5-2006

Model-Centered Instruction: A Design Research Study to Investigate an Alternative Approach to Patient Education

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MODEL-CENTERED INSTRUCTION: A DESIGN RESEARCH STUDY TO INVESTIGATE AN ALTERNATVE APPROACH TO PATIENT EDUCATION

by

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A dissertation submitted in partial fulfillment of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Instructional Technology

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2006

ABSTRACT

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While medical technology, intervention, and treatment continue to advance, patients often find themselves involved in an increasingly complex healthcare system. Because of this, many patients lack access to the knowledge to facilitate successful navigation or participation in healthcare systems to their best advantage. Patient education that provides experiential information has been shown to reduce anxiety levels and increase patient health outcomes and compliance with medical instructions or recommendations. Given the demonstrated effectiveness of experiential instruction in patient education, Model-Centered Instruction (MCI) has the potential to be an effective instructional design for patient education because it affords the learner experience with systems or models in the presence of instructional augmentation. While MCI design theory is well-documented, it has not been widely implemented and tested at the instructional product level.

education. This project combines both design study research in MCI and research into MCI and its application to patient education. The study utilized a quasi-experimental design and included 40 participants in a control group (N=20) and an experimental group (N=20). Survey instruments included a pre and post State-Trait Anxiety Inventory (STAI), a pre and post patient survey, a pre and post physical therapist survey, and an instruction survey that was administered to the experimental group after each instructional session.

Results indicated that participants in the experimental group that received the MCI were less anxious and more compliant than the participants in the control group that did not receive the MCI. The experimental groups did not differ in anxiety or compliance with regard to age or gender. The experimental group also felt more confident than the control group in talking to healthcare providers and asking friends and family for assistance. The experimental group participants were also more likely to complete their physical therapy sessions at the facility and at home. The significance of these findings for MCI design and its application to patient education is discussed.

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My interest in this research grew out of my work experience in instructional product design and production over the past decade. I often felt that our products, though based on research, were not effectively meeting the needs of the target audience. During my years of employment at an organization that produced training materials for families of children with special needs, I frequently thought that the instruction was not as effective as it could be in facilitating desired behavioral outcomes. During the course of my graduate study, my exposure to Model-Centered Instruction (MCI) theory illustrated the potential for utilizing a more effective way to design and produce instruction.

Similarly, my personal experience as a patient in the health care system led me to realize how inefficient much of the patient education is (where it exists at all) and to conclude "there has to be a better way." Thus I devoted my doctoral study and research to the fields of Instructional Technology, patient education, and patient health behaviors.

In 2003, I had the opportunity to participate in a clinical research study at a local hospital. This study was concerned with pain control in hospitalized, orthopedic surgery patients. While it was not related to MCI, it gave me an opportunity to conduct nearly 600 patient interviews over the course of a year. These interviews were conducted at preoperative, presurgical, and postsurgical intervals during the patients' hospital stay. While conducting the interviews, I was also able to informally discuss the surgical and hospital experience with the patients and ask about their feelings regarding the instruction they had received with regard to their healthcare in this specific situation. Most of these patients informed me that they had received little patient education about the procedure and no patient education about experiences that they might have during this time. They also expressed much anxiety and uncertainty. In designing the MCI and clinical study for this project, this original hospital clinical research study experience provided me a window into an instructional need and MCI provided a proposed solution and a basis for research.

I hope that this research will bring forth and highlight some of the future research issues of MCI in the field of Instructional Technology.

CHAPTER I

INTRODUCTION

Background

The medical system is in dire need of effective patient education. "We need to put the patients at the center of the health-care universe. While there may have been lip service to that in the past, we really need to design how we provide service around patients, around patients' needs," said Kenneth Kizer, president of the nonprofit National Quality Forum that deals with health-care measures (McQueen, 2001) Patient responsibility for personal health is the ultimate goal of patient education. "Teaching patients what they want to know is a clear way to improve chances that they actually will learn and change behaviors" (Fox, 1998, p. 3).

While medical technology, intervention, and treatment continue to advance, many patients find themselves increasingly involved in a health care system for which they have had no training to successfully navigate or participate in to their best advantage. In order to be successful in this system, patients need skills and knowledge that enable them to be a partner and participant in their own health care (Ornstein, 2001). Partnership and participation in the health care system fosters compliance by patients, that is, following health care advice and instruction, thus facilitating patient recovery (Koop, 1996).

