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EFFECTS OF ADVANCE ORGANIZERS ON LEARNING AND RETENTION FROM A
FULLY WEB-BASED CLASS

by

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A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Educational Research, Technology and Leadership
in the College of Education
at the University of Central Florida
Orlando, Florida

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ABSTRACT

The purpose of this study is to investigate the short-term and long-term effects of two kinds of advance organizers (AOs), a visual concept map and a text outline. The AOs were administered in a fully Web-based course in health care ethics. The outcome measures are students' knowledge acquisition and application in two posttests.

This study was conducted through a post-test only control group design with a random assignment. The population of the study involved 166 college students who participated in this online class in their junior or senior year. The voluntary research participants were randomly assigned into the two treatment groups and one control group.

The treatment of AO was administered as an integral part of a one-week-long online module on the topic of patient-physician relationships. Students of the two treatment groups were presented with one of the two AOs, while the control group was instructed to proceed to textbook reading without an AO. Then, students were tested on the subject matter with two parallel posttests. Both posttests were composed of a multiple-choice question quiz and a set of scenario-based essay questions. The students took posttest I at the end of the instructional week, and posttest II four weeks after. A survey and interviews were also conducted to supplement the quantitative results with contextual information.

The findings do not demonstrate a statistically significant AO effect among the treatment groups and the control group. However, in agreement with the previous research, this study shows a positive but inconclusive benefit of using AOs for students' short-term knowledge acquisition. The students using a concept map consistently obtained higher learning achievements than individuals using a text outline. More importantly, this study

reiterated the proposition that students of lower-learning abilities benefit more from using an AO for online learning than those of higher-learning abilities.

The current study extends our knowledge on the use of AOs in fully Web-based educational environments. The results indicated that although AOs more often than not have small facilitative effects for learners, they are not equally effective for all learners in all learning situations. The incorporation of the instructional strategies, such as AOs, in Web-based courses and programs might benefit online learners, especially those students of lower verbal and analytical abilities, or of lower prior knowledge of the material-to-be-learned.

**To my dearest and kindest grandmothers, Ahxiang Qiu and Jie Peng, who are gone
but never forgotten. I miss you from the bottom of my heart.**

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CHAPTER ONE: INTRODUCTION

Distance education provides people unprecedented opportunities to access learning across temporal and geographical boundaries. Compared with traditional classroom education practice, the most prominent characteristic of distance education is the physical separation between learning and teaching. To bridge the time and physical instructional gap, various technologies, such as print, audio, video, computer, Internet, and simulation, have been used to facilitate communication over time.

Distance education dates back to the early 1880s with courses of instruction delivered by postal correspondence. The first generation of distance education is the correspondence study with the media of written mail and prints, which, for the first time, extended education opportunities for people to study at home or at work.

In the early part of the twentieth century, the second generation was brought by new broadcasting technologies—radio, television, videotapes and cable—which resulted in significant advances in instruction quality and student enrollment. Due to these technology progresses, instruction was delivered in a systematic approach. The first open university was set up in 1967 in Britain, and then all over the world. Student enrollment of the open universities exceeded 250,000 in the late 1970s and early 1980s.

The advent of the computer and Internet boosts the distance education system to the next generation. Ever since the 1960s, in parallel to the rapid development of new media and technologies, distance education has evolved through stages of interactive television, computer-based instruction, Web-based education, and the upcoming mobile learning. At the

same time, with easier accessibility and higher instruction quality, there is a growing demand for courses, degrees, and programs through online distance education. The annual market for distance education in 2003 is reported to be \$4.5 billion, and it is expected to grow to \$11 billion by 2005 (Howell, Williams, & Lindsay, 2003).

Distance Education Defined

The most quoted definition of distance education is described by Moore and Kearsley (2005, p.2) as “planned learning that normally occurs in a different place from teaching, requiring special course design and instruction techniques, communication through various technologies, and special organizational and administrative arrangements.” Distance education implies both the learning and teaching activities. A term synonymous with distance education is “distributed learning”, which refers to an instructional model that provides instruction and learning at any place and any time (Schlosser & Simonson, 2005).

While Internet is becoming dominant among other distance-education media (Howell et al., 2003), popular terms that people use interchangeably with distance education are “e-learning,” “virtual learning,” “online learning,” and “Web-based learning.” E-learning focuses on the electronic media that students interact with other students and instructors while learning, including audio and video communication. As opposed to computer-based learning, both e-learning and virtual learning refer to learning activities in a totally computer-based environment which incorporates technologies that support interactivity beyond those which would be provided by a single computer. Online learning and Web-based learning refer to the use of the Internet to access learning materials. In other words, all these terms are usually used

as substitutes for modern distance education delivered through the computer and Internet technologies. Online learning and Web-based courses are the focused learning environments for the purposes of this dissertation.

Online Learning

In the 21st century, online learning has become pervasive in higher education. According to the latest survey conducted on the state of online learning at the United States' higher-education institutions (Allen & Seaman, 2005, 2006), more than 96% of the very largest institutions (more than 15,000 total enrollments) have online offerings, and the enrollment in 2005 in Web-based courses reached nearly 3.2 million, up nearly 35% over the 2004 figures.

Both students and instructors perceive that online learning provides major benefits (Hartman, Dziuban, & Moskal, 2000). The biggest benefit for them is convenience. Online learning provides students with time and location flexibility. Students can access learning materials virtually at anytime and any place. Also, the Internet brings expanded resources to the learners at a very low cost or even free of charge. Recently, multi-media learning environments have been created online with audio, video, graphic and animation to simulate true task environment which can bring tremendous interests and motivation to learners. For the instructor, on the other hand, online teaching is beneficial in terms of structure and time convenience. Instructors are able to reach out for students regardless of physical boundary, and access expanded instruction and research tools. New educational technologies offered teaching and learning a new horizon.

To clearly define fully Web-based courses in online learning, the Center for Distributed Learning (CDL) at the University of Central Florida, where this study took place, provides further explanation. This educational institution uses the Internet for instruction delivery both on campus and at a distance to provide courses of three modalities (i.e. fully Web-based course, mixed mode course, and Web enhanced course). Fully Web-based courses (W) are delivered totally through the Internet and are accessible to students at a distance anytime and anywhere they have Internet access. Mixed mode courses (M) combine both face-to-face class and Web delivery where the Web-based instruction reduces class sitting time. Web-enhanced courses (E) include substantial use of the Internet for content delivery and learning activities without reducing face-to-face class time. Among the three modalities, mixed-mode courses and Web-enhanced courses require traditional class attendance, and only the fully Web-based courses refer to distance education classes (Center for Distributed Learning, 2000).

This dissertation focuses on the Web-based courses that are delivered through the Internet with multimedia communications where students and the instructor are physically apart. To distinguish from technology/Web-enhanced classroom classes or mixed-mode classes, the term “fully Web-based courses” is utilized to refer to online distance education courses where students and the instructor are at a distance with the Internet as the communication method.

Statement of Problem

With the rapid development of communication media and technology, online learning has grown and brought both opportunities and challenges to learners, instructors, and the education system as a whole. For teaching and learning, people are obtaining access to education

resources more easily and flexibly than ever before. On the other hand, the new educational delivery methods require both students and instructors to learn to use new technologies and adapt to the ever-changing Web-based multi-media learning environment.

In fully Web-based courses, the use of multimedia and Internet often brings challenges of cognitive overload and learner disorientation (Dias & Sousa, 1997). While the learners enjoy the flexibility and abundance of Internet resources, they are, at the same time, overwhelmed with multiple searching and browsing tasks in the non-linear environment. As distant learners, the students cannot obtain immediate direction or feedback from instructors or colleagues, and need to make decisions on their own to locate course materials and complete assignments. While they recognize hyperlinks as a method for accessing electronic resources and navigating online courses, these students are most likely to experience greater difficulties with cognitive overload and learner disorientation than students in instructor-led face-to-face classes in terms of not knowing where they are and determining what to do next. Effective online teaching and learning strategies have been perceived as potential solutions to these learning challenges (Bonk & Dennen, 2003).

Advance Organizers

What kind of teaching and learning strategy exists for effective Web-based learning? Unfortunately, no single school of learning is exclusively designed for online learning. There is limited research to prove the effectiveness of learning strategies in fully Web-based environments. While many studies have shown no significant difference between online courses and traditional courses, applying traditional learning strategies at a distance leaves a

great deal of uncertainty (Howell et al., 2003). The literature reveals an increasing need to exploit research-based pedagogical strategies in fully Web-based environments.

Use of advance organizers is one of the evidence-based pedagogical strategies to promote meaningful learning in traditional classrooms. An advance organizer is defined as relevant introductory materials presented in advance of a lesson of higher abstraction, generality and inclusiveness than the learning tasks itself (Ausubel, 2000). This learning strategy has been proven to be an effective learning strategy to activate existing knowledge and to provide information to incorporate details of new lessons in traditional classroom environments (Ausubel, 1968; Hirumi & Bowers, 1991; Kenny, 1992; Luiten, Ames, & Ackerson, 1980; Mayer, 1979b; Stone, 1983). Among the different formats of advance organizers, the concept map, a visual advance organizer, has been widely used in classrooms and noted with positive effects on learning (Gil-Garcia & Villegas, 2003; Kang, 2002; Millet, 2000).

Recent studies conducted on the use of advance organizers, including both text advance organizers and concept maps in computer-based classes, reveal a mild but positive effect on learning and retention (Calandra, 2002; McManus, 2000; Tseng, Wang, Lin, & Hung, 2002; Yeh & Lehman, 2001). Although many of the researchers claim that their studies tested the use of advance organizers in online learning, all identified research studies took place in physical computer-equipped face-to-face classrooms or labs where students and teachers were both present during a limited duration of time. None of the study was conducted in a fully Web-based environment where the instructor was physically and geographically separated from the learners.

It is hypothesized that employment of advance organizers in online learning might improve students' performance by helping them initiate online activities with less cognitive resources in complicated navigation tasks, reducing possibilities of students getting lost in the hyperspace (Ally, 2004; Chang, 2004). There is a paucity of research-based evidence in using advance organizers in fully Web-based courses. Such research is needed to provide empirical evidence to identify the best teaching and learning practices in online environments.

Purpose

The current study investigated both short-term and long-term effects of presenting two kinds of advance organizers in a fully Web-based course. The advance organizers take both visual and text formats. A concept map was used as the visual advance organizer, and a textual outline was used as the text advance organizer. Students' knowledge acquisition and application were tested both immediately and four weeks after the instruction. All course materials and assignments were accessed and completed on the Internet without any face-to-face instruction or meetings.

Statement of Hypotheses

Two hypotheses are posited for this study.

Null hypothesis I:

There is no difference in the short-term knowledge-based and performance-based learning achievements among students in the concept map, outline and control groups.

Null hypothesis II:

There is no difference in the long-term knowledge-based and performance-based learning achievements among students in the concept map, outline and control groups.

Definitions

This paper depends on the definitions of use advance organizers as a learning strategy and terminologies of online distance education. Also, operational definitions of treatment and achievement test are described in this section.

Advance organizer

Advance organizers are “appropriately relevant and inclusive introductory materials . . . introduced in advance of learning. . . and presented at a higher level of abstraction, generality, and inclusiveness than the learning passage itself” (Ausubel, 1968). Usually, advance organizers appear in written form. Specific pre-discussions or visuals that begin instruction can also be considered advance organizers (Leu & Kinzer, 2003). In the recent three years, some educators began to use Microsoft PowerPoint, Macromedia Flash or other computer software to create hypermedia advance organizers.

In this study, both text and visual advance organizers were used at the beginning of the instruction. The text advance organizer takes the form of a textual outline, and the visual advance organizer takes the form of a concept map. Both of the advance organizers are the same in content, with an abstraction relevant to the instructional materials that follow it.

Treatments

There are three research groups in this study. The students in the experimental group received a treatment of a concept map before instruction. The students in the comparison group received a treatment of a textual outline before instruction. The control group received no treatment and proceeded directly into textbook reading and assignments.

Achievement tests

Parallel achievement tests were administered online both immediately and four weeks after the instruction. The immediate achievement tests, posttest I, are short-term learning achievement tests, consisting of a 9-item knowledge-based quiz and three performance-based open-ended scenario questions. The two assignments were open to students in the instruction week. Posttest II were administered four weeks after the instruction as long-term learning achievement tests. Similar with the short-term tests, the long-term tests include a 9-item knowledge-based quiz and three performance-based open-ended scenario questions. Both tests are parallel in format, but with different question items.

Distance Education

Distance education is planned learning activities that occur in a different place from teaching, requiring special course design and instruction techniques, communication through various technologies, and special organizational and administrative arrangements (Moore & Kearsley, 2005).

Online Learning

Online learning refers to the use of the Internet to access learning materials. Online learning activities might happen both in traditional classrooms and distance education. In this

study, the focus of online learning refers to students' learning activities at a distance from the instructor and other class colleagues.

Fully Web-based course

Fully Web-based courses (W) are delivered totally through the Internet and are accessible to students at a distance anytime and anywhere. These W courses are an important element in the distributed learning system at the University of Central Florida. Opposed to fully Web-based courses, the university's distributed learning system is comprised of two other course modalities, mixed-mode courses (M) and Web-enhanced courses (E). Requiring class attendance, the latter two course delivery modalities do not belong to distance education. The major interest of this research study is fully Web-based courses (W).

Module

A module is one lesson of a Web-based course. In this study, each course module lasts for one week and contains three parts: introduction, readings, and assignments. The students are required to finish the module within one week time and complete the module quiz and assignments at their convenient time by the end of the week.

WebCT

WebCT (Web Course Tools) is an online commercial virtual learning environment system used extensively in many higher educational institutions for online learning. Students and instructors in this study used WebCT course tools such as discussion boards, course mail and live chat, along with Web pages and documents for learning and teaching.

Theoretical Foundations

The rationale for using advance organizers is deeply rooted in cognitive learning theories. Cognitive learning theories claim that learning depends on the processing capacity of the learners, and one of the most important elements of learners' processing capacity is their prior or existing knowledge (Driscoll, 1999). With the aid of advance organizers, learners are able to link what they already know to new information, transform the knowledge, and apply it in the new context.

Ausubel first introduced the concept of advance organizers in his assimilation theory of meaningful learning and retention. Like other cognitive theorists, Ausubel asserted that learning is based on schemata or mental structures by which students organize their perceived environment. He stressed that students can only learn best when they find meaning in learning. In teaching, Ausubel promoted that use of advance organizers helps students activate prior knowledge in the new instructional context and makes the instructional process meaningful to the students (Ausubel, 2000). His early experiments provided the most-cited research supporting the effectiveness of advance organizers with increasing achievement over the material-to-be-learned.

Mayer reinterpreted Ausubel's use of advance organizers in terms of his assimilation encoding theory (Mayer, 1979a). He indicated that the successful use of advance organizers is highly influenced by the availability of an assimilative context in memory and the active use of knowledge during learning. He reported the results of a series of nine studies and also examined 27 advance organizers studies conducted by other researchers in the 1960s and 1970s (Mayer, 1979a, 1979b). The results supported his contention that advance organizers will

facilitate learning in situations where learners do not possess a rich set of relevant past experiences and can actively integrate the advance organizers in the new context.

Based on neurophysiological science, the recent brain-based learning research supports the idea of meaningful learning and active processing as well. It is asserted that meaning is more important than information and active processing information is strongly connected to prior learning (Caine & Caine, 1991). The brain-based learning theories also imply that the teacher needs to prepare the students before a unit of study to attach new information to prior knowledge so the new information has something to “latch onto”(Jensen, 1996). In addition, empirical studies support many of the proposition regarding advance organizers and learning, posed by various theories, and the following section summarizes the relevant empirical research.

Empirical Evidence

Extensive research was conducted on the effectiveness of using advance organizers in classroom teaching from the 1960s to the 1990s. The research evidence concerning any facilitative effect of advance organizers upon learning and retention is variable, but positive in general. Although Ausubel’s early experiments supported the effectiveness of advance organizers with significant increased learning achievement (Ausubel, 1960; Ausubel & Fitzgerald, 1961, 1962; Ausubel & Youssef, 1963), later studies failed to show a consistent positive facilitative effect on this cognitive instructional strategy (Barnes & Clawson, 1975; Luiten et al., 1980; Mayer, 1979b; Stone, 1983). The discrepancies regarding the effectiveness

of advance organizers might result from inadequate construction of advance organizers or weak research procedures or control (Kenny, 1993; Luiten et al., 1980; Mayer, 1979b).

In the 1990s and 2000s, advance organizers still remained an actively debated topic. Research on the traditional advance organizers drastically decreased in number possibly due to the non-statistical-significance of the research results. However, many researchers began to conduct studies on advance organizers in a variety of formats, such as visual advance organizers (DaRos & Onwuegbuzie, 1999; Herron, Hanley, & Cole, 1995; Hirumi & Bowers, 1991; Millet, 2000) and multimedia advance organizers (Calandra, Lang, & Barron, 2002; Hale, 2003; Minchin Jr., 2004; Tseng et al., 2002; Yeh & Lehman, 2001). Consistent with the historical findings, recent research again failed to generate statistically significant results on effectiveness of advance organizers on posttest scores between treatment groups and control groups, though most researchers continued to suggest a mild but positive effect of advance organizers on learning and retention.

The statistical non-significance of the research might be attributed to imprecise construction of organizers, short duration of treatment, inadequate research control, and insufficient instruction on how to use organizers (Kenny, 1993; Luiten et al., 1980; Mayer, 1979b). Synthesizing the findings of recent research on advance organizers, it is suggested that future researchers might consider the following aspects of the issue in designing their experiments pertaining to advance organizers:

1. Future research might investigate advance organizers as a helpful orienting device not only in the context of computer-assisted instruction, but also in the online learning environment.

2. Studies might test different types of advance organizers, including graphic, graphic + text, and multimedia instructional organizers.
3. Studies need to be implemented to compare participatory organizers (student-constructed organizers), which is a form of post organizers, with the teacher-constructed organizers.
4. Future researchers could consider testing not only the effect of advance organizers alone, but also the combined effectiveness of this orienting technique and other instructional strategies and learner characteristics.

The current study is an attempt to follow the first two directions stated above. The study investigated the use of different types of advance organizers, including text and multimedia graphic organizers in a Web-based course in the online distance education environment.

Significance

It is hoped that the results of this study will contribute as building blocks for research on using strategies for online learning, and serve as empirical evidence for using advance organizers as one of the best practices in Web-based courses. In the mid-1990s, studies on advance organizers were prevalent in education. Now, the instructors use this teaching strategy as a common practice. This study might provide perspectives answering the following questions. Is the advance organizer an effective strategy in the Internet age? How can this orienting strategy be used for online learning? What format of advance organizers best facilitates students' learning achievement in fully Web-based courses?

There is an increasing need for learning and teaching strategies that exploit the capabilities of technology. Research on using advance organizers in technology-enhanced environments is limited in number. No relevant literature is found in the field of online learning. Therefore, this study examined both text and visual advance organizers in a fully Web-based course, and filled the gap of advance organizers research in an online distance education setting. The advance organizers conceptual framework originated by Ausubel was updated and improved to fit the new Web-based multimedia environments.

Specifically, this study would assist parties in the online learning system. The use of advance organizers is a helpful teaching and learning practice in the context of self-paced online learning. Instructors might follow the procedures described in the study to integrate multimedia advance organizers for effective online instruction, and assisted students to actively use them to enhance learning. Students, especially those of lower learning abilities or limited prior knowledge, might benefit from using advance organizers not only in the traditional face-to-face classes, but also in the self-directed Web-based learning environment.

CHAPTER TWO: LITERATURE REVIEW

Advanced technologies such as the Internet and hypermedia have brought tremendous opportunities for education. Web-based environment allows an unprecedented amount of navigation freedom and learner control. Instructors and learners take advantage of online learning to enjoy the structure and time convenience, increased student outreach and contact, availability of expanded research tools, and abilities to learn new technologies (Hartman et al., 2000). On the other hand, the use of Internet and multimedia demands high cognitive capabilities of learners in their strategy selection of searching and browsing activities. The nonlinear context and multi-information channels usually bring problems of cognitive overload and learner disorientation (Dias & Sousa, 1997). In the user-driven online learning environment, some researchers suggest using advance organizers to provide structural assistance to learners without jeopardizing the flexibility of hypermedia and the Internet, and thus to assist them in navigating and learning (Chang, 2004). Current research (Calandra, 2002) also suggests that the multimedia widely used in online learning lends a richness of combining textual, graphics, oral and animation to advance organizers that can facilitate their effectiveness.

