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The Effects of Elaborative Interrogation and Summarization on Student Comprehension, Retention, and Satisfaction in Online, Self-Paced Instruction

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THE EFFECTS OF ELABORATIVE INTERROGATION AND SUMMARIZATION ON STUDENT COMPREHENSION, RETENTION, AND SATISFACTION IN ONLINE, SELF-PACED INSTRUCTION

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ABSTRACT

THE EFFECTS OF ELABORATIVE INTERROGATION AND SUMMARIZATION ON STUDENT COMPREHENSION, RETENTION, AND SATISFACTION IN ONLINE, SELF-PACED INSTRUCTION

by
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The purpose of this study was to investigate the effects of two elaboration strategies, elaborative interrogation questioning (EIQ) and summarization, on student comprehension, retention, and satisfaction in a self-paced online environment. There were four treatment groups: (a) Control (no treatment); (b) EIQ only; (c) Summarization only; and (d) EIQ and Summarization. Both undergraduate and graduate students (mean age = 25.84 years) volunteered and completed the study (N=191).

Results revealed a significant interaction between strategy type and age on comprehension. Older participants in the Control and EIQ/Summarization strategy groups comprehended more than the younger participants, and the younger participants in the EIQ and the Summarization groups comprehended more than the older participants.

Retention was tested one month later and was significantly affected by prior knowledge. Those with more prior knowledge had higher mean scores (M=63.89) than those with less prior knowledge (M=58.03). Both the EIQ and summarization strategies—alone and in combination—while effective when tested immediately following module completion, were evidently not effective one month later. Learners with more prior knowledge of the to-be-learned material retained more information than those with less prior knowledge.

Lastly, satisfaction results revealed a significant interaction between age and gender and strategy type and age. As age increased, females were more satisfied than males, however as age

decreased, females were less satisfied than males in the online instruction module. Furthermore, younger participants were more satisfied in the EIQ group than older participants, and younger participants were less satisfied in the Summarization group than older participants.

Specifically, participants using the EIQ strategy were 87 percent satisfied with this learning strategy, 86 percent were satisfied with the Summarization strategy, and 81 percent were satisfied using the combination of EIQ/Summarization strategies. Overall, 93 percent of the participants were satisfied with this self-paced online module.

DEDICATION

To my parents Pat and Becky Brown. It was your support and encouragement that helped me accomplish this goal. I love you.

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CHAPTER I

INTRODUCTION

The ubiquitous computer has been used for educational instruction at grades k-12 and at higher institutional levels for many years. However, a fairly recent trend has emerged. Computer-based instruction (CBI) containing all the information needed to acquire knowledge in a specific domain is being used as a training tool by educational institutions. Because this trend is increasing, CBI has garnered its share of praise and criticism: criticized for its passive instruction but praised for its ability to produce cost-effective training. Various studies have shown that CBI does not have to be passive in nature and, if appropriately designed, can be quite engaging and thought provoking. Using learning theories and strategies, instructional designers can develop engaging CBI that promotes knowledge acquisition and construction, while providing a satisfying experience for the learner.

COMPUTER BASED INSTRUCTION

Since the early 1960's, educational technologists have been creating CBI programs to drill, tutor, and test learners (Kulik & Kulik, 1991). Early CBI programs have been referred to as passive page-turners, lacking in learner engagement, often leading to boredom, and resulting in limited learning (Andrisani, Gaal, Gillette, & Steward, 2001). With contemporary CBI, topics can be grouped and offered as independent modules, thus allowing learners more control of the content (Cyboran, 1995). CBI is usually considered a self-contained learning environment (Mason & Bruning, n.d.), a one-stop shop for instruction. CBI provides essential content to learners and may be categorized as limited, yet precise, instruction in a specific domain that provides little or no human interaction.

The role of CBI varies greatly depending on the needs of a particular organization. Universities have begun using the CBI concept in the form of the online instruction module (OIM), which is either mandated by policy or driven by organizational initiatives. Topics

addressed have ranged from sexual harassment prevention and awareness to information technology (IT) security awareness instruction. Within universities, the OIM has focused on precise and succinct information in certain domains that are constrained by time and instructor/peer resources. As a result, the OIM design is often passive and lacking key elements found in good online course instruction. Learners in this environment have not been able to completely exercise their cognitive abilities, thus limiting the amount of learning and retention of information. Typically, this low-level type of instruction has been the result of the institution (and/or instructional designers and developers) focusing on providing maximum instruction while minimizing the expenditure of faculty and peer resources.

How does the design of an OIM materialize when institutions attempt to maximize the instructional design process while minimizing costs by reducing available resources? The OIM produced under these circumstances generally has the following features: (a) introduction (why you must take this training), (b) pretest/challenge questions (possibly), (c) presentation/lessons, (d) post-assessment, and (e) resources (if any). The resulting OIM tends to exclude many effective and efficient design features that are engaging to the online learner and critical to successful learning (i.e., learning strategies and alignment of objectives with the content and assessments).

The purpose of this dissertation was to investigate the effects of the following two cognitive learning strategies on student comprehension, retention, and satisfaction: 1) elaborative interrogation questioning (EIQ) and 2) summarization. This study tested the hypotheses that the insertion of these strategies in the OIM will correct the following shortcomings often present in current OIMs, 1) minimization of resources, 2) low level learning attributes, 3) lack of instruction's capability to take advantage of learner's cognitive abilities, and 4) reduced learning and retention of information by the learner.

ONLINE INSTRUCTION MODULES USED IN THIS STUDY

The OIM in this study has been developed as part of a Responsible Conduct in Research (RCR) training program for students. This training program is part of the University's long-term goal to incorporate "training in RCR, ethics, and professional standards into the culture and programmatic requirements of its graduate and research training activities" (Langlais, 2006, pg. 2).

These RCR training modules will be available anywhere, anytime for individual learning. They provide entry-level knowledge and skills in RCR, ethics, and professional standards. There are a total of nine modules, one of which will be used in this study. The ethic module is entitled: Compliance: Ethical, Legal and Professional Standards.

BACKGROUND

Quality Online Instruction

What elements contribute to quality online instruction, and how should they be incorporated to provide an effective, efficient, and engaging OIM that will enhance learner comprehension, retention, and satisfaction? To answer the question, one is on firm ground to say that quality online instruction involves sound pedagogy and instructional design development grounded in learning theories that are not limited to one perspective. Theories, such as behavioral, cognitive, and social learning, can be incorporated in OIM design to provide online learning with a synthesized approach to instruction that integrates various learning theories. Quality Matters™ (QM)*, a faculty-centered, peer-review approach to quality assurance and continuous improvement in the design of online education, describes the following critical components that contribute to effective online instruction: (a) a course overview and introduction, (b) learning objectives, (c) assessment and measurement, (d) resources and materials, (e) learner engagement, (f) course technology, (g) learner support, and (h) accessibility (MarylandOnline, Inc., 2006). As with any instruction, these elements may be represented in varying degrees depending on

* Sponsored by MarylandOnline, Inc.

instructional designers, faculty, and administrators working together to optimize the effectiveness of learning.

By aligning learning objectives, assessment and measurement, resources and materials, and learning engagement (strategies), learner performance can be measured effectively. These key components can be aligned through the use of a taxonomy such as a two-dimensional revision of Bloom's taxonomy table (Anderson & Krawthwohl, 2001). The intent of good instruction is to enable the learner to process new information and apply that knowledge to future situations. With the emergence of online learning delivered through course management systems (CMS), instructional designers must be cognizant of the key elements required for good online instruction to take place. Instructional designers attempt to ensure that content is structured in a way that supports the learner in processing information, while keeping cognitive overload at a minimum (Mayer, 2001). Researchers agree that in order for learning to take place, active and meaningful learning needs to transpire (Jonassen, 1985; Mayer, 1984, 1996, 2001).

LEARNING THEORIES

Memory and Knowledge Construction

Understanding the cognitive processes of how people learn new information and access stored information is vital to understanding how people control their thoughts and behaviors and make sense of their environment. Schema theory addresses knowledge and how we cognitively acquire and retrieve that knowledge. Schema theory proposes a hierarchical associative system by which knowledge is represented (Rumelhart, 1980). Learners encode newly encountered information into memory. Craik and Lockhart (1972) suggest that what gets encoded into memory depends on the level at which the information is processed; the deeper the level of processing, the more meaning that is associated with the information, thus the more information available for recognition. Recall of information requires deeper processing and access to prior knowledge (PK) to help organize and integrate new information (Craik & Lockhart, 1972).

Generative Learning

Generative learning theory asserts that when learners are presented with new information (e.g., text, graphics, and tables), they associate this information with PK to interpret the newfound knowledge (Johnsey, Morrison, & Ross, 1992; Jonassen, 1988; Wittrock, 1974). This generative learning process influences comprehension (Wittrock, 1992) and requires effort on the part of the learner (Nist & Holschuh, 2000).

In keeping with Craik and Lockhart's (1972) levels of processing argument, schema theory, and generative learning theory, Mayer (1996) suggests that meaningful learning takes place when the learner accesses PK. When presented with new information, learners interpret the new knowledge based on PK, and then integrate the old and new information. Mayer proposes a model of three cognitive processes involved in meaningful learning—selecting, organizing, and integrating— a model known as the S.O.I. Model of Knowledge Construction. This model assimilates processes of how we learn and handle information through sensory memory (audio and visual), working or short-term memory, and long-term memory. S.O.I. suggests that supplements, such as cognitive learning strategies, should be added to expository text to assist the learner in actively processing the information and promoting knowledge construction.

COGNITIVE LEARNING STRATEGIES

Weinstein & Mayer (1986) separated cognitive learning strategies into five different categories: rehearsal, organizational, elaboration, monitoring, and motivational. Learners use strategies in these different categories to select, organize, and integrate new information (Mayer, 1996; Olgren, 1998). Learning strategies are aids to learning and are what learners do at the time of learning new information (Weinstein & Mayer, 1986). Effective instructional design strives to use learning strategies found in each category to actively engage learners in meaningful learning in an online environment.

Elaboration Learning Strategies

Elaboration, one of the learning strategy categories, promotes generative learning, processing of information, deeper level processing, and knowledge construction. Elaboration is a process with which the learner reviews and processes material being presented and then formulates personal meaning based on PK and experiences (Jonassen, 1988).

Elaborative interrogation quesitoning, a specific elaboration strategy, is considered a higher-level processing strategy and has been widely researched to promote comprehension, retention of information, and use of PK (Ozgungor & Guthrie, 2004; Pressley, Symons, McDaniel, Snyder, & Turnure, 1988; Wood, Willoughby, McDermott, Motz, Kaspar, & Ducharme, 1999). The term elaborative interrogation was first coined by Pressley et al. in a study asking participants 'why' questions *(Why did that particular man do that?)*. Why questions encourage learners to access their PK and incorporate that knowledge with the newly learned information to generate answers. These questions are thought to provoke higher-order, deeper-level processing of the content (Dornisch & Sperling, 2004; Hsu & Dwyer, 2004; Willoughby & Wood, 1994).

Summarization, another type of elaboration strategy, also encourages the learner to integrate new information with PK (Weinstein & Mayer, 1986). The process of summarizing engages the learner and content, enabling the learner to generate meaningful connections between the important concepts within the text (Seifert, 1993a).

This study will use these two elaboration strategies, inserted into the OIM, to encourage deeper-level processing, comprehension, and retention of information.

SATISFACTION

A key component of education is to provide learners with a satisfying educational experience (Lorenzo & Moore, 2002). Student satisfaction is very important to the success of online courses and programs (Bower & Kamata, 2000; DeBourgh, 2003; Johnston, Killion, & Oomen, 2005; Shea, Frederickson, & Pickett, 2001). Key factors that affect student satisfaction

are: a) interaction, b) feedback, c) technology, and d) convenience and flexibility (Arbaugh, 2000; Beffa-Negrini, Miller, & Cohen, 2002; Bolliger & Martindale, 2004; DeBourgh; Song, Singleton, Hill, & Koh, 2004).

Interaction

Interaction is one of the key elements found in effective, efficient, and engaging online instruction. Interactions can be learner-to-learner, leaner-to-instructor, and learner-to-content (Moore & Kearsley, 2005; Woods & Baker, 2004) or learner learner-to-interface, which is unique to online learning (Hillman et al., 1994) While Anderson (2003) believes in the importance of the first three interactions, he postulates that:

> Deep and meaningful formal learning is supported as long as one of the three forms of interaction (student to teacher; student to student; student to content) is at a high level. The other two may be offered at minimal levels or even eliminated, without degrading the educational experience. High levels of more than one of these modes will likely provide a more satisfying educational experience, though these experiences may not be as cost or time effective as less interactive learning sequences. (p. 3)

Learner-to-Content Interaction

Anderson suggests that only one type of interaction needs to be present for meaningful learning to occur. In an OIM, where the instruction is content specific and time limited, learner-to-learner and learner-to-instructor interactions generally do not lend themselves to this type of instruction due, in part, to the time and instructor involvement required for each to occur. Learner-to-content interaction lends itself nicely to OIMs.

Feedback

Feedback is critical in an OIM environment in which there is no human-to- human interaction and learners are engaged only with the content. Feedback assists learners in: 1) determining their performance before completion of the instruction, 2) evaluating their level of understanding, and 3) exposing misconceptions (Mason & Bruning, n.d.). Because of the importance of feedback, this study will examine student's reaction to the elaboration strategies and associated feedback via a satisfaction survey.

STATEMENT OF THE PROBLEM

To a considerable extent, CBI has been associated with low-level, passive "page-turning" exercises that lack the human interaction that is often associated with good online instruction. So how can OIMs be designed to deliver effective, efficient, and engaging instruction? Incorporating the cognitive learning strategies of EIQ and summarization with feedback into the OIM may begin to answer this question.

THE PURPOSE OF THE STUDY

The purpose of this study was to determine if cognitive learning strategies, specifically EIQ and summarization, promote comprehension and retention of information provided by a self-paced OIM. Additionally, the study addressed the issues of 1) minimizing resources, 2) low-level learning found in many OIMs, 3) lack of instruction's capability to take advantage of learners' cognitive abilities, and 4) reduced learning and retention of information provided by the OIM.

RESEARCH QUESTION

How will four different learning strategies affect learner comprehension, retention of information, and learner satisfaction after controlling for age, prior knowledge, and gender?

SIGNIFICANCE OF THE STUDY

Investigating the effectiveness of the EIQ and summarization strategies may prove these strategies to be valuable and low-cost design elements for OIMs, especially costs associated with increased faculty time and resources.

Many EIQ studies to date have limited learner control with regard to returning to the text previously read for review before engaging in EIQ. Several researchers have criticized EI investigations because the studies have not imitated real world experiences where learners often review material before answering questions (Duchastel, 1983; Spring, Sassenrath, & Ketellapper, 1986). Therefore, learners in this study had the option to review content previously read in order to answer the EIQ and summarization exercise, adding to the literature on criticisms describing ecological validity in EIQ studies.

The assessments used in this study are different from those used in previous EIQ research. Most EIQ research used assessments that measured immediate fact recall, immediate recognition, immediate free recall, matching, classification test, and problem-solving tests (Dornisch & Sperling, 2006; Hamilton, 1997; Martin & Pressley, 1991; Pressley, McDaniel, Turnure, Wood, & Ahmed, 1987; Seifert, 1994; Wood, Fler, & Willoughby, 1992). The assessments in this study were written to measure achievement of OIM learning objectives based on Bloom's revised taxonomy table (Anderson & Krathwohl, 2001). In addition, this study will be the first to address whether these strategies are effective to the learner in an online, self-paced environment.

CHAPTER II

LITERATURE REVIEW

ONLINE LEARNING

With the rapid emergence of web-based technologies, participation in online learning continues to increase, especially in the higher education setting. Approximately 3.9 million students were enrolled in at least one online course in the fall of 2007, which was a 12-percent increase compared to online enrollment in 2006 (Allen & Seaman, 2008). This upward trend reflects a shift from traditional face-to-face course offerings and training to courses that are conducted entirely online through the use of web-based course management systems (CMSs), such as Blackboard®* and WebCT®†. These CMSs allow instructors and students to engage in learning and to communicate, collaborate, take exams, submit papers, conduct synchronous chats, and participate in asynchronous discussions through the web, anywhere, anytime.

To provide quality online education that is effective and engaging, institutions should follow a sound design and assessment model when developing online instruction. Quality is important if an institution is to have successful online instruction.

Quality Matters

To ensure quality online instruction, instructional designers strive to maximize effectiveness, efficiency, and attractiveness of the instruction by using sound instructional design models incorporating learning theories, instructional theories, and learning strategies that will support the instructional message (behavioral, cognitive, and constructivist). Several sound instructional system design models exist such as The Dick, Carey, and Carey Model, *The Systematic Design of Instruction* (2005); Morrison, Ross, and Kemps' Model, *Designing Effective Instruction* (2005); Smith and Ragan's Model, *Instructional Design* (2005) and MarylandOnline's

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* Blackboard is a registered trademark of Blackboard, Inc.
† WebCT is a registered trademark of Blackboard USA, Inc.

Quality Matters (QM) Model (2006). These models incorporate learning theory and instructional theories and strategies that create the overall instructional design plan/model (Morrison et al., 2004). By selecting an instructional design model, the instructional designer can make certain that development of the instruction is comprehensive, effective, and efficient, leading to a quality product and successful learner achievement (Morrison et al., 2004).

The QM model was chosen for this study because it is a faculty-centered, peer-based approach to quality assurance and continuous improvement in the design of online education. The QM model is based on research literature and national standards and includes the following eight main categories.

1. Course Overview and Introduction
2. Learning Objectives (Outcomes)
3. Assessment and Measurement
4. Resources and Materials
5. Learner Engagement
6. Course Technology
7. Learner Support
8. Accessibility

The standard for each category has specific review criteria to ensure quality of the design and assessment of online instruction (see Appendix A). Depending on what type of learning is to take place (e.g., training for use of a new system or changing behaviors), instructional designers need to understand how people learn and process information. Learning theories provide guidance on how learning takes place in different types of situations.

LEARNING THEORIES

Learning theories describe the learning process when trying to achieve certain learning outcomes (Morrison et al., 2004). Behavioral, socio-cognitive, and cognitive learning theories guide instructional designers in choosing the appropriate learning strategy to reach a particular

outcome. For instance, cognitive learning theory stresses the importance of how learners process, store, and retrieve information. The learning theories reviewed below support the learning strategies chosen for this study. For example, schema theory, one of the cognitive learning theories, proposes how new knowledge is acquired by a learner.

Schema Theory

The assimilation of new information, coupled with prior knowledge, builds schemas or schemata (Rumelhart, 1980). Schema theory (Rumelhart & Ortony, 1977; Rumelhart) is the creation of units of information-schemata-stored in memory that the learner has developed and manipulated over time. Rumelhart refers to schema as the 'building blocks of cognition'. In essence, a schema is 'what we know' and can access to make sense of our reality and environment. The ability to access prior knowledge from long-term memory helps make sense of new information, which stimulates knowledge construction leading to active and meaningful learning.

According to schema theory, a learner organizes information in memory by arranging the information into particular nodes. When new information is presented, the information either is assimilated into an existing memory node (schema) or is accommodated into a new node (schema). This process of encoding new information into long-term memory is where comprehension and understanding actually occur (Nist & Holschuh, 2000).

Generative Learning Theory

Generative learning is another cognitive learning theory that supports schema building. The generative learning theory model is a blend of principles, models, and theories of cognitive psychology wherein the more one makes associations with new information, the more significant and meaningful the information becomes (Jonassen, 1982). Wittrock (1974) states that the premise of generative learning "is that people tend to generate perceptions and meanings that are consistent with their prior learning" (p. 88). He maintains that this relationship between prior

learning and instruction is important when designing instruction for active and meaningful learning (Wittrock, 1974, 1990, 1992).

Clark and Harrelson (2002) report that three memory systems—the visual and auditory sensory memories, working or short term memory, and long-term memory — and their processes interact with one another to help move information among these systems for meaningful learning to take place. This compares favorably with Mayer's (1999) three views of learning: (a) learning as response strengthening, (b) learning as knowledge acquisition, and (c) learning as knowledge construction. Knowledge construction occurs when learners access prior knowlege, compare the prior knowledge to what they already know, and then assimilate the two, placing the new knowledge into knowledge structures, schematas, and mental models (Jonassen & Reeves, 1996).

While working memory has a limited capacity to process information, often referred to as the "magic number 7 plus or minus 2" (Miller, 1956), this is still considered the main initial step for thinking and learning (Clark & Harrelson, 2002). The concept of "7 plus or minus 2" means that individuals can only remember between five and nine pieces of information at a time. Cowan (2001) has suggested that this number may be even lower, four plus or minus one. Kirschner, Clark, and Sweller (2006) go even further, contending that when actually processing information, the amount processed may depend on what type of information is being processed, limiting processing capacity to two to three pieces of information. Therefore, learner attention should be focused on essential information that is relevant to learning new information rather than on irrelevant information.

Chunking of Content

To focus learner attention so that processing of the information does occur, instructional designers may 'chunk' the information. A 'chunk' contains 'bits' of information that the learner can process more easily than if the information was presented together. Gobet, Lane, Jones, Oliver, and Pine (2001) describe a chunk as a group of information having strong relationships within the group, but weak relationships to information within other chunks. Robbins (2003)

relates chunks to grocery store aisles where items are grouped (e.g., pasta, canned vegetables, and sauces). The instructional designer must consider chunks as part of a hierarchy, where each chunk is super-ordinate, subordinate, and/or coordinate to other chunks of information (Robbins).

Dick et al. (2005) suggest that five factors need to be considered when instructional designers are considering chunking instructional content and how much information goes into each chunk:

1. Age of the learner
2. Complexity of the material
3. Type of learning taking place
4. Whether the activity can be varied, thereby focusing attention on the task
5. Amount of time required to include all the events in the instructional strategy for each cluster of content presented. (p. 189).

Based on these five factors, the instructional designer may choose to chunk information into very small or larger units, such as a textbook chapter. Dick et al. (2005) state that more mature learners can handle larger chunks of information than less mature (younger) learners. Instructional designers also use chunking of essential information to be learned to reduce extraneous cognitive load and increase germane cognitive load.

Cognitive Load Theory

Cognitive load is the cognitive effort the learner expends while trying to process information (Morrison et al., 2004). Instructional designers need to be aware of the cognitive load placed on learners by the design of the instruction. According to Paas, Renkl, and Sweller (2003), there are three types of cognitive load: intrinsic (element), extraneous (ineffective), and germane (effective). Intrinsic cognitive load is brought on by the information itself. The information to be learned fluctuates from basic to advanced element interaction. Information with basic element interaction is, for example, something that can be learned and understood independently of another piece of information, such as learning the postal abbreviations for each state. The learner

does not need to know one state's abbreviation before learning the name of the state. Whereas advanced element-interaction information can't be learned independently, other elements must be processed at the same time for understanding to occur. The more advanced the element-information interaction, the harder to understand the material to be learned (Paas et al.). If the content has high element-interactivity, then there will be a high intrinsic cognitive load on the learner, something the instructional designer must pay attention to. Since different content fluctuates in the levels of element interactivity, instructional designers have some control over the amount of element-interaction by choosing simpler learning tasks that omit some of the interacting elements (Paas, et al.).

Extraneous cognitive load is what is presented in the design or layout of the information and the activities in which learners are expected to engage (Paas et al., 2003). For example, asking a learner to solve a problem when inadequate information has been presented, or the information is located elsewhere in the instruction, can cause working memory to utilize resources otherwise needed to build schemas (Paas et al.), which places a high cognitive load on the learner. If intrinsic cognitive load is high, instructional designers need to control extraneous cognitive load by careful use of instructional design to keep working memory at processing capacity.

The third type of cognitive load described by Paas et al. (2003) is germane cognitive load. Germane cognitive load is like extraneous load and is affected by the manner information is presented and the activities that learners are expected to engage in. However, germane cognitive load enhances learning, whereas extraneous cognitive load prohibits learning (Paas et al.), limiting working memory resources to actively build schema.

For online learning to be effective, efficient, and engaging to the learner, instructional designers should be cognizant of the design of the instruction. If learning is to occur, instructional designers must be aware of the additive effect that intrinsic, extraneous, and germane cognitive load have on working memory. Chandler & Sweller (1991) state that cognitive load is focused on

how cognitive resources are utilized during learning and problem solving. Placing too much intrinsic and extraneous load on the learner will inhibit understanding of the instructional content (Morrison & Anglin, 2005). Instructional designers attempt to reduce extraneous cognitive load and increase intrinsic and germane cognitive load through chunking of the essential information to be learned.

While learning theories are descriptive in nature, explaining how learning takes place, instructional theory is prescriptive, prescribing best practice methods of instruction that are environment specific (Reigeluth, 1983).

INSTRUCTIONAL THEORY

Instructional theory focuses on the instructor, what takes place in the educational environment, and the methods in which the instruction takes place (Reigeluth, 1983). Instructional theory applies the principles and assumptions of learning theory to the instructional design goal of interest (Morrison et al., 2004).

Instructional theories enable instructional designers to align learning objectives with instruction and assessments, based in part on learning theories. For example, using Bloom's revised taxonomy (Anderson & Krathwohl, 2001) as a "framework for classifying statements of what we expect or intend students to learn as a result of instruction" (p. 212), instructional designers and/or faculty have a solid framework in which to align learning outcomes, instructional activities, and assessment methods leading to effective and efficient instruction that is observable and/or measurable.

Bloom's Revised Taxonomy Dimensions

Through the use of a two-dimensional framework similar to Merrill's (1983) performance-content matrix and the revised Bloom's taxonomy (Anderson & Krathwohl, 2001), alignment among intended learning, instructional activities, and assessments are prescribed. Of the two frameworks, Bloom's is a more recent approach and will be discussed further.

Bloom's revised taxonomy is a unique instructional framework that organizes learning objectives for instruction. The taxonomy is a two-dimensional framework that consists of a knowledge dimension and a cognitive process dimension. The cognitive process dimension consists of six categories: remember, understand, apply, analyze, evaluate, and create (Anderson & Krathwohl, 2001). The progression through these six categories is from low to high-level thinking. Each category has verbs associated with it, allowing instructional designers/instructors to develop appropriate, measurable learning outcomes and assessments.