Patient education programs have been shown to support the overall welfare of the patient in terms of reduction of anxiety levels and an increase in patient compliance with medical instructions or recommendations (Devine & Cook, 1986; Lin, Lin, & Lin; 1997;

Wong & Wong, 1985). These patient behaviors relate to *self-efficacy issues* and *patient locus of control*, two of the personal factors pertaining to good health behavior (Bandura, 1986). These factors pertain to an individual's sense that they know what is happening and what to expect, have some control over the situation, and can influence the outcome of a given situation. In health care literature, this kind of knowledge has been described as *sensory information* (Suls & Wan, 1989) (i.e., information about what might happen, what feelings or sensations a patient might experience, or whom they might interact with).

The benefits of this sensory information for patients were described by Hartfield, Cason, and Cason (1981): "accurately described sensations reduced the discrepancies between expected and experienced sensations and reduced emotional responses" (p. 203). The value of authentic experience instruction was also described by Kolodner (1997), "Modern educational theory stemming from research in the cognitive sciences indicates that knowledge gained through activity that is motivating and authentic is learned more deeply and is more usable than is knowledge gained through memorization, prescriptive activities, or word problems" (p. 57). However, these products typically fail to provide either success and failure models of rehabilitation or experiential sensory information to the patient about the healing process (Moline, 2000).

The benefit of the presentation of sensory information has specifically been shown to positively affect patient anxiety levels and patient compliance rates.

As Ridgeway and Mathews (1982) stated,

> The most common type of preparation involves giving the patient detailed information about the surgical procedure and its effects. Alternatively, patients may be informed about actual sensations they are

> likely to experience, such as sleepiness, ... and so on. A certain amount of information about procedures is necessary to place the expected sensations in context. Also, a certain degree or reassurance is usually passed along in describing such sensations as normal. When sensation information has been compared with procedural information, the former was found to be more effective and it was suggested that congruency between expected and experienced sensations results in a lower emotional response. (p. 271)

Authentic scenario instruction is gaining widespread interest among educators. "Increasingly, theorists and educators are promoting reality-centered projects, theme-based learning, and other kinds of activities situated in real-life and life-like contexts as ways to engage students in meaningful learning" (Lebow & Wager, 1994, p.382). While much research has been done in public school settings with scenario and case-based instruction, this methodology has not been implemented and tested with patient education in the health care system.

According to Gibbons (2001), "The central premise of MCI is that the most effective and efficient instruction takes place through *experiencing* real systems or models in the presence of instructional augmentation designed to facilitate learning from the experience" (p.512).

Experience using these models is focused through carefully selected and sequenced problems. The learner can either solve these problems or observe them being solved. The MCI provides the opportunity to experience (a) interactions with issues concerning patient compliance, (b) examine success and failure aspects of the physical therapy process, and (c) learn what to realistically expect during recovery.

These activities build knowledge and self-efficacy skills in the patient and encourage patient compliance and positive interaction with the health care system by building patient confidence and reducing patient anxiety (Ridgeway & Mathews, 1982).

Statement of the Problem

Traditional approaches to patient education emphasize the use of static diagrams, text handouts or brochures, or fact sheets. However, these products typically fail to provide either success and failure models of rehabilitation or experiential sensory information to the patient about the healing process (Moline, 2000). MCI holds great potential for addressing patient education needs. However, while MCI design theory is well-developed, there is a lack of MCI products that have been designed, produced, and evaluated using a content base. Thus, experimental testing of MCI design theory is called for. Given this great patient education need, and the need to test the MCI product in context, the research of this MCI product will be developed using the content area of patient education.

The Purpose of this Study

Model-Centered Instruction (MCI) (Gibbons, 2001), by the nature of its design, holds the potential for addressing the inadequacies of traditional patient education. While MCI design theory is well-documented, it is not well implemented and tested at the instructional product level. Designing, producing, and evaluating an MCI product that adheres strictly to MCI design principles is one of the primary research endeavors of this project. Therefore, this research study proposes to investigate (a) the design, production, and evaluation of an MCI product that adheres to established MCI design theory and (b) the instructional efficacy of a Model-Centered Instruction (MCI)-based patient education module. The investigator will compare an MCI-based education product with traditional patient education in terms of the effects on cognitive and behavioral aspects of health behavior with patients recovering from orthopedic surgery. In this study MCI will be used to provide the patient with an opportunity to (a) experience interactions with issues concerning patient compliance, (b) examine success and failure aspects of the physical therapy process, and (c) learn what to realistically expect during recovery. These activities help the patient to build knowledge and self-efficacy skills and encourage patient compliance and positive interaction with the health care system by building patient confidence and reducing patient anxiety (Ridgeway & Mathews, 1982).