Chapter 2 reviews literature related to the use of advance organizers in education. First, the theoretical foundation of using advance organizers will be discussed. Second, the definition, construction procedures, and types of advance organizers will be enumerated. Third, this chapter will discuss the historical development of studies regarding advance organizers since the 1960s. It will highlight both the monumental investigations and the related

meta-analyses and reviews of literature on advance organizers. Fourth, studies using advance organizers in technology-enhanced environments in the 1990s and 2000s will be presented. Then, relevant qualitative studies will be discussed to supplement the quantitative data. Finally, a summary table will be attached at the end of the discussion, outlining the main features of the recent research conducted on advance organizers. In addition, based on the previous studies, issues and directions for future research, especially for this dissertation, will be discussed.

Theoretical Background

Cognitive research focuses on the information processing model during the act of learning. For a memory to be formed, new information is processed and identified in the sensory memory and then passed to the working memory, where it receives additional meaning-based processing. Only information that is relevant to one's goals is then stored indefinitely in the long-term memory until it is needed again (Bruning, Schraw, Norby, & Ronning, 2003).

According to the encoding theory (Bruning et al., 2003), how we encode to-be-remembered information makes a huge difference in how well we remember. That is why children can learn better with the help of mnemonics, such as making rhymes or drawing imageries. In regard to complex knowledge, it is important to encourage students to engage in active learning. The methods for improving active learning include: schema activation, knowledge elaboration and organization, and deeper level of processing.

Using advance organizers has been regarded as an effective strategy to activate schema by stimulating students' prior knowledge, focusing students' interests, and setting goals for

further instruction (Ausubel, 1968). Schema activation refers to “various methods designed to activate students’ relevant knowledge prior to a learning activity” (Bruning et al., 2003, p.75). The use of advance organizers is a method that seeks relationships among concepts and bridges what students already know and what they are to learn and thus renders learning an easier task. Moreover, it supports the long-term memory process as the information enters into it through the working memory. Advance organizers serve as a subsumer to assist the old information to be retrieved from the long-term memory and linked to incoming stimuli to facilitate the comprehension of new knowledge. For instance, a reader without any background knowledge of witchcraft or sorcery may even have difficulty in understanding children’s literature, such as Harry Potter.

Ausubel elaborates the concept of advance organizers in his assimilation theory of meaningful learning and retention. He asserts that learning is based on schemata or mental structures by which students organize their perceived environment. He stressed that students can only learn best when they find meaning in learning, and the use of advance organizers helps students activate prior knowledge in the new instructional context, making the instructional process meaningful to them (Ausubel, 2000). Many other educational psychologists also promote the use of advance organizers. Mayer reinterpreted Ausubel’s use of advance organizers in his assimilation encoding theory (Mayer, 1979a), and indicated that the successful use of advance organizers is highly influenced by the availability of an assimilative context in memory and the active use of knowledge during learning. He contended that advance organizers will facilitate learning in situations where learners do not possess a rich

set of relevant past experiences and can actively integrate advance organizers in the new context.

Recent brain-based learning research supports the idea of meaningful learning and active processing based on neurophysiological science. The proponents of brain-based learning assert that the brain is much more active than other times when it is immersed in a meaningful learning environment (Jensen, 1996). They state that meaning is more important than information and active processing information is strongly connected to prior learning (Caine & Caine, 1991). Thus, teachers need to prepare the students before a unit of study in order to attach new information to prior knowledge so the new information has something to “latch onto”(Jensen, 1996), and use advance organizers to bridge new and prior knowledge.

Definition & Construction Procedures

The concept of schema and use of advance organizers are now considered standard educational practice. It was first introduced by the educational psychologist, David P. Ausubel, as an application of his Meaningful Learning and Schema Theory in the 1960s. Ausubel found out that the use of textual advance organizers was an efficient way to relate new concepts to students’ prior knowledge, bridging the gap between the learners’ cognitive structures and the material-to-be-learned, and consequently enhancing learning and retention (Ausubel, 1978).

According to Ausubel (2000), an advance organizer is relevant introductory materials presented in advance. The organizers help students learn at a higher level of abstraction, generality and inclusiveness than the learning task itself. Operationally, Ausubel (2000) notes the differences between advance organizers, summaries and overviews. Advance organizers

are (a) more abstract, inclusive and general than the more detailed learning materials they precede, and (b) relatable to existing relevant ideas already present in cognitive structure.

Summaries and overviews, on the other hand, largely accomplish their effect by repetition and simplification.

Since research on advance organizers had generated equivocal findings since the 1970s, some criticized that Ausubel's definition for advance organizers was vague. Based on the results of nine experiments, Mayer (1979a) made suggestions on the procedures and operationally defined steps for generating advance organizers. He interpreted advance organizers as "information that is presented prior to learning and that can be used by the learner to organize and interpret new incoming information" (Mayer, 2003, p.350). To facilitate learning and retention, Mayer (1979b) suggests that advance organizers should:

1. Be composed of a short set of verbal or visual information;
2. Be presented prior to learning;
3. Contain no specific content from the preceding learning task;
4. Generate the logical relationships among the elements in the preceding learning task;
and
5. Influence the learners' encoding process.

Synthesizing Ausubel's ideas with more research findings in the 80s, a modified series of procedures for constructing advance organizers were suggested (Bricker, 1989; West, Farmer, & Wolff, 1991). The procedures for constructing textual organizers include the following steps:

1. Analyze learning materials to discover and list necessary prerequisite knowledge.

2. Map the cognitive structures of learners. Find out if students know this prerequisite material.
3. Summarize the major general ideas in the material-to-be-learned.
4. Determine characteristics of the advance organizer.
5. Write a paragraph (the advance organizer) emphasizing the major general ideas and similarities across old and new topics. Examine examples in the text. Use them as models.
6. The main subtopics of the lesson should be covered in the same sequence as they are presented in the advance organizers. Estimate the readability of the advance organizer.
7. Check the understandability of the advance organizer.
8. Assess the study time of the advance organizer.
9. Evaluate the validity of the advance organizer.
10. Revise the advance organizer.

In the current study, the advance organizers were constructed according to the 10 steps prescribed above.

Types of Advance Organizers

Today, advance organizers are widely used in classroom teaching. They are technically a prereading guide that clarifies concepts, sets up expectations, or builds background in any format of text, graphics, or hypermedia (Leu & Kinzer, 2003). The major types of text advance organizers are either expository or comparative. According to Ausubel (2000), an expository organizer needs to be used on relatively unfamiliar materials to provide relevant proximate

subsumers, while a comparative organizer is used for relatively familiar learning materials to integrate as well as discriminate between new ideas and existing ideas.

In addition to the verbal nature of advance organizers described above, visual materials may also serve effectively as advance organizers. Graphic organizers refer to “a visual and verbal organizational structure that assists the reader in organizing what may seem to be unrelated details and concepts”(Horton & Lovitt, 1989, p.627). The function of a graphic organizer serves as a nonverbal, visual-spatial referent that reflects or generates underlying principles and important ideas of the material-to-be-learned and the inter-relationships of ideas and their logical connections to higher, equal, or lower order pieces of information (Horton & Lovitt, 1989; Kang, 2002). Unlike text-based advance organizers, there are published procedures for constructing graphic organizers. In the current study, the graphic organizer was constructed based on the procedures for constructing textual organizers, which might affect the result of the study. Specifically, the effectiveness of graphic organizers might vary due to the experimenters’ design and construction. In the future, an operational definition and procedures for constructing graphic organizers need to be established.

There are many graphic organizer possibilities. Examples of popular graphic organizers include K-W-L organizers, Semantic Maps, Mind Maps, Step-By-Step Charts, Series of Events Chains, Sequence Organizers, Cause and Effect Chains, and Timelines (Minchin Jr., 2004). With the advancement of technologies, teachers and designers started to use hypermedia programs, including digital video, PowerPoint presentation, and Flash animations to construct advance organizers (Tseng et al., 2002). As construction of such hypermedia organizers

demands high technical skills and considerable time involvement, the applications of this technique and relevant studies are still limited in number.

Studies on Advance Organizers before the 1990s

Since the 1970s, extensive research has been conducted in various disciplines on the effectiveness of both textual and graphic advance organizers on learning within the classroom setting or computer-assisted lab environment. However, the results of the research have not been conclusive, since both positive effects and negative effects have been found.

Ausubel's Model

Ausubel's early experiments provided the most-cited research supporting the effectiveness of advance organizers. Ausubel and his associates conducted five studies on expository and comparative advance organizers in a Midwestern state university and a high school in Campaign, Illinois, from 1960 to 1963. All of the five studies reported statistically significant main effects for the organizer treatment group in the posttests, especially in the long-term retention posttest which was conducted 10 days after the treatment (Ausubel, 1960; Ausubel & Fitzgerald, 1961, 1962; Ausubel & Youssef, 1963; Fitzgerald & Ausubel, 1963).

Based on the experiments, Ausubel prescribed a model for predicting the effectiveness of advance organizers (Ausubel, 1968, 2000; Stone, 1983):

1. Students given advance organizers should perform better on tests on the material-to-be-learned than students in control groups.
2. The advance organizer effect should be at least as great in longer studies as in shorter

ones.

3. Abstract advance organizers should be more effective than those including concrete materials or analogies.
4. Subsuming advance organizers should be more effective than others.
5. The learning of students at the formal-operational level should be enhanced more than that of concrete-operational students.
6. Advance organizers bridging the gap from previous knowledge should be more effective than overviews or summaries of the material-to-be-learned.
7. Students having either low verbal or analytic ability or low prior knowledge of the material should be helped more by advance organizers than other students.

A detailed analysis of Ausubel's studies, however, revealed a number of problems. It is claimed (McEneaney, 1990) that no consistent evidence was found across the studies in support of advance organizers or for predicted interactions with verbal ability. In addition, Ausubel's definition of an advance organizer was called into question, and a sound operational definition was negotiated. Later studies in the 70s and 80s failed to show a consistent positive facilitative effect on advance organizers. A number of findings conflicted with Ausubel's model. In some cases, students given advance organizers before instruction did no better, or even worse, than students in control groups.

Barnes & Clawson's Review

Barnes and Clawson (1975) reviewed 32 advance organizer studies using vote counting. Studies reporting statistically non-significant results prevailed 20 to 12, leading the

investigators to conclude that advance organizers, as described by Ausubel, did not facilitate learning. They also differentiated among the studies according to length of study, ability, subject type, grade level, type of organizer, and learning task classification. In each comparison, the count favored non-significance. The authors recommended that further studies should be conducted using a wide variety of non-written advance organizers, provided that the organizers are operationally defined and constructed and that the studies last for more than 10 days. However, Barnes and Clawson's review has been strongly criticized as biased against favorable findings on its unscientific voting technique and inadequate analysis and control (Luiten et al., 1980; Mayer, 1979a).

Mayer's Theory

Mayer (1979a) pointed out the major inadequacies with Barnes and Clawson's review, and reinterpreted Ausubel's subsumption theory in terms of his own assimilation encoding theory. Mayer reported a series of nine experiments supporting his contention. Based on his assimilation theory, he stipulated characteristics for constructing advance organizers as stated in the first part of this review. According to Assimilation Encoding Theory, Mayer reasoned that the failure of advance organizers was due to the unavailability of an assimilative context in students' long-term memory or failure to use of that anchoring knowledge during learning.

Mayer (1979b) also reviewed advance organizer literature using 27 published studies containing an advance organizer group and a control group. He divided the studies into three categories based on three criteria: (a) Is the material unfamiliar, technical or lacking a basic assimilative context? (b) Is the advance organizer likely to serve as an assimilative context? (c)

Does the advance organizer group perform better than the control group on a test? Only three out of the 27 studies claimed statistical significance. However, considering the overall positive but insignificant treatment effects, Mayer concluded that there was a small but consistent advantage for the advance organizer group on tests of learning and retention. He found that advance organizers had a stronger positive effect if learners lacked prerequisite skills or knowledge, if the learning material was poorly organized, or if generalized outcomes were measured.

Luiten, Ames, & Ackerson's Meta-Analysis

Two other literature reviews use Glass's meta-analytic technique – effect size statistic – to compare and synthesize studies on advance organizers. In 1980, Luiten, Ames, and Ackerson (Luiten et al., 1980) examined 135 studies that showed the effects of advance organizers on classroom learning and retention. They found advance organizers to have a positive measurable effect on immediate learning (posttest within 24 hours of the treatment) and long-term knowledge retention (posttest 24 hours and after). The mean effect size for the advance organizer on learning was 0.21, indicating that the average participant performed better than 58% of the control group individuals. Table 1 reports the means and standard errors or effect sizes for advance organizers on learning and retention of the studies. One of the most interesting findings from this meta-analysis is that the retention data showed the advance organizer effect increased with time. The mean effect size on retention 24 hours and after was 0.26 and that of 22 days and longer was 0.38, considerably higher than effect size on immediate learning at 0.21.

Table 1

Means and Standard Errors or Effect Sizes for Advance Organizers on Learning and Retention (Luiten et al., 1980, p.213)

	<i>Learning</i>		<i>Retention</i>			
	0-1 Day	2-6 Days	7 Days	8-20 Days	21 Days	22+ Days
Number of Effect Sizes	110	8	17	8	9	8
Mean	0.21	0.19	0.20	0.23	0.30	0.38
Standard Error	0.04	0.15	0.10	0.16	0.11	0.16

Other variables such as grade level, subject area studies, organizer presentation mode, and subject ability level were also examined. Contradictory to Ausubel’s model, the data indicated that advance organizers were effective with individuals of all ability levels at all grade levels. Although studies involving other media of advance organizers are few in number, the effect size of studies on oral advance organizers is much higher than studies using only a written presentation mode for the advance organizers.

Stone’s Meta-Analysis

In another meta-analysis, Stone (1983) analyzed 29 long-term studies of advance organizers in which posttests were administered one week or later after the treatment and compared her results with predictions from Ausubel’s theory of meaningful learning. The results confirmed that advance organizer groups performed better than control groups. However, the effects of other variables, such as ability level or grade level, were not supported. Stone’s meta-analysis produced a mean effect size for all studies of 0.66 between experimental and control groups, associating advance organizers with increased learning and retention of new and unfamiliar materials. Stone also differentiated effect sizes by organizer characteristics, learner characteristics and learning condition. In Table 2, effect sizes and

standard deviations are classified into three types, written only (textual), written and illustrated (graphic), and other (multimedia). For different types of organizers, smaller effect sizes were more closely associated with written-only advance organizers (0.43) than written and illustrated (0.52) and other forms such as oral organizers, games, etc. (0.83). Table 3 illustrates the effect sizes by the length of the studies. The effect size of studies that examine the students' retention 10-12 weeks after the initial intervention reaches the peak at 1.12. The data suggest that the studies that last for longer time tend to result with higher effectiveness of advance organizers on students' learning and retention.

Table 2
Classification of Selected Effect Sizes by Advance Organizer Characteristics (Stone, 1983, p.196)

<i>Variable</i>	<i>Levels</i>		
	Written only	Written and illustrated	Other
Medium	Written only	Written and illustrated	Other
Median ES	0.34	0.40	0.68
Mean ES	0.43	0.52	0.83
Standard Deviation	0.72	0.89	0.75
N of studies	38	15	59

Table 3
Classification of Selected Effect Sizes by learning conditions (Stone, 1983, p.198)

<i>Length of</i>	<i>Levels</i>				
	1-3 weeks	4-6 weeks	7-9 weeks	10-12 weeks	13-15 weeks
Study	1-3 weeks	4-6 weeks	7-9 weeks	10-12 weeks	13-15 weeks
Median ES	0.41	0.30	-0.22	1.02	0.68
Mean ES	0.59	0.37	-0.03	1.12	0.68
Standard Deviation	0.80	0.39	0.35	0.77	0.45
N of studies	77	6	3	18	8

Corkill's Studies

Corkill and his associates conducted two studies on advance organizers in 1988. One study consisted of six experiments to investigate retrieval context set theory (Corkill, Bruning, Glover, & Krug, 1988). With an average effect size of 2.24, the results indicated that rereading true advance organizers before delayed recall significantly facilitated memory performance. The other study by Corkill (1988) compared the effects of concrete and abstract advance organizers on students' recall of prose, however, generated quite inconsistent results. It was expected that both organizers would facilitate learning and retention, but the results showed that only the concrete organizer treatments had a positive mean effect size of 2.25, while the abstract organizer treatments produced a mean negative effect size of -0.62.

Kenny's Review

Another major literature review pertaining to advance organizers was conducted by Richard Kenny in 1993. The review examined a series of studies associated with both textual and graphic advance organizers on learning and retention, as well as relevant research with computer-based instruction (CBI) (Kenny, 1993). Table 4 illustrates the effect sizes for advance organizers on learning and retention, as reported by Kenny (1993). Effect sizes for the studies on textual organizers ranged from -1.02 to 2.04 for measures of learning and from -0.18 to 4.08 for tests of retention. For graphic organizers, effect sizes ranged from -0.64 to 3.95 on learning, and from -0.95 to 1.76 on retention. Kenny concluded that the evidence of advance organizer effectiveness was mostly positive, though sometimes inconsistent.

Table 4

A Comparison of Effect Sizes for Recent Advance Organizer Studies (Kenny, 1993, p.7)

<i>Study</i>	<i>Learning (posttest within 24 hours)</i>	<i>Retention (posttest 24 hours & after)</i>
Corkill, Bruning, Glover, & Krug (1988)		
Expt. 3 (after 1 week)	---	1.96
Expt. 4 (after 24 hours)	---	2.85
Expt. 5 (after 2 week)	---	1.91
Corkill, Bruning, & Glover (1988)		
Concrete Organizer – Expt.1	1.56	---
Concrete Organizer – Expt.2	2.93	---
Abstract Organizer – Expt.1	-1.02	---
Abstract Organizer – Expt.1	-0.21	---
Lenz, Alley & Schumaker (1986)	1.03	---
After teacher training	2.93	---
After student training		
Kloster & Winne (1989)		
Comparative Organizer	---	-0.15
Expository Organizer	---	-0.18
Gilles (1984)	0.015	0.33
Doyle (1986)	0.74	1.03
Tripp & Roby (1990)	1.25	---
Tripp & Roby (1991)	0.33	---
Carnes, Lindbeck & Griffin (1987)	0.49	0.14
Tajika, Taniguchi, Yamamoto & Mayer (1988)		
Fragmented Pictorial	0.078	1.49
Integrated Pictorial	2.04	4.08
Kenny (1992)		
Adv. Org. > Partic. Graph Org.	-0.45	-0.95
Adv. Org. > Final Form Graph Org.	1.17	0.45
Mean	0.76	1.16

Note: Effect sizes compare advance organizer treatment groups to control groups.

Advance Organizers Studies after the 1990s

Researchers continue to test advance organizers in traditional classroom settings in different subjects at all grade levels. Most of the studies are conducted by in-service teachers, and their research control is sometimes limited by the convenience of classroom teaching and

administration. It is noted that problems of previous research still exist, such as unclear definition of advance organizers, limited experiment duration, and lack of control of students' prior knowledge. Recently, more studies have been conducted on a variety of organizers, including textual, graphic and multimedia in technology-facilitated classrooms/labs.

Textual Advance Organizers

The experimental evidence for textual advance organizers is limited compared to other forms of advance organizers. One study (Bastick, 2001), for instance, used vote counting to test the effectiveness of using lists of instructional objectives as advance organizers at the start of a lesson. Eight in-service teachers implemented the experiments in 17 classes, asking students aged 12 to 19 to recall the instructional objectives stated before instruction and differentiate the one unused objective in the instruction. About 65.8% of the students failed to correctly identify the unused objective. However, this might not be empirical evidence against advance organizers because the researchers implemented loose experiment control, such as no control group, or no randomized assignment. Additionally, it was questionable that using instructional objectives alone could be defined as true advance organizers.

Another study was conducted to determine if cooperative small-group instruction combined with advance organizers could positively affect the self-concept and academic achievement of elementary school students (Box & Little, 2003). The study utilized approximately 125 third graders in four experimental classes and one control class for a pre and post-test experiment and used a two-way ANOVA for data analysis. The researchers reported

that a significant gain in social studies scores in all classes, including the experiment and control groups, but no comparative statistics were reported between the groups.