The second dimension is the knowledge dimension consisting of factual, conceptual, procedural, and metacognitive knowledge. According to Anderson (2005), factual knowledge pertains to concepts, details, and terminology that learners must know to comprehend the subject domain. Conceptual knowledge refers to classifications and categories, principles, theories, models, and structures. Procedural knowledge is *knowing* how to make or do something. Metacognitive knowledge is the ability to be aware of one's learning and cognition in general. Instructional designers/instructors may acquire a more accurate understanding of intended learning by evaluating the interrelationships between the cognitive process and knowledge dimensions (Su, Osisek, & Starnes, 2004).

Instructional designers/instructors use learning outcomes to help choose appropriate instructional activities and resources. The revised Bloom's taxonomy table may be used to plot desired learning outcomes and assist in the selection of appropriate instructional activities and resources. The content's learning objectives, assessments, resources and materials, and learning strategies must be aligned. Instructional designers can work with faculty to align educational outcomes with content and assessments to effectively measure learner performance (Ball & Garton, 2005), thus assuring quality online learning. If objectives and assessments are misaligned, assessment outcomes will not reflect the achievement of the educational objectives (Ball & Garton, 2005).

Table 1 presents an example of how a learning objective is categorized according to using Bloom's revised taxonomy. This example is from the online Compliance Module used in this study. For Learning Objective One: The learner will identify the purpose of compliance standards.

Noun: the purpose of compliance standards **Verb:** identify

Table 1.

Example of Bloom's Revised Taxonomy Table for Online Compliance Module

The Knowledge Dimension	***The Cognitive Dimension***					
	Remember	***Understand***	***Apply***	***Analyze***	***Evaluate***	***Create***
Factual Knowledge		X				
Conceptual Knowledge						
Procedural Knowledge						
Metacognitive Knowledge						

The X indicates the cognitive level of the learning objective, Understand, and the knowledge dimension, Factual. The verb, identify, indicates the cognitive level of the learning objective is in the understand category.

COGNITIVE LEARNING STRATEGIES

Cognitive learning strategies "are activities that foster the unique interpretation and encoding of information into memory" (Jonassen, 1988, p.155). Since each learner enters the learning situation with very different experiences and ways of making sense of their environments, instructional designers need to use learning strategies that promote active cognitive processing of information. Cognitive learning strategies promote specific cognitive processing of information so learners are able to achieve the learning objectives of the instruction. Jonassen (1988) refers to generative learning strategies as those strategies that enable the learner to

assimilate new information with prior knowledge rather than responding to a strategy without personal, contextual knowledge.

Weinstein & Mayer (1986) categorized cognitive learning strategies into five categories: rehearsal, organizational, elaboration, monitoring, and motivational. They identified the first three as dealing with the learning of facts, ideas, and concepts. The last two categories, monitoring and motivation, address the metacognitive abilities of the learner and the ability to be self-regulating and focused when learning. Table 2 shows the five learning strategy categories, their functions, and examples of basic and complex strategies.

Table 2.

Five Learning Strategies[*]

Learning Strategy Category	***Description***	***Strategy Examples***
Rehearsal	Selection and acquisition of information	Basic: Rereading, memorizing
		Complex: highlighting, underlining, copying
Organization	Building internal connections	Basic: mnemonics, grouping
		Complex: concept-mapping, outlining
Elaboration	Integration of new information with PK	Basic: sentence forming, imagery
		Complex: note-taking, summarizing, elaborative interrogation
Monitoring	Metacognition	General: self-awareness of progress, self-checking
Motivational	Affective	General: focusing, managing one's time

These learning strategy categories are similar to those of Bloom's revised taxonomy (Anderson & Krathwohl, 2001). Weinstein & Mayers' (1986) rehearsal, organizational, and elaborative categories mirror the factual and conceptual knowledge dimension of Bloom's revised taxonomy. These categories are concerned with learning facts, ideas, and concepts. The last two categories in Weinstein & Mayer's learning strategy categories, monitoring and motivational, when combined, become the metacognitive knowledge dimension in Bloom's revised taxonomy.

Since OIMs lack face-to-face interaction with an instructor and peers, learners must interact with the instructional content and interface. Particular strategies promote learner

[*] Adapted from Weinstein & Mayer, 1986

interaction with online content and learners who are actively engaged with the instructional content are processing information that is essential for learning to take place (Morrison & Guenther, 2000). Specific cognitive learning strategies, such as elaborative strategies, may be utilized to promote comprehension and retention of information.

Bransford, Brown, and Cocking (2000) indicate that much of the learning that occurs emphasizes memorization of facts without understanding how or why the facts fit together. They do not deny that learning facts has a place in education; however, they postulate that "useable knowledge" is more than knowing a list of disconnected facts and that learners need to understand how these facts, based around concepts and principles, work together to support understanding and transfer of knowledge to other contexts. They further state that one of the "hallmarks of the new science of learning is its emphasis on learning with understanding" (Bransford et al., p.8).

To address the fact list versus understanding shortfall, the development of higher order cognitive skills has been on the agenda of national educational institutions for the past decade, yet learners still lack the ability to process information at higher levels (Ball & Garton, 2005). This study will investigate the use of elaborative learning strategies, which have been shown to foster active and meaningful learning, to assist the learner in understanding how facts, concepts, and principles work together.

Elaboration Strategies

Elaboration strategies are considered higher (deeper) level cognitive processing strategies and can be used to link understanding of how facts, concepts, and principles work together (Weinstein & Mayer, 1986). While rehearsal and organizational strategies are essential in encoding information in short term memory, elaboration strategies lead to more elaborate encoding into long term memory (Bruning, Schraw, Norby, & Ronning, 2004). Basic elaboration strategies include sentence forming and imagery. More complex strategies include inferencing, summarization, elaborative interrogation, reflective thinking, and questioning (Olgren, 1998;

Weinstein & Mayer). Complex strategies cognitively challenge the learner to access prior knowledge in order to understand and expand on the information (Jonassen, 1988).

Adjunct Questioning

Washburne (1929) introduced the idea of inserting questions into text and studied the effects of these questions on retention of information. Washburne also looked at the effect of the level of question, factual or generalization, on retention of questioned (relevant) information and nonquestioned (incidental) information. Washburne was the first to examine the effects of frequency of the inserted question, location (before, during, or after the paragraphs), and level of question (factual vs. generalization). He was the first to distinguish between incidental and intentional learning with inserted questions (Rickards & Denner, 1978).

In his study, Washburne presented a 3,000-word passage on the story of Florence, Italy, to 1,456 seventh, eighth, and ninth graders. The study had five treatment groups: (a) questions presented before the passage, (b) questions interspersed at the beginning of certain paragraphs, (c) questions interspersed after certain paragraphs, (d) questions presented at the end of the passage, and (e) no questions presented (control group).

Washburne (1929) found that the best placement for questions was at the beginning of a story or paragraph; however, there is some concern over how his statistical analysis was performed (Rickards & Denner, 1978), and the results should be interpreted with caution. Regardless, Washburne paved the way for future studies on inserted questions.

Although Washburne was the first to study inserted questions, Rothkopf (1965, 1966) is credited with creating an extremely lively educational research push on adjunct questioning (Rickards & Denner, 1978). Rothkopf (1965) examined verbatim (factual)-level questions requiring recall of precise information in a specific text passage. Rothkopf manipulated certain variables, such as question position, frequency, and mode of verbatim-level question, to study their effects on retention of incidental and intentional information. Rothkopf studied the effects of factual questions inserted immediately before or after associated text segments. His results

suggest that questions inserted after the reading material had a more positive effect on students' learning incidental information than on students who encountered questions before the text passage or no questions at all. In addition, the adjunct question group surpassed the reading only control group on retention of incidental information (Rickards & Denner).

Additional studies based on Rothkopf's (1966, 1965) seminal works have examined the use of adjunct questions (Anderson & Biddle, 1975; Andre, 1979; Frase, 1968; Hamaker, 1986; Rickards, 1979; Rickards & Denner, 1978) with respect to design features of adjunct questions, such as position and type of question, frequency, and level of question (see Anderson & Biddle, Rickards & Denner, Andre; and Hamaker for reviews).

Placement of questions. Many studies have been conducted on adjunct questions with regard to placement of questions. These studies include consideration of whether or not to allow the learner access to the text to answer the questions and determination of an appropriate number of questions to include with the content (see Hamaker [1986] for a review). Placing questions at the end of text facilitates learning more than placement at the beginning of text (Frase, 1967). In addition, placing questions close to the text that the questions refer to increases the questions' effectiveness (Boyd, 1973; Frase; Frase, Patrick, & Schumer, 1970).

Level of adjunct questions. There are two levels of adjunct questions: factual questions that ask learners to recall specific information from a text passage, and higher order questions that require learners to cognitively manipulate text information (Andre, 1979; Winne, 1979). In Hamaker's (1986) review on adjunct questioning research conducted between 1965 and 1983, he found that: (a) factual adjunct questions in short-answer format have a stronger facilitative effect than questions presented in multiple choice format; (b) factual post-questions facilitate learning covered explicitly or indirectly; and (c) when higher-order and factual adjunct question groups were compared on retention of information, the higher-order adjunct question group appeared to outperform on repeated, related, and unrelated higher-order test questions (see Hamaker for a full review).

Hsu and Dwyer (2004) examined the instructional effects of different cognitive levels of adjunct questions, which were embedded into a hypermedia program, on the performance of students. The students were categorized as either field-independent or field-dependent learners. Field-dependent learners are less likely to learn information that requires higher order processing when relevant cues are not provided. Field-independent learners do better without the structure of relevant cues. One hundred thirty two college students were presented with an instructional module comprised of 1,800 words and some visuals related to parts of the heart, blood circulation, and the blood cycle. Three treatments were given: (1) control group that saw no questions; (2) 10 questions presented where students had to identify parts of the heart and associate the proper name to the part; and (3) 11 higher order (comprehension) questions that required students to determine the difference between heart functions during systolic and diastolic phases. A significant finding from this study was that comprehension questions enhanced the learner's ability to connect new information with PK and to construct new meaning and relationships among concepts.

This study extended research on adjunct questioning. The focus was on the effects of embedded questioning and post-assessment questioning on higher level processing of information The learner needs to cognitively process the information at a deeper (higher) level and to transform the material read instead of only processing lower-level (factual) questions requiring the recall and/or recognition of facts. Information that will be well-remembered depends on higher levels of cognitive processing (Bruning, Schraw, Norby, & Ronning, 2004).

King (1994) suggests that for higher cognitive processing to occur, higher level questions need to be presented: "When questions are at higher cognitive levels, requiring inferences and analysis, evaluation, and integration of information, critical thinking is more likely to occur." (pg. 18) EIQ as a higher level questioning strategy should promote meaningful learning.

Elaborative Interrogation Questioning (EIQ)

Pressley et al. (1987) coined the term 'elaborative interrogation' in their study of fact learning in adults. Emerging from research in learning strategies and adjunct questioning, EIQs intend for learners to construct associations between what they already know and the new information presented. The EIQ strategy requires learners to generate answers to 'why' questions about the to-be-learned content (e.g., "Why did that particular man do that?" or "Why would that fact be true?"). By generating answers to why questions, learners activate their schema, processing information and generating connections between the new topic and what they already know (Pressley, et al., 1987; Willoughby & Wood, 1994). By connecting new information to PK, comprehension and retention seem to be facilitated (Dornisch & Sperling, 2006).

In early studies, particular why questions were based on artificial text developed for the purpose of the study on learning new facts (Pressley et al., 1987; Stein & Bransford, 1979). Subsequent elaborative interrogation studies focused on other key factors:

- Presentation format of the topic domain, such as prose passages constructed in paragraphs rather than single fact sentences (Dornisch & Sperling, 2006; Ozgungor & Guthrie, 2004; Boudreau, Wood, Willoughby, & Specht, 1999; Seifert, 1993b)
- The role PK plays in elaborative interrogation (McDaniel & Donnelly, 1996; Ozgungor & Guthrie; Willoughby, Wood, & Khan, 1994)
- Age affecting effective use of the elaborative interrogation strategy (Wood, Pressley, & Winne, 1990)
- Intentional versus incidental learning (Pressley et al., 1987; Woloshyn, Willoughby, Wood, & Pressley, 1990)
- Retention of information (Dornisch & Sperling, 2004, 2006; Kahl & Woloshyn, 1994; Willoughby, Waller, Wood, & MacKinnon, 1993; Woloshyn, Paivio, & Pressley, 1994).

The assessments utilized in the above studies ranged from free recall to cued recall, associative matching, and combinations of the two to multiple choice recognition of facts and main ideas and to problem-solving tasks. The current study focused on multiple choice cognitive processing assessments that measure the learner's ability to actively process information at a range of cognitive levels.

Topic of the text used in EIQ studies. Early research focused on arbitrary facts, such as *man* sentences (e.g., "Why did that particular *man* do that?") (Pressley et al., 1987; Wood et al., 1990; Wood et al., 1992), Canadian provinces and universities (Martin & Pressley, 1991; Pressley et al., 1988; Woloshyn et al., 1990), and animals (Seifert, 1993a, 1993b; Willoughby et al., 1993; Wood, Miller, Symons, Canough, & Yedlicka, 1993). Eventually realistic text topics were used to conduct studies on fact learning, such as scientific topics (Woloshyn et al., 1994; Woloshyn & Stockley, 1995), scientific concepts from high school and college texts (McDaniel & Donnelly, 1996; O'Reilly, Symons, & MacLatchy-Guadet, 1998), reinforcement and punishment (Hamilton, 1997), and child-development (Boudreau et al., 1999).

More contemporary research has focused on authentic academic course content, such as retail, merchandizing, and accounting principles (Dornisch & Sperling, 2006). The content (text topic) used for the current study was composed by faculty subject matter experts on ethical standards, specifically compliance standards, ethical theory, and moral judgments.

Presentation format. The presentation format (e.g.,. sentence, paragraph, passages) for much of the early elaborative interrogation research focused on learners being presented a list of facts or factual sentences (Martin & Pressley, 1991; Pressley et al., 1987; Willoughby et al., 1993; Woloshyn et al., 1992; Wood et al., 1992). Woloshyn et al., (1990) manipulated sentence format and included sets of facts in paragraph format. They determined that elaborative interrogation led to increased comprehension over those in a rehearsal strategy group. However, Seifert (1994) argued that if (a) elaborative interrogation is going to be used as a learning strategy, learners will

unlikely be asked to elaborate on every single fact contained in the paragraph, and (b) these types of paragraphs lacked text structure and a main idea.

Boudreau et al. (1999) examined learner performance when a more realistic complex and lengthy expository text was presented. Undergraduate students assigned to five different conditions: (a) unsupportive elaborative interrogation, (b) elaborative interrogation with main ideas underlined, (c) elaborative interrogation with main ideas underlined and accompanied with specific why questions, (d) repetition, and (e) self-study read eight pages of prose passages taken from a textbook on child development. The passages consisted of 23 paragraphs (3,034 words).

Boudreau et al. (1999) found that learners who were given text with the main ideas underlined and asked to answer specific why questions were better able to remember the main ideas of the text. This finding is consistent with other elaborative interrogation strategy studies leading to the conclusion that elaborative interrogation promotes learning. Boudreau et al. concluded that for performance to be enhanced, learners must be able to recognize main ideas and create elaborations.

Ozgungor & Guthrie (2004) also used a realistic expository text on "Phantom Pain" taken from *Scientific American* magazine. This passage, which consisted of 1,481 words, was much smaller than the one used by Boudreau et al., (1999). Participants were undergraduate students randomly assigned to one of two treatment groups: (a) answering EIQs, or (b) rereading. Prior knowledge and topic interest were statistically controlled. Learners in the EIQ group recalled more information, recognized more inferences, and had more coherent mental images than those in the rereading control group. Ozgungor & Guthrie concluded that elaborative interrogation with long expository passages can increase performance.

Dornisch & Sperling (2006) studied EIQ in text describing retail, merchandizing, and accounting principles. The text consisted of 22 paragraphs (2,096 words). Participants were undergraduate students randomly assigned to one of two conditions: (a) elaborative interrogation, or (b) rereading. Those in the elaborative interrogation group answered questions such as, "Why

would general merchandise planning begin at the department level?" Dornisch & Sperling found no significant differences in immediate recall between the two groups. The researchers speculate the cause may be attributed to content. They indicated that prior studies examined the recall of specific, ambiguous, isolated, and sequential facts. Although they measured recall on everything that the learners could immediately recall from the text, they did not direct the learners' attention to any specific main idea within the text which may have contributed to finding no significant difference between the two groups.

In comparison, a study conducted by Hill (1999), which employed the elaborative interrogation strategy in a medical school setting utilizing immunology text, showed no benefit to learners using the EIQ strategy over learners in the rereading control group.

Prior knowledge. The more prior knowledge (PK) an individual possesses regarding a particular topic, the easier elaboration becomes (Kim & Van Dusen, 1998). Supporting this finding is an extensive review by Dochy, Segers, and Buehl (1999) that revealed PK is strongly connected to learning outcomes.

Willoughby et al. (1994) conducted several experiments involving college students. One experiment examined the hypothesis that positive effects from the EIQ strategy depend on learners who had either high or low PK of the text studied. Their results revealed that learners with higher levels of PK perform better than those with lower levels of PK, leading them to conclude that the elaborative interrogation strategy appears to benefit those with a rich knowledge base of the topic domain over those with very little knowledge. This study is consistent with others that found the elaborative interrogation strategy most effective when PK of the topic domain was high (Willoughby, Porter, Belsito, & Yearsley, 1999; Willoughby, Wood, McDermott, & McLaren, 2000).

McDaniel and Donnelly (1996) examined the responses to EIQs to determine if PK was actually used to answer the questions. The why questions used in their study pertained to scientific facts found in astronomy, biology, and physics. The participants were college students

whose responses to the EIQs were classified into two groups: text based or PK. Text-based answers rephrased only what was found in the text. PK answers contained additional information not in the text. They found that almost all responses were constructed from the text itself, even for those learners who were considered to have a richer knowledge base.

In Ozgungor and Guthrie's (2004) study, students were assigned to two experimental groups: elaborative interrogation or rereading. Participants were given a PK pretest and classified as having either more or less PK. They found that the elaboration interrogation strategy increased performance of those who had little PK as well as those who had higher levels. The study implies that elaborative interrogation works for both those with lower and higher levels of PK, not for those only with a rich knowledge base (Ozgungor & Guthrie, 2004).

Woloshyn, Wood, and Willoughby (1994) studied elaborative interrogation where PK on strategy effectiveness was examined. They examined studies on high and low PK, inconsistent PK (knowledge is incongruent with PK), and shared PK (learners studying together). Their conclusion was that elaborative interrogation may promote learning, especially when learners have some PK of the to-be-learned content.

This study measured PK with a pre assessment questionnaire containing open-ended and multiple choice questions regarding the Compliance content of the OIM. Since PK affects the outcome of the elaborative interrogation strategy, PK was controlled in this study.

Age and EIQ. Age affects learning outcomes, along with PK. As one ages, his or her knowledge base increases, enhancing the ability to make more associations between new and existing information. However, while elaborative interrogation is effective across life span development, some studies have shown that younger learners with low PK show positive results using elaborative interrogation (Willoughby & Wood, 1994). Both adolescent (e.g., Wood, Willoughby, Kaspar, & Idle, 1994) and adult learners (e.g., Pressley et al., 1988) have greater retention when activating a cognitive skills strategy, such as elaborative interrogation.

The Wood, Pressley, & Winne (1990) study examined the use of elaborative interrogation with participants ranging in age from 9 – 14 (Grades 4 to 8). Participants were given man-sentence facts, as well as animal facts, and asked to use the elaborative interrogation strategy and a self-study strategy. Performance on recall (memory) tests significantly increased with age with the man-sentence condition using EIQ. However, participants given animal sentences using EIQ had no significant differences in age-recall relationships, perhaps indicating that familiar materials (animals) were remembered better than unfamiliar materials (man-sentences). The authors suggest that this strategy might be useful to young learners of differing ages when studying more naturalistic topics.

Wood et al. (1999) conducted four experiments: (1) comparison among two treatment groups (EIQ and self-study [students choosing their natural strategy]), (2) familiar and unfamiliar text, (3) dyad and individual study, and (4) four different age groups (M = 10.5, 14.7, 19.9, and 21.9. Overall, their findings indicate memory performance increased with age. Individuals in the EIQ group remembered familiar text better than unfamiliar text when compared to individuals in the self-study group. Individuals in the forced EIQ group demonstrated greater memory performance when compared to the self-study group. However they caution that even though EIQ promoted higher performance than did the self-study condition, the two populations were younger. From this, they suggest that even though younger learners have a less sophisticated knowledge base, they benefit from EIQ.

In general, the research on EIQ and age reveals benefits for learners of all ages, though performance has been stronger as age increases. The participants in this study ranged from 17-54 with a mean age of 25.84. The research suggests that these students should benefit from the elaborative interrogation strategy.

EIQ versus imagery. Pressley et al. (1988) compared EIQ to another elaboration strategy, imagery. They performed four experiments in which participants were given arbitrary information

or real-life experiences. The real-life experiences were experiences that the participants could relate to based on prior experience.

In each experiment, adults in the elaborative interrogation groups were asked to orally provide a reason why each fact made sense to them. Those in the imagery groups were asked to read the text silently and imagine a representation of each fact. The reading control groups were asked to read each sentence aloud, making sure they were reading to understand the sentence. Pressley et al. (1988) found those in the elaborative interrogation and imagery groups, for all experiments performed, consistently benefited more than those in the reading control groups.

Even though there were no significant performance differences between elaborative interrogation and imagery groups, Pressley et al. (1988) concluded that elaborative interrogation is an effective learning strategy for fact learning for two reasons: (a) it supports extensive analysis and thinking of factual relationships, and (b) the procedure of answering EIQs seems to focus attention on the facts as presented.

Intentional versus incidental learning. Anderson and Armbruster (1984) suggest that learners who are aware they will be tested on content will remain focused throughout the instruction. Pressley et al. (1987) investigated the effect of EIQs in both intentional (knew there was a test) and incidental learning (unaware there was a test), and found that the EIQ strategy effect was larger in the group that did not know there would be a test (incidental learning).

In a similar study, Woloshyn et al., (1990) investigated the effectiveness of imagery, self-reference, elaborative interrogation, and rereading control when learners knew there was a test (intentional learning) and when learners were unaware there was a test (incidental learning). Those in the elaborative interrogation incidental group learned more than students using visual imagery or students who reread the text. When intentional learning was imposed, learners in the elaborative interrogation group equaled the performance of the rereading group on free recall and fact recall tests. On the associative

matching test, learners in the elaborative interrogation group performed better than learners in the rereading group.

The individuals in the rereading group may have used additional learning strategies, since the rereading group performed as well as the elaborative interrogation group when intentional learning occurred (Woloshyn et al., 1990). An important aspect of this finding is that elaborative interrogation may not be as effective in intentional learning situations as it is in other circumstances.

Pressley et al. (1988) and Woloshyn et al. (1990) suggested that incidental learning promoted learning that was explicitly intended to occur by the experimenter. Since the learner was not notified of an upcoming test on the to-be-learned information, the learner was less likely to use other learning strategies to aid in his or her comprehension and retention of information (Pressley et al.). The intent of this study was to notify learners of the assessments to be conducted, and not to focus on the effects of incidental learning.

Retention using EIQ. Several studies measured retention of information learned when the EIQ strategy was initially deployed (Dornisch & Sperling, 2004, 2006; Kahl & Woloshyn, 1994; Willoughby et al., 1993; Woloshyn, et al., 1994; Woloshyn & Stockley, 1995). Willoughby et al. (1993) were the first to measure retention. They gave a delayed recognition matching task to adult learners one month after the initial study and found that EIQ had positive effects over the repetition control group when studying facts about animals.

Woloshyn et al. (1994) conducted retention sessions 14, 74, and 180 days after the initial study. They found that learning gains were durable six months later. Kahl and Woloshyn (1994) also found that learning gains were durable when learners participated in associative matching tasks 30 and 60 days after the initial study. This task consisted of a list of animals and 36 target statements which had a 'blank' in front of each statement. Learners were instructed to put in the appropriate animals name in the blank space for each statement.

A study conducted by Dornisch and Sperling (2004) found mixed results for the durability of comprehension and retention with the EIQ strategy that was used in an online environment. Both recall and recognition tests were administered one week later. Learners who were in the EIQ treatment group had higher means than the other groups (repetition and factual questions) for both recall and recognition tests, however results were not statistically significant. Dornisch and Sperling suggested that those in the repetition control group found this learning strategy similar to what they typically utilize and were therefore successful without the benefit of EIQs, and that the type of text and type of learning outcome did not promote deeper cognitive processing.

In a follow-up study, Dornisch and Sperling (2006) conducted two delayed testing analyses and found no statistically significant differences between EIQ, factual questions, or recognition control groups on delayed free recall testing and recognition performance one week later. However, those who had been in the EIQ treatment group had a higher mean recall and recognition scores than those in the factual and repetition control groups.

Assessment measures. Table 3 identifies some of the dependent measures that have been used in EIQ studies, ranging from cued fact recall to true or false recognition tests.

An organizational strategy used in Willoughby and Wood's (1994) study, asked the learner to organize animals' activity with the fact they believed matched the animal. In another study using an organizational strategy (Willoughby, Wood, Desmarais, Sims, & Kalra, 1997), learners were asked to organize animal facts into intact stories where the animal names were omitted.

Table 3.

Dependent Measures

Dependent Measure Tests	*Citation*
Cued Fact Recall	Pressley et al., 1987, 1988; Woloshyn et al., 1990, 1992 Wood et al., 1990, 1994)
Associative Matching	Martin & Pressley, 1991 Wood & Hewitt, 1993
Combination of Cued Fact Recall and Associative Matching	Seifert, 1993b Woloshyn et al., 1990 Wood et al., 1992 Ozgungor & Guthrie, 2004
Multiple Choice Recognition	McDaniel & Donnelly, 1996 Willoughby et al., 2000
Free Recall	Martin & Pressley, 1991 Woloshyn & Stockley, 1995 Woloshyn et al., 1990 Dornisch & Sperling, 2004, 2006
True or False Recognition	Greene, Symons, & Richards, 1996 Woloshyn et al., 1994 Woloshyn & Stockley, 1995 Dornisch & Sperling, 2004 Dornisch & Sperling, 2006

In more recent studies, a combination of free recall and recognition multiple-choice measures were used as dependent measures (Boudreau et al., 1999; Dornisch & Sperling, 2004). Only two studies used free recall, multiple-choice recognition, and a problem-solving transfer measure (Dornisch & Sperling, 2006; Hamilton, 1997). What is not evident in the EIQ literature on assessment is the alignment of learning objectives of the content with the assessment measure.