Research Questions

This project combines both design study research in MCI and research into MCI and its application to patient education. Specifically, with regard to patient education, anxiety and patient compliance are known to be associated with patient recovery. The instructional goal was to give the learner exposure to interacting with dynamic models of environmental, social, and physical/medical aspects of rehabilitation treatment. The following research questions guided this study:

1. Gibbons and his colleagues, in numerous articles, book, and presentations, have proposed a theory of MCI and prescriptions for designing MCI. The first research question examines the use of these theoretical principles and prescriptions for capturing and demonstrating the design process of an MCI product. The goal was

to design, produce, and evaluate a product developed using established guidelines for MCI design.

2. Is there a difference in anxiety levels of orthopedic surgery patients who get MCI and those who get traditional patient education as measured by pre-post gain scores on the State-Trait Anxiety Index (STAI-S)?
3. For the experimental group, is there a difference in anxiety levels between male/female orthopedic surgery patients as measured by pre-post gain scores on the STAI-S?
4. For the experimental group, is there a difference in anxiety levels of orthopedic surgery patients as measured by pre-post gain scores on the STAI-S among participants aged 18-39, 40-49, and 50-69?
5. Is there a difference in compliance levels of orthopedic surgery patients who get MCI and those who get traditional patient education as measured by pre-post gain scores on the physical therapist survey?
6. For the experimental group, is there a difference in compliance levels between male/female orthopedic surgery patients as measured by pre-post gain scores on the physical therapist survey?
7. For the experimental group, is there a difference in compliance levels of orthopedic surgery patients as measured by pre-post gain scores on the physical therapist survey among participants aged 18-39, 40-49, and 50-69?

Outline of the Study

Chapter II presents the conceptual and theoretical framework on which the analysis will be based. MCI design theory will be reviewed, followed by an examination of health-behavior theory that is pertinent to this study. The chapter concludes with a discussion of the relationship between MCI and experiential patient education.

Chapter III outlines the methods used for the study. In this summary, MCI design procedures are discussed. In addition, data collection techniques, the study sample and its characteristics, measures used in the analysis, and a description of the chosen procedures of statistical analysis are discussed.

Chapter IV outlines the results of the MCI design analysis and the data analysis, including a summary of the findings for the statistical analyses. Lastly, Chapter V closes with a discussion of the study findings and conclusions. Implications for future research are discussed.

For purposes of clarity, each chapter in this document has a Part A (addresses Model-Centered Instruction (MCI) design study research) and a Part B (addresses MCI and its application to patient education.) Part A is written with a Times New Roman font and Part B is written with an Arial font throughout the document.

CHAPTER II

REVIEW OF LITERATURE

Chapter Introduction

This chapter outlines the theoretical and conceptual framework of the study. An overview of the existing literature on MCI design theory is presented first. Next, a discussion of health behavior literature is presented. Attention is then turned to existing literature on the key concepts used in the analysis including the Health Belief Model, Social Cognitive Theory, and the Transtheoretical Stages of Change Model.

Throughout the patient-education literature, the need has been demonstrated for a new paradigm of instruction. Model-centered instruction, the primary focus of this study, is proposed as a theory of instruction for developing a new generation of patient education. In order to understand the issues in health-behavior and patient education, the researcher also focused on this body of literature in an equally comprehensive manner. This chapter focuses on (a) model-centered instruction and (b) health-behavior theories. The nature of the literature reviewed for model-centered instruction is primarily theoretical while the literature reviewed for health-behavior is primarily analytical.

Part A: Model-Centered Instruction

Model-Centered Instruction Literature Characteristics and Search Procedures

This review of literature contains many works authored or coauthored by Professor Andrew Gibbons, the developer of the theory of model-centered instruction. The majority of these works was written beginning in the late 1990's to the present and were published as book chapters, academic journal articles, and technical reports for business or government organizations, although there are several unpublished works also included in the literature review. Several of the works in this literature review were obtained from Gibbon's course reserves between 1998 and 2004. The remainder of the articles in this literature review was located by electronic searches of ERIC and Google searches on the Internet. Keyword search terms included: modeling, instructional modeling, instructional simulation design, instructional design, instructional design theory, and simulation design.

Basic Description of Model-Centered Instruction

Gibbons (2001) developed MCI on the basis of cognitive science and the learner's experience with the model as the center of the instructional design. He outlined several theories of instruction that influenced MCI including: (a) Progressions of Mental Models (White & Frederiksen, 1990), (b) Goal-Based Scenarios (Schank, 1992), (c) Anchored Instruction (Bransford, J., Sherwood, R.D., Hasselbring, T.S., Kinzer, C.K., & Williams, S.M., 1990), (d) Problem-Based Learning (Barrows, 1988, 2000), (e) Situated Learning

(Lave & Wenger, 1991), and (f) Cognitive Apprenticeship (Collins, Brown, & Newman, 1989).