Graphic Advance Organizers

Recent research explores the effectiveness of graphic organizers, or illustrated (text+graphic) graphic organizers, instead of the textual organizers. Some claim that graphic organizers have better facilitating effects than textual ones, especially for visual learners (Kenny, 1993). In one study, the effects of using concept trees on learning and motivation were assessed, compared with a control group with no advance organizer (Hirumi & Bowers, 1991). The immediate posttest indicated that students who used the concept tree outperformed those learners who did not ($F_{(1,67)}=5.71$, $p<0.05$), and reported higher motivation ($F_{(1,67)}=7.77$, $p<0.01$). The effect size of the study was calculated as high ($d=0.86$) according to Cohen's convention.

Table 5 Table 5 shows the mean scores for learning with a concept tree are considerably higher than those for learning without a concept tree. The investigators concluded that this study lent evidence to the premise that the use of graphic advance organizers can improve learning from text.

Table 5
Mean Scores for learning (Hirumi & Bowers, 1991, p.277)

	<i>Concept tree</i>	<i>No-concept tree</i>
Mean	46.90	34.97
Standard Deviation	18.97	17.29

In another study, two types of advance organizers were tested, with no control group, in an instructional video class (Herron et al., 1995). The first organizer treatment consisted of six

sentences in text, and the second one combined both the six-sentence text and picture screens selected from the video. The video comprehension posttests later suggested that the advance organizers using both verbal descriptions and pictures, with a mean effect size of 0.35 as illustrated in Table 6 better improved students' performance.

Table 6
Mean Scores and Standard Deviations as a function of Advance Organizer Teaching Condition (Herron et al., 1995, p.392)

	<i>Description only</i>	<i>Description + pictures</i>
Mean of all quiz scores	0.31	0.35
Standard Deviation	0.14	0.13

The long-term retention effect of graphic organizers was tested in an experiment with 45 fifth grade social studies students, using pre-post and delayed posttest intact group design (Mazure, 1996). The experimental class used participatory graphic organizer instruction with their social studies lessons while the other class used text-based activities. The students in the experimental class assisted teachers in constructing several types of graphic organizers in a two-week instruction period. The posttest took place two months later. As shown in Table 7, the posttest shows no significant result in immediate learning, but the delayed posttest demonstrates a significant increase in knowledge retention of social studies material, with the significance level set at 0.10 for the 2-tailed t-test ($t=-1.999$, $p=0.05$).

Table 7
T-test values for chapter tests (Mazure, 1996, p.16)

	<i>T-value</i>	<i>P-value</i>
Pre-tests	0.03	0.97
Post-tests	0.62	0.54
Delayed posttests	-1.999	0.05

Additionally, the effectiveness of concept maps was tested in a graduate level research methodology course in the form of advance and post organizers (DaRos & Onwuegbuzie, 1999). The participants consisted of 218 graduate students. The difference between the experimental group and control group was the use of concept maps as advance and post organizers. The results revealed that the experimental group obtained higher levels of achievement ($t=4.9$, $p<0.001$) with a moderate effect size (0.54). However, the major limitation of this study is the lack of internal validity control, due to its use of a quasi-experimental design.

Graphic organizers were also implemented in a basal English reading class with an experimental group against a control group (Millet, 2000). This study utilized a pretest, posttest design to measure the reading comprehension achievement, and also analyzed a qualitative component to ascertain the quality and quantity of teacher and student interaction. The results showed that in a traditional basal reader environment, students with graphic organizers did significantly better in reading comprehension quizzes than students with exclusive basal reader instruction, but no specific data were shown in the article.

Using the meta-analysis technique, Kang (2002) synthesized 14 graphic organizer intervention studies for students with learning disabilities. She calculated the effect sizes by dividing the difference between the treatment and comparison group means by the pooled standard deviation. The overall finding revealed moderately large effects (weighted mean effect size = 0.76) of graphic organizers on learning from text materials, indicating that graphic organizers used before and after reading facilitated initial and subsequent learning of students with learning disabilities. In addition, she differentiated the effect sizes by instructional

features, graphic organizer features, length of intervention, instructional group size, instructional materials, and methodological features. Table 8 selects a few effect sizes reported. Opposed to the previous findings, Kang showed a negative relationship between the length of the study and the effect size. The result also indicated that teacher-constructed graphic organizers had a higher effect size than student-constructed graphic organizers. She explained the reason might be that constructing graphic organizers was difficult and time-consuming for students with disabilities. However, according to Kang, student-constructed graphic organizers still appeared to be helpful, because they were consistent with schemata in students.

Table 8
Summary of mean effect sizes to instructional features, construction type, and length of treatment (Kang, 2002)

	<i>N</i>	<i>K</i>	<i>Weighted Mean ES</i>
Instructional features			
Pre-GO	1	9	0.89
Post-GO	2	5	0.39
Pre- & Post GO	3	7	0.88
During- & Post GO	2	15	0.44
Pre-, During-, & Post	2	3	0.45
Construction type			
Teacher-constructed GO	12	36	0.66
Student-constructed GO	2	2	0.45
Number of treatment session			
1 to 3	4	16	0.91
4 to 10	6	12	0.65
Over 10	2	6	0.59

Note: GO= graphic organizer; N= number of studies; K=number of effect sizes aggregated

Advance Organizers in Technology-Enhanced Environments

Recently, studies concentrate on how advance organizers could be effectively incorporated with new instructional modes -- computer-assisted and Web-based instruction.

Kenny (1993) first reviewed studies using advance organizers with computer-based instruction (CBI) in his comparative analysis. Nine studies using true advance organizers, according to the guidelines provided by Ausubel and Mayer, were analyzed. For many of the studies, no statistically significant result was reported on learning or retention between the advance organizer group and the control group. Based on the mean effect size of 0.69 on learning, and 0.86 on retention as shown in Table 9, Kenny concluded that there was mild evidence to suggest advance organizers could be effective if incorporated in CBI.

Table 9
A Comparison of Effect Sizes for CBI Advance Organizer Studies (Kenny, 1993)

<i>Study</i>	<i>Learning</i>	<i>Retention</i>
Carnes, Lindbeck & Griffin (1987)	0.49	0.14
Tajika, Taniguchi, Yamamoto & Mayer (1988)		
Fragmented Pictorial	0.078	1.49
Integrated Pictorial	2.04	4.08
Tripp & Roby (1990)	1.25	---
Tripp & Roby (1991)	0.33	---
Kenny, Grabowski, Middlemiss, & Van Neste-Kenny (1991)	0.59	-0.07
Kenny (1992)		
Adv. Org. > Partic. Graph Org.	-0.45	-0.95
Adv. Org. > Final Form Graph Org.	1.17	0.45
Mean	0.69	0.86

Note: Effect sizes compare advance organizer treatment groups to control groups.

Kenny (1993) promoted the use of participatory organizers as effective post organizers instead of advance organizers. He suggested using Wittrock's Generative Learning Hypothesis for accurately predicting when such organizers would be effective in CBI. He differentiated participatory organizers (student-constructed organizers) from teacher-constructed organizers, which was the case for most advance organizers. According to the Generative Learning Hypothesis, Kenny suggested that the participatory organizers were more likely to affect

students' transfer and higher level learning than teacher-constructed organizers. However, along with the previous studies, the research evidence was not conclusive. In three out of the four studies, Kenny generated non-significant negative result, with the control group better performing than the organizer group (Harris, 1992; Jonassen & Wang, 1992; Kenny, 1992; Kenny et al., 1992). Among the four studies, only two conducted by Kenny are included in Table 9 because the others were focused on treatment of post-instruction activity instead of advance organizers. Kenny insisted that the participatory organizer held promise for CBI environment, arguing that the current research evidence used small sample sizes and might have been underpowered.

Zittle (2001) continued the research on participatory organizers. He compared the use of a text organizer, a completed concept map, and a structured concept map in a study with distance based education. All three groups read the problem text first. Then three instructional strategies were administered. The text group studied the key points of the problem in text form. The concept map group studied the same points in the form of a teacher-constructed concept map. The third group filled out a partially-blank concept map by themselves. The dependent variable was the number of hints required for solving the second problems. The result indicated that participants using a participatory organizer required significantly fewer hints to correctly solve the problems than either of the other two groups ($F_{2,136}=19.58, p<0.01$). Table 10 represents the descriptive data from an analysis of mean solution scores by different instructional methods.

Table 10
Means and Standard Deviation Data (Zittle, 2001, p.108)

<i>Method</i>	<i>Mean</i>	<i>SD</i>	<i>N</i>
Text	7.35	3.40	48
Completed CM	6.21	3.21	42
Participatory CM	3.43	2.90	49
Total	5.63	3.58	139

McManus (2000) conducted a study in a Web-based hypermedia learning environment with a population of 159 college students in a southwestern university. He integrated short prose paragraphs as expository organizers to link the new lesson with students' preexisting knowledge structure. The study, utilizing a 3x3x2 repeated-measure ANCOVA with co-variables, was designed to search for possible interactions between nonlinear presentation, advance organizers and learner self-regulation in an introductory level technology class. Table 11 illustrates the means and standard deviations on learning for both the experiment and control groups. The results show no significant main effects or interactions ($F_{(2,117)}=3.05$, $p=0.052$).

Table 11
Advance Organizer Group Means (McManus, 2000, p.238)

	<i>No Advance Organizer</i>	<i>With Advance Organizer</i>
Mean	23.81	23.91
Standard Deviation	6.72	6.82

Yeh and Lehman (2001) also investigated the use of advance organizers, English learning strategies, and the effects of learner control on learning English as a Foreign Language from interactive hypermedia lessons. They constructed the advance organizer according to Bricker's (1989) procedures and used short paragraphs to provide subsumers for students before they began to learn the unfamiliar Middle East history. Results of this study reveal significant

effects of learner control and the use of advance organizers. The authors reported that subjects who experienced the treatment with the advance organizer scored significantly higher ($F_{(1,109)}=6.23, p=0.014$) than their counterparts who did not have the advance organizer treatment in the CBI environment.

With the ease and flexibility of combining multimedia elements into instruction, teachers and designers also tried to construct advance organizers with multimedia computer programs. Tseng, Wang, Lin, and Hung (2002) administered one experiment on computerized advance organizers designed with Macromedia Flash and Microsoft PowerPoint. In this study, 276 sixth graders were divided into two learning environments, one using computer assisted learning systems and the other using traditional teaching mode. In each learning environment, subjects were further divided into one control group and two experimental groups, respectively, using organizers designed with multimedia computer software, Macromedia Flash and Microsoft PowerPoint. The results of the study suggest that the students who used computerized advance organizers evidently demonstrated higher learning achievements than those who used none, with $F_{(2,99)}=3.515, p<0.34$ for CBI environment and $F_{(2,100)}=3.315, p<0.48$ for traditional teaching mode.

Calandra (2002) tested the use of both textual and text + graphic advance organizers in Web-based classroom instruction, and compared the effectiveness of these two types of organizers. The population consisted of over 200 college students located in two campuses. The advance organizers were created strictly with the definition Mayer (1979a) defined. The text-only organizer consisted of abstractions of seven components of a Timeline from the course content. The text + graphic organizer was composed of the same text as the text-only

organizer, combined with graphics reflecting the historical events along the Timeline. The results of both of the two campuses indicate that the use of advance organizers before a one-time, Web-based activity on history did not significantly improve users' knowledge on that subject or their attitudes towards traditionally marginalized groups as compared to a control group with no advance organizers. This is evidenced by the lack of a statistically significant interaction effect between the Treatment Group and Time for all pretest and posttest measures. Calandra attributed the negative results to the limited time duration of the treatment, and suggested that future research could be designed over an extended period of time as opposed to only one class meeting in his study. Table 12 and Table 13 show the means, standard deviations and effect sizes for knowledge-based and performance-based achievement respectively.

Table 12
 Knowledge test score mean differences, standard deviations, and effect sizes for Treatment Groups (Calandra, 2002, p.111-113)

	<i>Treatment</i>	<i>Mean Score</i>	<i>SD</i>	<i>ES</i>
Campus 1	Control	2.39	6.04	--
	TAO	2.39	4.2	0.00
	TGAO	0.94	5.47	-0.24
Campus 2	Control	0.53	5.00	--
	TAO	2.16	7.48	0.32
	TGAO	0.63	5.94	0.02

Note: TAO=text-only advance organizers; TGAO=text+graphic advance organizers.

Table 13

Activity sheet mean scores, standard deviations, and effect sizes for Treatment Groups (Calandra, 2002, p.127-128)

	<i>Treatment</i>	<i>Mean Score</i>	<i>SD</i>	<i>ES</i>
Campus 1	Control	28.24	4.13	--
	TAO	28.75	3.56	0.12
	TGAO	29.02	4.3	0.19
Campus 2	Control	28.06	3.80	--
	TAO	28.00	3.79	-0.01
	TGAO	28.79	3.11	0.19

Note: TAO=text-only advance organizers; TGAO=text+graphic advance organizers.

Another study investigated the effects on student learning performance and computer anxiety of Navy enlisted personnel using two different forms of concept maps as graphic organizers in computer-based training sessions (Hale, 2003). There were one control group and two experimental groups using spider and hierarchical concept maps respectively. Both advance organizers were composed of important concepts drawn from the material-to-be-learned. The spider map consisted of a central concept with related concepts branching off in many different directions. The hierarchical map indicated a more linear relationship between the central concept and the sub-concepts. The study was implemented in three locations in networked computer training centers. All learning materials were provided on a CD by the researcher. The experiment was a 90-120 minute one-time session, with a pretest quiz, a posttest quiz and an attitude survey. Students were randomly assigned to a computer station, with either no concept map, a hierarchical map, or a spider map as a preinstructional strategy. Means and standard deviations are illustrated in Table 14. A significant relationship was found to exist between the number of high school science courses

taken and the posttest scores, but no statistical significant effect was associated with graphic organizers on student learning performance or computer anxiety level.

Table 14
Means, standard deviations and number of posttest performance scores by treatment (Hale, 2003, p.54)

<i>Treatment</i>	<i>N</i>	<i>Means</i>	<i>SD</i>
Control	45	56.58	26.54
Hierarchical	49	59.25	26.14
Spider	51	60.14	27.09

Qualitative Research

While quantitative data failed to provide a conclusive result supporting the use of advance organizers, some researchers adopted multiple qualitative methods to understand the effects of advance organizers and determine the value of using advance organizers in teaching and learning in the past five years. The benefit of using qualitative methods is that researchers are able to immerse themselves in the natural context, observe all factors, and interpret findings in a more naturalistic and subjective way (Padgett, 2003; Rossman & Rallis, 2003). The purpose of the qualitative research is to present the process how instructors and students use advance organizers, instead of testing for cause-and-effect relationships. In addition to the quantitative data, some researchers analyzed the interviews and surveys of teachers and students and provided qualitative research evidence to support the assertion that utilization of advance organizers was valuable for teaching and learning (Millet, 2000).

Gil-Garcia and Villegas (2003) developed a case study on higher education faculty and undergraduate and graduate students regarding the value of advance organizers. A total of 17 students and five faculty members participated in the study and their responses were analyzed

and categorized into themes, which reflect that most participants found the graphic organizers useful tools for students to organize and understand the text. This investigation provides in-depth views and contextual information about how and why students and teachers use this traditional orienting technique in classes. The authors suggested that graphic organizers “facilitate breaking down the content, using cognitive and metacognitive strategies to approach the text, organizing the text according to its patterns, and classifying essential and nonessential information” (Gil-Garcia & Villegas, 2003, p.8).

Minchin Jr. (2004) also implemented a participatory action research, using document analysis, survey and focus group strategies, to investigate the facilitative effect of graphic organizers in introductory information technology classes as part of his dissertation. The findings of the study support the use of graphic and advance organizers in the classroom with positive feedback from both students and instructors. The results indicate that using graphic organizers is helpful for increasing learners’ understanding, especially for handicap and at risk students in the class, and this educational strategy also shifts the more traditional approach of instruction to a more student-centered approach.

In the above qualitative studies, the population consists of college students in both cases and the sample size is comparatively smaller than the quantitative counterparts. These studies carry out a case study design, using observations, interviews, survey and focus group as data collecting strategies. For data analysis, they follow the Interpretative approach (Erickson, 1986) or the Grounded theory (Charmaz, 2000), analytically inducting themes or theories from narratives and quotes of participants. The advantages of such qualitative design are that they provide a greater information base and engaged wide range of audiences in data gathering and

findings. However, compared to the quantitative methodology, the most serious limitation is the lack of generalizability to larger population due to the subjectivity of the findings.

Summary

In general, use of advance organizers has been an actively debated topic since the 1960s until recent years. Based on the aforementioned reviews, the research evidence concerning any facilitative effect of advance organizers upon learning and retention is variable, but positive in general. Table 14 illustrates the features of recent studies on effectiveness of advance organizers since the 1990s. The majority of the following selected studies are targeted at the college students as research participants. Without exception, all the research was conducted in face-to-face classrooms or technology-facilitated lab environment. In addition, most studies examine the effects of graphic organizers or compared the effects of graphic organizers with those of the textual organizers. Five out of the nine selected studies illustrate a statistical significance, and the effect sizes are considered medium, based on the Cohen convention, with an average of 0.26. Again, research evidence fails to generate overpoweringly statistically significant results on effectiveness of advance organizers on posttest scores between the treatment group and the control group, though most researchers continue to suggest a mild but positive effect of advance organizers on learning and retention.

Table 15

Research design and methodology of recent studies on advance organizers

<i>Study</i>	<i>Population</i>	<i>Learning Environment</i>	<i>AO Type</i>	<i>Length of Study</i>	<i>Sig. AO/C</i>	<i>ES</i>
Hirumi et al. (1991)	73 U	F2f print	GAO TAO &	1 Day	<0.05	0.86
Herron et al. (1995)	39 U	F2f video	TGAO	1 Semester	<0.05	---
Mazure (1996)	45 E	F2f print	GAO	2 Months	0.052	---
DaRos et al. (1999)	218 G	F2f print Web-based	GAO	1 Day	<0.05	0.54
McManus (2000)	159 U	f2f	TAO	3 Days	0.674	0.015
Millet (2000)	38 E	F2f print	GAO	1 Day	---	---
Bastick (2001)	684 M	F2f print	TAO	---	---	---
Yeh (2001)	150 U	F2f CBI	TAO	100 minutes	0.01	---
Tseng et al. (2002)	276 E	F2f CBI	GAO TAO &	1 Day	<0.05	---
Calandra (2002)	154 + 63 U	F2f CBI	TGAO	1 Day	>0.05	0.11 (TAO) 0.04 (TGAO)
Box et al. (2003)	125 E	F2f print				
Gil- Garcia et al. (2003)	17 U + 5 professors	---	GAO	---	---	---
Hale (2003)	161 adults	F2f CBI	GAO	---	>0.05	0.10 0.13
Minchin Jr. (2004)	Teachers	F2f CBI	GAO	---	---	---

Note: a. In Population, E=elementary pupils; M=middle school students; U=undergraduate students; G=graduate students. b. In AO type, TAO=text-only advance organizers; GAO=graphic advance organizers; TGAO=text+graphic advance organizers.

Even though many of the historical studies fail to achieve statistical significance, their composite effect size approximates a medium to large effect as illustrated in Table 16. However, the effect sizes in three of the aforementioned recent studies decrease below 0.20 (Calandra, 2002; Hale, 2003; McManus, 2000). Since current studies that provide sufficient statistics for calculating effect sizes are limited in number, there has been little evidence to demonstrate that advance organizers are no longer positively effective in CBI and Web-based instruction.

Table 16
Comparison of effect sizes in meta-analysis and research review

	<i>ES for learning</i>	<i>ES for retention</i>
Luiten et al. (1980)	0.21	0.19-0.38
Stone (1983)	0.59	-0.03-1.12
Kenny (1993)	0.76	1.16
Kang (2002)	0.76	---

The discrepancies regarding the effectiveness of advance organizers might be attributed to imprecise construction of organizers, short duration of treatment, inadequate research control, and insufficient instruction on how to use organizers. Therefore, the summary of the literature review suggests that the following factors need to be addressed in AO research:

1. Construction of advance organizers should follow the precise definition and procedures.
2. Students need appropriate instruction about how to use advance organizers.
3. Learners' ability level and prior knowledge should be closely examined.
4. Learners' characteristics need to be taken into consideration.
5. Short-term study lasting within 10 days should be avoided.
6. Objective methods are needed for qualifying and quantifying learning results.