Summarization

Summarization, a type of elaboration strategy, requires learners to engage in two types of thinking: selection and reduction (Anderson & Hidi, 1988/1989).

- Selection — the learner makes a judgment and seeks out information that needs to be included or rejected in the summary.

- Reduction — the learner takes the more general ideas of the text and processes them into more detailed ones.

The ability of the learner to include or omit information in a summary shows their capability to understand and remember text they have read (Garner, 2001).

Summarization should be effective in two ways: (a) it requires learners to focus on important facts, ideas, and concepts, which enables the learner to generate meaningful relationships between them; and (b) it requires learners to generate main ideas in their own words, which involves deeper processing of information (Seifert, 1993a).

Nature of the text. Learners find that identifying text to include in summaries is easier if the texts are narrative in nature rather than expositions (Anderson & Hidi, 1988/1989). Also, longer and more complex texts require more selection and reduction to determine what ideas and/or concepts are important to include.

Critical components. Brown, Campione, and Day (1981) identified six basic skills and their application that are critical to summarization: (a) deletion of insignificant information; (b) deletion of redundant information; (c, d) substitution of a subordinate term or event for a list of items or actions (e.g., 'goldfish,' 'cats,' and 'dogs' can be substituted for 'pets'); (e) selection of lists or topic sentences; and (f) creation of their own. They examined learners in Grades 6, 7, and 10 and at the college level. They found that all learners were able to successfully delete insignificant and redundant information in summaries. However, for more complex rules, age became a factor, indicating that younger learners (Grades 6, 7, and 10) had a more difficult time than those at the college level in determining a topic sentence or inventing their own.

Garner (1985) conducted a study with learners in Grades 9 and 11 and at the college level. Learners were asked to read a descriptive passage entitled "Intuitive Physics," containing seven paragraphs. The learners were asked to write both a good and bad summary of the text. Across age groups, 73 percent were able to differentiate between appropriate and inappropriate material to include in a good summary. Ninety percent of the college students showed

significantly more awareness than their younger counterparts. Garner concluded that an increase in age and experience plays a role in learners' ability to identify central information from text to include in appropriate summaries. Garner also found that college students had a harder time keeping optimal summaries relatively short compared to younger learners and had a more difficult time producing optimal summaries that included important ideas in a succinct manner.

In a later study conducted by Garner (2001), undergraduate students were asked to generate summaries where the 'efficiency of summarization' was assessed. Garner looked at total number of words and the proportion of important concept ideas included in the summaries. The summaries were categorized into high-efficient and low-efficient proportions of inclusions and omissions. Participants were then asked to verbalize the content of an optimal summary five days later. Garner found those learners who had a difficult time verbalizing elements of an optimal summary also had difficulty with the efficiency of their summary. Garner states, "it may be that effective summarizers streamline the information they have read so successfully as they summarize, that the summary product becomes the text which is stored and retrieved" (p. 279).

Another element that is crucial in effective summarization is allowing learners to review the content they are summarizing. This review allows more 'mental space' for the selection and reduction processes required for effective and efficient summaries (Anderson & Hidi, 1988/1989).

This study allowed learners to review all subtopics in each main topic in order to effectively answer the summary exercises. Since the summarization exercises were not evaluated for content, automated immediate feedback was given through the CMS once the learner answered the exercise. This immediate feedback contained specific information regarding key concepts/facts related to the topic that should have been incorporated into the summary.

STUDENT SATISFACTION

Factors Leading to Student Satisfaction

Student satisfaction is very important to the success of online courses and programs (Bower & Kamata, 2000; DeBourgh, 2003; Johnston et al., 2005; Shea et al., 2001) and could have an impact on the comparisons of the learning strategies. Satisfaction will be examined in this study to determine if the learning strategies, specifically EIQ and summarization, enhance overall satisfaction with the OIM.

Many factors have been attributed to online student satisfaction, such as (a) interaction, (b) feedback, (c) technology, and (d) convenience and flexibility (Arbaugh, 2000; Beffa-Negrini et al., 2002; Bolliger & Martindale, 2004; DeBourgh, 2003; Song et al., 2004). What hasn't been a major focus of research but has an impact on satisfaction is gender and age (Billings, Connors, & Skiba, 2001; Bower & Kamata, 2000).

Interaction

Interaction is a critical aspect in the online environment and has been shown to be paramount to the success of online courses and programs (Beffa-Negrini et al., 2002; Bolliger & Martindale, 2004; Bower & Kamata, 2000; DeBourgh, 2003; Shea et al., 2001; Song et al., 2004). Chickering & Gamson (1999) include interaction as a core element in their seven principles of good practice in undergraduate education. Many other researchers have described several facets that comprise interaction, such as the social, cognitive, and teacher presence aspects (Garrison, Anderson, & Archer, 2000), as well as collaboration and active learning (Kenny, 2002).

Wagner (1994) states interactions "are reciprocal events that require at least two objects and two actions" (p. 3) that mutually influence each other. Garrison and Shale (1990) add that all forms of education are interactions among student, teachers, and content. Anderson (2003) contends that interaction found in formal education is designed to guide learners to meet specific learning objectives and outcomes. Thurmond and Wambach's (2004) definition will be adopted

for the purpose of this study, which combines aspects of Hillman et al. (1994), Wagner (1994), and Moore (1989), defining interaction as the:

> learner's engagement with the course content, other learners, the instructor, and the technological medium used in the course. True interactions with other learners, the instructor, and the technology results in a reciprocal exchange of information. The exchange of information is intended to enhance knowledge development in the learning environment. Depending on the nature of the course content, the reciprocal exchange may be absent – such as in the case of paper printed content. Ultimately, the goal of interaction is to increase understanding of the course content or mastery of the defined goals (p. 2).

Moore (1989) first identified three distinct contexts of interaction found in the traditional classroom environment and in the online environment: (a) learner-to-learner, (b) learner-to-instructor, and (c) learner-to-content. While not all courses require equal interaction among learners, instructor, and content, active and meaningful learning will occur if at least one of the interaction contexts is supported at a higher level than the other two (Anderson, 2003). Hillman et al. (1994) adds a fourth context called learner-to-interface interaction. Here the learner must interact "with the technological medium in order to interact with the content, instructor, or other learners" (p. 4). This interaction engages the learner with the tools needed to accomplish a task, such as answering an EIQ or writing a summarization. These four types of interaction are not mutually exclusive.

Learner-to-learner. Many researchers concur that learner-to-learner interaction is a very important component in the design of an online course (Jiang & Ting, 2000; Jung, Choi, Lim, & Leem, 2002; Pena-Shaff & Nicholls, 2004; Picciano, 2002; Woods & Baker, 2004). One of the strongest predictors of student satisfaction is the interaction students have with one another (Beffa-Negrini et al., 2002). Through interaction, students are able to share their experiences and reflect on different perspectives that may impact their thinking (Jiang & Ting).

Shea et al. (2001) reported that 73 percent of students surveyed who had high levels of interaction with their classmates were highly satisfied with their courses. In concert with this finding, Fredericksen, Pickett, Shea, Pelz, and Swan (2000) reported that students with the

highest learner-to-learner interaction had the highest levels of perceived learning and satisfaction with their online course. Beffa-Negrini et al. (2002) suggest that interaction should be maximized between learner and learner. Furthermore, Jiang and Ting (2000) imply that the degree of interaction and collaboration may influence a student's perceived learning and satisfaction.

Learner-to-learner interaction can take place when instructional strategies are present that encourage students to collaborate, debate, discuss, and communicate with one another, thereby creating what some researchers refer to as a sense of community (Frey, Alman, Barron, & Steffens, 2004; Rovai, 2002; Song et al., 2004). Song et al. found that 71 percent of graduate students surveyed who were less satisfied with their courses indicated that there was a lack of sense of community. Yet, Picciano (2002) suggests that just because interaction is taking place does not necessarily mean that a sense of community is present. A student can post a message on a discussion board, but that doesn't mean he or she feels connected to the other students (Picciano).

Learner-to-instructor. Learner-to-instructor interaction develops when the instructor and student communicate effectively with each other in a traditional class setting, hybrid course, and/or an online environment (Moore & Kearsley, 2005; Woods & Baker, 2004). In an online environment the learner–to-instructor interaction concept is one where the instructor effectively communicates with the students through a response to online discussion posts or in-class interaction. While learner-to-instructor interaction affects learner satisfaction in some situations, the online modules used in this study will not incorporate this type of interaction, which may affect the satisfaction of learners in the long run.

Learner- to- content. The third key interaction affecting learner satisfaction is learner-to-content. The learner develops his or her own knowledge by engaging with the content provided in the course (Moore & Kearsley, 2005). Frey et al. (2004) found graduate students were satisfied with their courses if the content was of quality and pertinent to their learning. Northrup (2002) found that the learners agreed that interacting with the content (i.e., audio-narrated online

presentations, and some instructor interaction) and learning strategies (i.e., case studies, games, and readings with online discussion) was essential to the online experience.

Despite the abundance of literature that asserts interaction is a necessity, learner-to-learner and learner-to-instructor, for satisfaction and successful online courses and programs, there is evidence that suggest some students deliberately choose instruction that allows them to minimize the amount of these two types of interaction (Kramarae, 2003; May, 1993). This evidence is consistent but does not necessarily conform with Anderson's (2003) postulate that, as long as one of the three learner interactions is at a higher level than the other two, the lower two interactions can be minimal, if not non-existent, without degrading the learning experience.

Feedback

Feedback is a critical factor in CBI. Debourgh (2003) and Thurmond, Wambach, Conners, and Frey (2002) found that graduate nursing students who were satisfied with their online courses identified timely feedback as a factor. Feedback notifies the learner of their progress, increases their level of confidence, and reduces their anxiety level (Andrisani et al., 2001). Immediate feedback validates that the learner understands the information or should review the content for better comprehension, thus motivating the learner to continue with the instruction. With immediate feedback, learners can move to new content or review the current content without delay (Cyboran, 1995).

Bolliger and Martindale (2004) surveyed 105 graduate students and found instructor variables, such as feedback, were important factors in online student satisfaction. Morrison, Ross, Gopalakrishnan, and Casey (1995) conducted a study on CBI using several forms of feedback, (answer until correct, knowledge of correct response, delayed feedback, questions only, and no-questions) and incentives (task-rewarded subjects for completion of task regardless of level of achievement; performance-based grades on level of achievement). The study concluded that providing feedback was effective for lower-level learning however, results were only slightly higher for higher-level learning with no feedback. In addition they found that those in the

performance incentive group learned more than those in the task incentive group regardless of type of feedback.

In the current study there is no formal peer or instructor interaction, which may affect the learner's overall satisfaction with the OIM. However, in this study, OIM feedback was automatic when the learners engaged the OIM's learning strategies and assessments, which may affect satisfaction. Also, the lack of formal interaction between instructor and other students, in this case, may be a benefit, considering that faculty time in terms of providing interaction and feedback is eliminated.

Technology

With the increase in hybrid and online courses, technology has become a factor in student satisfaction. If students cannot access the technology, such as a home or campus computer, the Internet, CMS, and/or appropriate tools, their satisfaction with a course or program appears to decline (Beffa-Negrini et al., 2002; Bolliger & Martindale, 2004; Song et al., 2004). Eighty-two percent of the graduate students in the Song et al. study indicated that their level of comfort with the technology used in the course was an important factor in their satisfaction. Furthermore, 58 percent of those surveyed felt technical problems were a barrier directly affecting their satisfaction. Other research findings support this, adding that technical difficulties and access to reliable equipment affect student satisfaction (Bolliger & Martindale, 2004; Shea et al., 2001). Beffa-Negrini et al (2002) found that students satisfied with their instructor also had a positive attitude and more competence in the use of computer technology.

Gender

Much of the literature examining gender differences in online learning is focused on communication between women and men. Computer-mediated communication (CMC) enables instructors and students to communicate, collaborate, take exams, submit papers, conduct synchronous chats, and participate in asynchronous discussions through the web regardless of specific gender-gender interactions.

Barrett and Lally (1999) found that men expressed more in a CMC environment by posting more messages than women did. Men tended to contribute more to the socio-emotional dialogue, whereas women were more task oriented and included previous responses to their messages. In contrast, Guiller and Durndell (2006) found that men had more of an authoritarian tone and negative socio-emotional content compared to women, who used more attenuated language and were more positive in their socio-emotional communication. Women felt they had more voice in an online learning environment than in a traditional setting (Anderson & Haddad, 2005). These differences could be attributed to the nature of the course being studied, and perhaps the ratio of women to men in the course. Wherever the discrepancies lie, gender differences in CMC do exist.

Other studies suggest that women prepare more for online courses than men do, accomplish their course work later in the evening after family obligations have been met (Gunn, French, McLeod, McSporran, & Conole, 2002), and experienced higher levels of satisfaction than men do (Arbaugh, 2000; Bower & Kamata, 2000). Sullivan's (2001) study revealed women were more likely than men to mention family and children, and referred to flexibility as one of the primary reasons for choosing online courses. Women participated more in all aspects of online courses (e.g., discussion board, chats, groups) than their male counterparts, and were more collaborative in their approach (Arbaugh, 2000). Similarly, Rovai and Baker (2005) found that women graduate students participated at higher levels than men did, and commented that their environment was "socially richer" than that of men. Yet, 11 percent of the women students in Sullivan's (2001) study revealed lack of face-to-face interaction as a drawback to online learning compared to only 5 percent of the men, proving to be the single most negative comment regarding online learning.

One focus of this study was the role gender plays in factors associated with satisfaction of an online environment and learning strategies.

Convenience and Flexibility

Research regarding student satisfaction frequently mentions convenience and flexibility when taking online courses. The most cited reason for taking online courses by both women and men was the convenience and flexibility online courses offer (Sullivan, 2001). In the Frey et al. (2004) study, the student consensus was that convenience and flexibility were the main reasons for taking the online course. This included those who were able to commute to campus to take the face-to-face course. Students often cite not having to be in a particular place at a specific time as flexible and convenient due to other demands, such as family and work (Arbaugh, 2000; Bolliger & Martindale, 2004; Bower & Kamata, 2000; Song et al., 2004).

SUMMARY OF THE REVIEW

Incorporating cognitive learning strategies in OIMs encourages active cognitive processing of information. Two cognitive learning strategies, EIQ and summarization, considered to be elaboration strategies, have shown positive learner outcomes. The EIQ strategy engages the learner's cognitive processing ability and encourages the learner to tap into PK and assimilate the to-be-learned information into existing schemas or accommodate a new schema. When learners use the summarization strategy, two types of thinking take place: selection and reduction of essential information.

For online information to be effective and efficient, and to actively engage the learner, instructional designers need to consider cognitive load by appropriately chunking the content (Miller, 1956). EIQ and summarization strategies embedded throughout the OIMs, promotes active engagement with the content.

There are various factors that affect student satisfaction in online instructional environments including interaction, technology, course design, and instructor role. Many of these factors overlap, (e.g., interaction and instructor overlap when the instructor initiates interaction with the students). Interaction takes different forms in traditional and online courses. The most commonly found interactions are learner-to-learner, learner-to-instructor, and learner-to-content.

In many cases if interaction is lacking in the course, students lack a sense of community and feel isolated. Therefore, good instructional design often includes interaction among student, instructor, and content. However, if at least one of these interactions is at a heightened level compared to the others, learners may still benefit greatly and engage in meaningful and active learning.

Other course design factors affect satisfaction such as organization , clarity of goals and expectations and timely feedback. The convenience and flexibility of taking online courses, along with interactions, course design, the instructor, and access to the appropriate technology, seem to foster student satisfaction in the online learning environment, regardless of gender. While the gender factor is clearly important, gender-specific studies mainly targets communication. However, some research suggests women are more satisfied and feel they have a much stronger voice in their online learning experience than in the traditional classroom setting.

Online programs must address student needs and be responsive to factors influencing satisfaction. For retention purposes, identifying and addressing factors affecting student satisfaction will be paramount for the success of many online programs and courses. For the instructional designer, knowing how and why these factors affect student satisfaction can facilitate the development of effective, efficient, and attractive online instruction modules.

CHAPTER III

METHODOLOGY

The purpose of this study was to investigate the effects of embedding elaborative interrogation questioning (EIQ) and summarization learning strategies on comprehension, retention, and learner satisfaction of a self-paced, online instruction module (OIM). Both strategies have the potential to increase comprehension and retention of new information in both traditional and online environments, but their combined effects on acquisition and construction are unknown.

The Quality Matters™* (QM) framework, based on research literature and national standards, was used to ensure that the OIM used in this study is of high quality. The QM™ framework identifies eight key areas that should be included in online course: (a) course overview and introduction, (b) learning objectives, (c) assessment and measurements, (d) resources and materials, (e) learner engagement, (f) course technology, (g) learner support, and (h) accessibility (Appendix A).

The learner engagement guidelines were augmented by empirical research literature on EIQ and summarization; and the strategies were embedded in the OIM to promote knowledge acquisition and construction. The study is comprised of a pilot study to establish instrument construct validity and reliability; a main study with one main research question; a description of the variables, treatments, instruments, and feedback; data analysis; study limitations; study assumptions; ethical consideration of participants, and conclusion.

Participants took the Compliance module and experienced one of four treatments (control, EIQ, Summarization, EIQ/Summarization combined) and submitted data for demographics, prior knowledge, comprehension, retention, and satisfaction.

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* Sponsored by MarylandOnline, Inc.

RESEARCH QUESTION

How will EIQ and summarization learning strategies affect learner comprehension, retention of information and learner satisfaction after controlling for age, PK, and gender?

To answer the main research question (RQ), a multivariate analysis of covariance (MANCOVA) experimental design was used. Figure 1 reflects the conceptual model for the study.

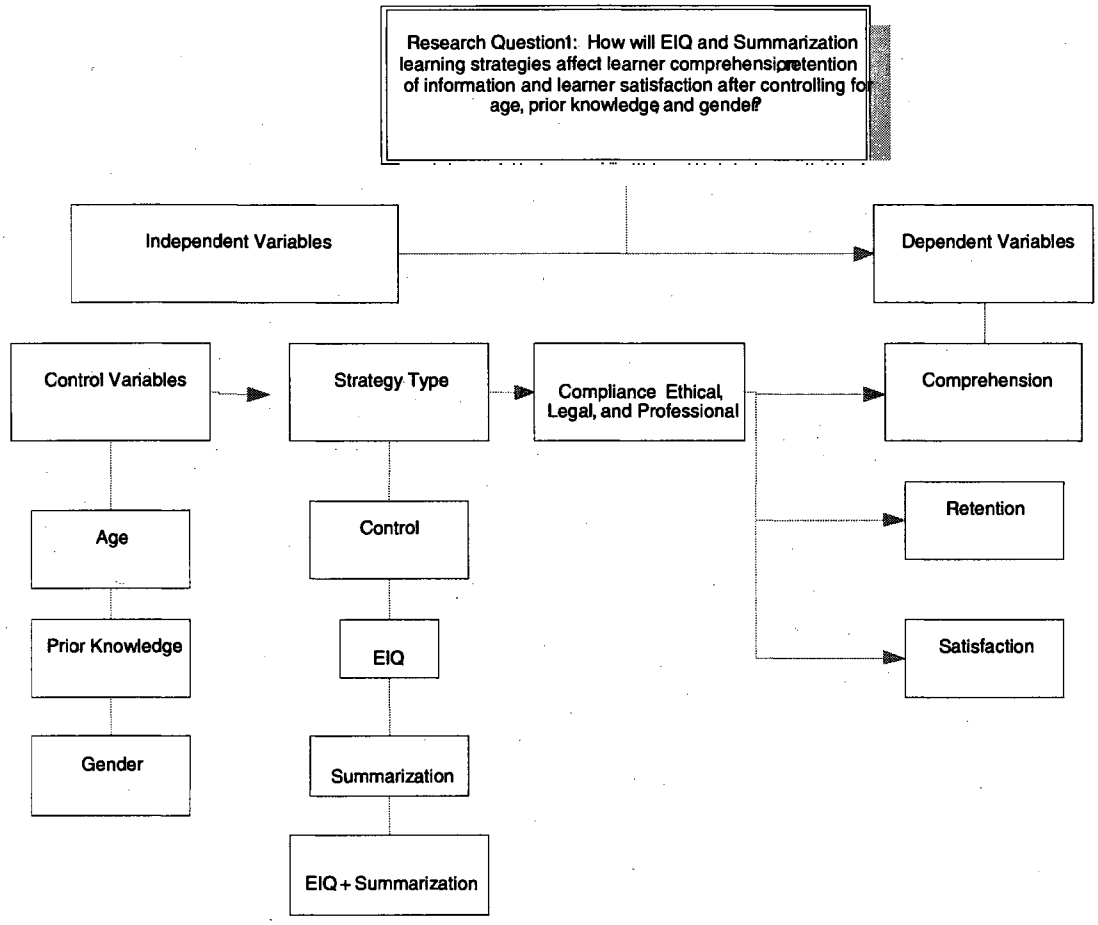

Figure 1. Conceptual model for the study.

WEB-BASED COMPLIANCE MODULE

The web-based ethics module selected for this study was *Compliance: Ethical, Legal, and Professional Standards*. This multimedia module was designed to be delivered with the

Blackboard Learning Management System and accessed via the 'my professional learning' organization area of Blackboard. Each treatment group had a unique login link.

The web-based module was designed to be delivered as either a formal part of an online course or separate on an as needed basis. Learners could move back-and-forth within a topic but were prevented from moving to the next topic until the treatment (strategy) had been answered. The control group learners however were given control to move through the module in any topic order. By allowing the learners to have control to move within the topic addresses criticism by some researchers that elaborative interrogation investigations have not imitated real-world learning environments by restricting learners' access to the content when answering EI questions, therefore affecting ecological validity (Duchastel, 1983; Spring et al, 1986).

The OIM design used the QM™ framework standards, resulting in an identical structure for the four treatment groups. (Figure 2):

- Announcements — learning organization students are welcomed to the study and given further instructions on how to proceed.
- Demographic Questionnaire — links to the demographic questionnaire.
- Navigation Tutor — provides a PDF document to students that can be printed out for review and explains navigation through the module presentation.
- Compliance Presentation —consists of a prior knowledge questionnaire, Overview, Topics in the Presentation (content), Post-Assessment, and Survey.
- Resources —two folders containing university web links, articles, and general information for further review (if desired) relevant to the module.
- Tools — access to a Glossary of Terms related to the module and a user manual for Blackboard.

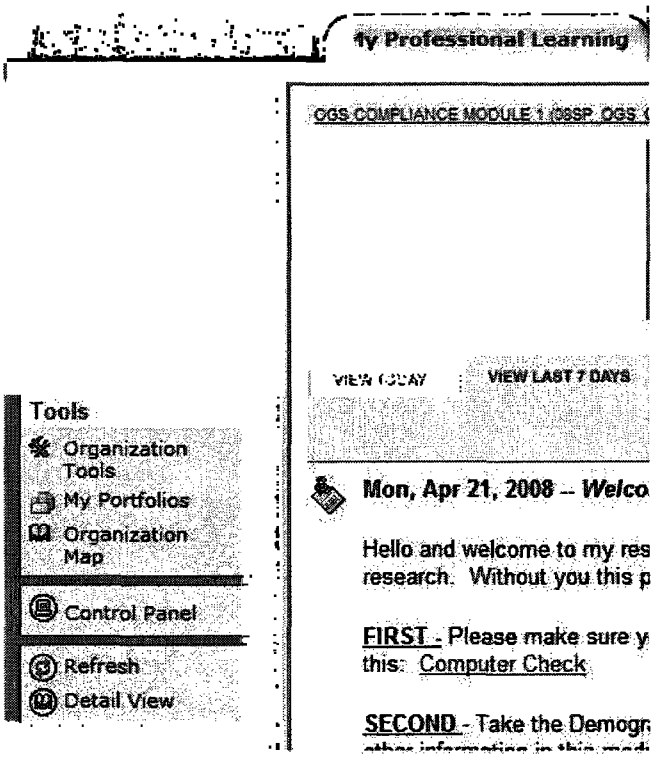

Figure 2. Screen shot of learning organization structure.

The Module Content

The module content, developed by a faculty subject matter expert who has a strong interest in ethical and moral responsibility of researchers in higher education, consists of fact-based, descriptive, expository text broken into conceptual pieces or 'chunks'. Chunks or chunking is a term coined by George Miller (1956) when he proposed that learners tend to break down or 'chunk' information into manageable pieces based on prior knowledge of the subject at hand. As discussed in Chapter 2, later research linked the notion of chunking to cognitive load which provided more guidance to instructional designers whose task is to break the presentation of information into pieces suitable for the identified audience. In computer based instruction (CBI) each chunk is often presented one a single screen as recommended by Shirk (1991).

The content for this module was chunked by the faculty subject matter expert and the researcher according to topic and subtopics, and face validity verified by professional staff instructional design personnel.

The entire text of the module is 3,558 words in length and is divided into four topics: Introduction to Compliance, Ethical, Legal, and Professional (1,356 words); Legal Aspects of Compliance (1,006 words); Professional Aspects of Compliance (1,082 words); and Conclusion (114 words). The following illustrates how the content was chunked:*

> "Going beyond the ethical standards and legal structures that guide our behaviors, we also have a professional responsibility to adhere to the highest level of integrity. Compliance is not just about following the rules that are set before us. Self-monitoring and holding ourselves to a higher standard are the marks of a good scholar.
>
> With a career in academia comes the notion of "academic freedom." We are free to study and work on the issues we consider to be important. With this freedom comes the responsibility of monitoring our own actions. When the system we have is abused, the consequences can be wide-reaching.
>
> Consider the Stanford Prison Experiment. Was the reputation of psychology as a discipline damaged by this research project?
>
> How many universities became overly conservative in their project approvals to avoid this type of disaster?
>
> Did volunteers become wary of participating in studies because of potential risk?
>
> Non-compliant work can damage the reputation of an entire profession as well as the individual and the institution."
>
> With the exception of the elaboration strategies, the modules were identical.