Model-centered instruction (Gibbons, 2001) is a general theory of instructional design that prescribes placing the learner in interaction with and observation of environments. This theory, appropriate for learning in individual or group instruction, may be used to design instruction for a wide variety of media delivery systems and technologies. With regard to MCI, researchers van Merrienboer, Seels, & Kirschner (2002) reported that, "This theory has the potential to provide "a broader foundation of [instructional design]...to better accommodate a diverse, widely distributed set of students that needs to learn and transfer complex skills to an increasingly varied set of real-world contexts and settings" (p. 62).

Designing and Creating an MCI Experience

In order to design and create an effective MCI experience, the instructional designer must analyze the components and abstractions of the experience they are striving to design (Gibbons, 2001). That is, the model of the experience. In some situations, it is not possible to have learners work with real objects, events, or environments. For example, flight simulators are used to train pilots because mistakes can be disastrous in the real environment. In MCI, one of the design tasks is to create representations of these objects, events, or environments called *models*. A model, which defines or represents an object, event, or environment, contains some degree of information regarding its properties, actions, or cause-effect relationships. This kind of model representation described in MCI is different from a mental model. A model representation can take various mediated forms, from role-playing or simple textual descriptions to complex, multimedia simulations. A mental model, on the other hand, exists only in the mind of the learner. According to Gibbons (2002), the role of an instructional designer in the development of MCI is to provide real systems or models with which the learner can interact while solving a problem. The theory of model-centered instruction aids learners by (a) focusing their attention on targeted information about objects, events, or environments and (b) intervening with events or activities designed to initiate learning processes (Gibbons, 2001, pp. 513-518).

Gibbons (2001) specified that the models in MCI have two parts: (a) a set of abstractions of cause-effect or time-space sequences, and (b) a media representation of the abstractions" (Gibbons, 2001, p.515). He also specified that three types of models, system, environment, and expert performance, form a comprehensive framework for the representation and communication of subject-matter information in any domain (Gibbons, 2001, pp. 519-522).

Model Type: Environment

This type of model represents the background in which systems operate. Environments can be literal or figurative places, or can be the source of influences on the system and performance environment that do not arise from the systems themselves nor from their response to the performance (Gibbons, 1998a).

Model Type: Systems

This type of model represents the "terms of forces in opposition and balance, elements on which forces act, states, relationships, configurations, transitions, and patterns" (Gibbons, 2001, p. 521). In order to determine the component parts, a system can be analyzed top down (decomposition) or bottom up (prototyping and recycling). Once the system has been decomposed and analyzed and is no longer yielding useful information with regard to the basic elements or variables of the system and the corresponding relationships, the process is finished.

Model Type: Expert Performance

This type of system represents "performance within an environment that uses information from environmental locations to act upon the systems that exist within the environment" (Gibbons, 2001, p.522). This expert performance involves interaction in cause-effect systems that can change dynamically as the instruction progresses. "For instructional purposes, it does not necessarily mean impeccable or correct, since may theorists feel there is value in erroneous responses as well (Collins, Brown, & Newman, 1989; Schank, 1994; Skinner, 1953)"(Gibbons, 2001, p.522). Expert performance may be "structured in terms of goals, actions, motives, decision points, rationales, system affordances, system indicators, system controls and forces opposing action" (Gibbons, 1998a, p. 13).

All of these model types function together in a system. A system is not characterized by its elements or components but by the interdependent relationships between those elements. Owen (1997) pointed out that all elements of a system affect each other and changes in one aspect of the system change the other elements.

The Use of Interactions and Experiences in MCI

Many instructors have viewed learners as empty vessels to be filled with information. This traditional view of learning has its origins in the schoolhouse model of learning and education (Collins, Brown, & Newman, 1989). However, taking in information is only partially related to real learning. Real learning involves experience--performing activities, making decisions, and directly experiencing the consequences of those activities and decisions (Collins et al., 1989; Lave & Wenger, 1991).

According to some researchers, knowledge and experience are different. Caine and Caine (1991) stated "We acquire knowledge--we learn by processing experience" (p. 146). They also reported that "Orchestrated immersion provides learners with rich, complex experiences that include options and a sense of wholeness. It presents what is to be learned in ways that allow for the perception of new patterns and relationships and make what is being learned intrinsically more meaningfully" (p. 146). The instructional experiences one has must contain cause-effect relationships that would realistically be there in the experience. "However, experiential learning is only effective if the feedback one receives in response to one's actions and decisions is rapid and consistent with reality" (Bloom & Loftin, 1998, p. 94-95).