Rapid development of computer and the Internet technologies brought changes to research on advance organizers. In the 21st century, the new frontier of educational technology is E-learning, virtual classrooms, and distance education. However, the discussed studies using organizers in technology-enhanced instruction, without exception, took place in physical computer-equipped classrooms/labs where students and teachers were both present during a limited duration of time. It is hypothesized that employment of advance organizers in Web-based learning might improve students' performance by helping them easily initiate online activities with less cognitive resources in the complicated navigation tasks and reducing the possibilities of students getting lost in the hyperspace (Chang, 2004). Therefore, later studies should empirically examine the effects of advance organizers on online learning achievement.

Based on the findings of research on advance organizers, the following aspects of the issue in designing the experiments pertaining to advance organizers are considered in the current study.

1. To best control the internal validity, both the organizers were constructed based on the definition and procedures prescribed in the literature and a randomly-assigned repeated-measure posttest design was carried out.
2. To better measure the effects of advance organizers, the study was conducted over 4 weeks, testing the long-term impacts of advance organizers on learning.
3. For the selection of types of organizers, the effectiveness of both textual and graphic advance organizers was examined.
4. Most importantly, the current research was conducted in a fully Web-based course where

the instructor and the students were not present at the same physical environment.

This dissertation examined if graphic advance organizers would assist students' learning and retention in an adaptive and interactive student-centered online learning environment. It is hoped that this study would fill in the research gap and establish empirical evidence on using strategies, specifically advance organizers, for online learning.

CHAPTER THREE: METHODS

Chapter three describes the method that was used to answer the research questions and hypotheses posed in the study to investigate the effects of advance organizers on learning and retention. This chapter consists of a description of the subjects, research design, interventions, instruments, procedure, data analysis techniques, and limitations.

Power

Based on the literature review, sample size of studies on advance organizers is usually larger than 40, and often exceeded 100, with over 25 students in each treatment group. To maximize the chances of rejecting null hypotheses, an a-priori power analysis was performed to determine the sample size for the dissertation project. In one of the most cited recent review, Kenny (1993) had reported a mean effect size of 0.76 for learning and 1.16 for retention. Based on his synthesis on research relevant with computer-assisted instruction, a mean effect size of 0.69 was calculated for learning and 0.86 for retention. Therefore, adopting a moderate to high effect size of (0.69), it is reasonable that the sample size could be reduced to below 50 in each group while still maintaining a power of 0.80.

Since, a repeated measure ANOVA was performed for this study, a power analysis specifically for a 3-group one-way ANOVA was calculated using a professional statistic software-- nQuery Advisor's® (nQuery, 2005). nQuery Advisor's®'s result showed that, with an effect size of 0.69, to maintain a power of 0.99 for the posttests, the sample estimate was 43 for each group.

Subjects

Participants of the current study were selected from a population of undergraduate students enrolled in a fully Web-based health care ethics class in the College of Health and Public Affairs at the University of Central Florida. This course, entitled “Health Care Ethics,” is required for all health-related major undergraduate students in the college. The course is a fully Web-based, requiring no face-to-face meetings, where the instructor and students log into a WebCT account and communicate through course pages, discussions and e-mails within the online account. The course studies ethical issues in health care, including life-saving measures, rights to die, transplants, surrogate parenthood, privacy and confidentiality, and decision-making.

The class for this study encompassed 166 students (n=166). With few exceptions, all enrolled students are junior and senior undergraduate students, majoring in health-related fields, such as health sciences, health services administration, health information management, and nursing. The majority of participants are in their early 20s. Three fourths of the participants are female students, and most of the students are white Caucasians. All enrolled students were invited to participate in this study on a voluntary basis. Bonus points towards the course credit were awarded for participants who complete all instruments. Among the total 166 class students, 145 of them voluntarily agreed to participate in the study, and 112 students completed all instruments for the study at the end.

Sampling

All class students were randomly assigned into three groups within the online WebCT course account. Three separate versions of module 2, the experiment module, had been created, with different interventions and instruction. Each version was released to one group of students only in the fully Web-based course. During the first week, all students in this course read an invitation letter as part of module 1. The students were informed that a research study would take place in module 2 and that participation in this study was voluntary. Students who were willing to participate needed to complete a posttest I and a survey in week 2, and a posttest II in week 6. Students could also ignore these instruments, and no score would be deducted from their final course credits for not participating in the study.

At the beginning of the second week, all students in the class (n=173) were randomly assigned into three groups with the “Generate groups” feature inside WebCT. During the second week, seven students dropped from the course, with a total of 166 remaining in class. Therefore, the experimental group consists of 57 students, who access a concept map intervention in the online module. The comparison group consists of 55 students, who access a text organizer intervention. The control group consists of 54 students, without any form of advance organizer in their module 2.

Research Design

This study used a repeated-measure, control-group posttest-only design with random assignment to examine the effects of advance organizers on learning as illustrated in *Figure 1*.

R	E ₁	X ₁ (Graphic Organizer)	O ₁	O ₂
R	E ₂	X ₂ (Text Organizer)	O ₃	O ₄
R	C	(No Advance Organizer)	O ₅	O ₆

Figure 1. Research Design Diagram

“R” indicates that all participants were randomly assigned to three groups, two treatment groups (E₁ and E₂) and one control group (C). Advance organizers were the intervention in this experimental event. The experimental group (E₁) reviewed a concept map, a form of graphic organizer, before reading textbook. The comparison group (E₂) reviewed a text organizer, and the control group (C) did not read any advance organizer before textbook reading. During the course of the study, all three groups completed an immediate posttest (O₁, O₃, and O₅) and a delayed posttest (O₂, O₄, and O₆).

Dependent & Independent Variables

The dependent variable in this study is students’ learning achievement, encompassing their short-term (O₁, O₃, and O₅) and long-term knowledge acquisition and application (O₂, O₄, and O₆). The short-term and long-term knowledge acquisition was tested with two corresponding 9-item knowledge quiz. The short-term knowledge application was tested with problem-based scenario essay questions. Details of the quizzes and scenario questions will be described in the Instrument section.

One of the independent variables is the treatment of advance organizers (X₁ & X₂). The three groups had the same instruction, except for the treatment of advance organizers. As introduced before, the experimental group was presented with a multimedia graphic organizer (concept map) (X₁) of key concepts in module 2; the comparison group was presented with a

textual outline of the same concepts (X_2); and the control group had no advance organizers exposure before textbook reading. Both advance organizers (X_1 & X_2) will be later described in details in the Intervention section.

Since a posttest I-posttest II repeated-measure design is exploited in this study, time becomes a confounding variable for the research. It is assumed that the time factor might influence students' learning achievement over a period of four weeks' time.

Interventions

Online Modules

This course is divided into 15 modules which focus on matters as: Foundations of the Physician-Patient Relationship; Hospitals, Families, and Medical Confidentiality; Death and Dying; Contraception, Abortion, and Prenatal Diagnosis; Reproductive Issues and Genetics; Human and Animal Experimentation; and Allocation, Social Justice, and Health Policy.

Each module is divided into three parts: instruction, textbook reading, and assignments. The students access the course module at a convenient time during the instruction week. They first read the instruction page to get an overview of the module objectives, activities, and assignments. Then, they start to read the assigned chapters in the textbook *Biomedical Ethics* (Mappes & Degrazia, 2005). After textbook reading, they proceed to the assignment Web page to read for detailed instruction for module assignments.

Module 2, the experiment module, discusses the concepts and issues in the physician-patient relationship. The module started on Monday morning of week two in the fall semester, 2006, and all assignments were due on the following Monday morning. Like the

other modules, it is divided into one instruction page and one assignment page. For this module, students had four major assignments. First, students played with a flash-created vocabulary game, but no credit was counted for the game. Second, they needed to complete an essay question and a case study question for course credit points. Also, they needed to make preparatory work for a future debate project and a future discussion project. As part of the module assignments, the researcher designed a multiple-choice quiz and a student survey to collect data for the study. The quiz and survey score weren't directly counted into the final course credit, but a bonus of 10 points was awarded to the students if all research activities were fulfilled.

Advance Organizers

Two forms of advance organizers were designed respectively for the experimental and comparison groups. The construction of the advance organizers was based on the criteria prescribed by Mayer (1979b) and followed a series of research-based procedures (Bricker, 1989; West et al., 1991), as listed and described in the section of Definition & Construction Procedures of advance organizers in Chapter 2. Students were instructed to review the advance organizers before they read the textbook. *Figure 2* and *Figure 3* illustrate the advance organizers that were used in the study.

Please click the concept box for detailed explanations of each concepts	Concept Explanations
	<p>Patient's Rights: Patient's fundamental rights advocated by American Medical Association</p> <ol style="list-style-type: none"> 1. Right to accept or refuse recommended medical treatments; 2. Right to confidentiality; 3. Right to have available adequate health care

Figure 2. Graphic Organizer: Concept Map

The graphic advance organizer is a flash-based interactive concept map as illustrated in Figure 2. Each button represents an important concept in the chapter. Detailed description of each concept shows if the concept is moused over.

Module 2: The Physician-Patient Relationship

2.2 Chapter 2 Summary



Module 2 addresses the **important concepts and principles** in the physician-patient relationship, as well as related **key moral issues**.

The important concepts and principles from Chapter 2 are selected as follows:

1. The fundamental **ethical values** in physician-patient relationship are:
 - Promotion of the patient's well-being;
 - Respect of the patient's autonomy.
2. Other important concepts include:
 - a. **Physician's Obligations:** Three-tier system of obligations prescribed by Pellegrino
 - Obedience to the law
 - Obedience of moral rights and fulfilment of moral duties
 - Practice of virtue
 - b. **Patient's Rights:** Patient's fundamental rights advocated by American Medical Association
 - Right to accept or refuse recommended medical treatments
 - Right to confidentiality
 - Right to have available adequate health care
 - c. **Physician-Patient Relationship:** Childress and Siegler's 5 model doctor-patient relationships
 - Paternalism
 - Partnership
 - Contract

Figure 3. Text Organizer: Textual Outline

The text advance organizer presents the same concepts and explanation as the concept map in a text format, as illustrated in *Figure 3*. Both advance organizers are linked to the instruction page of module 2. The only difference between the two organizers is the presentation of the relationship among the concepts. The concept map illustrates the relationship visually in a nonlinear way, and the textual outline presents it textually in a linear way. The validity of both advance organizers was tested and confirmed by expert review from both the instructor and the outside instructional designer, and modifications were made based on their suggestions.

Instruments

This study utilizes three major instruments: posttest I, posttest II, and a student survey for post hoc analysis. Posttest I and II are parallel in content and format, with nine multiple choice questions examining concept acquisition and three open-ended questions based on a scenario, testing knowledge application. In the pilot study, the measurement for the two quizzes of 18 questions is judged to be fairly reliable (Tuckman, 1975), with a reliability coefficient of 0.67. The validity of the instrument was established by content expert review.

Posttest I

Posttest I was administered in module 2, as one part of the assignments. Posttest I consists of two parts. The first part includes nine randomly-selected multiple choice questions out of an 18-question quiz bank. Students had 20 minutes to complete the quiz. The questions were designed on the key concepts and principles in this module. Each question has four choices and

only one correct answer. The full score of this quiz is 90 points and each question is worth of 10 points. This score was not counted as part of the final course credit score. The questions were reviewed and modified by the course instructor. To prevent cheating in the online quiz, for each student, the questions and related choices were given in a random order. The discriminating scores for quiz 1 were 0.45 on average, judged to be medium (between 0.3 and 0.6).

The second part of posttest I consists of three short essay questions. Students were presented with a scenario taken from the textbook on the issue of patient responsibility. The students were instructed to answer three questions based on the scenario. The teaching assistant of this course graded students' answers based on the criteria specified in a published assessment rubric (see Appendix E for details). The total score for the answers to the scenario questions is 25 points. The scenario question is an obligatory assignment for the students, and the score is counted as part of the final course credit points.

Posttest II

Posttest II was administered four weeks after posttest I during week six of the semester. Students were instructed that they would take another quiz and complete a scenario question based on the content of module 2, and they had the flexibility to complete posttest II anytime during that week. Neither the quiz nor the scenario question was an obligatory assignment for the students. The results of these two assignments were not be directly counted in the final course credit, but a 10 bonus points would be awarded to the students who completed both posttest I and II.

The first part of posttest II is a 9-question multiple choice quiz. Like quiz 1, in quiz 2, nine questions were randomly selected out of the same 18-question quiz bank. Students were given 20 minutes to complete quiz 2, and the total possible points for quiz 2 is 90, with 10 points allocated for each question. All questions and choices to each question were released to the students in a random order. The discriminating scores for quiz 1 were 0.38 on average, judged to be medium (between 0.3 and 0.6).

The scenario question of posttest II is taken from the Medical and Public Health Law Site at <http://biotech.law.lsu.edu/cases/consent/index.htm>. Three questions are related to the issue of informed consent, and the total score for these questions are 25 points, but it is not counted towards the final course credit points. The teaching assistant of this course graded the students' answers based on their understanding of the scenario and the adherence to the assignment rubric (see Appendix E for details).

Post hoc Analysis

The student survey contains 18 multiple-choice questions on students' prior online learning experience, study environment, use of concept maps, use of quiz, and demographic information. One additional open-ended question collects further comments from student participants. For the experimental and comparison group students, additional questions were asked about their experience and attitudes towards using the concept map or the text outline.

Also, student interviews were conducted via phone or live chat system on sample students respectively for the three groups. A sample of 21 students was randomly selected for the interview, and 10 students agreed and participated in the interview. Each interview lasted about

seven to eight minutes. Students were asked about their online learning experience and their perspectives of using advance organizers for Web-based learning. Another interview was conducted with the teaching assistant about the assignments grading and online teaching experience. Additional data were obtained from course assignments, the WebCT orientation quiz and other student records. All the information collected here will be used as covariates for the post hoc analysis.

Procedures

This study was conducted over six weeks. During the first week of the semester, participants were randomly assigned into three groups. Each group was provided with one version of module 2 at the beginning of the second week. The first group was only able to access the module with a concept map; the second group was only able to access the module with a textual outline; and the third group was only able to access the module without any form of advance organizer.

The three versions of module 2 were released to the students at the same time on Sunday mid-night during week two of the semester. In the course module, the students were suggested to first review the advance organizers to gain an overall idea of the key concepts and issues covered in this module, if they had one available in their group. The students in the experimental group reviewed the multimedia concept map before reading the book. The students in the comparison group reviewed the textual outline before reading the book. The students in the control group were not given an advance organizer, and they proceeded directly to textbook reading.

Chapter 2, “The Physician-Patient Relationship” of the textbook, *Biomedical Ethics* (Mappes & Degrazia, 2005), is the designated reading materials. After textbook reading, the students were instructed to complete all the assignments on the assignment page, including the two parts of the posttest I. The knowledge quiz of posttest I is a timed WebCT quiz. The students had 20 minutes to complete the nine questions and they could only access and submit the quiz once. However, as it was a fully Web-based course, the quiz was not proctored and students had the flexibility to do the quiz at their convenience during the instruction week. For the second part of Posttest II, the students needed to complete the questions based on a scenario using Microsoft Word and submit the assignment to the WebCT Dropbox tool by the next Monday morning. The assignment rubric was given to the students in the assignment page inside WebCT.

During week two, students were also given the opportunity to fill out a student survey. The survey was open to the students in WebCT all throughout the instruction week. Right after week two, 12 students were randomly selected, with 4 from each group. These students were contacted by the researcher for the purpose of an interview regarding their online learning experience. Six out of the 12 students were finally interviewed during that week via phone or WebCT chat. The students were asked about how they learned with or without the advance organizers for this Web-based class. Each interview lasted around seven to eight minutes.

Four weeks after module 2, in week six, posttest II was administered through WebCT. Together with all the other assignments for module 6, posttest II, including a quiz and three scenario questions, was open for the students. It was stated in module 6 that both the quiz and scenario questions of posttest II were part of the voluntary research. The students needed to

complete this posttest with the knowledge they had learned in module 2. After week six, another sample of nine students was randomly selected and contacted for interviews. Four of them were finally interviewed on their experience and perceptions of Web-based learning.

Data Analysis

The data collected from the posttests and survey were analyzed using the Statistical Package for the Social Sciences (SPSS). Statistics procedures, including descriptive analysis, one-way analysis of variance (ANOVA), and repeated-measure regression were performed.

Descriptive Analysis

Descriptive analysis was conducted for students' demographic background, such as age, class standing, major, gender, ethnicity, and GPA distribution. Also, descriptive analysis was used for scores in the posttests. Means, standard deviations, and effect sizes of students' learning achievement scores were computed for each quiz and scenario question of posttest I and II. The assumptions of the analysis, including the homogeneity of variance and the normality of population distributions, were examined using the Levene's test and the Q-Q plot procedures.

ANOVA Analysis

To test hypotheses I and II, ANOVA was used to compare the mean scores of posttest I and those of posttest II of the experimental, comparison, and control groups. Null hypothesis I suggests that students who are exposed to text or graphic advance organizers before textbook reading would show no difference, in both the short-term knowledge-based and

performance-based learning achievements, from those who are not exposed to advance organizers. Similarly, according to null hypothesis II, it is supposed that no difference would be found in the long-term knowledge-based and performance-based learning achievements among students in the concept map group, outline group, and control group.

Repeated-Measure Regression Analysis

To study the time effect between the two posttests, group difference in changes from posttest I and posttest II on knowledge acquisition and application were assessed using repeated-measure ANOVA regression. The alpha level is set at 0.05 to determine if there are statistically significant changes in students' academic achievement over time.

In addition, students' were divided into a group of high-scorers and a group of low-scorers based on their performance in posttest I. Repeated-measure regressions were performed separately for high-scorers and low-scorers to investigate if learners of diverse learning abilities performed differently over time.

Limitations

External & Internal Validity of the Study

A posttest-only repeated-measure study has limitations. The generalizability of this study is only suitable for four-year college students in fully Web-based courses in the subject of Health Care Ethics. The population is disproportionately distributed across gender and ethnicity, since the majority of the participants in this study are white, female, and Caucasians.

The internal validity of the study might be subject to potential defects due to procedural issues. First, the students were aware that the quizzes results would not be counted toward final course credit. It is possible that the students do not make an adequate effort on the posttests. Thus, it is not completely certain whether the scores truly represent students' learning achievement. Second, as indicated in the pilot study, the scores in the performance-based tests vary. Thus, a ceiling effect may be another limitation to the study. Finally, in online research, it is difficult to monitor the testing process. Despite the fact that questions and choices are given to the students in a random order, students are not prevented from consulting their textbook and colleagues during the designated quiz time. Therefore, the quiz results may not accurately represent students' knowledge acquisition abilities.

Validity & Reliability of the Instruments

The validity and reliability of the test instruments need further examination. The validity of the achievement test instruments is measured by no further procedures except expert review. Besides the content validation, a more complete validation which includes criterion-related validation and construct validation procedures might be considered to identify possible measurement errors for the use of the instruments.

In the pilot study, the reliability coefficient for the achievement quizzes is judged to be fairly reliable (Tuckman, 1975), with a reliability coefficient of 0.67. In the dissertation study, the same test questions were administered as posttests. However, in both posttest I and II, a random sample of 9 questions were selected out of the 18 question bank for each student. The content sampling might have weakened the reliability coefficient, but, on the other hand,

have decreased the chances for students to cheat with each other. In addition, providing that there are only nine questions in the scale, the value of the reliability coefficient can be quite small (Pallant, 2005).

CHAPTER FOUR: RESULTS

Statistic procedures, including descriptive analysis, one-way analysis of variance (ANOVA), and repeated-measure regression (RMR) were performed to test the research hypotheses. This chapter presents the analysis results. It includes a brief account of the students' demographic information, learning achievement scores obtained from the quizzes and scenario questions in posttest I and II, and results on students' attitudes and experiences regarding using advance organizers (AOs) in Web-based learning. In addition, a descriptive report of students' interview about their online learning experiences will be discussed to better answer the research questions.