SAMPLE

A total of 282 volunteer undergraduate and graduate students at a medium-sized research university located in a mid-Atlantic state agreed to participate in the study (Table 4). However, only 191 participants actually completed the PK questionnaire, post- and follow-up assessments, and satisfaction survey; of those, one person did not complete the satisfaction survey. Out of the 191 participants, 181 participants completed the follow-up retention assessment one month later. Of the 91 participants who did not complete the study, 84 did not start the study and 7

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* The full transcript for this module, including the EIQ, Summary, and rereading placements, may be found at Appendix G.

participants were removed because they failed to complete the PK questionnaire and demographic survey.

Table 4.

Analysis Sample for Each Dependent Variable

	N for Comprehension	*N for Retention*	*N for Satisfaction*
Pilot	92	90	92
Full Study (includes Pilot)	191	181	190

Of those who completed the study (N=191), females accounted for 71.7 percent of the participants, and males 28.3 percent. Those aged 25 and younger accounted for 61 percent of the participants, 18 percent were between 26 and 30 years old, 11.5 percent were between 31 and 39 years old, and 10 percent were 40 or older. The majority of the participants, 61.3 percent (N=117), did have PK of the topic domain, Compliance; and of the participants who had PK, 76.9 percent were female and 23.1 percent were male.

Participants were asked to reply to a consent statement located in the solicitation email (Appendix E). In addition, participants were notified that their names and University identification numbers (UIN) would be used only to ensure they completed all three assessments, and to match the data. No names or UINs were used in the written results. Students were informed that a copy of the results would be emailed to them if they so desired.

The proposal for this study was approved by the College of Education's Human Subjects Review Committee.

TREATMENT VARIABLES

Learning Strategy Type

Participants were randomly assigned to one of four treatment groups: (a) Control Group (Control), (b) Elaborative Interrogation Questions (EIQ), (c) Summarization (SUMM), and (d) elaborative interrogation questions and summarization combined (EIQ/SUMM). Each time the

participants encountered an embedded elaboration strategy, instructions on how to complete the task were given within the text, similar to the research by Ozgungor and Guthrie (2004). Feedback was provided immediately after each elaboration instance because doing so contributes to higher learner satisfaction for online courses (Cyboran, 1995; Debourgh, 2003; Thurmond et al., 2002). The feedback itself was developed by the researcher by identifying the main points and key concepts of each topic and subtopic which is a recommended strategy by Brown et al., (1981) and Anderson & Hidi, (1989). Feedback was reviewed by a faculty subject matter expert for content and face validity.

The control group. The control group received no EIQ or summarization treatments and were directed to complete the module at their own pace, and then take the post-assessment and satisfaction survey.

The EIQ group. The EIQ group answered five EIQs embedded throughout each module topic: one in Topic 1, one in Topic 2, and three in Topic 3. The EIQ strategy required learners to generate answers to 'why' questions about the to-be-learned content (e.g., "Why is it important to have compliance standards in place?") along with the following instructions, "Your response to the following exercise is required before you move on to the next section of this module. If you are unable to answer the question, please indicate such in the text topic box provided." Immediate feedback appeared in a pop-up window. The following is an example of an elaborative interrogation question and the associated feedback:

> "EIQ – Why is it important that we have compliance standards in place? (Feedback: When you were thinking through your response, did you base your answer on an experience you may have had, or witnessed? If not, try and think about a situation in which it was important to have ethical standards in place, either a personal experience or one perhaps you read about.)"

Summarization group. The summarization group was asked to summarize the content at the end of each of the three main topics. Participants were given the following instructions: "Your response to the following exercise is required before you move on to the next section of this

module. If you are unable to answer the exercise, please indicate such in the text topic box provided." An example of a summarization exercise was, "In your own words, summarize the content found in Lesson One/Topic One Ethical and Compliance Introduction." Immediate feedback appeared in a pop-up window. The following is an example of summary feedback:

> "Feedback: An example of a correct response to this exercise would be to include some of the following key ideas/concepts such as (a) Foundation of compliance is the desire to conduct activities in responsible, ethical ways, (b) examples of non-compliance- Stanford Prison Experiment, Tuskegee Syphilis Experiment, Enron, and The Plagiarism Cases (you should discuss major aspects of each briefly in your summary), and (c) remember these past cases in order not to repeat non-compliance. If your summary did not include any of the above information, it is strongly suggested you review the content for better understanding."

The EIQ and summarization group (EIQ/SG). The EIQ and summarization group received both the EIQ and the summarization strategies with eight instances: one EIQ and one summarization strategy at the end of Topic 1, one EIQ and summarization strategy at the end of Topic 2, two EIQs throughout Topic 3, and one EIQ and summarization strategy at the end of Topic 3. Instructions and feedback were identical to the separate EIQ and summarization strategies.

Dependent Variables

Comprehension. Comprehension was measured by a self-administered multiple-choice, post-assessment questionnaire immediately after the OIM was completed and is described in more detail in the Instrument section of this chapter.

Retention. A follow-up assessment questionnaire was administered 4 weeks after the completion of the OIM. Research has shown that instructional strategies, similar to those used in this study, produce differential effects on retention (e.g., Willoughby et al., 1993; Dornish & Sperling, 2004). In Dornisch and Sperling's (2006) study, participants accessed experimental materials online and were given a delayed free-recall test one week after the study. Participants in the EIQ treatment group had higher mean recall than those in the repetition control group.

Willoughby et al. (1993) conducted a delayed recognition-matching task to adult learners and found that EIQ had positive effects over the repetition control group after one month.

Satisfaction. Satisfaction was measured via a 28 question, Likert-type survey derived from the QM™ rubric by the researcher (See Appendix D). The questionnaire was initially divided into nine domains: (a) overview/introduction, (b) learning objectives, (c) resources/materials, (d) assessments/measurements, (e) learner engagement, (f) feedback, (g) course interface/design, and (h) overall satisfaction. Internal reliability consistency and validity are reported in the Instrument section in this chapter.

Covariates

Prior Knowledge. Prior knowledge, a categorical variable (less, more), was measured by a seven-item pre-treatment questionnaire (See Appendix B). Further description of the questionnaire is found in the Instrument section of this chapter. PK was included as a covariate variable because the amount of PK may influence the effectiveness of the EIQ strategy on comprehension (e.g., Willoughby, et al., 1994).

Age. Age, reported by subjects in years and considered a continuous variable, was included as a covariate because age has been found to affect learning outcomes associated with the EIQ strategy on comprehension and retention (Pressley et al., 1988; Wood et al., 1990, 1994, 1999). Age has also been reported to have a positive relationship with satisfaction in an online environment (Billings et al., 2001).

Gender. Gender was included as a covariate because males and females often experience different levels of satisfaction with online instruction (e.g., Guiller & Durndell, 2006; Bower & Kamata, 2002). Differences have also been found with regard to comprehension and retention all though results have been mixed. For example, Frederickson et al. (2000) found that females' perceived learning was higher than males in online environments, and Swan et al. (2000) reported that females performed better than males in web-based courses. In contrast, Arbaugh (2000), Huang (2002), and Ory et al. (1997) found no differences.

PROCEDURES

Participants were recruited through the University's online Student Announcements and Instructional Design and Technology (IDT) listserv. A video iPod and a $200 gift certificate to the university bookstore were used as incentives. Participants were required to complete all phases of the study to qualify for the video iPod and gift certificate raffle.

All students participating had active university email accounts. Once university email addresses were verified, participants were randomly assigned to one of four treatment groups by utilizing the Research Randomizer, www.randomizer.org, offered by the Social Psychology Network online. The Research Randomizer program uses the "Math.random" method within the JavaScript programming language to generate random numbers.

The solicitation for participation (Appendix E) included the purpose of the study and the approximate time each participant should anticipate for completion of their portion of the study.

To ensure the study had a sufficient sample size for robust statistical analyses, a power analysis using G*Power software to calculate group sample size was conducted. Statistical power is a measure of a test's ability to reliably detect the effect of independent variables of given sizes and thus accurately (correctly) reject the null hypothesis. In practical terms, to reliably detect a small effect requires a larger number of subjects than is required to reliably detect a moderate effect. However, small effect sizes may be functionally less meaningful than moderate or large effects. The effect size is the standardized measure of the magnitude of the observed effect and allows the researcher to determine if a significant statistical test is meaningful (Field, 2005). Jacob Cohen (1992) suggests effect sizes of 0.10 as small, 0.30 as medium, and 0.50 as large. However, in practice, the practical value of mean differences depends on the specific circumstances and scales. A medium effect size of .3 was selected for this study because no specific effect size that reflects practical value is identifiable through contemporary literature. The results of the G*Power analysis, based on power = 0.90 (90% chance of detecting an effect if

one genuinely exists), alpha = 0.05 and effect size = 0.3 for an MANOVA with four groups and three dependent variables indicated that at least 57 subjects were needed.

Students who agreed to participate in the study were sent an email to their University email account clearly stating the expectations and importance of completing the OIM, and specifically that the demographic and prior knowledge questionnaire needed to be completed first in order to view additional content within the OIM. Once the demographic questionnaire and prior kowledge questionnaire were completed, participants were instructed to locate the Navigation Tutor on the left sidebar (**Error! Reference source not found.**) to begin the online module. The Navigation Tutor document provided instructions on how to take the OIM. After reading the Navigation Tutor, the participants were instructed to start the Compliance lesson. Within the lesson, participants either encountered the module content with no learning strategies (control group), EIQ questions, a summarization task, or an EIQ and summarization task. Once the participant completed the ethics lesson, they were instructed to take the post-assessment questionnaire and satisfaction survey.

The participants were given one week to complete the OIM. Reminder emails were sent to participants half way through the week encouraging those who had not completed the OIM to do so. After completion a thank you email and reminder of the follow-up assessment questionnaire to be taken in three weeks was sent by the researcher.

Three weeks later the participants were contacted by email and directed to take the follow-up assessment questionnaire within one week, followed by a reminder email to those who had not yet done so. Participants who failed to complete the follow-up were disqualified for the raffle but remained in the study for data analysis. All data were downloaded from Blackboard and Inquisite into MSExcel and SPSS for statistical manipulation. Participants not completing the follow-up may affect generalizability.

PILOT STUDY

To establish instrument construct validity and reliability, a subset of participants were treated as a pilot study. The pilot study used the same procedures, measurements, and design intended for the main study. The pilot study results revealed that an answer to one of the questions was split in half, resulting in two answers possibly correct answers, resulting in its elimination from pilot post- and follow up assessments. However, the question was corrected for the main study participants.

The pilot study consisted of N=129 participants. Ninety two (N=92) completed all data collection instruments (demographic, prior knowledge, post-assessment, student satisfaction survey, and follow up). The 37 participants who did not complete the study, either failed to start the pilot study at all or did not complete the PK and /or demographic survey. Details of the analytic methods used to evaluate each instrument (demographic, post-assessment, follow-up, and satisfaction survey) are presented in the Instruments section of this chapter.

INSTRUMENTS

Demographic Questionnaire

Participants were required to provide age and gender, two of the three covariates used in this study (Appendix H).

Prior Knowledge Questionnaire

The prior knowledge questionnaire was developed by the researcher (Appendix B). The questionnaire consisted of seven selected-response questions, five short-answer and two multiple-choice items directly related to the module learning objectives (Appendix H). This type of assessment was selected as opposed to self-report and researcher judgment because the latter two tend to underestimate prior knowledge (Shapiro, 2004). The prior knowledge assessment scores were used as a covariate, but not as a comparison measure with the post-assessment. An example question is, "Choose the research protocol committee which assists in determining human subject research at ODU:

- Institutional Review Board
- Equal Opportunity Office
- Office of Graduate Studies
- Research Foundation."

In order to determine whether participant's answers to the five open-ended questions indicated the existence of a pre-determined level of prior knowledge, a dichotomous rubric was created following a similar protocol by Ozgungor (2001). The researcher and a second assessor (a faculty member) identified key words/phrases found in the module content which corresponded to each specific question. The prior knowledge assessment data for the five open-ended questions were then analyzed by both the researcher and the second assessor independently using the rubric. (Appendix J) Zero points were given for an individual's answer if they did not have any key words/phrases identified in their response, and one point reflected the inclusion of key words/phrases for a particular question. The overall prior knowledge score for each participant was determined by adding all points received (zero points to seven). Those answering four or more questions adequately were associated with having more prior knowledge, and those who answered three or less adequately were associated with having less prior knowledge. The two analyses were then compared to determine any discrepancies in scoring. The researcher and the second assessor disagreed on 116 of 903 responses indicating an inter-rater reliability of 87 percent. The researcher and second assessor discussed the differences and subsequently revised the rubric to include additional key words/phrases. The initial 116 responses on which disagreement occurred were re-analyzed independently according to the revised rubric which reduced the number of items on which disagreement occurred to 5, for a final inter-rater reliability of 99 percent.

The next step was to determine how the prior knowledge assessment data should be interpreted in a categorical fashion to serve as a covariate. The researcher and the second assessor

discussed data trends observed and determined that those who correctly answered two or three questions exhibited less cohesive responses than whose who correctly answered four or more questions. Therefore, it was determined that scores of less than or equal to three were categorized as having less prior knowledge as opposed to those with more prior knowledge.

Finally, because inter-rater reliability was high for the pilot study participants' answers, the researcher independently scored the prior knowledge assessment data in the main study.

Post- and Follow-Up Assessments

The post/follow-up assessment was collaboratively created by the faculty subject matter expert who developed the module content, and the researcher (Appendix C). Face and content validity was established in the pilot study by two experts in the field of research ethics.

The post/follow-up-assessment consisted of multiple-choice questions categorized according to Bloom's revised taxonomy (Anderson & Krathwohl, 2001), shown in Table 5. The taxonomy is a "framework for classifying statements of what we expect or intend students to learn as a result of instruction" (p. 212). The questions and their position in the taxonomy are included in Appendix G.

Table 5Table 5. The taxonomy is a "framework for classifying statements of what we expect or intend students to learn as a result of instruction" (p. 212). The questions and their position in the taxonomy are included in Appendix G.

Table 5.

Bloom's Revised Taxonomy Table

The Knowledge Dimension	***The Cognitive Dimension***					
	Remember	***Understand***	***Apply***	***Analyze***	***Evaluate***	***Create***
Factual Knowledge						
Conceptual Knowledge						
Procedural Knowledge						

The progression through the six cognitive process dimensions is from lower- to higher-level thinking; an Understand question requires a higher—level of cognitive processing than Remember, and Apply is higher than both Understand and Remember. The post/followup-assessment range from Remember to Apply, consistent with the intent for Both EIQ and summarization strategies to elicit higher cognitive level processing. The completed question matrices was validated by a faculty expert. Two example items are:

Remember question:

1. Compliance Standards mandate that we:
   a. determine if a new research area is ethically permitted.
   b. prohibit risk prone research.
   c. **apply ethical principles to the review of scholarly activity.**
   d. hold researchers using living subjects (human and animal) to a higher ethical standard than other scholarly activity.
   e. all of the above.

To answer this question a learner must remember what compliance standards mandate.

Understand question:

2. Concerning Professional codes of ethics and standards, which of the following is NOT true:
   a. they address both the obligations and privileges of the profession.
   b. work environments may involve multiple professional codes.
   c. **they make determining the "right thing to do" straightforward and uncomplicated.**

d. virtually all professions have established some set of standards and a code of ethics for their members.

To answer correctly, the learner must remember what professional codes of ethics are and are not in order to understand the differences and be able to answer the question.

The post/follow-up-assessment consisted of 18 multiple-choice questions—eight Remember, six Understand, and four Apply with point values of four, six and 8 respectively for a maximum total score of 100. Incorrectly answered questions received zero points.

Student Satisfaction Survey

A 29-item, 4-point Likert-Type Satisfaction Survey (Appendix D) was developed by the researcher based on the eight key constructs of the QM™ rubric (Appendix A). Content validity was established by a faculty member who is an expert in student satisfaction. The 29 questions were grouped into nine constructs: (a) course overview and introduction, (b) learning objectives, (c) content of the module, (d) assessments and measurements, (e) resources, (f) learner engagement, (g) feedback, (h) course interface and design, plus a general (i) overall satisfaction construct. An example satisfaction question is: "The learning activities ("why" questions and/or summaries) helped me better understand the content of the module." In addition, the feedback and overall satisfaction categories each included two open-ended (comment) items such as: "What did you like most about this on-line instruction module?"

Construct validity of the satisfaction survey was established during the pilot study through an exploratory factor analysis. While each question created for the survey were meant to relate to a specific QM™ construct, the factor analysis was conducted to verify whether the questions loaded on the nine key constructs, or factors, as intended. Significant factor loadings depend on the pilot study sample size. According to Field (2005), a loading of 0.7 with a sample size of 50, is considered significant; if the sample size reaches 100, a factor loading of 0.53 is sufficient. For this factor analysis, the sample size was N=92.

Two factor analyses were conducted, one for the questions everyone, N=92, in the study answered (18 questions), and then another factor analysis for the additional subset of questions (7 in all) answered only by the treatment groups (EIQ, Summarization, and EIQ/Summarization) (N=66 which are a subset of the N=92 group).

Prior to conducting the factor analyses, the data was pre-screened by examining the intercorrelation between questions to identify any extreme multicollinearity and/or singularity. Multicollinearity exists when there is a strong correlation between two or more questions. There should be some correlation between questions contained within a defined domain because they are targeting the same construct even though they focus on different aspects (e.g., measuring overall satisfaction but focusing on content and resources). However, Field (2005) suggests that question(s) that do not correlate with any other question(s) should be removed because questions that do not correlate with any other question, or singularity, indicates a perfect correlation which means that determining the unique contribution of the question to a particular factor is virtually impossible (Field). Therefore, the object of factor analysis is to remove any questions that do not correlate with other questions.

The factor analysis R Matrix (correlation matrix) presents the correlation among questions. Questions that have the majority of values at > 0.05 in relation to other questions, indicates a potential problem due to singularity and should be removed. Question 9 showed singularity in the R Matrix with 10 questions having values at >.05 out of the 17 questions and was therefore removed. In addition, the R Matrix showed that no questions had extreme multicollinearity or singularity ($r > 0.9$). The additional subset of questions administered exclusively to the treatment groups were also pre-screened for multicollinearity and singularity and all questions were retained.

Multicollinearity was also examined by looking at the determinant of the R Matrix, looking for a value of $p = > 0.00001$ indicating multicollinearity is not a problem. The determinant for the first data screening was $p= 0.001$ and $p =0.061$ for the second, indicating

multicollinearity/singularity was not a problem. After the data screening, 28 of the 29 questions were retained.

Second, the KMO (Kaiser-Meyer-Olkin) measure of sampling adequacy was used (Table 6). This measure is also used to test for multicollinearity and singularity. The KMO indicates whether the study's sample size is adequate to determine reliable loadings on factors. Kaiser (1974) suggests the absolute acceptable minimum is 0.5; anything above this is considered good and values between 0.8 and 0.9 are even better (Field, 2005). The KMO values for the questions the entire sample answered were 0.809 and 0.856 for the additional subset of questions only the treatment groups answered which indicates that the sample size was adequate to conduct the factor analyses.

Table 6.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy for Everyone and Treatments Groups

KMO and Bartlett's Test		***Everyone***	***Treatment Groups***
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.809	0.856
Bartlett's Test of Sphericity	Approximately Chi Square	635.493	172.614
	df	120	21
	Sig	0.000	0.000

Third, the diagonal values in the anti-image correlation matrix were examined to verify that the values were all above 0.5, indicating the sample is adequate for a pair of questions in which they have some correlation to one another (Field, 2005). The off diagonal values (partial correlations between questions) also should be small (close to zero) (Field). The analysis for the anti-image matrix for all questions revealed all values were above 0.5 diagonally and small for the values off diagonally. The additional subset of questions were similar and no additional questions were removed.

The final data screening was Bartlett's Test of Sphericity to test if the R Matrix is an identity matrix (all correlations are zero). Bartlett's test should reveal a significant ($p = < 0.05$)

value indicating the R matrix is not an identity matrix and therefore factor analysis is appropriate (Field, 2005). The value for all questions and the additional subset was ($p = 0.000$) indicating factor analysis is suitable.

In addition, the researcher was notified by a participant that Question 10 had two possible 'strongly agree' choices and was therefore not included in the initial factor analysis; however, the question was corrected for the main study participants.

After the preliminary data-screening analysis, a principle component analysis was conducted with an orthogonal varimax rotation for the questions everyone answered (Q1-8, 11, 12, 20-25; open ended questions were not part of the factor analyses). Principle component analysis was chosen because exploration of the data was being conducted and conclusions made are contained to the sample assembled. Principle component analysis is a technique to identify the underlying themes (factors) of all survey questions plus the additional subset of questions. An orthogonal varimax rotation was chosen because this process loads a smaller number of questions highly onto each factor which results in being able to better understand the underlying themes of the clusters of factors.

Eigenvalues associated with each factor are the total amount of variance explained by each question (Field, 2005). Kaiser (1960) proposed that eigenvalues 1.0 or greater be retained because this number represents a substantial amount of variation. However, Jolliffe (1986) reports that 1.0 is too stringent and advises that factors with eigenvalues of 0.70 or higher be considered. Given the formative nature of this research study, a level of 0.70 was used.

The initial examination of the data for the first set of questions resulted in the retention of six factors. Three criteria were used in determining the appropriate number of factors to retain; the eigenvalues, variance, and scree plot. (Eigenvalues and variance are shown in Table 7) Stevens (1992) suggests researchers retain and interpret components that comprise at least 70 percent of the total variability and to look at the scree plots to determine how many components to retain by examining the point at which the line appears to level off, which is often the bend in

the line (Stevens) (*Figure 3*). The scree plot shows 'magnitude (vertical axis) plotted against their ordinal numbers (horizontal axis)' (Mertler & Vannatta, 2005, p. 250.). After examination of these three criteria, the initial six factors were retained.

After the varimax rotation, the following six factors accounted for 74.58 percent of the total variance: (1) 15.49%, (2) 13.40%, (3) 13.07, (4) 11.26%, (5) 10.81%, and (6) 10.54% (Table 7).

Table 7.

Total Variance Explained by the Six Factors

	Initial Eigenvalues			*Rotation Sums of Squared Loadings*		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	5.790	36.186	36.186	2.478	15.489	15.489
2	1.969	12.306	48.492	2.144	13.402	28.891
3	1.326	8.287	56.779	2.091	13.070	41.961
4	1.031	6.446	63.225	1.803	11.257	53.228
5	0.949	5.932	69.156	1.729	10.807	64.035
6	0.867	5.419	74.575	1.686	10.540	74.575

Note: Extraction Method: Principal Component Analysis

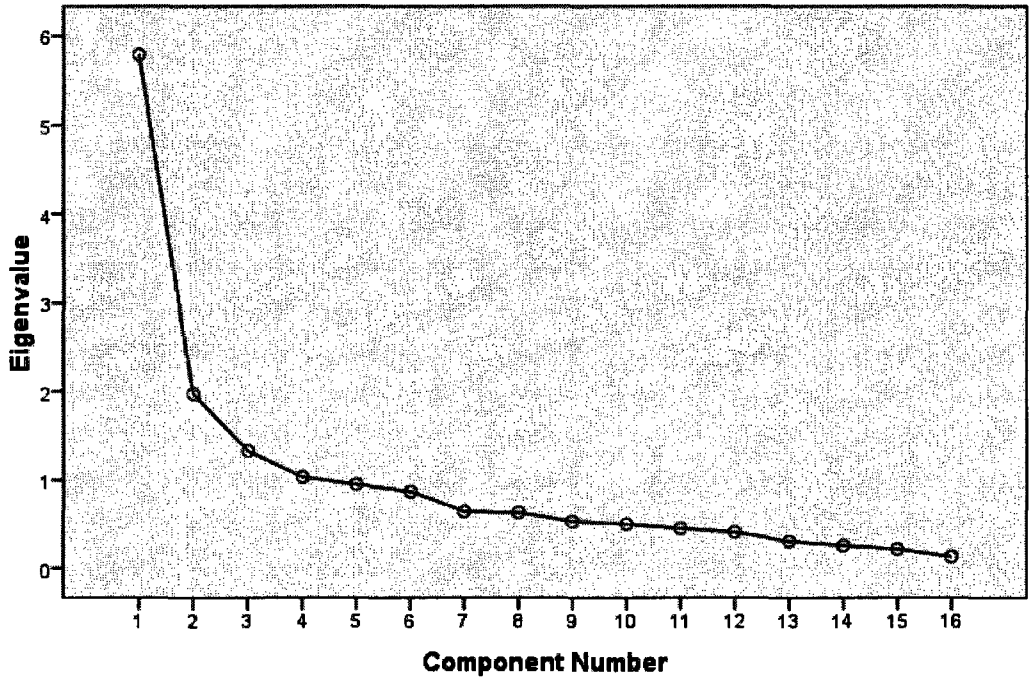

Figure 3. Scree plot of factors from satisfaction survey.

Examination of the factor loadings for the six factors revealed high loadings as follows (Table 8):

- Factor 1: Questions 20, 21, and 22
- Factor 2: Questions 3, 4, and 5

- Factor 3:Questions 23, 24, and 25
- Factor 4: Questions 1, 7, and 8
- Factor 5: Questions 11, and 12
- Factor 6: Questions 2 and 6

Table 8.

