the Teacher-Librarian for Chamblee Middle School, a magnet program in DeKalb County Georgia. Her students won an Apple Innovation Award for an iMovie entitled *All Quiet on the Western Front*. Chamblee Middle School Media Center was chosen by the Director of Educational Media as a visitation site prior to receiving *AASL National School Library Media Program of the Year 2001*. She received her Masters Degree in Library and Information Sciences from University of South Florida in 1998 and is a member of the international library honorary, Beta Phi Mu, 1999.