Students' Demographic Information

The population of this study includes the junior and senior students majored in health-relevant fields at the University of Central Florida. A total of 166 students enrolled in a Web-based class were invited to participate in this voluntary research study. 112 students completed all quizzes, scenario questions and a survey of the study. At the end of the second week of the semester, the survey was administered to all students to collect information regarding their demographic data and attitudes towards using AOs. 144 students completed the survey. Demographic information for the students is presented in Table 17. In the subsequent tables, group 1 refers to the experimental group using a concept map, group 2 refers to the comparison group using an outline, and group 3 refers to the control group.

Table 17
Gender, Age, Ethnicity, Major, & Class Standing Composite

		<i>Group</i>			<i>Total</i>
		<i>1</i>	<i>2</i>	<i>3</i>	
Gender	Male	11 (21.2%)	12 (25.0%)	10 (22.7%)	33 (22.9%)
	Female	41 (78.8%)	36 (75.0%)	34 (77.3%)	111 (77.1%)
	Total	52	48	44	144
Age	19		1 (2.1%)	1 (2.3%)	2 (1.4%)
	20	6 (11.5%)	4 (8.3%)	6 (13.6%)	16 (11.1%)
	21	24 (46.2%)	11 (22.9%)	14 (31.8%)	49 (34.0%)
	22	7 (13.5%)	9 (18.8%)	10 (22.7%)	26 (18.1%)
	23	6 (11.5%)	6 (12.5%)	4 (9.1%)	16 (11.1%)
	24		3 (6.3%)	4 (9.1%)	7 (4.9%)
	25	2 (3.8%)	2 (4.2%)	2 (4.5%)	6 (4.2%)
	Older	7 (13.5%)	12 (25.0%)	3 (6.8%)	22 (15.3%)
	Total	52	48	44	144
Ethnicity	White	27 (51.9%)	30 (62.5%)	26 (59.1%)	83 (57.6%)
	Hispanic	9 (17.3%)	3 (6.3%)	3 (6.8%)	15 (10.4%)
	African ^a	7 (13.5%)	9 (18.8%)	10 (22.7%)	26 (18.1%)
	Asian ^b	8 (15.4%)	2 (4.2%)		10 (6.9%)
	Others	1 (1.9%)	4 (8.3%)	5 (11.4%)	10 (6.9%)
	Total	52	48	44	144
Major	Health Admin. ^c	29 (55.8%)	27 (56.3%)	27 (61.4%)	83 (57.6%)
	Health Prof. ^d	8 (15.4%)	4 (8.3%)	2 (4.5%)	14 (9.7%)
	Liberal Studies	3 (5.8%)	5 (10.4%)	5 (11.4%)	13 (9.0%)
	Others ^e	12 (23.1%)	12 (25.0%)	10 (22.7%)	34 (23.6%)
	Total	52	48	44	144
Class Standing	Junior	13 (25.0%)	12 (25.0%)	11 (25.0%)	36 (25.0%)
	Senior	36 (69.2%)	34 (70.8%)	33 (75.0%)	103 (71.5%)
	Graduate	2 (3.8%)			2 (1.4%)
	Others	1 (1.9%)	2 (4.2%)		3 (2.1%)
	Total	52	48	44	144

Note: a. African is abbreviated for African American. b. Asian is abbreviated for Asian American/Pacific Islander. c. Health Admin is abbreviated for Health Service Administration. d. Health Prof. is abbreviated for Health Professions. e. Others include Health Sciences, Biology, Political Science, Psychology and Communicative Disorders.

As indicated in the above Table 17, the majority of the students who participated in this study are health-relevant majors in their early 20's. Most of them are in the junior or senior year at the university. In this study, the number of female students exceeds that of males by 300%.

And more than half of the students are white/Caucasians. Also, it is worth mentioning that, as the above table shows, students are equally distributed among the three groups in terms of their demographic background.

In the survey, information regarding students' prior and present learning experiences has also been collected. The following Table 18 presents the data regarding students' prior Web-based learning experiences, and their current study habits for this particular Web-based course.

Table 18
Prior Web-based classes taken before this semester

		<i>Group</i>			<i>Total</i>
		<i>1</i>	<i>2</i>	<i>3</i>	
Web Class^a	0	4 (7.7%)	6 (12.5%)	6 (13.6%)	16 (11.1%)
	1	6 (11.5%)	1 (2.1%)	3 (6.8%)	10 (6.9%)
	2	7 (13.5%)	5 (10.4%)	1 (2.3%)	13 (9.0%)
	3 or more	35 (67.3%)	36 (75.0%)	34 (77.3%)	105 (72.9%)
	Total	52	48	44	144
Health Class^b	0	1 (1.9%)	3 (6.3%)	1 (2.3%)	5 (3.5%)
	1	4 (7.7%)	1 (2.1%)	3 (7.0%)	8 (5.6%)
	2	5 (9.6%)	2 (4.2%)	3 (7.0%)	10 (7.0%)
	3 or more	42 (80.8%)	42 (87.5%)	36 (83.7%)	120 (83.9%)
	Total	52	48	43^c	143
Weekly Study Time	0-3 hours	6 (11.5%)	9 (18.8%)	7 (15.9%)	22 (15.3%)
	3-5 hours	29 (55.8%)	24 (50.0%)	23 (52.3%)	76 (52.8%)
	5-8 hours	13 (25.0%)	11 (22.9%)	11 (25.0%)	35 (24.3%)
	8-10 hours	3 (5.8%)	2 (4.2%)	2 (4.5%)	7 (4.9%)
	More	1 (1.9%)	2 (4.2%)	1 (2.3%)	4 (2.8%)
	Total	52	48	44	144
Study Location	Home/dorm PC ^d	45 (86.5%)	43 (89.6%)	31 (70.5%)	119 (82.6%)
	Home no PC ^e	1 (1.9%)	1 (2.1%)	3 (6.8%)	5 (3.5%)
	Campus Lab ^f	2 (3.8%)	3 (6.3%)	6 (13.6%)	11 (7.6%)
	Others ^g	4 (7.7%)	1 (2.1%)	4 (9.1%)	9 (6.3%)
	Total	52	48	44	144

Note: a. Web class refers to students' prior Web-based classes taken before. b. Health class refers to students' prior health-related classes taken before. c. One student in group 3 did not report prior health class experience. d. Home/dorm PC refers to "At home/dorm with computer." e. Home no PC refers to "At home/dorm without computer." f. Campus Lab refers to "On campus with computer." g. Others include at work, at coffee shops, etc.

Table 18 indicates that most students are very experienced in taking Web-based classes. The majority of them studied at home or at dorm with convenient computer and Internet access. More than half of the students spent around 3-5 hours for this course every week. Also, the majority of the students had exposure with health classes, since most of them had taken three or more health courses before this semester.

The demographic information presented in the aforementioned tables indicates that all students were randomly assigned into the three groups, and students of diverse demographic background were equally distributed in the groups.

Posttest I Results

Posttest I results refer to the null hypothesis I: There is no difference in the short-term knowledge-based and performance-based learning achievements among students in the concept map, outline and control groups. Knowledge-based learning achievements are measured in quiz 1, and performance-based learning achievements are measured in scenario question 1. In the subsequent results summary, group 1 refers to the experimental group using a concept map, group 2 refers to the comparison group using an outline, and group 3 refers to the control group.

Posttest I Quiz 1 Results

A total of 145 students completed quiz 1 at the end of week 2 in the study. There were 54 students in group 1 using a concept map, 47 in group 2 using an outline, and 44 in group 3. One outlier of quiz 1 scores was deleted from group 2, with 46 students remaining in the group.

Table 19 illustrates the means, standard deviations, and effect sizes of students' learning outcomes in quiz 1, as well as the number of participants in the three groups.

Table 19
Descriptive Analysis of Quiz 1 Scores

		<i>Group</i>			Total	<i>Full Score</i>
		<i>1</i>	<i>2</i>	<i>3</i>		
Quiz 1	Mean	61.11	60.00	56.59	59.38	90
	Std Deviation	18.19	16.33	18.67	17.748	
	ES	0.25	0.19	--		
	N	54	46	44	144	

Note: One outlier was deleted from group 2.

In posttest I, students of group 1 using a concept map had the highest mean score (M=61.11) in quiz 1, compared with those of the other two groups. Students using an outline AO in group 2 achieved a slightly higher mean score (M=60.00) than those of group 3 (M=56.59). The effect size for group 1 compared to group 3 is 0.25, considered as a small to medium effect, according to the Cohen's convention (Cohen, 1988). The effect size for group 2 compared to group 1 is 0.19, which is also considered as a small effect. Group 3 is used as the benchmark for effective size calculation, so no effective size value is reported for the group.

Table 20
ANOVA Summary Table: Quiz 1

<i>Source</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Quiz 1	521.780	2	260.890	0.826	0.440

One-way ANOVA was performed to further investigate the differences of learning achievements in quiz 1 among the three groups. Table 20 illustrates the ANOVA results of quiz 1. There is no statistically significant difference in learning achievements among the three groups in the quiz ($F_{2, 141} = 0.826, p > 0.05$). In spite of the small to medium effect size between

group 1 and group 3, the ANOVA results demonstrate that the change in the quiz 1 scores is not significantly different among the three groups.

Posttest I Scenario 1

A total of 131 students completed Scenario 1 questions at the end of Week 2.

Respectively, there were 46 students in group 1, 46 in group 2, and 39 in group 3. Table 21 illustrates the descriptive analysis results.

Table 21
Descriptive Analysis of Scenario 1 Scores

		<i>Group</i>				<i>Full</i>
		<i>1</i>	<i>2</i>	<i>3</i>	Total	<i>Score</i>
Scenario 1	Mean	22.89	22.60	22.46	22.76	25
	Std Deviation	2.28	2.24	2.14	2.08	
	ES	0.19	0.06	--		
	N	46	46	39	131	

In scenario 1 questions, students in group 1 with a concept map achieved the highest mean scores (M=22.89) among the three groups while students in group 3 scored the lowest (M=22.46). Due to little variance in mean scores among the three groups, the effect sizes for both group 1 (d=0.19) and group 2 (d=0.06) are small.

Table 22
ANOVA Summary Table: Scenario 1

<i>Source</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Scenario 1	4.175	2	2.087	0.422	0.657

Table 22 illustrates the ANOVA results on scenario 1 questions. Similar to the findings in quiz 1, the change in the scenario 1 questions scores is not significantly different among the three groups ($F_{2, 128}=0.422, p>0.05$).

Overall, the null hypothesis I fails to be rejected. The findings show no difference in the short-term knowledge-based and performance-based learning achievements among students in the concept map, outline, and control groups.

Posttest II Results

Posttest II results refer to the null hypothesis II: There is no difference in the long-term knowledge-based and performance-based learning achievements among students in the concept map, outline and control groups. Knowledge-based learning achievements are measured in quiz 2 and performance-based learning achievements are measured in scenario 2 questions. In the subsequent results summary, group 1 refers to the experimental group using a concept map, group 2 refers to the comparison group using an outline, and group 3 refers to the control group.

Posttest II Quiz 2

Posttest II was administered in Week 6, four weeks after posttest I. Like the first test, posttest II consists of a knowledge-based quiz and three performance-based scenario questions. A total of 129 students completed quiz 2 by the end of Week 6. One outlier was deleted from group 1, with 128 students remaining in the result. Table 23 shows the means, standard deviations, and effect sizes of students' learning outcomes in quiz 2, and the number of students in the three groups.

Table 23
Descriptive Analysis of Quiz 2 Scores

		<i>Group</i>			Total	<i>Full Score</i>
		<i>1</i>	<i>2</i>	<i>3</i>		
Quiz 2	Mean	59.78	57.39	61.11	58.91	90
	Std Deviation	14.06	17.82	16.17	16.55	
	ES	-0.09	-0.22	--		
	N	46	46	36	128	

Note: One outlier was deleted from group 1.

In quiz 2, students of the control group achieved the highest mean scores (M=61.11) among the three groups. Group 1 students achieved a higher mean score (M=59.78) than those of group 2 (M=57.39). Both the effect sizes for group 1 (d=-0.09) and group 2 (d=-0.22) were negative and small.

Table 24
ANOVA Summary Table: Quiz 2

<i>Source</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Quiz 2	296.381	2	148.190	0.573	0.565

Table 24 presents the ANOVA results for quiz 2. No significant difference is found on learning achievements ($F_{2, 125}=0.573, p>0.05$) in quiz 2 among students of the three groups.

Posttest II Scenario 2

A total of 131 students completed scenario 2 questions in posttest II in week 6. Three outliers were excluded from the result, with one deleted from each group. Table 25 presents the detailed descriptive analysis for scenario 2 questions.

Table 25
Descriptive Analysis of Scenario 2 Scores

		<i>Group</i>			<i>Total</i>	<i>Full Score</i>
		<i>1</i>	<i>2</i>	<i>3</i>		
Scenario 2	Mean	21.67	21.36	21.69	21.56	25
	Std Deviation	2.91	3.45	2.74	3.05	
	ES	-0.01	-0.11	--		
	N	45	46	37	128	

Note: One outlier was deleted from group 1; one deleted from group 2; and one deleted from group 3.

In scenario 2 questions, students in group 3 achieved a slightly higher mean score (M=21.69) than those of group 1 (M=21.67). The students of group 2 (M=21.36) scored the lowest among the three groups. However, due to little variation in the learning outcomes, the effects of both AOs are small, with an effect size of -0.01 for group 1, and an effect size of -0.11 for group 2.

Table 26
ANOVA Summary Table: Scenario 2

<i>Source</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Scenario 2	2.993	2	1.496	0.159	0.854

Table 26 presents the ANOVA results for scenario 2 questions. Like the results for the other sections of the posttests, there is no statistically significant difference ($F_{2, 125}=0.159$, $p>0.05$) in the long-term performance-based learning achievement among the three groups.

Overall, null hypothesis II fails to be rejected. The findings show no difference in the long-term knowledge-based and performance-based learning achievements among students in the concept map, outline, and control groups.

Repeated-Measure Regression

Repeated-measure regression (RMR) was performed to examine the time effect of AOs on learning achievements across the six weeks' period of study. In addition, the RMR model was used to investigate the influences of student characteristics on their learning performance. The independent variable—treatment group—has three levels: concept map group (group 1), outline group (group 2), and control group (group 3). The other independent variable—time—has two levels: posttest I and posttest II. The level of significance is set at 0.05.

The RMR model was conducted at two stages, respectively on all students and on differentiated students. It was first used to analyze the results of all students, regardless of their learning abilities or prior knowledge. Based on Ausubel's assimilation theory, students having low verbal or analytic ability or low prior knowledge of the learning material should benefit more from advance organizers (AOs) than their peers (Ausubel, 1968). To validate this theoretical proposition, students of this study were divided into two sub-groups based on the average mean score of posttest I in the RMR analysis. The sub-group differentiated student analysis is the second stage.

Quiz 1 & Quiz 2

Regression with All Students

A total of 128 students completed both quiz 1 and quiz 2. One outlier was excluded from group 1, and one was excluded from group 2. As a result, group 1 has 45 valid scores, group 2

has 45 scores, and group 3 has 36 scores. This section analyzes the scores of 126 students who had completed both quiz 1 and 2.

Table 27
Descriptive Analysis of Quiz Scores

		<i>Group</i>				<i>Full</i>
		<i>1</i>	<i>2</i>	<i>3</i>	Total	<i>Score</i>
Quiz 1	Mean	61.11	60.00	58.06	59.84	90
	Std Deviation	17.35	16.51	19.10	17.48	
	N	45	45	36	126	
Quiz 2	Mean	59.56	58.00	61.11	59.44	90
	Std Deviation	14.14	17.53	16.17	15.92	
	N	45	45	36	126	

Note: One outlier was deleted from group 1; and one deleted from group 2.

Table 27 compares the means and standard deviations of scores between quiz 1 and quiz 2 among the three groups. Students in group 1 and group 2 achieved slightly lower in quiz 2 than in quiz 1. However, students in group 3 outperformed by more than 3 credits in quiz 2 compared with what they achieved in quiz 1.

Table 28
ANOVA Summary Table: Quiz 1 & Quiz 2

<i>Source</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>	<i>Partial squared</i>	<i>Eta</i>
Time	1.731	1	1.731	0.009	0.923	0.000	
Time * Group	302.579	2	151.290	0.822	0.442	0.013	
Error (time)	22637.500	123	184.045				

Note: One outlier was deleted from group 1; and one deleted from group 2.

Table 28 indicates no significant decrease or increase in knowledge-based test scores over the four week's time ($F_{1, 123}=.009$, $p>0.05$).

Regression with Differentiated Students

The average mean score of quiz 1 for all students is 59.38 out of a full score of 90. In the subsequent analysis for quiz scores, students are divided into two sub-groups by the threshold of 60 in quiz 1 scores. Students with scores higher than or equal to 60 in the first quiz were grouped as high-scorers. And students with scores lower than 60 in quiz 1 were grouped as low-scorers.

Quiz High-Scorers. ANOVA and repeated-measure regression were performed on the quiz scores of students with scores over or equal to 60 in quiz 1. Like the ANOVA results for all students, there is no statistically significant difference either in quiz 1 scores ($F_{2, 85}=0.329$, $p>0.05$) or in quiz 2 scores ($F_{2, 74}=1.055$, $p>0.05$) among the high-scorers of the three treatment groups. However, it is interesting to note a statistically significant decline in learning outcomes from quiz 1 to quiz 2, and the decline is consistent among the three groups. Table 29 and Table 30 demonstrate means, standard deviations, effect sizes, and the F values of the ANOVA analysis the higher-scorers.

Table 29
Descriptive Analysis of Quiz Scores (High-Scorers)

		<i>Group</i>			Total	<i>Full Score</i>
		<i>1</i>	<i>2</i>	<i>3</i>		
Quiz 1	Mean	72.14	70.36	71.43	71.30	90
	Std Deviation	11.01	9.72	7.93	9.65	
	ES	0.07	-0.12	--		
	N	28	28	21	77	
Quiz 2	Mean	62.14	60.71	67.14	62.99	90
	Std Deviation	15.95	16.31	14.88	15.82	
	ES	-0.32	-0.41	--		
	N	28	28	21	77	

Note: One outlier was deleted from group 1.

Among the high-scorers, group 1 achieved the highest mean score ($M=72.14$), with group 3 in the middle ($M=71.43$), and group 2 lowest ($M=70.36$) in quiz 1. In quiz 2, group 3 ($M=67.14$) outperformed group 1 ($M=62.14$) and group 2 ($M=60.71$). The effect sizes are small in quiz 1 and small to medium in quiz 2.

Table 30
ANOVA Summary Table: Quiz 1 & Quiz 2 (High-Scorers)

<i>Source</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>	<i>Partial Eta squared</i>
Time	2404.821	1	2404.821	15.881	0.000*	0.177
Time * Group	234.903	2	117.451	0.776	0.464	0.021
Error (time)	11205.357	74	151.424			

Note: One outlier was deleted from group 1.

Comparing the results of the first and the second quiz, there is a statistically significant decrease between quiz 1 and quiz 2 ($F_{1,74}=15.881$, $p<0.01$), possibly because of considerable long-term memory loss. Nearly 18% of the dropping in scores is explained by the elapsed time between quizzes.

Quiz Low-Scorers. The ANOVA analysis of quiz results of the low-scorers demonstrates no statistically significant difference either in quiz 1 scores ($F_{2,53}=0.495$, $p>0.05$) or in quiz 2 scores ($F_{2,47}=0.208$, $p>0.05$) among the three groups. However, it is worth mentioning that, just opposite to the results of the high-scorers, there is a statistically significant increase in learning outcomes from quiz 1 to quiz 2 among the low-scorers of the three groups. Table 31 and Table 32 demonstrate the means, standard deviations, effect sizes, and the F values of the ANOVA analysis of the low-scorers.

Table 31
Descriptive Analysis of Quiz Scores (Low-Scorers)

		<i>Group</i>			Total	<i>Full Score</i>
		<i>1</i>	<i>2</i>	<i>3</i>		
Quiz 1	Mean	42.94	42.94	39.33	41.84	90
	Std Deviation	7.72	9.85	13.35	10.34	
	ES	0.33	0.31	--		
	N	17	17	15	49	
Quiz 2	Mean	55.29	53.53	52.67	53.88	90
	Std Deviation	9.43	19.02	14.38	14.55	
	ES	0.22	0.05	--		
	N	17	17	15	49	

Note: One outlier was deleted from group 2.