Factors (1-6) and Loadings From Each Question on a Factor

Questions	***Factor and Loadings***					
	1	***2***	***3***	***4***	***5***	***6***
Q1_N	0.324	0.122	0.255	0.759	0.022	0.059
Q2_N	0.141	0.351	0.230	-0.142	0.052	0.803
Q3_N	0.034	0.773	0.226	0.258	0.082	0.196
Q4_N	0.258	0.803	0.175	0.070	0.123	0.000
Q5_N	-0.081	0.593	-0.155	0.370	0.362	0.261
Q6_N	0.182	-0.034	-.0006	0.381	0.282	0.781
Q7_N	-0.226	0.347	0.209	0.664	-0.032	0.042
Q8_N	0.227	0.222	0.291	0.443	0.420	0.150
Q11_N	0.186	0.272	0-.190	0.039	0.778	0.056
Q12_N	0.094	0.004	0.242	-0.018	0.808	0.144
Q20_N	0.639	0.243	0.210	-0.015	0.186	0.186
Q21_N	0.814	0.041	0.118	0.281	0.039	0.150
Q22_N	0.842	0.032	0.249	0.132	0.047	0.001
Q23_N	0.442	0.172	0.693	0.152	0.113	0.338
Q24_N	0.194	0.060	0.758	0.277	-0.007	-0.103
Q25_N	0.294	0.271	0.686	0.138	0.088	0.303

Note. Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 8 iterations

Examination of the six factors revealed that factors two, four, and six had a common underlying theme related to the module content and, were therefore combined into a single 'Module Contents' factor . The remaining factors (one, three and five) measured different factors and were named course interface, overall satisfaction, and resources respectively. Even though

factor five—resources—had only two loadings on questions 11 and 12 (10 was removed for the initial analysis because of the two identical response choices) the researcher believed that when question 10 was temporarily removed due to the inaccurate wording, this factor was affected and skewed the outcome. After question 10 was corrected for the main study, another factor analysis was run resulting in three loadings on questions 10, 11, and 12, ultimately strengthening factor five.

The second principle component analysis with orthogonal varimax rotation with eigenvalues set a 0.7 was run for the additional subset of questions answered only by the three treatment groups (Q13-17, 28-29). Initial analysis revealed two factors which, after interpreting the eigenvalues, variation, and scree plot, were retained.

Factor loadings for Questions 14, 15, 16, and 17 on component one were high 0.736 - 0.820, as indicated in Table 9. Upon examination of the variables that loaded highly on Factor 1, feedback appeared to be the underlying g measure.

Table 9.

Factors (1, 2) and Loadings From the Additional Subset of Questions on a Factor

	Factors and Loadings	
	1	***2***
Q14_N	0.779	0.228
Q13_N	0.365	0.720
Q15_N	0.820	0.117
Q16_N	0.763	0.264
Q17_N	0.736	0.419
Q28_N	0.159	0.837
Q29_N	0.208	0.790

Note. Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization. N=66.

Rotation converged in 3 iterations.

Questions 13, 28 and 29 loaded on Factor 2, revealing high factor loadings (0.720-0.837) as indicated by Table 8. After examining the questions that loaded highly on Factor 2, the underlying measure was learner engagement.

Data extracted from the two factor analyses, resulted in six factors within the satisfaction survey, (a) module content, (b) course interface/design, (3) resources (4) learner engagement, (5) feedback, and (6) general overall satisfaction. These factors (constructs), with the exception of module content, were originally included in the survey development based on the eight QM constructs. The final satisfaction survey consisted of 28 questions, four of which were open-ended, and six subcategories.

Internal consistency was analyzed using the Cronbach alpha coefficient statistic. Cronbach alpha coefficient scores range from 0 to 1, with values approaching 1 indicating high reliability. Cronbach alpha coefficients of at least 0.70 are considered acceptable (Nunnaly, 1978).

The total scale reliability was high for all questions (1-8; 11, 12, 20-25) with α =0.872 and α =0.851for the additional subset of questions (13, 14, 15 -17, 28, 29). The subscale reliabilities for all questions were strong: module content, α = 0.802, course interface (Q20-22) α = 0.789, and general overall satisfaction (Q23-25) α = 0.792. The subscale reliabilities for the additional subset of questions was also strong with feedback (Questions 14, 15, 16 and 17) having an α of 0.827 and learning engagement (Questions 13, 28 and 29) α = 0.761.

The overall satisfaction score for participants was based on the 4-point Likert Type Scale, 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree. Overall satisfaction score was a continuous variable comprised of four subscales—(a) module content, (b) course interface/design, (c) resources, and (d) general overall satisfaction.

DATA COLLECTION

The data from the demographic questionnaire, pre-, post-, and follow-up assessments, and the student satisfaction survey were collected using Inquisite and Questionmark in

Blackboard. Inquisite uses a required response format and was used for the post- and follow-up assessments. This was to ensure each participant completed all questions for the post- and follow-up assessments. Screening for nonrandom missing values, which can have a significant impact with respect to generalization of the results (Mertler & Vannatta, 2005), was not conducted for the post- or follow-up assessments because the confined response format eliminates the possibility of missing data as participants must answer all the questions before completing the instruments.

The data for the prior knowledge, demographic questionnaire and satisfaction survey were in Questionmark. Questionmark does not have a required response format. However, data was checked for missing values. Missing values were found for seven individuals for the prior knowledge (PK) and demographic questionnaire and were eliminated from the study. Elimination took place because PK, age, and gender were covariates in this study and were essential to data analyses.

Multivariate normality was checked by examining univariate normality for each dependent variable. In addition, inspection of normal Q-Q plots and bivariate scatterplots took place in which normality was tenable (Mertler & Vannatta, 2005), indicating this assumption was met. The homogeneity of covariance matrices assumption was tested to determine whether the population variance-covariance matrices of the different strategy groups are equal. This was conducted using Box's Test. This assumption was met, $p=0.994$. Linearity suggests there is a straight line relationship between two variables (Mertler & Vannatta, 2005). Linearity was assessed by examining residual plots and determining if residuals cluster around the zero line (Mertler & Vannatta, 2005). All residuals for the dependent variables in the study clustered around the zero line, indicating that the linearity assumption was met.

DATA ANALYSIS

A multivariate analysis of covariance (MANCOVA) was used to examine the effects of strategy type on the three dependent variables—comprehension, retention, and satisfaction—that

have a theoretically sound linear relationship to one another, and to control for the effects of possible concomitant variables (age, PK, and gender). The test was used to identify significant main effects of the various elaborative learning strategies on comprehension, retention, and satisfaction after removing the effects of age, PK, and gender. By controlling for the covariates—age, PK, gender—the error variance is reduced within the groups, which increases the chance of rejecting the null hypothesis (Mertler & Vannatta, 2005). Research has shown that age and PK influence the effects of EIQ on comprehension, retention, or satisfaction. (e.g., Willoughby et al., 1994, 1999; 2000; Wood et al., 1990, 1999) and that gender and age can have an effect on learner satisfaction (e.g., Arbaugh, 2000, Rovai & Baker, 2005).

STUDY ASSUMPTIONS

1. The participants answered the demographic, pre-, post-, and follow-up questions honestly and to the best of their ability.
2. The participants followed, to the best of their ability, the instructions regarding answering questions in accordance with the strategy in their treatment group, and the directions for the tests and survey.
3. The participants put forth their best effort in answering the elaboration strategies, thus accurately reflecting their learning and retention.
4. All statistical assumptions were met for the descriptive and inferential analysis.
5. Participants in the study were familiar with computer technology, specifically the use of Blackboard.
6. Participants in this study were active rather than passive learners.

CHAPTER IV

RESULTS

The following research question guided this study: How will four different learning strategies affect learner comprehension and retention of information, as well as learner satisfaction after controlling for age, prior knowledge, and gender? No hypotheses were made regarding the outcome of this inquiry. The main statistical analysis conducted to answer this question was a factorial multivariate analysis of covariance (MANCOVA). The MANCOVA was chosen because this test allows for the examination of several dependent and independent variables while partialling out the effects of covariates.

COMBINED EFFECTS OF COMPREHENSION, RETENTION, AND SATIFACTION

A factorial MANCOVA was run to examine the effects of strategy type, gender, age, and prior knowledge (PK) on the dependent variables comprehension, retention, and satisfaction. After examining the full factorial model (all four, three, and two-way interactions of the variables and their main effects), the MANCOVA was reduced by removing the non-significant interactions and main effects, resulting in a final MANCOVA model consisting of a two-way interaction between gender and age, and strategy type and age, and main effects for strategy type, age, gender, and PK on the combined dependent variables. The final MANCOVA results revealed significant main effects on the combined dependent variables for the independent variable strategy type (Wilks' Λ=0.896, F(9, 409)=2.10, p=0.028, partial η^2=0.036), and the covariates gender (Wilks' Λ=0.946, F(3, 168)=3.207, p=0.025, partial η^2=0.054), and age (Wilks' Λ=0.932, F(3, 168)=4.10, p=0.008, partial η^2=0.068) on the combined dependent variables. Prior knowledge did not reach significance as a main effect on the combined dependent variables (Wilks' Λ=0.957, F(3, 168)=2.52, p=0.060, partial η^2=0.043).

There were statistically significant interaction effects between strategy type and age (Wilks' Λ=0.892, F(9, 409)=2.19, p=0.022, partial η^2=0.037) and between gender and age

(Wilks' Λ=0.9363, F(3, 168)=3.8, p=0.011, partial η^2=0.064) on the combined dependent variables (Table 10).

Table 10.

Main MANCOVA Test Showing Significance

Variables	*Value*	*F*	*Hypothesis df*	*Error df*	*p*	η^2
Strategy type * age	.892	2.189	9	409	**.022**	.037
Gender * age	.936	3.798	3	168	**.011**	.064
Strategy type	.896	2.102	9	409	**.028**	.036
Prior Knowledge	.957	2.516	3	168	**.060**	.043
Gender	.946	3.207	3	168	**.025**	.054
Age	.932	4.104	3	168	**.008**	.068

Note. Test statistic was Wilks' Lambda. * indicates an interaction (e.g., Strategy type*age).

Following the significant results of the MANCOVA, the Univariate ANOVAs were used to further identify where the differences occurred (Table 12).

Six statistically significant main effects were found: (a) strategy type on comprehension, F(3, 170)=3.47, p=0.018, partial η^2=0.058; (b) strategy type on satisfaction, F(3, 170)=2.94, p=0.035, partial η^2=0.049; (c) prior knowledge on comprehension, F(1, 170)=4.58, p=0.034, partial η^2=0.026, and retention F(1, 170)=5.85, p=0.017, partial η^2=0.033; (d) prior knowledge on retention, F(1, 170)=5.85, p=0.017, partial η^2=0.033; (e) gender on satisfaction, F(1, 170)=7.85, p=0.006, partial η^2=0.044; and (f) age on satisfaction, F(1, 170)=10.32, p=0.002, partial η^2=0.057.

Table 11.

Analysis of Covariance in Main MANCOVA

Source	*Dependent Variable*	*df*	*F*	*p*	η^2
Strategy type * age	Comprehension	3	2.866	**0.038**	0.048
	Retention	3	1.187	0.316	0.021
	Satisfaction	3	3.632	**0.014**	0.060
Gender * age	Comprehension	1	0.634	0.427	0.004
	Retention	1	0.094	0.760	0.001
	Satisfaction	1	10.497	**0.001**	0.058
Strategy type	Comprehension	3	3.465	**0.018**	0.058
	Retention	3	1.039	0.377	.018
	Satisfaction	3	2.939	**0.035**	0.049
PK	Comprehension	1	4.576	**0.034**	0.026
	Retention	1	5.851	**0.017**	0.033
	Satisfaction	1	0.106	0.745	0.001
Gender	Comprehension	1	1.379	0.242	0.008
	Retention	1	0.085	0.771	0.000
	Satisfaction	1	7.850	**0.006**	0.044
age	Comprehension	1	1.379	0.242	0.008
	Retention	1	0.000	0.987	0.000
	Satisfaction	1	10.321	**0.002**	0.057
Error	Comprehension	170			
	Retention	170			
	Satisfaction	170			

Note. Strategy type accounted for 10% of the variation on overall post assessment (Adjusted R Squared = 0.102), and 11% of the variation on overall satisfaction (Adjusted R Squared = 0.110). Significance at p=<.05.

Three significant two-way interactions were identified: (a) strategy type and age on comprehension, $F(3, 170)=2.87$, p=.038, partial $\eta^2=.048$; (b) strategy type and age on satisfaction, $F(3, 170)=3.63$, p=<0.014, partial $\eta^2=0.060$; and (c) gender and age on satisfaction, $F(1, 170)=10.50$, p=0.001, partial $\eta^2=0.058$.

FOLLOW UP ANCOVA – COMPREHENSION

To follow-up the significant results found for the interaction between strategy type and age, and main effects of strategy type and prior knowledge (PK) on comprehension in the MANCOVA, a separate ANCOVA was run. The model included the two-way interaction between strategy type and age, and then main effects for strategy type, age, and prior knowledge (Table 12).

Table 12.

Follow-Up ANCOVA Test for Significant Main MANCOVA effects on Comprehension

Variables	*df*	*F*	*p*	η^2
Strategy type * age	3	2.689	**0.048**	0.042
Strategy type	3	3.109	**0.028**	0.049
age	1	0.895	0.345	0.005
PK	1	3.522	0.062	0.019
Error	182			

Note. This model accounted for 7% of the variation on comprehension (Adjusted R Squared = 0.072).

Significance at p=<.05.

There was a significant main effect of strategy type on comprehension after controlling for participants age and PK, $F(3, 182)=3.12$, p=0.028, $\eta^2=0.049$. There was not a significant main effect for age after partialling out strategy type and PK, $F(1, 182)=0.895$, p=0.345, $\eta^2=0.005$, or for PK after partialling out age and strategy type, $F(1, 182)=3.52$, p=0.062, $\eta^2=0.019$, on

comprehension. However, there was a significant interaction between the strategy type and age, $F(3, 182)=2.69$, p=<0.048, $\eta^2=0.042$ on comprehension.

The Sidak post-hoc analysis of the main effect of strategy type on comprehension was conducted (Table 13).

Table 13.

Post-hoc Analysis of Main Effects

(I) Strategy Type	*(J) Strategy Type*	*Mean Difference (I-J)*	*SE*	*p*
EIQ/Summarization	Summarization	-0.061	2.544	1.000
	EIQ	3.017	2.536	0.801
	Control	5.821	2.578	0.142
Summarization	EIQ/Summarization	0.061	2.544	1.000
	EIQ	3.077	2.368	0.729
	Control	5.882	2.418	0.092
EIQ	EIQ/Summarization	-3.017	2.536	0.801
	Summarization	-3.077	2.368	0.729
	Control	2.804	2.382	0.808
Control	EIQ/Summarization	-5.821	2.578	0.142
	Summarization	-5.882	2.418	0.092
	EIQ	-2.804	2.382	0.808

Note. Mean differences based on estimated marginal means.

Adjustment for multiple comparisons: Sidak. This was used because it is slightly less conservative than the Bonferroni method.

No significance was found between comprehension level and each of the four strategies compared to one another. However, the ANOVA table (Table 12) shows strategy type as being significant which indicates that at least two means are significantly different from one another, the Control group (M=59.88) and Summarization group (M=65.76) (Table 14). Even though the EIQ/Summarization group (M=65.70) mean is close to the Summarization mean, there is no

evidence that this mean or the mean of the EIQ group (M=62.68) are significantly different on comprehension after partialling out age and PK.

Table 14.

Means for Strategy Type After Adjusting for Covariate Age and PK on Comprehension

Strategy Type	*Adj. Mean*	*SE*
Control	59.879[a]	1.725
EIQ	62.683[a]	1.648
Summarization	65.761[a]	1.711
EIQ/SUM	65.700[a]	1.946

Note. a. Covariates appearing in the model are evaluated at the following values: AGE = 25.84.

Due to an interaction between strategy type and age, strategy type cannot be discussed in isolation. Figure 4 represents the interaction between strategy type and age on comprehension scores. The mean continuous covariate age was 25.84 years and is indicated by the vertical line in Figure 4.

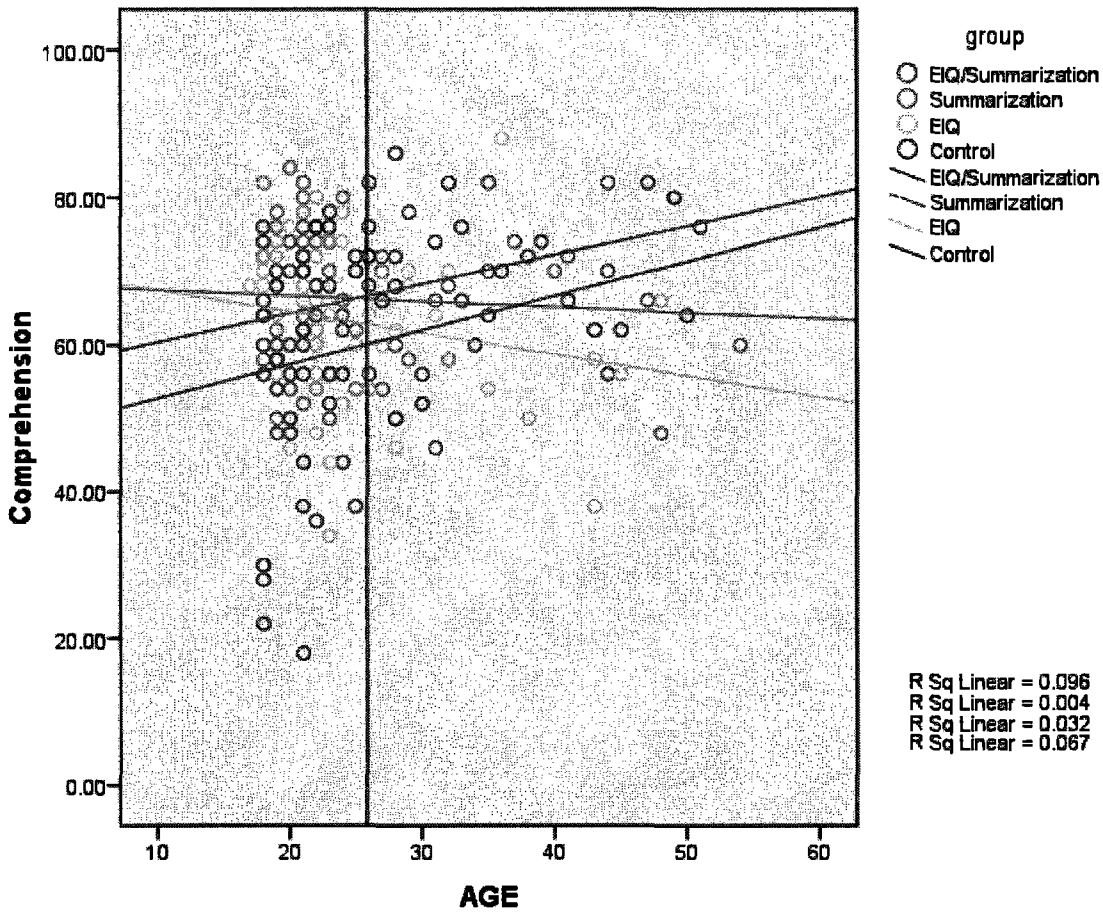

Figure 4. Interaction graph between strategy type and age on comprehension.

The interaction between age and strategy type indicated that the effect of strategy type on comprehension differs depending on participant's age. Although none of the slopes were significantly different from 0, the Control (B = 0.39, p = 0.07) and EIQ/Summarization (B = 0.411, p = 0.06) approached significance, and both of these slopes were significantly higher than the slopes of the two single strategy conditions (EIQ and Summarization). Their slopes were slightly negative, EIQ (B = -0.298, p = 0.180) and Summarization (B= -0.096, p = 0.62).

FOLLOW-UP ANOVA – RETENTION

Because the univariate ANOVA indicated significant differences in retention levels, a second follow-up ANOVA was run with prior knowledge as a covariate which identified a

significant main effect of PK on retention, $F(1, 179)=7.84$, p=<0.006, $\eta^2=0.042$ (Table 15). Subjects with more prior knowledge had higher mean scores (M=63.89) than those with less PK (M=58.03) (Table 15).

Table 15.

Follow Up ANCOVA Test From Significant Main MANCOVA on Retention Assessment

Source	*df*	*F*	*p*	η^2
PK	1	7.843	0.006	0.042
Error	179			

Note. This model accounted for 4% of the variation on follow-up assessment (Adjusted R Squared = 0.037).

Table 16.

Overall Mean Scores for PK on Retention Assessment

PK	*Mean*	*SD*	*N*
More	63.8929	13.06350	112
Less	58.0290	14.63474	69
Total	61.6575	13.93931	181

Note. Mean scores for the PK covariate are presented as a sum of scale items (0=no PK, 1= yes PK for seven questions)*

FOLLOW-UP ANCOVA – SATISFACTION

A final follow-up ANCOVA examined the significant interaction effects between strategy type and age (p=0.014), and gender and age (p=0.001) on the overall satisfaction score identified as significantly different in the main MANCOVA. The model used for this test included 2-way interactions between strategy type and age and gender and age, and the main effects for all factors. Results revealed significant main effects for (a) strategy type after

* A nonparametric – 2 independent sample –Mann-Whitney test was run to determine if older participants had more prior knowledge (PK) than the younger participants. Results were significant, p=<.01, indicating those with more PK tended to be older than those with less PK.

controlling for participants age and gender, $F(3, 180)=43.45$, p=0.018, $\eta^2=0.054$, (b) age, after controlling for gender and strategy type, $F(1, 180)=6.68$, p=0.002, $\eta^2=0.051$, and (c) gender after controlling for strategy type and age, $F(1, 180)=8.37$, p=0.004, $\eta^2=0.044$, on overall satisfaction score. In addition, a significant interaction between strategy type and age, $F(3, 181)=4.551$, p=0.004, $\eta^2=0.070$, and gender and age, $F(1, 180)=11.23$, p=0.001, $\eta^2=0.059$, on overall satisfaction was found (Table 17).

Table 17.

Follow-Up ANCOVA Test from Significant Main MANCOVA on Overall Satisfaction

Source	***df***	***F***	***p***	η^2
Strategy type * age	3	3.795	**0.011**	0.059
Gender * age	1	11.234	**0.001**	0.059
Strategy type	3	3.452	**0.018**	0.054
Gender	1	8.373	**0.004**	0.044
age	1	9.676	**0.002**	0.051
Error	180			

Note. This model accounted for 11% of the variation on follow-up assessment (Adjusted R Squared = 0.109).

Significant at p=<0.05

A Sidak post-hoc analysis of the main effect of strategy type and gender on comprehension was conducted. No significant differences were found (Table 18).

Table 18.

Post-hoc Analysis of Main Effects on Satisfaction

Strategy Type (I)	*Strategy Type (J)*	*Mean Difference (I-J)*	*SE*	*Sig.*
EIQ/Summarization	Summarization	-0.119	1.466	1.000
	EIQ	0.123	1.450	1.000
	Control	0.075	1.479	1.000
Summarization	EIQ/Summarization	0.119	1.466	1.000
	EIQ	0.242	1.361	1.000
	Control	0.194	1.399	1.000
EIQ	EIQ/Summarization	-0.123	1.450	1.000
	Summarization	-0.242	1.361	1.000
	Control	-0.048	1.385	1.000
Control	EIQ/Summarization	-0.075	1.479	1.000
	Summarization	-0.194	1.399	1.000
	EIQ	0.048	1.385	1.000
Gender (I)	Gender (J)			
Male	Female	-0.819	1.119	0.465
Female	Male	0.819	1.119	0.465

Note. Means based on estimated marginal means. The Sidak adjustment for multiple comparisons was used.

The ANOVA table (Table 17) however, shows strategy type, gender and age as being significant which indicates that at least two means for strategy type are significantly different from one another, EIQ (M=52.97) and Summarization (M=53.21), and the female means (M=53.48) were significantly different than male means (M=52.66). There is no evidence that any other means for strategy type are significantly different on satisfaction after partialling out age and gender. Table 19 shows the estimated marginal means for strategy type on satisfaction after controlling for age and gender; and gender on satisfaction after controlling for age and strategy type.

Table 19.

Estimated Marginal Means for Strategy Type and Gender on Satisfaction

Variable	*Adjusted Mean*	*SE*
Control	53.02	1.051
EIQ	52.97	0.966
Summarization	53.21	1.001
EIQ/SUM	53.09	1.124
Male	52.66	0.953
Female	53.48	0.591

Note. a. Covariates appearing in the model are evaluated at the following values: AGE = 25.84. Mean scores for overall satisfaction are presented as a sum of scale items (1=strongly disagree; 4= strongly agree on 18 questions).

The main effects for strategy type, age, and gender cannot be discussed in isolation due to an interaction between strategy type and age, and gender and age. The mean age of 25.84 is depicted in Figure 5 by the vertical line. Subsequent examination of the parameter estimates revealed that age had no effect on satisfaction in the Control or in the EIQ/Summarization groups — (B=0.108, p=0.39 and B=-0.022, p=0.879, respectively). In the Summarization group, as age increased, so did satisfaction (B=0.272, p=0.028). This slope was significantly more positive than 0, although not significantly more positive than the slope of the Control condition (p=0.39). In contrast, as age increases in the EIQ-only condition participants were generally less satisfied, (B= -0.287, p=0.043). Although the slopes appear to have a bigger effect on satisfaction in the graph, these estimates of slope are controlling for the other variables in the model, such as gender and the gender*age interaction. The graph does not control for these variables.

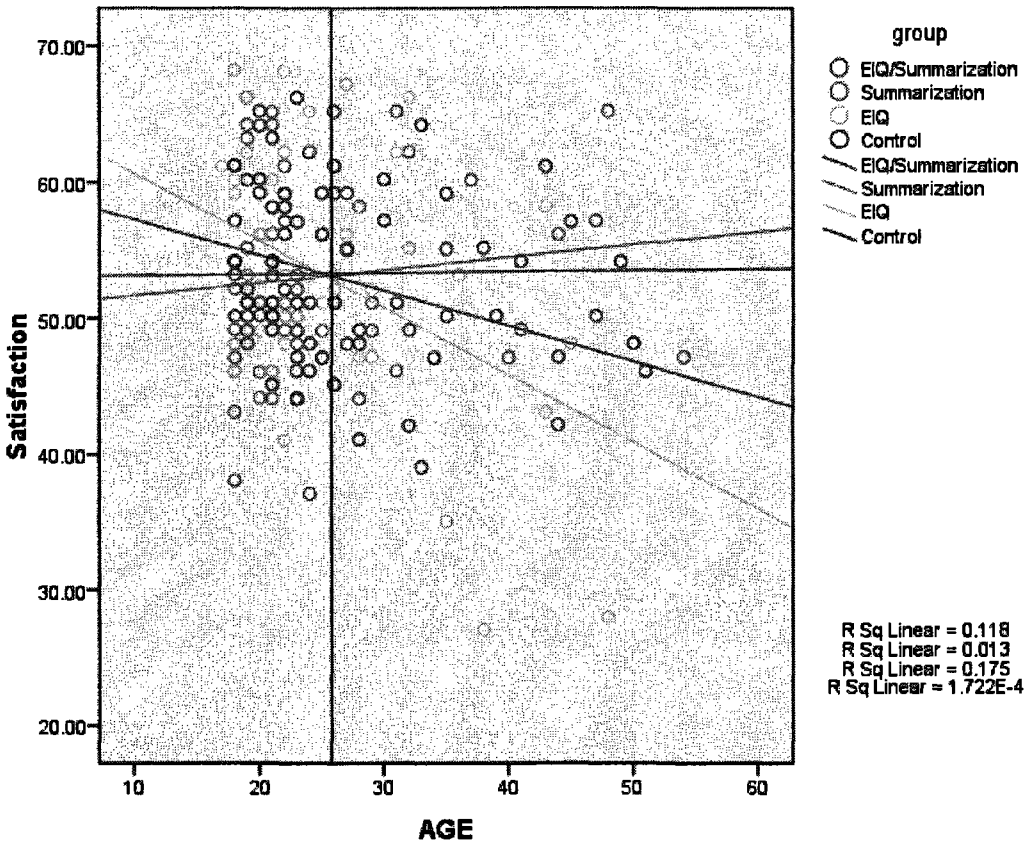

Figure 5. Interaction graph between strategy type and age on overall satisfaction.

Table 20 presents the overall satisfaction mean scores for strategy type before and after the interaction with age. Younger participants were more satisfied in the EIQ group than older participants, and younger participants were less satisfied in the Summarization group than older participants.

Table 20.

Means on Overall Satisfaction Scores for Strategy Type Before and After Interaction With Age

Strategy type		*Group*Age(22)*	*Group*Age(30)*	
	Means	*M*	*M*	*N*
Control	53.30	53.02	53.88	48
EIQ	53.08	54.47	52.18	52
Summarization	53.14	52.59	54.76	49
EIQ/SUM	52.65	53.59	53.42	41

Note. The ages of 22 and 30 were used to calculate the means of the interaction between age and strategy type from the parameter estimates. Mean scores for overall satisfaction are presented as a sum of scale items (1=strongly disagree; 4= strongly agree on 18 questions).

Figure 6 shows the interaction between gender and age on overall satisfaction, and Table 21 shows the means for gender on overall satisfaction before and after interaction with age. As the age of male participants increased, satisfaction decreased significantly, (B=-0.425, p=0.001). Satisfaction of females, on the other hand, increased with age but not significantly, (B=0.108, p=0.39). The estimates of slope are controlling for the other variables in the model, such as strategy type, and strategy type*age interaction. The graph does not control for these variables.

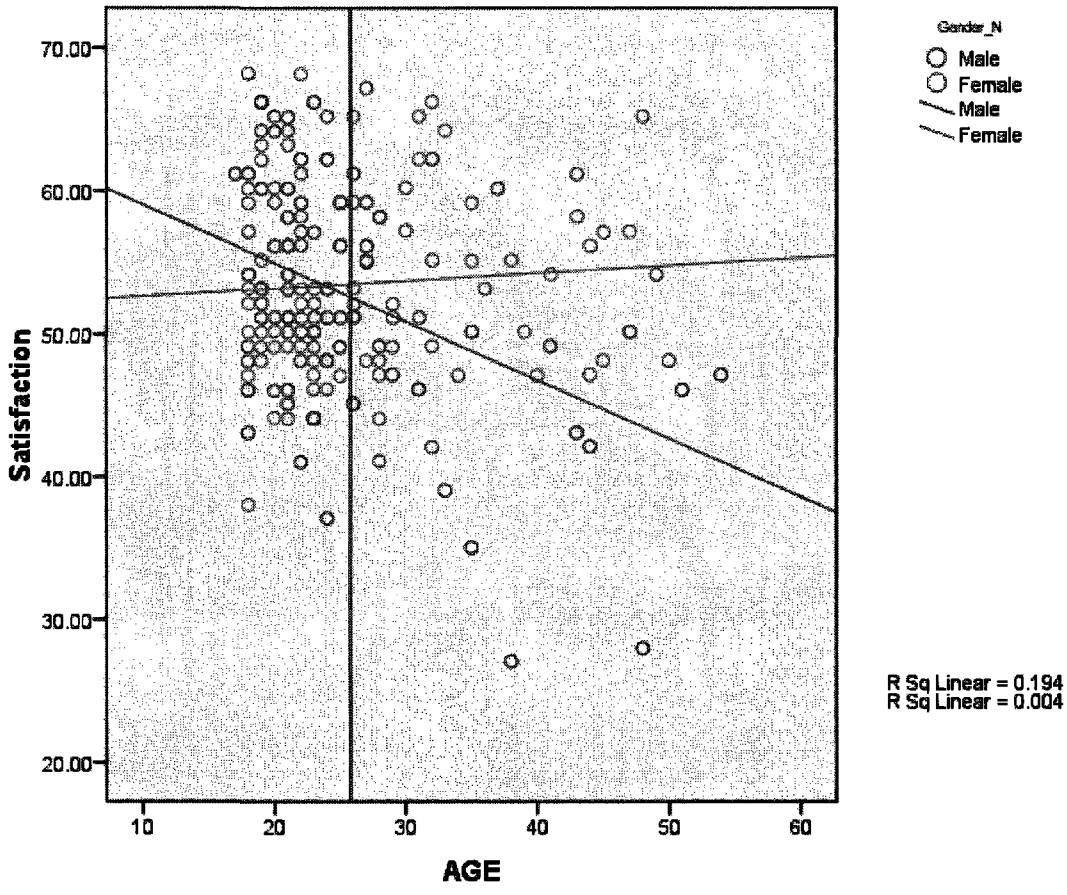

Figure 6. Interaction graph between gender and age on overall satisfaction.

Table 21.

Means for Gender on Overall Satisfaction Score Before and After Interaction with Age

Gender	*Mean*	*SD*	*Gender*Age (22)* *M*	*Gender*Age (30)* *M*	*N*
Male	52.01	9.12	53.80	51.27	54
Female	53.48	6.32	53.42	53.88	136

Note. The ages of 22 and 30 were used to calculate the means of the interaction between age and gender from the parameter estimates. Mean scores for overall satisfaction are presented as a sum of scale items (1=strongly disagree; 4= strongly agree on 18 questions).

Younger females were less satisfied than older females, and younger males were more satisfied than older males; however, older females were more satisfied than both younger and older males.

To further examine satisfaction results, **Error! Not a valid bookmark self-reference.** presents the percentage outcomes of the learners answers on the Satisfaction subcategories: (a) module content, (b) course interface and design, (c) resources, and (d) general overall satisfaction (e) Total Overall Satisfaction (f) strategy type, and (g) feedback. Participants using the EIQ strategy were 86.5 percent satisfied with the strategy along with 85.9 percent satisfied with the Summarization strategy. However, 16.7 percent of the participants were dissatisfied with the EIQ/Summarization combined strategy event.

Table 22.

Satisfaction Results by Subcategories and Overall Satisfaction with OIM

Subcategories	*% Very Satisfied*	*%Satisfied*	*% Total Satisfied*	*%Dissatisfied*	*%Very Dissatisfied*	*Did Not Answer*	*M*	*N*
Module Content	51.3	47.1	98.4	0.5	-	2	25.15	189
Course Interface and Design	58.1	37.7	95.8	2.1	0.5	3	10.02	188
Resources	59.2	33.5	92.7	5.2	-	4	6.26	187
General Overall Satisfaction	29.8	59.2	89	7.3	1.6	4	8.92	187
Total Overall Satisfaction Score (All subcategories combined)	52.9	41.4	94.3	1	-	9		182
Strategy Type	22.5	40.3	62.8	9.9	1.0	50	8.7	141
Control	-	-	-	-	-	-	-	-
EIQ	34.6	51.9	86.5	13.5	-	-		52
Summarization	32.7	53.1	85.5	12.2	2	-		49
EIQ/Summarization	21.4	57.1	78.5	14.3	2.4	2		40
Feedback	16.8	40.8	57.6	9.9	-	62	11.26	129
Control	-	-	-	-	-	-		-
EIQ	17.3	59.6	76.9	13.5	0	5		48
Summarization	28.6	51.0	79.6	10.2	0	5		44
EIQ/Summarization	21.4	52.4	73.8	16.7	0	4		38

Note. The satisfaction survey is at Appendix H. Control group did not answer questions associated with 'Strategy Type' nor 'Feedback'.

CHAPTER V

DISCUSSION AND IMPLICATIONS

The purpose of this dissertation was to investigate the effects of different learning strategies, specifically elaborative interrogation questioning (EIQ) and summarization, on knowledge comprehension and retention, as well as overall satisfaction with a self-paced Online Instruction Module (OIM), *Compliance: Ethical, Legal, and Professional Standards*. The QM™ framework was used to ensure that the module was well designed. The module development platform was Blackboard, a course management system for online learning. Utilizing the learner engagement guidelines from the QM™ framework and research literature on EIQ and summarization, the EIQ and summarization learning strategies were embedded independently or together throughout the OIM. Both learning strategies have been shown to increase comprehension and retention of new information in both traditional and online environments (e.g., Pressley et al., 1987; Dornisch & Sperling, 2006).

Study participants were randomly assigned to one of four different treatment groups: (a) control (no treatment), (b) EIQ embedded questions, (c) summarization embedded exercises, and (d) a combination of EIQ and summarization embedded strategies. Three variables were controlled in this study—prior knowledge, age, and gender—due to their possible effects on EIQ and summarization outcomes. Table 23 shows a summary of findings in this study.

Table 23.

Summary of Significant Main and Interaction Effects

	Comprehension	*Retention*	*Satisfaction*
MAIN EFFECTS			
Learning Strategy	p=0.028	ns	p=0.018
Prior Knowledge	ns	p=0.006	ns
More Prior Knowledge	ns	Retained more information	ns
Less Prior Knowledge	ns	Retained less information	ns
Age	ns	ns	p=0.002
Gender	ns	ns	p=0.004
INTERACTIONS			
Learning Strategy and Age	p=0.048	ns	p=0.011
Control	Increased w/age	ns	Increased w/age
EIQ	Decreased w/age	ns	Decreased w/age
Summarization	Decreased w/age	ns	Increased w/age
EIQ/Summ	Increased w/age	ns	Decrease w/age
Gender and Age Interaction	ns	ns	p=0.001
Females	ns	ns	Increased w/age
Males	ns	ns	Decreased w/age

Note. Significant at p=<0.05.

ns = non-significant.

More prior knowledge indicates participants answered 4 or more questions out of 7 accurately on the prior knowledge questionnaire.

To address the study's research question, "How will four different learning strategies affect learner comprehension, retention of information and learner satisfaction while controlling for prior knowledge, age and gender?", the discussion and implications of the three primary aspects of the study (comprehension, retention ,and satisfaction) are addressed in the following

paragraphs. Interpretation, discussion, and implications take into account the small effect sizes found for comprehension and retention.

COMPREHENSION

A finding that may be of interest to those responsible for designing online instruction modules for university-level learners is the potential benefit of EIQ and summarization strategies on comprehension. However, while there were achievement gains that may be attributed to these strategies, the gains were not sizeable gains and thus may not be warranted for use in this particular type of self-paced, online instruction module environment, particularly as forced choice strategies.

Learning strategies and age. As younger college-age learners advance through their education, exposure to more advanced cognitive learning strategies, such as EIQ and summarization techniques is likely, increasing their ability to become better able to self-select appropriate cognitive strategies according to the learning task, thus becoming more effective learners over time (Garner, 1990). Therefore, exposing younger college-level learners to more sophisticated cognitive learning strategies not currently in their repertoire appears to be beneficial.

For instance, this study found that younger college-age learners benefited from the use of EIQ-alone and summarization-alone strategies which is consistent with studies that investigated the use of these strategies by college students learning factual information and from expository text (e.g., Brown & Day, 1983; King, 1992; Ozgungor & Guthrie, 2004; Pressley et al., 1987; Smith, 2003; Wood et al., 1998, Wood et al., 1999). A plausible explanation for the younger college-aged learners comprehending more than the older college-aged learners in the EIQ-only and summarization-only groups is that the younger college-aged learners may not have acquired the ability to choose more sophisticated strategies on their own and, thus, performed better when prompted to use these specific strategies. Whereas the older learners, having more experience with additional sophisticated learning strategies, found the use of the EIQ or the summarization

strategy as interfering with what they believe to be more effective strategies that match the task demand. Findings in the Wood et al. (1998) and Wood et al., (1999) studies generally support these explanations.

Additionally, in the Wood et al., (1999) study, grades 5-6, 9-10, and first-year and fourth-year university students were compared using EIQ and self-study, and found that comprehension in general improved with increasing age. Wood et al., found that older university students (mean age was 21.9 years) in the self-study condition had increased comprehension means compared to first year students (mean age was 19.9 years) and engaged in more sophisticated cognitive learning strategies such as imagery and other elaboration strategies. Findings in the current study support Wood et al.'s findings, in that the older participants in the self-select group comprehended more than the younger participants, suggesting that perhaps the younger learners used less sophisticated rote learning strategies such as rereading (Garner, 1990). The older participants may already have a well-established learning strategy protocol and know *that* a particular strategy is good for learning a particular task, know *how* to use the strategy, and know *when* the use of a particular strategy is appropriate (Paris, Lipson, & Wixson, 1983). Wood demonstrated that older college-aged learners left to self-select learning strategies, utilized more effective learning strategies over younger college-aged learners. Further research is needed to investigate this line of reasoning.

There does not appear to be any prior research using the EIQ and summarization strategies in combination and their interaction with age to see what effects they might have on comprehension and retention of information. Therefore, a unique and noteworthy result that merits further research, is the significant effect that the combination of these two learning strategies and age had on comprehension. Older learners in this study comprehended more than their younger counterparts when the EIQ and summarization were combined. Perhaps the older college-aged learner is more adept at utilizing more than one sophisticated strategy at a time to learn new information and the younger college-aged learners, while able to use the two strategies

separately as shown in this study, are less skilled at utilizing more than one at the same time. The Wood et al., (1998) findings lend some support to this explanation. Wood et al. found that university students claimed to have used at least two learning strategies as opposed to the majority of high school students who claimed they used only a single strategy.

Another factor that may have contributed to the learning strategy and age interaction results is the possible use of additional learning strategies in comprehending the to-be-learned information that were not controlled for in this study. Further research on the strategic use of learning strategies, such as in the Wood et al., (1998) study, is suggested. Wood et al., examined high-school and university student's use of cognitive learning strategies when left to self-select, and their strategic use of learning strategies depending on the nature of the learning task. Some learners utilized strategies such as elaborative rehearsal, chunking, and imagery regardless of course difficulty. Additionally, some learners in their study indicated that their experience with more sophisticated learning strategies did not happen until they were in college. Wood et al., indicated that learners perform better on academic tasks when they have more complex learning strategies in their repertoire than learners who do not (Wood, et al., 1998).

While comprehension was significantly affected by strategy type and age, effect sizes were quite small (e.g., effect size for strategy type and age was η^2=.042), utilization of the EIQ and summarization strategies remain worthwhile since both contribute to learning and require few resources.

RETENTION

Two findings related to retention merit discussion. First, both the EIQ and summarization strategies—alone and in combination—while effective when tested immediately following module completion, were evidently not effective one month later and, second, learners with more prior knowledge of the to-be-learned material retained more information than those with less prior knowledge. The lack of durability of the learning strategies is consistent with the Dornisch & Sperling (2004, 2006) and Dornisch (2002) findings in which no statistically significant

retention benefits were shown for EIQ at delayed testing in an online environment. Perhaps the failure of the learning strategies to facilitate retention of information was due to lack of interest of the subject as provided by Dornisch and Sperling (2006) and Dornisch (2002). These researchers indicated that both situational and individual interest may interact with text supplements. Hidi & Harackiewicz (2000) have argued that human cognition and remembering of information are affected by learner interest. Individual interest develops over time and can have lasting effects (Hidi, 1990); where with situational interest, interest created when certain conditions and/or stimuli are present in the learning environment (e.g., text supplements, i.e. learning strategies), may or may not have lasting effects. Perhaps the EIQ and summarization strategies did not facilitate situational interest in the current study and therefore did not have any significant effects on retention as was indicated by Dornisch (2002) and Dornisch & Sperling (2006).

For those participants with more prior knowledge in the current study, they already have a sufficient understanding of the topic, allowing for easier encoding and retrieval of information as was found in the Kim & VanDusen (1998) study, making the use of the EIQ and summarization strategies essentially ineffective for those learners. Kim and VanDusen suggested that undergraduate learners with high prior knowledge of the topic automatically generate their own "elaborations to maintain the coherence of the texts without using any specific strategy" (p. 373) thus increasing comprehension and recall, which is a possible explanation for the retention results in this study. They demonstrated that prior knowledge had a 'powerful' effect on memory performance on text comprehension. The older college-age participants in the present study had more prior knowledge than the younger participants, lending credibility to the notion that older learners have a more sophisticated learning strategy repertoire from which to choose from and utilize for comprehension, as discussed above, and for retaining that information.

Another possible reason for the retention outcome and one that is well known, is knowledge decay. When learners are not afforded the opportunity to physically and/or mentally practice the newly acquired information, knowledge decay is robust (see Arthur, Bennett,

Stanush, & McNelly, 1998 for a review) deteriorating in as little as one day. Through their meta-analysis on knowledge decay, Arthur et al. (1998) discovered that longer periods of non-practice led to increased loss of information.

SATISFACTION

Findings in this study show that learners were satisfied with the OIM in general and when using the EIQ and summarization strategies specifically. In addition, age interacted with both the learning strategy and gender on satisfaction. First, to lend insight into the learners' satisfaction with the OIM, two open-ended questions were asked in the survey. Common themes found in the question: "What did you like MOST about this OIM?", were (a) the ability to go at one's own pace, (b) convenience, (c) easy to follow, and (d) the ability to access additional information through hyperlinks and related materials. Participant comments included: "Great job on the set up and overall structure, ideas and content"; "I didn't have to sit in [a] class that would have taken more time to explain compliance"; "It was self-paced and provided more information if needed." These themes are consistent with studies that show convenience and flexibility of online courses as the most cited reasons for taking an online course (e.g., Sullivan, 2001; Frey et al., 2004).

Similarly, common themes emerged from responses to the question: "What did you like LEAST about the OIM?" such as (a) the OIM was boring, (b) the videos were not liked, and (c) the navigation was poor. Participants comments included: "What I liked least about the OIM were the videos, they were boring. I would have preferred to read what the speaker was saying", "I wasn't really interested in the topic", and "Maybe it was just Blackboard, but I didn't like how I had to click on the presentation link again, then scroll down to see that the next module topic had opened." These themes are consistent with overall findings from satisfaction research in online instruction (e.g., Bowers & Kamata, 2000; DeBourgh, 2003) where CMS/technology and motivation/interest play a role in satisfaction (e.g., Beffa-Negrini et al., 2002; Bollinger & Martindale, 2004).

Second, females in this study were more satisfied than males with the OIM, a finding consistent with other studies (e.g., Arbaugh, 2000; Bower & Kamata, 2000). Interestingly, though, younger females were less satisfied than younger males, whereas older females were more satisfied than older males. These results contribute to the literature because domains specific to various aspects of the OIM (e.g., learning objectives, videos, assessments, learning strategies, feedback, resources, etc.) were examined, whereas most of the literature on learner satisfaction has been in the context of communication that takes place between learner-to-learner, and learner-to-instructor (e.g., Barrett & Lally, 1999; Guiller & Durndell, 2006), and not specifically learner-to-content and the differences in age and gender on satisfaction.

Interaction with the Module Content

Interaction in online environments, particularly learner-to-learner and learner-to-instructor, has become a critical factor contributing to the success and satisfaction of learners in online environments and thus a topic worthy of study (e.g., Bolliger & Martindale, 2004; Bower & Kamata, 2000; DeBourgh, 2003, Song et al., 2004). A wealth of studies examining those two types of interaction led to this study's focus on the third type of interaction—learner-to-content—exclusively and resultant satisfaction. Participants were 98.9 percent satisfied with the OIMs content (e.g. learning objectives, videos, additional resources) thus supporting Anderson's (1999) claim that as long as one of the three interaction events (i.e., learner-to-learner, learner-to-instructor, learner-to-content) occurs at a high level, interactions at the other two levels need only be minimal and perhaps even nonexistent.

Age and Learning Strategy on Satisfaction

An interaction also occurred between age and learning strategy on satisfaction. Caution is warranted when interpreting these results because one might conclude that participants in a particular treatment group were more and/or less satisfied with their particular learning strategy which is not the case. For instance, younger participants who were in the summarization group tended to be less satisfied than older participants in the same group. This may suggest that the

younger participants were unhappy with their learning strategy which is misleading. To clarify, the pertinent satisfaction subcategories will each be discussed.

Discussion of Satisfaction Subcategories

The satisfaction survey was based on the QM™ core elements of good design (Appendix A). A more complete picture of satisfaction emerges from further examination of some of the satisfaction subcategories: (a) Module Content, (b) Course Interface and Design, (c) Resources, and (d) Overall Satisfaction.

Participants were 98.9 percent satisfied with the module content (e.g., learning objectives, assessments, video), 95.8 percent were satisfied with the course interface and design (e.g., Blackboard, navigation), 92.7 percent were satisfied with the resources (e.g., hyperlinks, websites, reading material), and 89 percent were satisfied with the overall satisfaction-specific elements (e.g., recommend to someone else to take, learned as much online as in face-to-face, and general satisfaction with the OIM). Participants indicated positive satisfaction with these four subcategories lending additional support to Anderson's (1999) postulate.

In addition, there does not appear to be any prior research which specifically addresses learner satisfaction with the use of EIQ and/or summarization strategies found in OIMs which was a major focus of this investigation. The results for satisfaction on the subcategories (a) Learning Strategies, and (b) Feedback, are intriguing and will be further explored.

Interaction with learning strategies and feedback. Participants using the EIQ strategy were 87 percent satisfied/very satisfied with this learning strategy, 86 percent were satisfied/very satisfied with the summarization exercise strategy, and 79 percent were satisfied/very satisfied with using the combination of the EIQ/summarization strategies. These results are stand-alone results and were not intended for comparison.

Feedback provided by both instructor and peers has long been known as a factor contributing to satisfaction in the online environment (e.g. Arbaugh, 2000; DeBourgh 2003; Thurmond et al., 2002). In this OIM, feedback was provided to participants when they completed

an EIQ and/or summarization exercise. While the programmed feedback was necessarily not specific with regard to an individual's response, the feedback provided examples of appropriate answers and what main ideas/concepts should have been included, enabling the learner to self-determine the accuracy of his/her answers. Participants were reasonably satisfied with this type of feedback for all three strategies: EIQ (77 percent), Summarization (80 percent), and EIQ/Summarization (74 percent).

Participant responses to two open-ended questions provide further elucidation. Participants were asked, "What did you like MOST about the feedback in this module?" Common themes were: (a) immediacy of feedback, (b) easy to understand, (c) useful, and (d) specific and concise. Several responses were: "It helped me tie meaning to my personal experiences", "Easy to understand", and "I liked that it gave me a clear view of what I was supposed to have in it." These results are similar to other findings on feedback and satisfaction in online environments (e.g., Andriasani et al., 2001; Cyboran, 1995; DeBourgh, 2003; Thurmond, et al., 2002).

While the majority of participants were satisfied with the feedback, some were dissatisfied. Responses to the second question, "What did you like LEAST about the feedback?." revealed themes of repetition and excessive detail. Responses included: "I was not sure of the purpose of the feedback since a 'live' person was not reading my responses and therefore it was not personalized", "The feedback seemed really wordy to me", and "After the first few questions, I knew in advance what was expected. I became irritated with the pop-up." One participant unsatisfied overall with the feedback made the point twice, first as a negative comment regarding what she liked most about the feedback— "I didn't find it helpful."—and again when asked what was liked least about the feedback—"It was unnecessary after the first one." That some participants were less satisfied is not surprising; the feedback is programmed by necessity and is therefore static. However, like the chunking of content, the feedback was designed to be appropriate for the anticipated answers of the intended audience. The slightly lower satisfaction rates likely reflect the disparity between some student's answers and the associated programmed

feedback, particularly with those who desire more personalized feedback, but does not negate the value of the strategy as the large majority were satisfied.

STUDY LIMITATIONS

While results of this study may prove beneficial for university administrators, educators, and instructional designers, there are limitations. The study sample was comprised of university volunteers enticed to participate through incentives and the results may therefore be biased toward students who were motivated extrinsically to participate in the study than those learners who will actually have to take the modules as required training. Because of this, results cannot be generalized to the university population, or to the remaining series modules currently under development.

Replication of this experiment may be limited due to the subjectivity of chunking content. Breaking the content into suitable chunks for a heterogeneous population will always be a compromise as the chunks may be too large for some, too small for others. However, this is a characteristic of all instruction and will affect all students equally, but should be considered a potential limitation in generalizing to other audiences.

FUTURE DIRECTIONS

Further research is recommended in the following four areas; (a) learner fatigue and cognitive overload, (b) utilizing a direct prior knowledge measure, (c) longer exposure to learning strategies, (d) gender and age differences in short term OIMs, and (e) motivation and interest on satisfaction.

This study showed that younger college students comprehended less than older students when EIQ and Summarization events were used together. This was a unique finding and further research to identify the reason for the disparity is warranted. One approach might be to explore learner fatigue and cognitive overload as possible independent variables.

The continued use of a direct measure of prior knowledge is suggested. This method of assessing prior knowledge has been used in other recent studies (e.g., Ozgungor, 2002; Ozgungor

& Guthrie) and should be replicated and perhaps utilized with the other OIMs under development.

Another possible area for further research is utilizing the EIQ and Summarization strategies with the other OIMs in the Responsible Conduct in Research program, which will have different university populations whose participation will be mandatory, is justified. Furthermore, using these two strategies in longer treatments (e.g., semester long online course) may provide additional information on their overall effectiveness on comprehension and retention of information.