Among the low-scorers, both AO treatment groups achieved the same mean score (M=42.94), considerably higher than that of group 3 (M=39.33) in quiz 1. In quiz 2, the concept map group earned the highest scores (M=55.29), with group 2 the second (M=53.53), and group 3 lowest (M=52.67). Both effect sizes are small to medium between the treatment groups and the control group.

Table 32
ANOVA Summary Table: Quiz 1 & Quiz 2 (Low-Scorers)

<i>Source</i>	<i>Sum Squares</i>	<i>of df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>	<i>Partial squared</i>	<i>Eta</i>
Time	3569.566	1	3569.566	31.177	0.000*	0.404	
Time * Group	31.293	2	15.646	0.137	0.873	0.006	
Error (time)	5266.667	46	114.493				

Note: One outlier was deleted from group 2.

Comparing the results of quiz 1 and quiz 2, there is a statistically significant increase in scores between quiz 1 and quiz 2 ($F_{1, 46}=31.177, p<0.01$). The time effect accounts for more than 40% of the increase of scores between quizzes.

Scenario 1 & Scenario 2

Regression with All Students

Repeated measure regression (RMR) was performed on the results of scenario 1 and scenario 2 for all students. The scores of 112 students who had completed both scenario 1 and 2 questions were analyzed. The following tables show detailed means, standard deviations, and F statistics of the scenario questions for all students.

Table 33
Descriptive Analysis of Scenario Scores

		<i>Group</i>			<i>Total</i>	<i>Full Score</i>
		<i>1</i>	<i>2</i>	<i>3</i>		
Scenario 1	Mean	23.01	22.75	22.55	22.78	25
	Std Deviation	1.90	2.21	2.26	2.12	
	N	37	42	33	112	
Scenario 2	Mean	21.91	21.76	21.98	21.88	25
	Std Deviation	3.00	3.03	2.63	2.882	
	N	37	42	33	112	

Note: One outlier was deleted from group 1; one deleted from group 2; and one deleted from group 3.

Table 33 compares the means and standard deviations of scores between scenario 1 and scenario 2 among the three groups. Students in all the three groups achieved slightly lower in scenario 2 questions than in scenario 1 questions.

Table 34
ANOVA Summary Table: Scenario 1 & Scenario 2

<i>Source</i>	<i>Sum Squares</i>	<i>of df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>	<i>Partial squared</i>	<i>Eta</i>
Time	43.497	1	43.497	10.616	0.001*	0.089	
Time * Group	2.865	2	1.432	0.350	0.706	0.006	
Error (time)	446.595	109	4.097				

Note: One outlier was deleted from group 1; one deleted from group 2; and one deleted from group 3.

Table 34 indicates a statistically significant decrease in scores from scenario 1 to scenario 2 ($F_{1, 109}=10.616, p<0.01$). Almost 9% of the variance of the scores can be explained by the elapse of the four weeks' time between scenario 1 and 2.

Regression with Differentiated Students

To further study the impact of treatments on students of differentiated learning abilities, students are divided into a high-scorer group and a low-scorer group. In scenario 1 questions, the average mean score for all students is 22.76 out of a full score of 25. Therefore, the dividing threshold is set at 22.5 in scenario 1 scores. Students with scores higher than or equal to 22.5 in scenario 1 are considered as high-scorers. And students with scores lower than 22.5 in scenario 1 are considered as low-scorers.

Scenario High-Scorers. ANOVA and repeated-measure regression were performed on the scenario scores of students with a score over 22.5. Like the ANOVA results for all students, there is no statistically significant difference either in scenario 1 scores ($F_{2, 88}=0.165, p>0.05$) or in scenario 2 scores ($F_{2, 76}=0.013, p>0.05$) among the high-scorers of the three treatment groups. However, there is a statistically significant decrease in learning outcomes from scenario 1 scores to scenario 2 scores among the high-scorers of the three groups. Table 35 and Table 36 demonstrate means, standard deviations, effect sizes, and the F values of the scenario higher-scorers.

Table 35
Descriptive Analysis of Scenario Scores (High-Scorers)

		<i>Group</i>			<i>Total</i>	<i>Full Score</i>
		<i>1</i>	<i>2</i>	<i>3</i>		
Scenario 1	Mean	23.74	24.04	23.86	23.88	25
	Std Deviation	1.215	1.105	1.274	1.185	
	ES	-0.10	0.15	--		
	N	29	28	22	79	
Scenario 2	Mean	22.55	22.54	22.43	22.51	25
	Std Deviation	2.791	3.144	2.504	2.812	
	ES	0.05	0.04	--		
	N	29	28	22	79	

Note: One outlier was deleted from group 1.

In scenario 1 questions, there is little variation in scores among the three groups. Group 2 achieved the highest mean score (M=24.04), with group 3 in the middle (M=23.86), and group 1 the lowest (M=23.74). In scenario 2 questions, group 1 (M=22.55) and group 2 (M=22.54) outperformed group 3 (M=22.43). The effect sizes are quite small between the treatment groups and the control group in both posttests.

Table 36
ANOVA Summary Table: Scenario 1 & Scenario 2 (High-Scorers)

<i>Source</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>	<i>Partial Eta squared</i>
Time	73.438	1	73.438	18.155	0.000*	0.193
Time * Group	0.750	2	0.375	0.093	0.912	0.002
Error (time)	307.427	76	4.045			

Note: One outlier was deleted from group 1.

Comparing the results of scenario 1 with those of scenario 2, there is a statistically significant decrease ($F_{1,76}=18.155$, $p<0.01$), possibly because of a considerable memory loss over the time. Over 19% of the score decrease can be explained by the four weeks' time between posttests.

Scenario Low-Scorers. The ANOVA analysis of scenario questions results of the low-scorers demonstrates no statistically significant difference either in scenario 1 scores ($F_{2, 37}=0.373$, $p>0.05$) or in scenario 2 scores ($F_{2, 30}=0.676$, $p>0.05$) among the three groups.

Similar to the results of the quiz high-scorers, there is an increase in the learning outcomes from scenario 1 to scenario 2 among the low-scorers of the three groups. Even though the increase is not statistically significant, the increase in scores over time is worth noticing, given the small sample size in this analysis. Table 37 and Table 38 demonstrate the detailed means, standard deviations, effect sizes, and the F values of the low-scorers.

Table 37
Descriptive Analysis of Scenario Scores (Low-Scorers)

		<i>Group</i>			<i>Total</i>	<i>Full Score</i>
		<i>1</i>	<i>2</i>	<i>3</i>		
Scenario 1	Mean	19.60	20.18	19.91	19.93	25
	Std Deviation	2.271	1.489	1.221	1.646	
	ES	-0.17	0.20	--		
	N	10	14	11	35	
Scenario 2	Mean	19.75	20.21	21.09	20.36	25
	Std Deviation	2.372	2.137	2.764	2.403	
	ES	-0.52	-0.20	--		
	N	10	14	11	35	

Note: One outlier was deleted from group 2; and one deleted from group 3.

Among the low-scorers, group 2 achieved the highest mean score ($M=20.18$), higher than that of group 3 ($M=19.91$) and that of group 1 ($M=19.60$) in scenario 1 questions. In scenario 2 questions, group 3 ($M=21.09$) scores the highest, with group 2 ($M=20.21$) the second, and group 1 ($M=19.75$) the lowest. Most of the effect sizes are negative between the treatment groups and the control group, indicating a negative effect of the treatment.

Table 38

ANOVA Summary Table: Scenario 1 & Scenario 2 (Low-Scorers)

<i>Source</i>	<i>Sum Squares</i>	<i>of df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>	<i>Partial squared</i>	<i>Eta</i>
Time	3.564	1	3.564	0.911	0.347	0.028	
Time * Group	4.589	2	2.294	0.586	0.562	0.035	
Error (time)	125.197	32	3.912				

Note: One outlier was deleted from group 2; and one deleted from group 3.

Comparing the results of scenario 1 and scenario 2, there is an increase in scores between posttests, but the change is not statistically significant ($F_{1,32}=3.912$, $p>0.05$).

Qualitative Results

Attitudes & Experiences with AO

Students using advance organizers (AOs) were given the opportunity to state their experiences and attitudes towards using AOs in the survey conducted in Week 2. A total of 52 students from the concept map group (group 1) filled out an online questionnaire about how they had used and their opinions of the concept map AO. A total of 48 students in the outline group (group 2) responded to the questions about how they had used and their opinions of the outline AO. Table 39 summarizes students' experience using AOs.

Table 39

Survey Results on Students' Experience with Using AOs

	<i>Concept Map</i>			<i>Text Outline</i>		
	Mean	%	N	Mean	%	N
Time spent on AO	6-10 min	46.2%	24	1-5 min	47.9%	23
How many times read AO	Once	44.2%	23	Twice	41.9%	25
When read	Before textbook	50.0%	26	Before textbook	41.7%	20
Usefulness	Agree	67.3%	35	Agree	83.3%	40
Total			52			48

Approximately half of the respondents in the concept map group indicated that they spent 6-10 minutes reading the concept map, and that they read it only once. Approximately half of the respondents in the outline group reported that they spent 1-5 minutes reading the text outline, but that they read it twice. The majority of the respondents in both groups agreed that advance organizers were helpful.

Interview Results

Interviews were conducted individually with the instructor of this course and a sample of 10 students randomly selected from three groups. The interview with the instructor was conducted in Week 7 of the semester after both posttests were completed. Questions were asked about her teaching experience and how she taught this fully Web-based course. This is the sixth time for the instructor to teach the online health care ethics class. She basically interacted with students through discussion postings and e-mails all throughout the semester. She graded both scenario questions for this study based on a provided rubric (Appendix E). The instructor noticed that there was little variation in scenario scores among students. The reason she explained is that students knew very well what was expected from them in the answers because they were given the same requirements for all scenario assignments every week. Also, questions were asked about her opinions on usefulness of the instructional strategy of AOs for Web-based classes. She preferred the interactive concept map and suggested both formats of AO are helpful for students in online learning.

A sample of seven students was randomly selected from each group and invited for student interviews. A total of ten students agreed to participate in the interviews, among which

three from the concept map group, three from the outline group, and four from the control group. Six interviews were conducted in Week 4 right after posttest I, and the other four in Week 7 after posttest II. Questions were asked about how they were studying for the fully Web-based class with or without AOs. Most interviewees said that they spent around three hours weekly reading the textbook chapters and completing the assignments. They felt that the quiz questions for this study were fair but challenging, and that the designated 20 minutes time limit was enough for completing all questions. It is worth mentioning that all 10 interviewees admitted to using either textbook or lecture notes to some degree during the online quizzes. When asked about the AOs, all but one interviewee agreed that AOs helped them by scaffolding key concepts from the chapter. However, one interviewee from the concept map group stated that the map is helpful for students who are new to online learning; students like her who had taken many online classes before this study would not utilize it very much.

The interviews were recorded with students' agreement and students' responses were analyzed for common themes. Such qualitative data might provide insights for explaining the quantitative results.

CHAPTER FIVE: DISCUSSIONS

This study investigates the effects of advance organizers (AOs) in a fully Web-based course. Although considerable research has examined the effects of AOs in traditional classroom settings, empirical studies are limited in a fully Web-based environment. This study used two formats of AOs in an online class, a visual concept map, and a text outline. Students' learning achievements were measured in two posttests. Posttest I, measuring students' short-term learning achievements, was administered in the instruction week during week 2 of the semester. Posttest II, measuring students' long-term learning achievements, was administered four weeks after the instruction week during week 6 of the semester.

Chapter four detailed results of this study. In this chapter, the results related to each of the two research hypotheses will be discussed and explained in light of existing literature and prior research findings. Additional findings derived during this study will also be discussed in relation to short-term and long-term learning achievement results and the students' differentiated learning abilities. Finally, this chapter will discuss the limitations of the study, and posit recommendations for future research.

Short-term Learning Achievements

Ausubel's AO model predicts that learners given AOs should perform better on immediate knowledge acquisition tests on the material-to-be-learned than learners without AOs (1968). The first null hypothesis in this study states that there is no difference in the short-term knowledge-based and performance-based learning achievements among students in

the concept map, outline, and control groups. The findings fail to reject null hypothesis I. The prediction based on Ausubel's theory was not supported. No statistically significant difference is found in scores of either quiz 1 or scenario 1 questions of posttest I among students of the three groups. However, a detailed analysis of the findings demonstrates a pattern that students with an AO performed practically better in both the knowledge acquisition and application tests. In both tests, students in the concept map group achieved the highest mean scores ($M_{\text{quiz}}=61.11$, $M_{\text{scenario}}=22.89$), and the effect sizes of the concept map are small to medium ($d_{\text{quiz}}=0.25$, $d_{\text{scenario}}=0.19$), indicating that on average, students using a concept map performed better than the control group individuals.

Previous studies examining the effects of AO in traditional classrooms failed to provide a statistically significant result concerning the facilitative effect of AOs (Calandra et al., 2002; Mazure, 1996; McManus, 2000), but the majority studies generated a positive AO effect size in general (Kenny, 1993; Luiten et al., 1980; Stone, 1983). Consistent with the literature, short-term findings of this study suggest that AOs have an inconclusive but positively measurable effect on immediate learning, and the graphic AO works better for students than the textual AO does. In both tests, students in the concept map group outperformed the outline group and the control group ($M_{\text{quiz}}=61.11$, $M_{\text{scenario}}=22.89$). Also, the outline group students ($M_{\text{quiz}}=60.00$, $M_{\text{scenario}}=22.60$) achieved relatively higher learning outcomes than the control group students ($M_{\text{quiz}}=56.59$, $M_{\text{scenario}}=22.46$). The mean effect size for the concept map is small to medium ($d=0.22$), and that for the text outline is small but positive ($d=0.125$).

The student interviews further explain how AOs facilitate learning in this study. The interviewees described that AOs provided them with a general overview of the main topics

which prepared them to be more involved in their own reading and learning. They pointed out that AOs refreshed their memory of the declarative knowledge in assessments and helped them relate important concepts with real-life scenarios. The research findings in the short-term posttest support the practical significance of AOs: that with the aids of an advance organizer, students may perform better in fully Web-based environments than those without an AO.

The reasons for non-statistical difference might be attributable to the short duration of the treatment, small differentiation of the assessments, and loose control of the Web-based experiment. First, prior research suggest that the studies that last for a longer time tend to result with higher effectiveness of AOs on students' learning and retention (Stone, 1983). The current study focuses on a one-week-long module on the topic of patient-physician relationship, and the short-term tests were administered at the end of the instructional week. AOs were used in this Web-based course for the experiment week only, not in any other instructional weeks. Also, AOs had not been included in any of interviewed students' previous online courses. Possibly, students did not have enough time to become familiar with the instructional strategy of using AOs in a Web-based class, thus crippling the effectiveness of AOs. Had the AOs been administered to students for every module of this Web-based course, results on the final assessments at the end of the semester might generate significant difference among the treatment groups and the control group.

Second, the results of scenario essay questions had little differentiation among students. The mean score for scenario 1 questions is 22.76 out of a total score of 25, and the standard deviation of the whole class is 2.08. Such a ceiling effect might be a reason that prevents the results from reaching a statistically significant level. Third, students' low performance in the

quiz might indicate that students had not spared adequate efforts in preparing for the posttest. On average, students obtained less than 60 out of a full score of 90 in quiz 1. All students were informed that the quiz was part of a voluntary study and the score of the quiz would not be counted towards their final credits in this course. One of the interviewed students admitted that he took quiz 1 before reading either the AO or the textbook at the very beginning of the instructional week. His low quiz score was not the result of his poor learning skills, but a lack of adequate learning efforts. If he had carried out the instructional activities properly and completed the assessment after reading the textbook, his learning performance might have been much improved. Also, since this is a fully Web-based class and students study at their own pace, it is impossible to guarantee that students follow the procedures strictly in the experiment. The students confessed in the interview that they referred to textbooks or lecture notes during the tests. The scores might not truly represent their knowledge acquisition considering the possibility of cheating. Consequently, the loose control of the Web-based experiment might have seriously damaged the reliability of the results. The internal validity of the study was threatened by the instrumentation effect.

Long-term Learning Achievements

Meta-analyses on AOs in the 80s and the 90s suggest that AOs have an evident long-term effect on students' learning achievements. In many long-term studies in which posttests were administered one week or later after the treatment, the results suggested that the AO group performed better than the non-AO group (Kenny, 1993; Luiten et al., 1980; Stone, 1983). Based on this trend, the second null hypothesis states that there is no difference in the

long-term knowledge-based and performance-based learning achievements among students in the concept map, outline, and control groups. Again, findings of the current study fail to reject null hypothesis II. No statistically significant difference is found in scores of either quiz 2 or scenario 2 questions in posttest II among students of the three groups. On the contrary, the findings indicate a negative result against the long-term effect of AOs. Contradictory to the prediction from the prior research, four weeks after instruction in posttest II, the control group students ($M_{\text{quiz}}=61.11$, $M_{\text{scenario}}=21.69$) consistently performed better than the treatment groups, and the outline group ($M_{\text{quiz}}=57.39$, $M_{\text{scenario}}=21.36$) achieved the lowest mean scores in both tests. The effect sizes of the treatment of AOs between the treatment groups and the control group are negative, indicating that students of the control group performed better than individuals using either a concept map or a text outline.

The long-term findings do not support the historical research that AOs have a facilitative effect on learning, but demonstrate a negative AO effect on long-term knowledge retention and application. Despite measurement errors, other explanations attributing to the negative results might involve the student population selected for this study and types of teacher-constructed AOs used as described hereafter.

First, the students selected for this study generally possess high learning abilities. They possibly do not fall into the category, learners of low learning abilities or little prior knowledge, who might benefit from AOs the most. The current study involves junior and senior students at a four-year health-relevant college program. The average GPA of the participating students is 3.03, suggesting that students of this study be of higher-than-average learning abilities.

Moreover, 83.9% of the surveyed students reported that they had taken three or more

health-related courses before this semester, and 81.3% of them had taken three or more Web-based WebCT classes before. In addition, one of the interviewed students who used the concept map related that as an experienced online learner, she did not utilize the AO very much, which she thought might be helpful for students who are new to online learning. The demographic information and interview data strongly suggest that the student population in the current study is of high learning ability, adequate prior knowledge of the subject matter, and sufficient experience in online learning. On the other hand, Ausubel (1968) and other researchers (Mayer, 1979b) associate the effectiveness of AOs with students of low verbal or analytic ability or low prior knowledge of the material. In the previous studies, Ausubel and other researchers found out that AOs helped the middle and high school at-risk students significantly (Fitzgerald & Ausubel, 1963; Tseng et al., 2002). Compared with those of the majority prior research, the student population of the current study is regarded to be of higher-learning ability, considering that they maintained a college GPA score over 3. These students are capable of taking an organized and deliberative approach to learning without the help of AOs. The forced use of AOs might have compromised their effective use of other learning strategies that they would usually apply in learning. If the study is replicated with another student population of lower-learning ability, findings might generate more positive results regarding the effectiveness of AOs.

Second, this study utilized teacher-constructed organizers. The findings indicate that such teacher-constructed AOs, especially the text outline, might promote students' short-term learning, but limit their long-term learning performance for the current student population. Nevertheless, recent researchers (Kenny, 1993; Zittle, 2001) promoted the use of participatory

organizers (student-constructed organizers) over teacher-constructed organizers in computer-based instruction, despite that research on participatory organizers does not result in a conclusive positive outcome. Researchers reasoned that students learn better when they construct their own meaning from transforming information and elaborating information into a more individual form (Kenny, 1993). The participatory organizers make the materials more memorable and more comprehensible than teacher-constructed AOs. In research interviews of the current study, students of the treatment groups also expressed an interest in trying to create a concept map by themselves instead of using a teacher-constructed one. Participatory organizers might be a better instructional strategy for students of higher learning abilities. While composing a concept map of one's own, the student is able to process the textbook information deeply and organize the acquired knowledge according to their own styles. Therefore, it is interesting to investigate the effectiveness of participatory organizers in Web-based courses of future research.

Comparison of Short-Term & Long-Term Learning Achievements

The time effect was investigated by comparing the short-term and long-term learning achievements. First, scores for posttest I and posttest II for all students were analyzed using repeated-measure multiple regression (RMR). In the knowledge-based quiz test, no significant difference ($F_{1, 123}=.009, p>0.05$) was identified between quiz 1 and quiz 2. However, there is a significant decrease ($F_{1, 109}=10.616, p<0.01$) in scores from scenario 1 questions to scenario 2 questions in the performance-based test. As a result, students achieved consistent learning outcomes in the short-term and the long-term knowledge-based tests. But time effect was

observed on students' performance-based learning achievements throughout the six-week study.