Because this investigation provided an incentive to participate in and complete the study, satisfaction results may have been positively affected. By examining student's motivation levels with short term OIMs, more may be revealed on what motivates learners to complete mandatory online, self-paced instructional modules. In addition, evaluating individual and situational interest using EIQ and summarization strategies should be conducted as interest has shown to affect learning outcomes in prior studies.

A closer look at age and gender differences with overall satisfaction in an OIM should also be conducted. While this study's findings largely support those of others who found females to be more satisfied than males in the online environment, additional research should investigate further the interaction age has with gender, in this study, in overall satisfaction with OIMs. Perhaps a combination of quantitative and qualitative studies delving deeper into how ones' age and gender relate to satisfaction is warranted. The qualitative component would likely lend further understanding of the quantitative results. Furthermore, exploring learner satisfaction with EIQ and summarization strategies in different domains in OIMs would benefit learning strategy research and provide additional information to instructional designers.

Further research on the amount of time participants spent, from start to finish, on performance outcomes is suggested. Participants in this study may have experienced different overall completion times. For example, someone in the control group, not encountering any type

of learning strategy may have very different results than someone who encountered the combined EIQ/Summarization learning strategies (e.g., completion time of approximately 45 minutes compared to completion time to an hour and half). To compound this possible effect, everyone was given a full week to complete the OIM and the retention assessment. Differences in results could have been impeded or improved depending on participants' time to actually complete the OIM once started. Therefore time to complete may itself impact comprehension and retention of information.

SUMMARY

This investigation showed that both EIQ and Summarization learning strategies can have positive effects on comprehension, dependent on age, yet they did not show positive effects on retention, when used in short-term, online, self-paced environments which could be interpreted as not having any benefit over other learning strategies. However, this study indicates that when younger learners are left to self-select their own learning strategy or are forced to use the EIQ and summarization strategies together, they did not perform as well as their older counterparts. In addition, the portion of those younger college-aged learners with less prior knowledge than their older counterparts performed better when either using the EIQ or the summarization strategies.

The results also make sense in terms of learner control in computer-based instruction. Learner-control, as described by Hannafin (1984), is the amount of control a learner has over "the path, pace, and/or contingencies of instruction" (p. 6). In addition, prior knowledge of the subject in an OIM is a variable Hannafin states should be taken into consideration when deciding on degree of learner control; those with more prior knowledge of the subject can be afforded more program -control over those who possess little to no prior knowledge. Since results of the present study show that younger college-aged learners comprehended slightly more when using EIQ or summarization strategies over self-selected strategies or the combination of the two, and tended to have less prior knowledge of the subject, allowing them limited control to choose either the EIQ or summarization strategy seems acceptable.

Conversely, the older college-aged learners, who tended to have more prior knowledge over their younger counterparts comprehended more when left to self-select and when the EIQ and summarization strategies were used together. Older learners, having more sophisticated learning strategy repertoires and a better understanding of how and when to use a particular strategy, can decide on their own which strategies to utilize in relation to their existing knowledge (Lin & Hseih, 2001). In this study older learners may have chosen to ignore the EIQ's and summarization strategy events altogether, or chose to do one over the other. Further inquiry into learners choice on strategy implementation is needed.

Therefore, a recommendation is to simply provide learner control through 'coaching'. By providing 'coaching', learners are advised to participate in strategies based on their "past, current, or cumulative performance" (p. 5) in the relevant instruction while still maintaining control whether to participate in or reject the strategy (Hannafin, 1984).

Unfortunately the use of EIQ and summarization strategies did not show any differential effects on retention of information. Therefore, follow-up activities such as face-to-face workshops to actively engage the learner in practice with the content may reduce knowledge decay. Instructional designers may also choose to utilize a direct-measure for prior knowledge in order to provide an opt-out of previously known content, as findings in this study showed that prior knowledge was the lead variable in retention of information.

While the embedded learning strategies appeared to have no differential effects on information retention, they still have value in terms of overall satisfaction with the OIM. Specifically, the EIQ and summarization strategies yielded positive results on satisfaction, while not requiring interaction between instructor and/or peers, supporting learner-to-content interaction which Anderson (2003) claims to be sufficient as long as the interaction is at a higher level than the other two (learner-to-learner and learner-to-instructor). These strategies can be implemented in OIMs without taxing faculty/peer resources and time, while contributing to comprehension and positive learner satisfaction.

While generalizations are limited, the comprehension and satisfaction results could prove promising for online learning and mandatory training across disciplines at this particular higher educational institution. Overall, 92 percent of the participants were satisfied with the short-term OIM, and over 84 percent of those in the learning strategy treatment groups were satisfied with the EIQ and summarization strategies.

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APPENDIX A

QUALITY MATTERS™ (QM™) FRAMEWORK

All Quality Matters Rubric Standards with Assigned Point Values

	Standard	Points
Course Overview and Introduction	I.1 Navigational instructions make the organization of the course easy to understand	3
	I.2 A statement introduces the student to the course and to the structure of the student learning and, in the case of a hybrid course, clarifies the relationship between the face-to-face and online components	3
	I.3 Etiquette expectations with regard to discussions, email, and other forms of communication are stated clearly	2
	I.4 The self-introduction by the instructor is appropriate and available online	1
	I.5 Students are requested to introduce themselves to the class	1
	I.6 Minimum technology requirements, minimum student skills, and, if applicable, prerequisite knowledge in the discipline are clearly stated	1
Learning Objectives	II.1 The course learning objectives describe outcomes that are measurable	3
	II.2 The module/unit learning objectives describe outcomes that are measurable and consistent with the course-level objectives	3
	II.3 The learning objectives are stated clearly and written from the students' perspective	2
	II.4 Instructions to students on how to meet the learning objectives are adequate and stated clearly	2
	II.5 The learning objectives address content mastery, critical thinking skills, and core learning skills	2
Assessment and Measurement	III.1 The types of assessments selected measure the stated learning objectives and are consistent with course activities and resources	3
	III.2 The course grading policy is stated clearly	3
	III.3 Specific and descriptive criteria are provided for the evaluation of students' work and participation	3
	III.4 The assessment instruments selected are sequenced, varied, and appropriate to the content being assessed	2
	III.5 "Self-check" or practice types of assignments are provided for timely student feedback	1
Resources and Materials	IV.1 The instructional materials support the stated learning objectives	3
	IV.2 The instructional materials have sufficient breadth, depth, and currency for the student to learn the subject	3
	IV.3 The purpose of each course element is explained	2
	IV.4 The instructional materials are logically sequenced and integrated	1
	IV.5 All resources and materials used in the course are appropriately cited	1
Learner Engagement	V.1 The learning activities promote the achievement of stated learning objectives	3
	V.2 Learning activities foster instructor-student, content-student, and if appropriate to this course, student-student interaction	3
	V.3 Clear standards are set for instructor response and availability (turn-around time for email, grade posting, etc.)	3
	V.4 The requirements for course interaction are clearly articulated	2
	V.5 The course design prompts the instructor to be active and engaged with the students	2
Course Technology	VI.1 The tools and media support the learning objectives, and are appropriately chosen to deliver the content of the course	3
	VI.2 The tools and media enhance student interactivity and guide the student to become a more active learner	2
	VI.3 Technologies required for this course are either provided or easily downloadable	2
	VI.4 The course components are compatible with existing standards of delivery modes	1
	VI.5 Instructions on how to access resources at a distance are sufficient and easy to understand	1
	VI.6 The course design takes full advantage of available tools and media	1
Learner Support	VII.1 The course instructions articulate or link to a clear description of the technical support offered	2
	VII.2 Course instructions articulate or link to an explanation of how the institution's academic support system can assist the student in effectively using the resources provided	2
	VII.3 Course instructions articulate or link to an explanation of how the institution's student support services can assist the student in effectively using the resources provided	1
	VII.4 Course instructions articulate or link to tutorials and resources that answer basic questions related to research, writing, technology, etc.	1
Accessibility	VIII.1 The course acknowledges the importance of ADA requirements	3
	VIII.2 Course pages and course materials provide equivalent alternatives to auditory and visual content	1
	VIII.3 Course pages have links that are self-describing and meaningful	1
	VIII.4 The course demonstrates sensitivity to readability issues	1

To meet Quality Matters review expectations a course must: Answer 'Yes' to all 3-point Essential Standards: I.1, I.2, II.1, II.2, III.1, III.2, III.3, IV.1, IV.2, V.1, V.2, V.3, VI.1, VIII.1 ***AND*** Earn 68 or more points.

APPENDIX B

OIM PRIOR KNOWLEDGE QUESTIONNAIRE

Compliance OIM Prior Knowledge Questionnaire

1. What is your current understanding of ethical research as a required practice at Old Dominion University?

2. State one purpose for the compliance standards in place at Old Dominion University.

3. Choose the research protocol committee which assists in determining human subject research at ODU?
    a. Institutional Review Board
    b. Equal Opportunity
    c. Office of Graduate Studies
    d. Research Foundation

4. Choose the campus office that can help you determine if your research project requires a review?
    a. Office of Graduate Studies
    b. Office of Research
    c. Research Foundation
    d. Office of the Registrar

5. Why are professional codes of conduct essential to a compliant program of scholarly activity?

6. State two legal, ethical or professional consequences of your failure to comply with compliance standards.

7. Describe a situation where non-compliance can be a potential risk.

APPENDIX C

OIM POST ASSESSMENTS

Compliance Post Assessment

Assessment 1: Compliance standards mandate that we:

a. determine if a new research area is ethically permitted.
b. prohibit risk-prone research.
c. apply ethical principles to the review of scholarly activity.
d. hold researchers using living subjects (human and animal) to a higher ethical standard than other scholarly activity.

Assessment 2: Examples like the Stanford Prison Experiment demonstrate that compliance lapses can occur even when policies are in place to prevent them. This demonstrates that:

a. better structures are necessary for enforcing compliance standards
b. compliance standards should be reviewed and revised regularly and, if necessary, modified
c. greater emphasis on compliance training should be included in graduate programs
d. review of research protocols needs to be more rigid

Assessment 3: Which of the following statements is MOST TRUE:

a. Compliance standards are a result of scholars wanting to ensure that their work is held to a high standard
b. Compliance standards pertain only to the biomedical sciences
c. Faculty and administrators are mostly and sometimes solely responsible for compliance with professional standards
d. None of these statements are true.

Assessment 4: Many ethical standards that govern scholarly activity are based upon:

a. correcting lapses found in previously conducted research.
b. refinements of previously used ethical standards.
c. popular opinion regarding what is ethical research
d. **all of the above**

Assessment 5: If findings based upon research misconduct are published, other researchers can design projects based upon faulty assumptions. With this result in mind, what type of compliance standard should prevent a researcher from committing this type of transgression?

a. ethical
b. legal
c. professional
d. personal

Assessment 6: Concerning Professional codes of ethics and standards, which of the following is not true:

a. they address both the obligations and privileges of the profession
b. work environments may involve multiple professional codes
c. they make determining the "right thing to do" straightforward and uncomplicated

d. virtually all professions have established some set of standards and a code of ethics for their members.

Assessment 7: Professional codes of conduct are essential to a compliant program of scholarly activity because:

a. they place federal guidelines in an easier to understand format for specific disciplines
b. they supersede the federal, state, and local guidelines for discipline specific activities
c. they inform protocol review committees on discipline specific standards
d. they provide guidance to professionals on ethical decisions related to their fields

***Assessment 8:** The legal oversight of research comes from:

a. federal regulations
b. state regulations
c. local regulations
d. university policies and procedures
e. all of the above

Assessment 9: While entering data into a spreadsheet, Dr. Smith misreads the column headings and transposes his data. He fails to check for this type of error later in his analysis and as a result publishes a study based upon incorrect information. This is an example of:

a. fabrication
b. falsification
c. excusable error
d. none of the above

***Assessment 10:** Jim is a graduate student in criminology and is interested in determining if substance abuse, child abuse and other forms of abuse are predictive of criminal activity and if this effect is greater in men than women. He proposes to send a survey via email to undergraduate and graduate students at the university in which they would answer questions regarding their history of abuse and criminal activity. He has missed the deadline for submitting his protocol for IRB approval and will have to wait another three months before the protocol can be reviewed and approved. Jim is certain there are no problems so he distributes the survey and gathers the data, in the expectation that IRB approval will be granted before defending his dissertation. What consequences/risks if any, does Jim face because he did not get IRB approval before starting his study?

a. Disciplinary action and possible expulsion.
b. He's fine since he sees no problem with his study, afterall he believes he's not harming anyone.
c. The IRB can stop his study and prevent him from obtaining any results.
d. Both a & c

Assessment 11: An act of non-compliance may go undiscovered. Even so, some consequences may arise from the action. These consequences may include:

a. loss of individual reputation in a particular field
b. doubt surrounding the findings from an entire discipline
c. loss of generalizable findings from research that is based upon the non-compliant work
d. the development of more rigid compliance standards

Assessment 12: Among the serious and negative effects of failing to comply with ethical, professional and legal standards, are:

a. Loss of personal and professional credibility and reputation
b. Unnecessarily endangering the health or well-being of others
c. Loss of time, money and effort pursuing ideas and projects based on faulty or d. misleading information
e. All of the above

Assessment 13: One of the main points to be learned from the Stanford Prison Experiment case was:

a. Don't conduct studies using prisoners
b. Use only professional actors rather than research scientist as confederates
c. Policies and an institutional review board are not always sufficient to prevent serious violations of legal and professional standards
d. Carefully evaluate the number of subjects needed to properly test your hypothesis.

Assessment 14: The Office of Research at ODU can assist you in all of the following except:

a. ensuring your project adheres to ethical guidelines.
b. educating you to classify your own work as exempt.
c. determining if your project requires regulatory oversight.
d. determining if your project requires continuing review.

Assessment 15: Scholarly activity at ODU that requires regulatory oversight can be approved by:

a. a protocol review committee
b. the Office of Research
c. the President or Provost
d. any of the above

Assessment 16: The ODU committee responsible for preventing human subjects from inappropriate or harmful research is:

a. IACUC
b. RSC
c. IRB
d. IBC

Assessment 17: The Office of Research Integrity investigates and punishes both individuals and institutions found to have intentionally committed which of the following:

a. Fabrication
b. Sexual Abuse
c. Coercion
d. Discrimination

Assessment 18: If you wanted or needed training and/or advice pertaining to conducting scholarly-research activities, which of these individuals should you contact:

a. Director of Student Affairs
b. Compliance Officer
c. Departmental academic advisor/mentor
d. b&c

* = Written by the researcher

APPENDIX D

STUDENT SATISFACTION SURVEY

QUALITY MATTERS™ STUDENT SATISFACTION SURVEY

(1. Strongly Agree; 2. Agree; 3, Disagree; 4 Strongly Disagree)

Module Content

1. The module overview and relevance was clear and easy to understand, it made sense to me.
2. I liked the video introduction by the faculty member.
3. The learning objectives for this module were clear and easy to understand.
4. The learning objectives were consistent with the topics within the module content.
5. The content of this module improved my awareness of Compliance standards.
6. The videos, pictures, and graphics helped in my understanding of the module content.
7. The module content was organized well and easy to follow.
8. The prior knowledge and post assessments measured the appropriate objectives of the module.

Resources

1. I found that the external resources, such as hyperlinks, websites, and reading materials supported the content of this module.
2. The resources afforded me additional opportunities to learn more about the content of this module.
3. I found the links to additional information useful.

Learner Engagement

1. I found that the learning activities (answering the Why questions and/or writing a summary) within this module helped me better understand the content of the module.
2. I found that the learning activities (answering the Why questions and/or writing a summary) within this module enhanced my interactivity with the module content.
3. The learning activities (answering the Why questions and/or writing a summary) helped me when answering the post assessment questions.

Feedback

1. The feedback given when I participated in the learning activities (the Why questions and writing a summary) was clear and easily understood.
2. I appreciated the feedback given.

3. The feedback given when I did the learning activities (answering the Why questions and writing a summary) helped me understand what was expected of me as a learner.
4. The feedback helped with my motivation to continue through the module topics.
5. What did you like most about the feedback found in this module?
6. What did you like least about the feedback found in this module?

Course Interface and Design

1. I found that Blackboard was appropriate to deliver this instruction module.
2. I found the interface, Blackboard, intuitive and easy to use.
3. I was comfortable navigating through the online module content (overview, presentation/topics, assessments, surveys, resources).

Overall Satisfaction

1. I was very satisfied with this online instruction module.
2. I learned as much in this online instruction module as I would have if I had taken this in a classroom setting.
3. I would recommend this online instruction module to other people.
4. What did you like most about this online instruction module?
5. What did you like least about this online instruction module?

APPENDIX E

EMAIL TO SOLICIT PARTICIPANTS

Hello ODU Undergraduate/Graduate Student,

My name is Heather Brown and I am a PhD candidate in the College of Education in Instructional Design and Technology here at Old Dominion University. I am soliciting volunteers to take part in my research study.

The procedure will involve participating in one online module in Blackboard, lasting approximately 45 minutes. A follow up will be given 3-4 weeks after you have completed the online module, lasting approximately 10-15 minutes.

Every one who completes the module **and** follow up will be entered into a drawing to win either a video iPod or a $200 ODU Bookstore gift certificate. You MUST complete all phases of this study, initial module completion AND follow up, to be considered for the drawing.

Your name will not appear in any of the research documents that are included in the study. Your MIDAS ID (this is what you use to log into Blackboard) will only be used to align the data. At the conclusion of this research, documents containing your MIDAS ID will be destroyed no later than January 1, 2010.

You must be a currently enrolled student at ODU to participate and be familiar with Blackboard.

Please respond to my ODU email address, HMBROWN@odu.edu indicating your interest and consent to participate in this research. Please respond as soon as possible but no later than September 15, 2008.

If you have further questions, please feel free to contact me.

I appreciate your consideration in participating in my PhD research.

Heather M. Brown

APPENDIX F

OIM - COMPLIANCE: ETHICAL, LEGAL, AND PROFESSIONAL CONDUCT TRANSCRIPT

LESSON ONE

PAGE ONE

Introduction via video by Dr. Rubenstein

The goal of all scholarly pursuits is to produce meaningful and reliable new information. A major benefit to understanding and complying with ethical, legal, and professional standards is that you will avoid making errors that could seriously compromise the validity and reliability of your scholarly endeavors. Furthermore, violating these standards can seriously harm your reputation and that of your colleagues, the institution, and your profession. While ODU has an infrastructure for tracking compliance, a great deal of responsibility for adhering to standards and regulations falls upon you.

My name is Adam Rubenstein and I am the Research Compliance Coordinator at Old Dominion University. I have been in academia for over 15 years, conducting research in infant development and as an administrator who teaches others about the various policies and regulations that guide our scholarly pursuits.

This module is divided into 3 sections: ethical, legal, and professional. The relationship of each of these principles or standards to research compliance will be discussed and you will be asked to listen to information related to research compliance, consider hypothetical situations, and apply this information to your own work.

These sections may also contain case studies or video clips presenting compliance issues for your consideration. At the end of the module, you will be presented with a short quiz testing your knowledge on the information just presented.

Links to additional information are provided at the end of the module that will allow you to more fully explore this topic if you care to do so.

It is important to remember that you have a responsibility to utilize these standards in your own work and teach them to your students and colleagues.

PAGE TWO

Why comply? There are many reasons which I have grouped into three categories, ethical, legal, & professional in order to make our task of understanding compliance much easier.

At the foundation of compliance is the desire to conduct our activities in ways that are responsible and ethical. From the time we are toddlers, we begin learning the difference between right and wrong. We are raised with the goal that we will make the right decisions later in life. However, there have been many instances of non-compliance as unethical decision making in our distant and not-so-distant past. Consider these other examples:

PAGE THREE

Ethical – Stanford Prison Experiment

Consider the following situation: A psychologist is interesting in studying group dynamics. Specifically, he wants to know how a group in power can maintain control over a subordinate group. To do this, he divides the participants into two groups and moves them into an isolated environment for the duration of the study. The group in power dictates when the subordinates sleep, eat, relax, exercise… no decision making ability is given to the subordinates. Control can be maintained through the use of verbal abuse, forced calisthenics, withholding food, and removal of comforts such as mattresses and blankets. When members of the subordinate group indicate they want to leave the study, the researcher tells them that they can only withdraw for medical reasons and must stay in their role.

Doesn't sound very ethical, does it? Yet this is a study that actually happened. In 1970, the study known as the Stanford Prison Experiment took place. Twenty college students were

recruited to participate in a study of guard/prisoner dynamics. Half of the participants were randomly selected to be prisoners and the remainder were guards.

The prisoners were "arrested" at their homes, booked at the local police station, and brought to their prison in the basement of the Psychology building at Stanford University. The situation quickly deteriorated as the prisoners were subjected to abusive conditions and led to believe that they could not withdraw from the study. The principal investigator lost his objectivity in the study as he took on the role of prison warden.

The study was stopped after 5 days, well short of the initially planned 2 weeks. Although approval for this study was granted by an ethics committee it demonstrates that ethical lapses can still occur in research.

PAGE FOUR

Ethical - Tuskegee syphilis experiment

This study was initiated by the US Public Health Service and studied the natural history of syphilis by denying treatment to the poor Black sharecroppers who were enrolled in the study. From 1932-1972 African American males were denied treatment for syphilis, even after the effectiveness of Penicillin as a treatment was established.

Officials conducting the study told these men that they were being treated when in reality they did not receive any medical intervention for their disease. When this gross violation of decent and ethical behavior was discovered, public outcry was fierce which led to the adoption of a set of federal standards for conducting human subjects' research.

PAGE FIVE

Ethical - Enron

Until 2001, the Enron Corporation was a leader among American industry. With ties to electricity, natural gas, communications, and other business areas, Enron possessed a substantial economic influence within the United States. That changed in 2001 when it was revealed that the Enron economic success was a creation of fraudulent accounting practices. Driven by the desire

to grow and reap profits for themselves and their shareholders, Enron executives misrepresented their assets and minimized their debts. The result was a major economic downturn for everyone involved with Enron, the folding of Arthur Andersen Consulting, and indirect effects on the American economy. This scandal and others like it have led to a call for greater self-monitoring and teaching better ethical decision making not only in business schools but in all disciplines.

PAGE SIX

Ethical - Plagiarism

Two high-profile cases of plagiarism by nationally acclaimed historians came to the public's attention in 2002. Charges of plagiarism were leveled against historians Doris Kearns Goodwin and Stephen Ambrose (in unrelated cases). Both cases revealed the use of passages from previously published works of other authors.

While both authors claimed that the plagiarism was unintentional, professional organizations such as the Modern Language Association emphasize that authors are responsible for ensuring that proper credit is given to others whose published ideas and statements are being used. Failure to do so is cheating others of the recognition they properly deserve.

Ignorance is not an excuse and professionals must hold themselves accountable. Although plagiarism is an issue that has been addressed for many years, high-profile cases such as these often inspire institutions to more explicitly teach ethical standards in research and writing as well as increase their enforcement efforts.

A quote from George Santayana is very relevant here: "Those who cannot remember the past are condemned to repeat it." We need to remember past lapses in ethical decision making and realize that these lapses, along with other factors, motivate us to develop compliant research and professional programs.

PAGE SEVEN

Ethical – One Final Point

Our ethical standards determine how we react to examples such as those just outlined. Our sense of what is right mandates that we take steps to correct errors and prevent them from happening again. What is very telling about our ethical standards is that we are constantly trying to improve upon the decisions we have made. The standards and regulations that guide our research endeavors are under constant review.

For example, the first consent documents were developed around 1900 followed by some of the first human subjects guidelines being developed in the 1940's. While aspects of these guidelines still exist in today's regulations, we have current standards that are much more rigorous than the original. This applies to work with human subjects, animal subjects, biosafety, historical research, and plagiarism just to name a few areas.

Rapidly changing technology and scientific advances in areas like stem cell research and recombinant DNA, and the explosive growth of the internet and data sharing require us to make even more difficult ethical decisions.

One final issue should be raised in this section on ethics and compliance: how to determine what type of research should be allowed. While we cannot attempt to answer that question here, it is worth noting that many research areas exist that are subject to controversy. Research with vulnerable populations, work with stem cells, cloning, and many other areas have proponents and opponents. Our ethical standards guide our views of whether or not such work should be allowed and, if it is allowed, how it should be regulated to ensure that compliance occurs.

EIQ - Why is it important that we have compliance standards in place?

(Feedback: When you were thinking through your response, did you base your answer on an experience you may have had, or witnessed? If not, try and think about a situation in which it was important to have ethical standards in place, either a personal experience or one perhaps you read about.) (LO1)

SUM - In your own words, summarize the content found in this Lesson - topic, Ethical and Compliance Introduction.

(Feedback: An example of a correct response to this exercise would be to include some of the following key ideas/concepts such as (a) Foundation of compliance is desire to conduct activities in responsible, ethical ways, (b) examples of non-compliance- Stanford Prison Experiment, Tuskegee Syphilis Experiment, Enron, and The Plagiarism Cases (you should discuss major aspects of each briefly in your summary), and (c) remember these past cases in order not to repeat non-compliance. If your summary did not include any of the above information, it is strongly suggested you review the content for better understanding.)

LESSON TWO – Legal Aspects of Compliance

PAGE ONE

Legal Oversight of Research

The Stanford Prison Experiment example demonstrates that the policies we have in place are not always sufficient. Although the project was approved by an ethics board, it is clear in hindsight that the regulatory standards were insufficient and that ongoing compliance monitoring could have prevented this explosive situation. Ethical lapses in scholarly activities inevitably lead to the modification of the legal principles that guide our work.

Legal oversight of research comes from federal regulations, state regulations, local regulations, and university policies & procedures.

Everyone has something to say about what can and cannot be done as well as the legal consequences of non-compliance. Furthermore, the constantly changing nature of scholarly activities leads to adaptation and change in regulatory guidelines. The legal aspects of compliance can be difficult to navigate, but they are essential to follow if we are going to avoid the ethical dilemmas that we've seen in the past.