Both posttest I and II consist of a knowledge-based quiz and a performance-based scenario-question test. In the knowledge-based quizzes, students using an AO scored lower in quiz 2 ($M_{\text{graphic}}=59.56$, $M_{\text{text}}=58.00$) than in quiz 1 ($M_{\text{graphic}}=61.11$, $M_{\text{text}}=60.00$). In contrast, students without an AO scored higher in quiz 2 ($M_{\text{control}}=61.11$) than in quiz 1 ($M_{\text{control}}=58.06$). Both the score increase and the decrease are insignificant. In the performance-based scenario questions, all students scored lower in scenario 2 questions than in scenario 1 questions. The mean scores of the students using a concept map dropped by 1.1, that of the students using an outline dropped by 0.99, and that of the students without an AO dropped by 0.57 out of a total score of 25.

As indicated in the previous sections, the AOs are suggested to have a better effectiveness on learners of low learning abilities than on learners of high learning abilities in prior research (Ausubel, 1968). To test the differentiated AO effect, students were divided into two sections based on their scores in posttest I and their scores were analyzed independently for the knowledge-based quiz and performance-based scenario questions test. The mean scores for posttest I were set as the benchmark. Students with scores higher than or equal to the mean scores of posttest I were grouped as the high-scorers. Students with scores lower than the mean scores were grouped as the low-scorers.

High-Scorers

In the differentiated analyses, the high-scorer section consists of fewer than 80 students, which is a small population and underpowered in term of significance tests. The RMR analyses were conducted separately for the knowledge-based quizzes and performance-based scenario questions. For most of the tests analyses, there is little difference in scores among groups, especially for the learning outcomes of the scenario questions, and no AO effect was found.

However, the limitation of using teacher-constructed AOs is evidenced in the long-term knowledge-based learning achievements. In quiz 2, the control group ($M_{\text{control}}=67.12$) scored considerably higher than the other two treatment groups ($M_{\text{graphic}}=62.14$, $M_{\text{text}}=60.71$) by over five points out of a full score of 90. Both AO effect sizes were negative and range from small to medium. The effect size of the concept map is -0.32, and that of the outline is -0.41. Even though the differences among the groups are not statistically significant, the control group outperformed the treatment groups considerably, given the small sample size in the sub-group analysis. In summary, AOs do not assist students of higher learning abilities in this study for their knowledge acquisition or retention. Moreover, as indicated in the previous sections, the use of teacher-constructed AOs, as the ones utilized in this study, might even have restrained students' long-term knowledge retention. This high-score section is capable of taking a structured and deliberative approach without the assistance of a pre-existing organizer. It is worth trying to engage them with a participatory organizer for future studies.

The comparisons of scores between posttest I and II demonstrate statistically significant differences ($F_{1, 74(\text{quiz})}=15.881$, $p<0.01$; $F_{1, 76(\text{scenario})}=18.155$, $p<0.01$). The substantial time effect suggests a memory loss over a period of four weeks' time between the two posttests. In

student interviews, most of the respondents reported that they prepared for posttest I, but did not review the materials before posttest II. With adequate preparatory work and a fresh memory, it is reasonable that students achieved higher learning outcomes in the first posttest than the second one.

Low-Scorers

According to Ausubel's assimilation theory (1968), it is anticipated that the low-scorers would benefit more from the AOs than the high-scorers would. In the current study, AO benefits were demonstrated by better quiz performances of low-score students who had used an AO (Quiz 1: $M_{\text{graphic}}=42.94$, $M_{\text{text}}=42.94$, $M_{\text{control}}=39.33$; Quiz 2: $M_{\text{graphic}}=55.29$ $M_{\text{text}}=53.53$, $M_{\text{control}}=52.67$), taking into consideration that the low-scorer section consists of less than 50 students in the analyses, even though a statistical significance was not reached.

In both the short-term and long-term quizzes, students in the treatment groups ($M_{\text{graphic/text/quiz1}}=42.94$; $M_{\text{graphic/quiz2}}=55.29$, $M_{\text{text/quiz2}}=53.53$) outperformed the control group ($M_{\text{control/quiz1}}=39.33$, $M_{\text{control/quiz2}}=52.67$) in mean scores. The effect sizes of the AO groups were small to medium. Although no statistical significance was found among the three groups, given the small sample size in the analysis on low-scorers, the small to medium effect sizes indicate considerable AO benefits with helping low-scorers in both short-term and long-term knowledge acquisition. The findings are in agreement with prior research, demonstrating that AOs, especially the visually-formatted AOs, might assist students of low-learning ability in knowledge acquisition. Compared with the high-learning ability peers, this section has more problems with taking an initiative when organizing new information. The AOs, especially the

concept map, helped them scaffold the new knowledge and thus made it easier for them to process the information deeply while they were reading.

However, the results in scenario 2 questions showed an opposite trend. The control group outscored the concept map group by over 1 point out of a full score of 25. The effect size of the concept map is medium and negative ($ES=-0.52$). A detailed analysis of the data shows that the negative effect might be caused by skewed and underpowered data, not by a negative impact of the concept map for low-scorers. The scatterplot for the results of scenario questions shows an abnormal distribution, and the analysis only includes a total of 35 students. With such a small population, a change of one student's score might have generated a very different result. In brief, small sample size and measurement error might be important attributors for such a high negative effect size.

There is a statistically significant increase in scores from quiz 1 and quiz 2 for low-scorers ($F_{1,46}=31.177, p<0.01$). As opposed to the decrease in scores for the high-scorers, low-scorers performed much better in the long-term test than in the short-term test. Despite measurement errors, one possible reason for score increase might be that students tried to make up for quiz 2 after they had received a relatively low score on the first quiz.

Attitudes on Using Advance Organizers

Most of the students in the study found using AOs, especially the concept map, helped them scaffold the learning materials. However, students experienced with online learning thought that the concept map might be more helpful for learners new to online learning. Their feedback in the survey indicates how they used AOs in learning. The majority of the students

would read AOs before they read the textbook. They spent, on average, 6-10 minutes reading the concept map, and some of them referred back to the concept map during or after they read the textbook. For the text outline, the students spent 1-5 minutes reading, and read it only twice. The interviewed students reported that the advance organizers were great guidelines for them to break down general topics so that they were able to spend more time in details during reading. Based on the survey and interview results, AOs would serve as an information organization tool in Web-based distance learning for students' use as a summary of key concepts, and the concept map was better received by the students compared with the text outline.

Implications of the Findings

The results discussed above extend our understanding of advance organizers in general, and in Web-based learning environments specifically. The results that built on Ausubel's theoretical framework enrich and reinforce the prior theory and literature in several perspectives. In this section, the implications of this study will be discussed in three aspects: theory, methodology, and practice.

Implications for AO Theory

Ausubel first introduced the concept of advance organizers in his assimilation theory of meaningful learning and retention. He asserts that the use of advance organizers helps students activate prior knowledge in the new instructional context, making the instructional process meaningful to them. Based on Ausubel's model and the later studies on AO (Ausubel, 1968,

2000; Kenny, 1993; Mayer, 1979b; Stone, 1983), a framework has been synthesized to predict the effectiveness of AOs. The following propositions originated from the theoretical framework have been tested in this study.

1. Students given advance organizers should perform better in tests on the material-to-be-learned than students in control groups.
2. The advance organizer effect should be at least as great in longer studies as in shorter ones.
3. The graphic advance organizers should be at least as effective as the text advance organizers.
4. Students having either low verbal or analytic ability or low prior knowledge of the material should be helped more by advance organizers than other students.

The first two propositions are not fully validated in this study. First, the findings do not yield a difference in learning achievements among the AO groups and the control group. However, the results demonstrate a positive but inconclusive short-term AO effect, as manifested in the majority of prior research. Second, the current study investigated both the short-term and long-term effects of AOs. However, the long-term effect does not exceed the short-term effect, as predicted in the framework. In fact, the current study demonstrates a negative long-term AO effect. It is estimated that the most important reasons attributable to the small and negative effects in regard to the first two proposals involve that students of this study are of high learning abilities. They are capable of activating prior knowledge and construing new information without the facilitation of an AO.

Third, the graphic AO is as effective as the text AO in this study. Specifically, students using a concept map (graphic AO) have consistently achieved higher scores than those using a text outline (text AO). The effect sizes for the concept map are mostly small to medium, while those for the outline are small. The students and the instructor also preferred the concept map to the outline, despite that the contents for both AOs are identical. The visual elements and interactivity of the concept map were favored by students in Web-based learning, and the outline was regarded as static and linear.

It is noteworthy that Ausubel's theory of low-ability learners is evidenced in the current study. Students of relatively low learning abilities performed better with an AO in both the short-term and long-term tests than those without an AO. The use of advance organizers helps those students cultivate a meaningful learning process by well organizing the relevant knowledge structure, and to develop an emotional commitment by integrating new knowledge with existing knowledge.

Implications for Research Methods

This study used a posttest-only control group design. Such design is greatly underused in educational and psychological research (Campbell & Stanley, 2005). A pretest had not been administered in the study because the intervention of a pretest might have confounded the effects of advance organizers. However, the measurement of prior knowledge is important to the question of whether or not AO did have an effect on students' learning achievements. To compensate for the absence of a pretest, other antecedent variables have been collected for leveling, or as covariates. The covariates used in lieu of pretests include GPA scores, WebCT

orientation scores, scores for module 1 (the previous module) tests, number of previous online courses, number of previous health-relevant courses, and class standing. Controlling the effects of the aforementioned covariates, no statistically significant difference was found between the students using an AO and those without an AO.

The major statistics to test the null hypotheses are ANOVA tests. Covariance analysis was also performed to control the aforementioned covariates. Repeated measure regression was used to compare the two posttests and the time effect was investigated. Based on the theory that AOs are beneficial to low-ability learners, analyses were conducted on all students and on differentiated students. Although the results on all students did not yield any statistically significant findings, it is noteworthy to find out statistically significant time effects on differentiated students. Among the students of lower-learning ability, students using an AO obviously achieved better learning outcomes than the control group. However, the differentiated analyses were underpowered because the number of students in each analysis was small. Had it been a bigger student population, the differentiated analyses might have provided more noteworthy differences.

Implications for Practice

This study has updated and improved the AO conceptual framework to fit the new Web-based learning environment. The original Ausubel's model was first developed for the face-to-face classroom setting where the blackboard is the main teaching medium. The framework had been constantly modified by later researchers to further investigate the methods for constructing and applying an AO in a computer-based instruction environment in the late

80s and early 90s. In the new century, school learning is enhanced and optimized with the explosive development of emerging Internet technologies and diversified digital media.

However, the research on AOs in fully Web-based learning is very limited. The current study expands the AO framework to a fully Web-based environment. The use of advance organizers is a good teaching and learning practice in the context of self-paced online learning. Students may benefit from using AOs not only in a traditional classroom, but also in the ever-growing Web-based learning environment.

The results of this study suggest that integration of advance organizers for online student remedial programs may be beneficial. Since the No Child Left Behind Act was signed into law in 2002, the schools have tried every means to help students of lower learning abilities to catch up with their peers. Many at-risk or dropout students are given another chance to make up for their school credits by taking online remedial courses or programs. It may be to the students' greatest advantages to incorporate AOs, especially an interactive multimedia concept map, into self-paced Web-based remedial courses. Such online programs need to promote meaningful learning instead of rote learning. Meaningful learning requires that the material-to-be-learned be conceptually clear and presented with languages and examples relatable to the learner's prior knowledge. Advance organizers help identify large general concepts prior to instruction of more specific details, and assist in the sequencing of learning tasks with progressively more explicit knowledge that can be anchored into developing conceptual frameworks. Moreover, visual and interactive advance organizers may strengthen students' motivation to choose to learn by attempting to associate new meanings with their prior knowledge, rather than simply memorizing concept definitions, propositional statements or computational procedures.

Advance organizers may be helpful Web-based learning devices for new online learners. Nearly 96% of the very largest institutions have some online offerings, which is more than double the rate observed for the smallest institutions (Allen & Seaman, 2006). Yet online learning can be intimidating and disorienting for laymen. Instructors and course designers can use advance organizers to map out course contents and instructional activities relative to their educational goals. With the aid of a visual or text AO, students are able to visualize the course in its entirety and the connections among subtopics. It is easier for new learners to navigate through different course components with a bigger picture of the course contents and clearly-delineated objectives in mind.

Recommendations for Future Research

In retrospect, this study may be improved in five areas. First, the results of this study need to be interpreted with caution and cannot be generalized to all students in online education. The population was selected from a four-year college health-relevant program, geographically located in the Southeastern United States. The population was disproportionately distributed across gender and ethnicity, since the majority of the students in this study are white, female, and Caucasian. The study involved a relatively small sample size of 164 students. Moreover, the analysis on low-learning-ability group includes a population less than 50 students, with less than 20 in each group. Even though the differences between the treatment groups and the control group are considerable, a statistically significant difference was not obtained based on a small sample size like this. It is anticipated that a significant result may be generated from a larger population in the future. Students of lower-learning abilities, such as K-12 remedial

program participants, need to be studied. Future research needs to be replicated with a student population in disciplines besides health care, in institutions outside of the University of Central Florida, and in K-12 educational settings. The generalizability is hence to be improved.

Second, a posttest-only control group design has limitations. A study without a pretest is much less vigorous than one where a pretest is available, due in part to distrust of randomization as equation (Campbell & Stanley, 2005). However, the measurement of prior knowledge with a pretest is an important index to predict the effects of intervention in AO studies. To compensate for an absence of a pretest, the current study used covariance analyses for controlling and leveling the population. It is recommended that future studies incorporate a Solomon four-group design which tests the effect of intervention in two pretested groups and two unpretested groups. Such a four-group design controls both the main effects and the interaction of testing, as well as a combined effect of maturation and history. In this way, the generalizability will be greatly increased.

Third, the limited intervention duration may be a major factor that negatively influenced the effectiveness of AO in this study. The current AO intervention lasted for one week. However, one week is not long enough for students to fully master the AO strategy in online classes. Longer intervention time is highly recommended for AO research. Future studies should be extended to semester-long interventions. Additionally, students' performance with the aid of AOs can be monitored and measured in multiple posttests throughout the semester.

Fourth, the assessment instruments for this study can be improved. One of the issues that the researcher had found in the study is that an online quiz is difficult to monitor. Though the quizzes had been instructed as closed-book tests and questions were randomized in order, it

was impossible to prevent students from referring to their lecture notes or textbooks while they were taking the online quizzes. This may seriously threaten the validity of the test instruments. An important implication for further research is to develop measures to prevent students from online cheating. Another reason for the non-significant result in the current study may be the lack of measurement of students' analytical and critical thinking abilities. The scenario questions may lack sensitivity and discrimination, since there is little differentiation in results for both performance-based tests. The standard deviation for the scores is very low and the average mean scores are approaching the full score. There is little room for differentiation or improvement in both scenario-question tests. Future studies need to develop more strict rubrics and assessment instruments to differentiate students' learning application outcomes.

Fifth, the participatory organizer (student-constructed organizer) is the new direction for future studies on instructional strategies in Web-based learning. According to the generative learning hypothesis (Kenny, 1993), participatory organizers may improve students' information retention and learning transfer by encouraging them to explore and construct the connections among concepts. In this way, students may interact with the learning materials in great depth, thus making the materials easy for them to comprehend and use. Recently, new instructional concept mapping tools have become available for instructors and students to create digital organizers in computer-assisted instruction and online education. For example, the Visual Understanding Environment (VUE) and the C-Map are two free information management applications that provide an interactive concept mapping interface. Future Web-based AO research studies can take advantage of these free concept mapping tools, focus

on helping students generate their own organizers, and measure the effectiveness of participatory organizers in both face-to-face and Web-based educational settings.

Conclusion

Web-based distance learning is becoming an important trend in the higher educational settings. An increasing number of instructors and students choose online classes to take advantage of the time and location convenience. Many students are stressful in their online learning process, especially the students of lower learning abilities. It has always been a challenge to examine the effects of pedagogical strategies in a fully Web-based environment. The current study investigated the use of advance organizers (AOs) in a fully Web-based health care ethics course. Consistent with results of the studies in the traditional classes, this study failed to show a statistically significant short-term or long-term effect of AOs on knowledge-based or performance-based learning achievements. However, there is a positive AO effect for students' short-term knowledge-based learning achievements, especially for students of lower learning abilities. Students showed positive attitudes towards using AOs in online learning by highlighting the important concepts and helping them break down the course contents.

This research demonstrates that instructional strategies, like advance organizers, can be incorporated into online education. It has been assumed by many researchers that the adoption of effective online teaching and learning strategies is a solution to learning challenges in an interactive multimedia Web-based environment. Although there were no differences in learning achievements between students using AOs and those without AOs, this study provided

some evidence for the positive effects of advance organizers in knowledge acquisition and application for online learners, especially for those of lower-learning abilities. It may be reasonable to predict that using advance organizers will facilitate teaching and learning in fully Web-based instruction. Further research is needed to examine the use of advance organizers, especially the participatory organizers, for a student population of lower learning abilities within Web-based learning milieus.

APPENDIX A INFORMED LETTER OF CONSENT: STUDENT

August 21, 2006

Dear Student of HSC4653 Health Care Ethics:

You are invited to participate in a study about using the concept map, a type of advance organizer in online courses. I am a graduate student in the College of Education, University of Central Florida. As part of my course work, I am conducting a study on how advance organizers assist learning achievement in web courses. Technically, the advance organizer is a prereading guide that clarifies concepts, sets up expectations, or builds background knowledge by using text, graphics, or hypermedia.

This research is to examine both the short-term and long-term effects of the concept map, a type of advance organizer, in a web-based course. This study will last one week while you finish Module 2 of the course "HSC4653 Health Care Ethics". All information gathered will be kept confidential. There are no anticipated risks for participating in this study. By participating in this research, you are stating you :

- * Read the research study information described in this information letter.
- * Voluntarily agree to complete a 20-minute Module 2 Quiz I during Week 2.
- * Voluntarily agree to complete a 20-minute Survey for Module 2 during Week 2.
- * Voluntarily agree to complete a 20-minute delayed quiz Module 2 Quiz II and a case study question four weeks after the study during Week 6.
- * Give me permission to contact you by emails or phone calls for brief interviews, if necessary.
- * Give me permission to access your demographic information, quiz scores, assignments and answers to the survey for the purposes of the research.
- * Give me permission to report your responses anonymously in the final research manuscript.
- * Understand that you as a participant are 18 years or older.
- * Understand that you as a participant are not expected to answer every question of the quizzes or survey if it makes you feel uncomfortable. You will not be penalized for refusing to answer a question or completing a task.
- * Understand that you are free to withdraw your consent to participate and may discontinue your participation in the study at any time without consequence.
- * Understand that, as a research participant, you may be able to get 10 bonus points for the course by participating and completing all instruments in this research. Please contact your instructor for extra bonus points.

Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida, Office of Research & Commercialization, University Towers, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246, or by campus mail 32816-0150. The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays. The phone number is (407) 823-2901.

If you have any questions about this research project, please contact Baiyun Chen, College of Education, at (407) 277-6537 or baiyun@mail.ucf.edu. You can also contact my faculty supervisor Dr. Atsusi Hirumi, College of Education, at 407-823-1760 or hirumi@mail.ucf.edu.

Thank you very much for helping with this important study!

Sincerely,
Baiyun Chen
Ph.D. Student
Instructional System Design
College of Education
University of Central Florida

**APPENDIX B INFORMED LETTER OF CONSENT: STUDENT
INTERVIEW**

October 3, 2006

Dear student:

I am a graduate student at College of Education, University of Central Florida. As part of my coursework, I am conducting a study on how advance organizers assist learning achievement in online courses. Technically, the advance organizer is a prereading guide that clarifies concepts, sets up expectations, or builds background in any format of text, graphics, or hypermedia.

This research is to examine both the short-term and long-term effects of concept maps, a type of advance organizers, in totally web-based courses. For the purposes of the study, I will interview you about your online course -- HSC4653 Health Care Ethics. The interview will last 10-15 minutes. Your interviews will be conducted via phone or online chat at your convenience. With your permission, I would like to take notes during your interviews. Your identity and all information gathered will be kept confidential.

There are no anticipated risks for participating in the interviews. In addition, you as a participant are not expected to answer every question of the interviews if it makes you feel uncomfortable. As a research participant you will not benefit directly from this research. You are free to withdraw your consent to participate and may discontinue your participation in the study at any time without consequence.

Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida, Office of Research & Commercialization, University Towers, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246, or by campus mail 32816-0150. The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays. The phone number is (407) 823-2901.

Please reply to this email and indicate if you voluntarily agree to participate in the interview. Your acceptance of this consent form indicates that you have read the information provided above and have agreed to participate. If you have any questions about this research project, please contact Baiyun Chen, College of Education, (407) 277-6537 or baiyun@mail.ucf.edu. You can also contact my supervisor Dr. Atsusi Hirumi, College of Education, at 407-823-1760 or hirumi@mail.ucf.edu.

Sincerely,

Baiyun Chen

Ph.D. student

Instructional System Design

University of Central Florida

____ACCEPT (I voluntarily agree to participate in the interview.)

____NOT ACCEPT (I don't agree to participate in the interview.)

APPENDIX C INFORMED LETTER OF CONSENT: INSTRUCTOR

October 9, 2006

Dear Ms. Amanda Raffenaud:

I am a graduate student at College of Education, University of Central Florida. As part of my coursework, I am conducting a study on how advance organizers assist learning achievement in online courses. Technically, the advance organizer is a prereading guide that clarifies concepts, sets up expectations, or builds background in any format of text, graphics, or hypermedia.

This research is to examine both the short-term and long-term effects of concept maps, a type of advance organizers, in totally web-based courses. For the purposes of the study, I will interview you about the online course -- HSC4653 Health Care Ethics that you have been assisting to teach. Your interview will be conducted over the phone or via e-mail. With your permission, I would like to take notes during your interviews. Your identity and all information gathered will be kept confidential.

There are no anticipated risks, compensation or other direct benefits to you as a participant in this interview. You are free to withdraw your consent to participate and may discontinue your participation in the study at any time without consequence.

Questions or concerns about research participants' rights may be directed to the UCFIRB office, University of Central Florida Office of Research, Orlando Tech Center, 12443 Research Parkway, Suite 302, Orlando, FL 32826. The phone number is (407) 823-2901.

Your acceptance of this consent form indicates that you have read the information provided above and have agreed to participate. If you have any questions about this research project, please contact Baiyun Chen, College of Education, (407) 277-6537 or baiyun@mail.ucf.edu. You can also contact my supervisor Dr. Atsusi Hirumi, College of Education, at 407-823-1760 or hirumi@mail.ucf.edu.

Sincerely,

Baiyun Chen
Ph.D. student
Instructional System Design
College of Education
University of Central Florida
40000 Central Florida Blvd.

Orlando, Florida 32826-2810

____ACCEPT (I voluntarily agree to participate in the interview.)

____NOT ACCEPT (I don't agree to participate in the interview.)

**APPENDIX D INSTITUTIONAL REVIEW BOARD APPROVAL
LETTER**



Revised 09/05



UCF IRB Addendum/Modification Request Form

This addendum form does NOT extend the IRB approval period or replace the Continuing Review form for renewal of the study.

INSTRUCTIONS: Please complete the upper portion of this form and attach all revised/new consent forms, altered data collection instruments, and/or any other documents that have been updated. **The proposed changes on the revised documents must be clearly indicated by using bold print, highlighting, or any other method of visible indication. Attach a highlighted and a clean copy of each revised form.** This Addendum/Modification Request Form may be emailed to IRB@mail.ucf.edu or mailed to the IRB Office: ATTN: IRB Coordinator, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or campus mail 32816-0150. Phone: 407-823-2901 or 407-882-2276, Fax: 407-823-3299.

- **DATE OF ADDENDUM:** 8/18/06 to IRB#05-3114 _____ IRB Addendum # 06-3682
- **PROJECT TITLE:** **Effects of Advance Organizers on Learning from Web-based Classes in Distance Education**
- **PRINCIPAL INVESTIGATOR:** Baiyun Chen
- **MAILING ADDRESS:** 12146 Menzel Dr., Orlando, FL, 32826
- **PHONE NUMBER & EMAIL ADDRESS:** 407-277-6537 baiyun@mail.ucf.edu
- **REASON FOR ADDENDUM/MODIFICATION:** Revisions of procedures in the second phase
- **DESCRIPTION OF WHAT YOU WANT TO ADD OR MODIFY:**
 1. Title change. New title: Effects of Advance Organizers on Learning and Retention from a Fully Web-based Class.
 2. Funding. This project is now funded by Information Fluency Initiative Grant, Quality Enhancement Plan Development, University of Central Florida. Principal Investigator (\$1,000, 2006-2007).
 3. Students who participate in the research maybe able to get 10 bonus points out of a total of 900 credit points. In the previous pilot study, students will only get 5 bonus points out of a total of 900 credit points. The students need to contact the instructor for extra bonus points.
 4. Update of consent form. See attached.
 5. Add student interview. See attached for sample student interview questions. A separate consent form will be given to interviewees beforehand. See attached interview consent form.

SECTION BELOW - FOR UCF IRB USE ONLY

<input checked="" type="checkbox"/> Approved	<input type="checkbox"/> Disapproved		<u>8/19/2006</u>
<input type="checkbox"/> Full Board	<input type="checkbox"/> Chair Expedited	IRB Chair Signature	Date
		_____	_____
		IRB Member/Designated Reviewer	Date



Invitation Letter

August 21, 2006

Dear Student of HSC4653 Health Care Ethics:

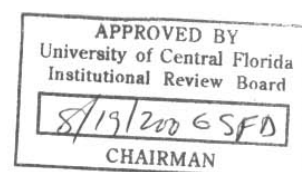
You are invited to participate in a study about using the concept map, a type of advance organizer in online courses. I am a graduate student in the College of Education, University of Central Florida. As part of my course work, I am conducting a study on how advance organizers assist learning achievement in Web courses. Technically, the advance organizer is a prereading guide that clarifies concepts, sets up expectations, or builds background knowledge by using text, graphics, or hypermedia.

This research is to examine both the short-term and long-term effects of the concept map in a Web-based course. This study will last one week while you finish Module 2 of the course "HSC4653 Health Care Ethics". All information gathered will be kept confidential. There are no anticipated risks for participating in this study. By participating in this research, you are stating you:

- Read the research study information described in this information letter.
- Voluntarily agree to complete a 20-minute **Module 2 Quiz I** during **Week 2**.
- Voluntarily agree to complete a 20-minute **Survey** for Module 2 during **Week 2**.
- Voluntarily agree to complete a 20-minute delayed quiz **Module 2 Quiz II** and a **case study** question four weeks after the study during **Week 6**.
- Give me permission to contact you by emails or phone calls for brief interviews, if necessary.
- Give me permission to access your demographic information, quiz scores, assignments and answers to the survey for the purposes of the research.
- Give me permission to report your responses anonymously in the final research manuscript.
- Understand that you as a participant are 18 years or older.
- Understand that you as a participant are not expected to answer every question of the quizzes or survey if it makes you feel uncomfortable. You will not be penalized for refusing to answer a question or completing a task.
- Understand that you are free to withdraw your consent to participate and may discontinue your participation in the study at any time without consequence.
- Understand that, as a research participant, you may be able to get **10 bonus points** for the course by participating and completing all instruments in this research. Please contact your instructor for extra bonus points.

Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida, Office of Research & Commercialization, University Towers, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246, or by campus mail 32816-0150. The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays. The phone number is (407) 823-2901.

If you have any questions about this research project, please contact Baiyun Chen, College of Education, at (407) 277-6537 or baiyun@mail.ucf.edu. You can also contact



 **REVIS**
8/18/06 *JW*

my faculty supervisor Dr. Atsusi Hirumi, College of Education, at 407-823-1760 or hirumi@mail.ucf.edu.

Thank you very much for helping with this important study!

Sincerely,
Baiyun Chen
Ph.D. Candidate
Instructional System Design
College of Education
University of Central Florida

APPROVED BY
University of Central Florida
Institutional Review Board
8/19/2006 SPH
CHAIRMAN

**APPENDIX E POSTTEST I PART A: QUIZ 1 & POSTTEST II PART A:
QUIZ 2**

Module 2 Quiz I & Quiz II

Time allowed: 20 minutes

Number of questions: 9 (randomly selected out of the following 18 questions)

Please select the BEST possible choice to answer the following items. You have 15 minutes to finish the quiz. This is a closed-book quiz and the score of this quiz will not be counted in your final grade for this course. Ten bonus points will be awarded to you towards this course for participating in this research, if you have met the requirements discussed in the information letter in Module 1. Please do not refer to your textbook or any of your reference materials.

1. Which model of the patient-physician relationship does the Hippocratic Oath reflect?
 - a) Partnership
 - b) *Paternalism
 - c) Contract
 - d) Friendship
2. How many models do Childress and Siegler examine for the physician-patient relationship in society?
 - a) 3
 - b) 4
 - c) *5
 - d) 6
3. Who suggested the metaphor of negotiation as an ultimate recommendation for the physician-patient interactions?
 - a) *Childress and Siegler
 - b) Edmund Pellegrino
 - c) Roger Higgs
 - d) Howard Brody
4. Howard Brody recommended which of the following standards of informed consent?
 - a) Conversation standard
 - b) Communication standard
 - c) Voluntary standard
 - d) *Transparency standard
5. In psychiatrist Peter Kramer's landmark book, *Listening to Prozac*, what does "Cosmetic psychopharmacology" refer to?
 - a) *The use of psychiatric medications for certain patients who lacked any diagnosable psychiatric disorder or illness
 - b) The use of a drug to make someone who is sick feel better
 - c) An elective procedure performed to reshape normal structures in the body in order to improve appearance

- d) The operative manual and instrumental treatment which is performed for functional or aesthetic reasons
6. Which of the following points is NOT included in Edmund Pellegrino's three-tiered system of obligations related to the special roles of physicians in society?
- a) Observance of laws
 - b) Observance of rights and fulfillment of duties
 - c) Practice of virtue
 - d) *Respect for autonomy
7. Which of the following is the argument that Benjamin Freedman recommended as an approach of offering truth to patients?
- a) Override patients' treatment-related preferences
 - b) Respect the cultural values of patients and their families
 - c) *Provide the patients the opportunity to learn the truth at whatever level of detail they desire
 - d) Tell the patients all of their medical diagnoses
8. Which of the following cases brought the topic of informed consent to the public's attention?
- a) Commonwealth v. Kenneth Kobrin, M.D.
 - b) *Jerry W. Canterbury v. Wm Spence, MD & Washington Hospital Center
 - c) Frank O'Neal Addington v. State of Texas
 - d) Simonsen v. Swenson
9. Which of the following values is perceived as fundamental in physician-patient interactions?
- a) Respect for patient's autonomy
 - b) Promotion of patient's well-being
 - c) Respect for patient's self-determination
 - d) *All of the choices
10. Which issue does the growth in American children's use of the stimulant Ritalin since the early 1990s reflect?
- a) Physician's obligations and virtues
 - b) Conflicts of interest, problems of conscience, and managed care
 - c) Informed consent
 - d) *Contested therapies within the physician-patient relationship
11. Which of the following conflicts became especially acute in the 1990s as managed care became the dominant model for health care in the United States?
- a) Conflict of interest between patient well-being and the health-related interests of physicians

- b) Conflict of interest between patient well-being and the political interests of physicians
 - c) Conflict of interest between patient well-being and society's financial interests
 - d) *Conflict of interest between patient well-being and the financial interest of an insurer
12. Which of the documents below reflects the traditional codes of the medical profession?
- a) Council on Ethical and Judicial Affairs, American Medical Association, *Fundamental Elements of the Patient-Physician Relationship*
 - b) President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, *The Values Underlying Informed Consent*
 - c) **The Hippocratic Oath*
 - d) Edmund D. Pellegrino, *The Virtuous Physician and the Ethics of Medicine*
13. Which of the following models do Childress and Siegler recommend for physician-patient interactions?
- a) Partnership
 - b) Paternalism
 - c) Friendship
 - d) *Negotiation
14. On the issue of informed consent, which of the following standards would recommend a physician provide adequate disclosure when his or her essential thinking about the medical situation had been made totally clear to the patient?
- a) Conversation standard
 - b) Communication standard
 - c) Voluntary standard
 - d) *Transparency standard
15. Which of the following ethical issues does the case of *Canterbury v. Spence* reflect?
- a) Truth telling
 - b) Conflicts of interest, problems of conscience, and managed care
 - c) *Informed consent
 - d) Physician's obligations and virtues
16. Which of the following terms refers to "the use of a drug to make someone who is not sick feel better"?
- a) Cosmetic surgery
 - b) *Cosmetic psychopharmacology
 - c) Cosmetic Neurology
 - d) Cosmetic Psychiatry

17. The council on Ethical and Judicial Affairs of the American Medical Association asserts that physicians should foster patients' rights. Which of the following statement is the patients' right that the American Medical Association has posited?
- a) To have available adequate health care
 - b) To make decisions regarding the health care that is recommended by his or her physician
 - c) To confidentiality
 - d) *All of the choices
18. On the dilemma of truth telling, which of the following is the approach that Benjamin Freedman recommended?
- a) Defer to a family's cultural expectations
 - b) *Provide the patients the opportunity to learn the truth at whatever level of detail they desire
 - c) Impose the truth on patients who may not want to receive it
 - d) All of the choices

APPENDIX F POSTTEST I PART B: SCENARIO 1

Patient Responsibility (Mappes & Degrazia, 2005, p.698)

For years Brian B has visited a public clinic that provides health care to uninsured persons. He has established a relationship with Dr. L, who always inquires about Brian's smoking habits and advises him to quit or at least curtail his smoking. Despite repeated warnings, Brian B has continued to smoke heavily, even after developing signs of emphysema in his early fifties. Now, at age 57, Brian B has a severe case of emphysema and goes frequently to the clinic—sometimes clearly for medical purposes, but sometimes apparently just to talk. The clinic, meanwhile, has been hit with budget cuts that have resulted in fewer staff to see patients. Dr. L is irritated with Brian B for ignoring all warnings and worsening his own medical condition. Dr. L tells him that, in the future, he must call before coming to the clinic and that there might not always be a staff member available to see him. Dr. L adds, “These days I am very busy with patients—patients who, by the way, follow doctor's orders—and I will be unable to see you.”

(1) To what extent is Brian B responsible for his severe case of emphysema? (2) Does Dr. L have an obligation to continue to be available to Brian B? Does virtue require his continued availability?

APPENDIX G STUDENT SURVEY

Please select the BEST possible choice to answer the following items. Ten bonus points will be awarded to you towards this course for participating in this research, if you have met the requirements discussed in the information letter in Module 1. Thank you very much for helping with this important study!

Prior online learning experience

1. How many Web-based classes have you taken before this semester?
 - a) 0
 - b) 1
 - c) 2
 - d) 3 or more
2. How many Web-based WebCT classes have you taken before this semester?
 - a) 0
 - b) 1
 - c) 2
 - d) 3 or more
3. How many health-related courses have you taken before this semester?
 - a) 0
 - b) 1
 - c) 2
 - d) 3 or more
4. How many ethics-related courses have you taken before this semester?
 - a) 0
 - b) 1
 - c) 2
 - d) 3 or more

Study Factors

5. On average, how much time do you spend on one module for this course weekly?
 - a) 0-3 hours
 - b) 3-5 hours
 - c) 5-8 hours
 - d) 8-10 hours
 - e) More than 10 hours
6. Where do you usually study for this course?
 - a) At home / dorm with computer and Internet
 - b) At home / dorm without computer or Internet
 - c) On campus with computer and Internet
 - d) On campus without computer and Internet
 - e) Others _____
7. Why did you take this course?
 - a) This is a required course for my program
 - b) I took it because I have a strong interest in it
 - c) My professor / friend recommended it to me

Use of Concept Map/Outline

8. How much time did you spend reading the Concept Map/Outline provided for Module 2?
 - a) Less than 1 minute
 - b) 1-5 minutes
 - c) 6-10 minutes
 - d) More than 10 minutes
9. How many times did you read the Concept Map/Outline?
 - a) Once
 - b) Twice
 - c) Three times
 - d) More than three times
10. When did you use the Concept Map/Outline?
 - a) Before textbook reading
 - b) After textbook reading
 - c) Both before and after textbook reading
 - d) Before quiz
 - e) Others _____
11. Do you think the Concept Map is easy to navigate?
 - a) Agree
 - b) Neither agree nor disagree
 - c) Disagree
 - d) Others _____
12. Do you agree that the Concept Map/Outline is useful for your study?
 - a) Agree
 - b) Neither agree nor disagree
 - c) Disagree
 - d) Others _____

Demographic Information

13. How long do you need to finish the quiz for Module 2?
 - a) Less than 5 minutes
 - b) 5-10 minutes
 - c) 10-20 minutes
 - d) More than 20 minutes
14. How old are you?
 - a) 18 years old
 - b) 19 years old
 - c) 20 years old
 - d) 21 years old
 - e) 22 years old
 - f) 23 years old
 - g) 24 years old
 - h) 25 years old
 - i) Older than 25

15. What is your current class standing?

- a) Freshman
- b) Sophomore
- c) Junior
- d) Senior
- e) Graduate student
- f) Others _____

16. What is your current major?

- a) Health Service Administration
- b) Health Professions
- c) Criminal Justice and Legal Studies
- d) Public Administration
- e) Liberal Studies
- f) Others _____

17. What is your gender?

- a) Female
- b) Male

18. What is your ethnicity?

- a) White / Caucasian
- b) Hispanic
- c) African American
- d) Asian American/Pacific Islander
- e) American Indian
- f) Other _____

19. Comments

Please provide us with any comments or suggestions for improving the modules in this course, such as the content module, the quiz, the survey, and others. Thank you for your time.

APPENDIX H POSTTEST II PART B: SCENARIO 2

Please read the case carefully and answer the questions in the following provided space.

Please write one paragraph for each question.

Mrs. Duttry was under the care of Dr. Patterson and Patterson Surgical Associates when she underwent surgery for esophageal cancer. Before Dr. Patterson operated on Mrs. Duttry, she asked the doctor the actual number of esophageal surgeries he had performed. She questioned Dr. Patterson about his experience and he advised her that he performs that same particular procedure an average of once a month. In fact, Dr. Patterson had only performed it five times in the preceding five years.

After the surgery, a leak occurred along the surgical site which developed into a rupture requiring emergency surgery. Mrs. Duttry then developed ARDS with permanent damage to her lungs. This rendered her unable to work.

(This case is taken from The Medical and Public Health Law Site
http://biotech.law.lsu.edu/cases/consent/Duttry_v_Patterson_brief.htm)

Question:

1. Was the number of times the doctor had performed a specific procedure important for Mrs. Duttry?
2. Did Mrs. Duttry have the right to the information about the doctor's surgical experience?
3. Was the doctor's surgical experience significant for her decision making?

APPENDIX I RUBRIC FOR SCENARIO 1 & 2

<p>Distinguished (25-21pts)</p>	<ul style="list-style-type: none"> • Identify key concepts and principles associated with the scenario. • Take a position and cite the book, notes, an article you might have read, another textbook etc. to support your point and give your answer credibility. • At least one page long and cover the question/answer thoroughly. • Clear and concise. • Format follows the assignment protocol strictly. • Submitted in the dropbox before the due date. • Free of cultural, ethnic or gender bias.
<p>Proficient (20-16pts)</p>	<ul style="list-style-type: none"> • Identify relevant concepts and principles associated with the scenario. • Take a position, and provide more description to support your point. • Almost one page and cover the question/answer appropriately. • Clear • For the most part, format follows the assignment protocol. • Submitted to the instructor within the before the cutoff date with good reasons. • For the most part, free of cultural, ethnic or gender bias.
<p>Unsatisfactory (<16pts)</p>	<ul style="list-style-type: none"> • Fail to identify any concepts and principles associated with the scenario. • Fail to take a position, or only use words out of your head, or copy word for word from the book or notes without any citation. • Only a few sentences • Unclear • Fail to follow the assignment protocol. • Submitted late • Include cultural, ethnic or gender bias.

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