PAGE TWO

Legal Oversight Here at ODU

To give you an idea of the legal structure behind compliance, let's look at the type of oversight conducted at ODU. Four major research protocol review committees exist at ODU:

- the Institutional Review Board (IRB) that oversees human subjects research
- the Institutional Animal Care and Use Committee (IACUC) that oversees animal research and teaching protocols
- the Radiation Safety Committee (RSC) that oversees research involving radioactive materials and radiation-producing machines
- the Institutional Biosafety Committee (IBC) that oversees research with recombinant DNA and biohazards

Each of these committees is mandated by federal and state regulations. They are required to be knowledgeable of the relevant legal guidelines so that they can make informed decisions about the scholarly work they review. These committees all have the power to approve research, require changes to research protocols, disapprove research, and stop existing research. Each committee is a gatekeeper – ensuring that only properly designed research is conducted at ODU.

In addition to the formal committees, offices at ODU such as the Office of Research and Environmental Health & Safety are tasked with monitoring other types of work for compliance. These include work with hazardous equipment such as high voltage machines and lasers, projects involving toxic chemicals, and the use of controlled substances. Training requirements are set by these offices so that researchers are informed about the compliance issues relevant to their work. Non-compliance with these guidelines can not only have legal ramifications, but lead to serious safety issues as well.

PAGE THREE

Office of Research at ODU

The Office of Research at ODU can assist you in adhering to these legal guidelines. In fact, many of the federal agencies that regulate compliance in scholarly activity require that an

uninvolved third party assist with certain decision making processes. To that end, there are certain questions that you should ask yourself when developing and conducting your projects. You can turn to the Office of Research for guidance when answering those questions.

- Am I conducting "research"? – Not all scholarly activity needs to be reviewed by the protocol review committees. This is a relatively straightforward question to answer if your project only involves library research. It can be more difficult if it involves interaction with human subjects. When in doubt, the Office of Research can let you know if your project requires review.
- Is my project ethical? – There are many resources to turn to when attempting to answer this question. The Research Compliance Coordinator in the Office of Research is one. Your colleagues in your department are another. It is always a good idea to let a fresh eye look over a proposal to potentially catch a problem that you may have missed. That way, potential problems can be caught before they impact your work.
- Is my project "exempt"? – Some projects are innocuous in nature. As such, they only require an initial review and then are exempt from continuing oversight. While you as an investigator cannot self-classify your project, you should be able to determine if your project will classify as exempt and then submit your proposal to the appropriate committee with this in mind. Both the IRB and the IBC can classify projects as exempt.
- What happens after my project is approved? – In the case of exempt projects, no further interaction with the review committee is necessary unless you change the nature of your project. For all other projects, the committees will only give approval for up to one year and then will require a resubmission of the proposal for continuation. At the end of your project, you will be required to notify the Office of Research so that they know your protocol is no longer active.

PAGE FOUR

Legal Compliance

Legal compliance goes beyond the guidelines set forth for the review mechanisms in place at ODU. We have policies and procedures that impact how we act as members of an academic community. The Office of Research Integrity (ORI) defines three areas of non-compliance that are worth noting.

- Fabrication – making up data or results and recording or reporting them.
- Falsification – manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
- Plagiarism – the inappropriate use of another person's ideas, processes, results, or words without giving proper credit

While the ORI understands that honest error can occur in scholarly activities, the penalties for intentional non-compliance can be severe. These include consequences for the individual researcher as well as consequences for the university tasked with oversight of scholarly work. Take for example the recent case of Eric Poehlman.

Eric Poehlman has the dubious distinction of being the first researcher sentenced to prison on legal charges of falsifying and fabricating research data. A respected scientist in obesity, menopause, and aging, Poehlman was the recipient of numerous grants from National Institute of Health and the author of many publications. His career came to a halt when charges of data fabrication and falsification were made. Poehlman's actions defrauded the government of millions of dollars and led numerous researchers to build their research upon a faulty foundation. The ethical decisions we make do not just impact ourselves. Often, they can have a wide-reaching impact.

EIQ - Why does the University need various administrative units which oversee ethical, legal, and professional compliance? (Feedback: When you were thinking through your response, did you base it on a personal experience with on of the administrative units such as the

research protocol review committee? If not, think about a situation either you or a colleague may have had in which you encountered one of the administrative units overseeing compliance.)(LO5)

SUM - In your own words, summarize Lesson Two. (Feedback: An example of a correct response to this exercise would be to include some of the following key ideas/concepts such as (a) definitions of fabrication, falsification, and plagiarism, and their affect on compliance standards & research (b) the questions which need to be asked and answered before fully conducting research, (c) describe the four main research protocol committees here at ODU and each one's purpose. If your summary did not include any of these key concepts/ideas, please review this lesson for a better understanding of the information.)

LESSON THREE – Professional Aspects of Compliance

Page One

Monitoring Our Own Actions

Going beyond the ethical standards and legal structures that guide our behaviors, we also have a professional responsibility to adhere to the highest level of integrity. Compliance is not just about following the rules that are set before us. Self-monitoring and holding ourselves to a higher standard are the marks of a good scholar.

With a career in academia comes the notion of "academic freedom." We are free to study and work on the issues we consider to be important. With this freedom comes the responsibility of monitoring our own actions. When the system we have is abused, the consequences can be wide-reaching.

Consider the Stanford Prison Experiment. Was the reputation of psychology as a discipline damaged by this research project?

- How many universities became overly conservative in their project approvals to avoid this type of disaster?
- Did volunteers become wary of participating in studies because of potential risk?

Non-compliant work can damage the reputation of an entire profession as well as the individual and the institution.

EIQ - Why should we be aware of issues involving non-compliance such as fabrication, falsification, and plagiarism when conducting research? (Feedback: When you were thinking through your response, did you base it on a personal or colleague's experience with either fabrication, falsification, and/or plagiarism? If not, think about a situation either you or a colleague may have had in which you one of these non-compliance issues.) (LO4)

PAGE TWO

Codes of Conduct

To protect professional fields from poorly conducted work, professional codes of conduct have been developed.

Professional codes of ethics and standards of conduct exist for a wide variety of professionals, including engineers, accountants, physicians, lawyers, teachers, law enforcement agents, marketing researchers, veterinarians, cosmetologists, historians, sociologists, librarians, athletic trainers and coaches, social workers, food handlers, auto mechanics and dealers, and dentists.

These codes of conduct grew out of the professions' need to provide guidance to its members in dealing with the frequent conflicts of interests and complex ethical decisions that take place in their daily work environment. These codes and standards reflect a sense of ethical responsibility inherent in the special knowledge and skills of the profession as well as the responsibility to the trust placed in them by those they serve.

Hence, professional standards and codes address both the obligations and privileges of the profession. As you probably have come to realize, ethics and professional codes have many values and goals in common. However, articulating the "right thing to do" in many real life situations is not so simple. It is often difficult to strictly enforce professional codes while at the same time allowing an individual to exercise personal freedom.

For example, a nurse refusing to follow a court order to disconnect life support to a terminally ill patient because of his personal belief in preserving life at all costs. Many individuals find themselves in work environments that have multiple professional codes.

For example, a university professor of psychology may find herself trying to comply with codes established by the American Psychological Association, the University who employs her, the agency that funds her research and those established by the State or Federal governments.

EIQ - Why should professional codes of conduct be put into place? (Feedback: When you were thinking through your response, did you base it on a personal or colleague's experience dealing with professional codes of conduct? If not, think about a time where you encountered a set of professional codes of conduct.) (LO2)

PAGE THREE

Professional Guidance

Professional guidance can be found within every discipline. For example, the American Historical Association (AHA) provides information on standards of professional conduct, plagiarism, discrimination, and diversity among many other issues that impact one's professional life. Additionally, the AHA has a Professional Division that helps members "in navigating the professional opportunities, challenges, and dilemmas they encounter in their work" and in addressing ethical issues.

Similarly, the National Society of Professional Engineers (NSPE) maintains information on a Code of Ethics, sponsors an annual Ethics Contest, and has Legal Fund to address regulations and legal issues that impact its membership. Assisting in professional development and conduct is at the forefront of professional societies' goals.

- Is it possible that we may have too many professional codes?
- Could we come up with a universal code for conducting scholarly/research activities or would it become just one more set of standards to somehow juggle?

These are not easy questions to answer. In the end, you and I have to make a decision about the values which will determine our behaviors.

PAGE FOUR

Professional Responsibility

Regardless of the code being followed, researchers have the professional responsibility to run "clean" programs. Designing ethical studies, checking sources to avoid plagiarism, teaching proper ethics: these all have their place in an ethical academic program. We and our colleagues agree upon the correct way to conduct ourselves in our fields. Following these codes allows us and others to have faith in the work produced within our disciplines.

This concept of professional responsibility is an important one. Non-compliance can lead to many negative consequences for a field. Take the following examples:

- Reputation of the field – The public perception of a field can impact the funding it receives and the prestige it holds in the academic community. When that perception is diminished, many can suffer. Consider instances of sloppy research or academic fraud. Unreplicable findings in cold fusion led to general distrust of the topic area. Instances of plagiarism in history led to questions of the integrity of other works. The recent academic fraud in the biomedical sciences by Poehlman leads many to question how many other researchers have conducted the same fraud.
- Poor data – Scholarly activity often builds upon the work of others. We research what has been done previously and endeavor to take the work in new directions. Therefore, we possess the assumption that we can trust the data in the extant literature. But what happens when that data is called into question? We can no longer make generalizable conclusions from a body of literature. Inaccurate findings leads others to base their work on faulty assumptions. A snowball effect can occur where research lines are built upon shaky foundations.

- Lost time – As a result of the previous two points, much valuable time can be wasted. Needing to rebuild a reputation or needing to sift through questionable data can set academic progress back month or years.

The understanding exists that we have the professional responsibility to avoid the problems outlined above. For example, the journal *Science* recently announced new policies for combating fraud. But this is a fairly reactive approach. What can we do as professionals to be proactive and enhance research compliance?

An important part of compliance originates in the models we set forth in the academic environment. Specifically, we can look at how professors are responsible to teach their students and how students are obligated to learn the standards of their disciplines.

Experienced scholars need to be role models. They should work side by side with their mentees to model the behaviors the students should be learning. At the same time, inexperienced researchers need to take the time to learn careful research practices. Students should ask questions about why research is structured a certain way and why certain procedures must be followed. Be curious!

EIQ - Why is it important for us to adhere to the concept of professional responsibility when conducting research? (Feedback: When you were thinking through your response, did you base it on a personal or colleague's experience when conduction research? If not, think about a situation either you or a colleague may have had in which professional responsibility was of the utmost importance in conducting research.) (LO4)

SUM - In your own words, summarize Lesson Three. (Feedback: An example of a correct response to this exercise would be to include some of the following key ideas/concepts such as (a) why we have a professional responsibility to adhere to a high level of integrity, (b) definition of professional codes of conduct and the reason behind them, (c) discuss why it's difficult to articulate the right thing to do in a professional situation, and (d) why non-compliance has negative consequences and some examples of non-compliance. If your summary did not include

any of the above information, it is strongly suggested you review the content for better understanding.)

LESSON FOUR –Conclusion – Compliance: Ethical, Legal, and Professional

PAGE ONE – Conclusion

(video)

Understanding everything that goes into research compliance can be an overwhelming task. Hopefully, the complexity of this area is obvious by now. Remember that you are not on your own. A number of resources are available at ODU to help you along.

Each of the review committees mentioned earlier (IRB, IACUC, RSC, IBC) have committee chairs that are knowledgeable in their fields. They can answer questions regarding regulatory oversight and good research design. Additionally, the Research Compliance Coordinator is available to help you. Questions regarding risk in research often merit an outside opinion. Use the resources available to you to ensure that your work meets the standards required in an active, dynamic academic environment.

APPENDIX G

THE COMPLIANCE MODULE

Learning Objective One

The learner will be able to identify the purpose of compliance standards.

Noun: the purpose of compliance standards **Verb:** identify

The Knowledge Dimension	The Cognitive Dimension					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	(A1)					
Conceptual Knowledge		(A2,3, 4)				
Procedural Knowledge						
Metacognitive Knowledge						

Assessment 1: Compliance standards mandate that we:

e. determine if a new research area is ethically permitted.
f. prohibit risk-prone research.
g. apply ethical principles to the review of scholarly activity.
h. hold researchers using living subjects (human and animal) to a higher ethical standard than other scholarly activity.

Assessment 2: Examples like the Stanford Prison Experiment demonstrate that compliance lapses can occur even when policies are in place to prevent them. This demonstrates that:

e. better structures are necessary for enforcing compliance standards
f. compliance standards should be reviewed and revised regularly and, if necessary, modified
g. greater emphasis on compliance training should be included in graduate programs
h. review of research protocols needs to be more rigid

Assessment 3: Which of the following statements is MOST TRUE:

a. Compliance standards are a result of scholars wanting to ensure that their work is held to a high standard
b. Compliance standards pertain only to the biomedical sciences
e. Faculty and administrators are mostly and sometimes solely responsible for compliance with professional standards
f. None of these statements are true.

Assessment 4: Many ethical standards that govern scholarly activity are based upon:

e. correcting lapses found in previously conducted research.
f. refinements of previously used ethical standards.
g. popular opinion regarding what is ethical research.

h. all of the above

Learning Objective Two

Distinguish between ethical, legal, and professional compliance standards.

Noun: between ethical, legal, and professional compliance standards. **Verb:** distinguish

The Knowledge Dimension	The Cognitive Dimension					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	(A7,8)					
Conceptual Knowledge		(A5,6)				
Procedural Knowledge						
Metacognitive Knowledge						

Assessment 5: If findings based upon research misconduct are published, other researchers can design projects based upon faulty assumptions. With this result in mind, what type of compliance standard should prevent a researcher from committing this type of transgression?

e. ethical
f. legal
g. professional
h. personal

Assessment 6: Concerning Professional codes of ethics and standards, which of the following is not true:

a. they address both the obligations and privileges of the profession
b. work environments may involve multiple professional codes
c. they make determining the "right thing to do" straightforward and uncomplicated
d. virtually all professions have established some set of standards and a code of ethics for their members.

Assessment 7: Professional codes of conduct are essential to a compliant program of scholarly activity because:

e. they place federal guidelines in an easier to understand format for specific disciplines
f. they supersede the federal, state, and local guidelines for discipline specific activities
g. they inform protocol review committees on discipline specific standards
h. they provide guidance to professionals on ethical decisions related to their fields

***Assessment 8:** The legal oversight of research comes from:

f. federal regulations
g. state regulations
h. local regulations
i. university policies and procedures

j. all of the above

Learning Objective Three

The learner will identify non-compliance risks in given scenarios.

Noun: non-compliance is a potential risk **Verb:** identify

The Knowledge Dimension	The Cognitive Dimension					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge						
Conceptual Knowledge	(LO1, LO2)	(A9)	(A10)			
Procedural Knowledge						
Metacognitive Knowledge						

Assessment 9: While entering data into a spreadsheet, Dr. Smith misreads the column headings and transposes his data. He fails to check for this type of error later in his analysis and as a result publishes a study based upon incorrect information. This is an example of:

e. fabrication
f. falsification
g. excusable error
h. none of the above

***Assessment 10:** Jim is a graduate student in criminology and is interested in determining if substance abuse, child abuse and other forms of abuse are predictive of criminal activity and if this effect is greater in men than women. He proposes to send a survey via email to undergraduate and graduate students at the university in which they would answer questions regarding their history of abuse and criminal activity. He has missed the deadline for submitting his protocol for IRB approval and will have to wait another three months before the protocol can be reviewed and approved. Jim is certain there are no problems so he distributes the survey and gathers the data, in the expectation that IRB approval will be granted before defending his dissertation. What consequences/risks if any, does Jim face because he did not get IRB approval before starting his study?

e. Disciplinary action and possible expulsion.
f. He's fine since he sees no problem with his study, afterall he believes he's not harming anyone.
g. The IRB can stop his study and prevent him from obtaining any results.
h. Both a & c

Learning Objective Four

The learner will be able to understand the negative consequences of non-compliance.

Noun: the negative impacts of non-compliance **Verb:** Understand

The Knowledge Dimension	The Cognitive Dimension					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge						
Conceptual Knowledge	(LO2, 3)		X (A11,12,13)			
Procedural Knowledge						
Metacognitive Knowledge						

Assessment 11: An act of non-compliance may go undiscovered. Even so, some consequences may arise from the action. These consequences may include:

e. loss of individual reputation in a particular field
f. doubt surrounding the findings from an entire discipline
g. loss of generalizable findings from research that is based upon the non-compliant work
h. the development of more rigid compliance standards

Assessment 12: Among the serious and negative effects of failing to comply with ethical, professional and legal standards, are:

a. Loss of personal and professional credibility and reputation
b. Unnecessarily endangering the health or well-being of others
c. Loss of time, money and effort pursuing ideas and projects based on faulty or d. misleading information
e. All of the above

Assessment 13: One of the main points to be learned from the Stanford Prison Experiment case was:

a. Don't conduct studies using prisoners
b. Use only professional actors rather than research scientist as confederates
c. Policies and an institutional review board are not always sufficient to prevent serious violations of legal and professional standards
d. Carefully evaluate the number of subjects needed to properly test your hypothesis.

Learning Objective Five

The learner will be able to recognize the different purposes of the various administrative units responsible for overseeing ethical, legal, and professional compliance.

Noun: purpose of various administrative units responsible for overseeing compliance

Verb: recognize

The Knowledge Dimension	The Cognitive Dimension					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	X (A14,15,16, 17, 18)					

Conceptual Knowledge						
Procedural Knowledge						
Metacognitive Knowledge						

Assessment 14: The Office of Research at ODU can assist you in all of the following except:

e. ensuring your project adheres to ethical guidelines.
f. educating you to classify your own work as exempt.
g. determining if your project requires regulatory oversight.
h. determining if your project requires continuing review.

Assessment 15: Scholarly activity at ODU that requires regulatory oversight can be approved by:

e. a protocol review committee
f. the Office of Research
g. the President or Provost
h. any of the above

Assessment 16: The ODU committee responsible for preventing human subjects from inappropriate or harmful research is:

a. IACUC
b. RSC
c. IRB
d. IBC

Assessment 17: The Office of Research Integrity investigates and punishes both individuals and institutions found to have intentionally committed which of the following:

a. Fabrication
b. Sexual Abuse
c. Coercion
d. Discrimination

Assessment 18: If you wanted or needed training and/or advice pertaining to conducting scholarly-research activities, which of these individuals should you contact:

a. Director of Student Affairs
b. Compliance Officer
c. Departmental academic advisor/mentor
d. b&c

* = Written by the reseacher.

APPENDIX H

DEMOGRAPHIC QUESTIONNAIRE

Hello and Welcome!

Thank you for volunteering to participate in my dissertation research study.

This is a demographic survey and should only take you a few minutes to complete.

You must complete this survey in order to begin the module presentation.

Once you have finished, please hit submit and close the window. You will still be connected to Blackboard.

If you encounter a problem, feel free to contact me at hmbrown@odu.edu, Thank you!

Heather M. Brown
Doctoral Candidate in Instructional Design and Technology

1. Please choose ONE of the following:

{Choose one}

( ) Female
( ) Male

2. How old are you?

APPENDIX I

GLOSSARY OF TERMS

Active Learning – learners are actively engaged in cognitive processes such as analysis, synthesis, and evaluation instead of just receiving knowledge.

Blackboard Course Management Systems (CMC) – an online environment which supports teaching and learning.

Comprehension – the definition of comprehension for this study is the end result of a post assessment taken when the participant completed the online instruction module.

Elaborative Interrogation Questioning (EIQ) – Term coined by Pressley et al. (1987) is a learning strategy intended for learners to construct associations between what they already know and the new information presented.

Generative Learning – the more one makes associations with new information, the more significant and meaningful the information becomes (Jonassen, 1982). In this study, the use of the elaborative interrogation questioning strategy and summarization strategy are forms of a generative strategy.

Learner-Control - learner's ability to 'control the path, pace, and/or contingencies of instruction' (Hannafin, 1984).

Learning Strategy – is an aid to learning and is something the learner does at the time of learning information (e.g. rehearse, underline, mnemonics, reread)

Meaningful Learning – When presented with new information, learners interpret the new knowledge based on PK, and then integrate the old and new information (Mayer, 1996).

Online Instruction Module (OIM) – a short, under an hour, self-paced online unit of instruction.

QM™ - Quality Matters – a term developed by MarylandOnline, Inc., is a "faculty centered – peer review process designed to certify the quality of online courses and online components." (Qualitymatters.org, 2009).

Satisfaction - Satisfaction relates to perceptions of being able to achieve success and feelings about the achieved outcomes (Keller, 1983).

Summarization - a type of elaboration, generative learning strategy requiring learners to include or omit appropriate information in a concise manner from the text they have read.

APPENDIX J

RUBRIC

	No Key Words/Phrases (0 pts)	Key Words/Phrases (1 pt)
Question One	Did not answer the question/no key words/phrases found	conduct our activities in ways that are responsible and ethical, making ethical decisions, ethical standards, regulations that guide our research, human subject guidelines, vulnerable populations
Question Two	Did not answer the question/no key words/phrases found	policies may not be sufficient, insufficient regulatory standards, ethical lapses in scholarly activities, constant changing nature of scholarly activities, legal aspects, federal and/or state regulations, hazardous materials or equipment, controlled substances, safety issues, avoid fabrication, avoid falsification of data, avoid plagiarism
Question Five	Did not answer the question/no key words/phrases found	Self-monitoring is characteristic of a good scholar, responsible for monitoring our actions, provide guidance for professionals, help with complex ethical issues, provide guidance in conflict of interest issues, provide guidance regarding the special knowledge and skills inherent to scholarly behavior.
Question Six	Did not answer the question/no key words/phrases found	being sent to prison, being barred from working in your profession, non-compliant work can damage the reputation of an entire profession or institution, falsification of data can impact other studies who base their research on your findings
Question Seven	Did not answer the question/no key words/phrases found	

VITAE

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EDUCATION:

PhD in Instructional Design and Technology, May 2009 anticipated, Darden College of Education, Old Dominion University, Norfolk, Virginia.
Master of Arts in Education, May 1994, College Student Personnel Services, Virginia Tech, Blacksburg, Virginia.
Bachelor of Science, May 1990, Housing and Resource Management, Concentration: Consumer Affairs, Virginia Tech, Blacksburg, Virginia.

EXPERIENCE and SKILLS:

Instructional Designer - Graduate Assistant
Old Dominion University, Norfolk, VA., 2006 – present

- Design and develop online instruction for the University through Blackboard.
- Conduct research on content for online and classroom instruction.
- Consult and collaborate with subject matter experts regarding content.
- Conduct task and learner characteristic analysis.
- Create learning objectives and ensure alignment with content.
- Apply on a daily basis concepts, principles, and practices of learning theory, instructional technology, instructional theory and human performance.
- Develop assessments to meet learning objectives.
- Develop storyboards and narratives.
- Design and develop instructional strategies for online modules.
- Conduct formative, summative and continuous evaluations of online instruction and training.
- Analyze data and validate materials for use in reports.
- Make revisions to online content and training materials as necessary.
- Collaborate with graphic artists, programmers, and quality assurance personnel.

Computer Lab Manager - Graduate Assistant, Darden College of Education.
Old Dominion University, Norfolk, VA., 2005 – 2006

- Managed daily operations of computer labs.
- Assisted students with various technological assignments.
- Maintained and updated IBM-compatible computers.
- Developed and maintained the computer lab web site.
- Assisted faculty/students with SPSS (statistical) software, Microsoft Word Office, Internet, Adobe, Blackboard, Questionmark, and Inquisite survey software.

Grant Assistant, WHRO and Old Dominion University
Old Dominion University, Norfolk, VA., 2005 - 2006

- Evaluated online PBS Teacherline courses to ensure quality.
- Evaluated lesson plans for clarity and appropriate objectives and assessments.
- Designed and disseminated online surveys in Inquisite.
- Downloaded and interpreted all pre/post online survey data.
- Interviewed teachers having taken a PBS Teacherline course.

Director, Asynchronous Programs/Corporate Development for Distance Learning (Student Services)

Old Dominion University, Norfolk, VA. July 2001 to Jan. 2005

- Managed ODU's videostreaming and online programs (student services).
- Advised, developed, and coordinated with distant students.
- Coordinated and collaborated with Center for Learning.
- Liaison to Military installations and corporations such as Intel, Delphi, Knolls Atomic Power Lab, and Ford.
- Presented seminars to Military and corporations on ODU's Distance Education programs.
- Presented information sessions via satellite and videostreaming.
- Developed articulation agreements with Military and Virginia's Community College System and across the Nation.

PROFESSIONAL AFFILIATIONS:

- Society for Applied Learning Technology, 2008 – present.
- Association for Educational Communications Technology, 2007 – present.
- Eastern Educational Research Association, 2005 – present.
- National Academic Advising Association, 1994 – 2005.
- American College Personnel Association, 1992 – 1994.

PUBLICATIONS/PRESENTATIONS:

- Brown, H. M. (2007, April) Factors that Contribute to Student Satisfaction with an Alternative Teacher Certification Program. Poster Session: Annual Research Exposition at Old Dominion University.
- Brown, H. M. (2007, February). Factors that Contribute to Student Satisfaction with an Alternative Teacher Certification Program. Presented at the annual conference of the Eastern Educational Research Association, Clearwater Beach, Florida.
- Brown, H. M., Nickel, C., & Overbaugh, R. (2006, April) Student Characteristics in a University-level Foundations Course: An Examination of Orientation Toward Learning and the Role of Academic Community. Poster Session: Annual Research Exposition at Old Dominion University.
- Brown, H. M., Nickel, C., & Overbaugh, R. (2006, February) Student Characteristics in a University-level Foundations Course: An Examination of Orientation Toward Learning and the Role of Academic Community. Presented at the annual conference of the Eastern Educational Research Association, Hilton Head, SC.

CONTINUING EDUCATION:

Leadership and Management Development Certificate Program Track III, -March 2004, Division of Human Resources, Old Dominion University, Norfolk, Virginia.

Leadership and Management Development Certificate Program Track II, - December 1998, Division of Human Resources, Old Dominion University, Norfolk, Virginia.

Human Resource Management Certificate, - April 1998, Center for Global Business, Old Dominion University, Norfolk, Virginia.