Forlizzi (1997, 2002) described experience in terms of John Dewey's uses of continuity (the aspects of experience as it relates to the individual) and interaction (the aspects of experience as they relate to the environment). "When the individual components and environmental components of an experience are working together, they form a situation – a complete and whole experience which changes both the user and the context of use" (p. 5).

Thus, providing the learner with experience with a real system or model, a central component of MCI, is widely considered a component of effective instruction.

Providing Instruction within a Model Environment

The MCI is designed around a realistic setting (scenario) that incorporates actions and events that occur *within the model environment*. Scenario-based instruction has been demonstrated to be effective in many educational settings (Bell, Barreiss, & Beckwith, 1994; Schank, 1992, 1994). According to Schank (1992), "The goal of effective training must be to repeat as well as possible the breadth of experience [a learner] needs in as intense, danger-free, inexpensive, and timely fashion as possible" (p. 10).

Nelson (1993) discussed the need for experiential cognition in instruction. The scenario format meets this goal and provides the appropriate fidelity for the instruction. Fidelity is defined as "how closely a simulation imitates reality" (Alessi, 1988, p. 40). Alessi and Johnson (1992) also explained that an effective instructional simulation typically simplifies complex systems and images, thus reducing the possibility of student confusion and errors. Fidelity can be appropriately high or low depending on the situation and materials. One of the central design principles of MCI is the determination of the scope of the instructional goal and the degree of fidelity that is warranted by the problem. Hertel and Millis, 2002, pointed out that the components of the scenario can come from actual events or they can be constructed. However they are created, scenarios must seem realistic to the learner. The learner's goals and interests must be incorporated. Choi, 1997, reported that the details of a given scenario are meant to explain the model situation in terms of what is happening, where it is happening, and the characters and objects involved. Problem-solving activity in scenarios should not be viewed as an isolated, decontextualized event. Olson and Bruner (1974) stated:

> The performance of any act may be considered a sequence of decision points, each involving a set of alternatives. These decision points are specified jointly by the intention motivating the act, the goal or end point, and the structure of the medium or environment in which the act occurs. A skilled performance requires that the actor have information available that permits him to choose between these alternatives. Problem-solving is a matter of trying our various means and assessing their contribution to the achievement of the end state (p. 129).

With regard to learning in an authentic, simulated environment, Van Ments cited in Treiber (1994) stated that, "Simulation techniques are particularly good at enabling the student to acquire an emotional, affective understanding which deepens the cognitive, intellectual grasp of the problem, an important element in the learning of social and communication skills"(p.7). Gibbons (2001) explained that instruction is fostered through interaction with a carefully defined model of cause-effect relationships and precise selection, sequencing, and posing of problems in relation to the model. In discussing MCI, he stated:

> The traditional notion of simulation is included within the scope of this definition, but this [MCI] is more; it also encompasses real environments, systems, and expert performances and relates them (and simulation experiences) to their specific application during instruction. This definition of an instructional type defines things in terms of how they are used in the instructional act. Not a definition of a product type, it defines a specific context and interaction with the learner—a type and structure of experience (Gibbons, 2002, p. 1).

The realistic experiences provided during interaction with models can bring important concomitant effects (e.g., emotions, perceptions, social interactions) to instruction. Caine and Caine (1991) stated:

> We do not simply learn things. What we learn is influenced and organized by emotions and mind sets based on expectancy, personal biases and prejudices, degree of self-esteem, and the need for social interaction. Emotions and cognition cannot be separated (Halgren, Wilson, Squires, Engel, Walter, & Crandall, 1983; Ornstein & Sobel, 1987; Lakoff, 1987; McGuinness & Pribram, 1980). Emotions are also crucial to memory because they cannot be switched on and off. They operate on many levels, somewhat like the weather. They are ongoing, and the emotional impact of any lesson or life experience may continue to reverberate long after the specific event (p. 82).

The way humans learn and think is central to MCI. Gibbons (2002) stated, "Model-centered instruction is a useful and important perspective because humans learn and think in terms of (mental) models, not in terms of isolated facts and dissociated elements of knowledge. In the absence of formal instruction, individuals seek experience with real or modeled systems as a source of learning" (p. 1). According to Caine and Caine, 1991, this type of learning generates emotional and sensory knowledge.

This degree of model definition sets the stage for consequent instructional design decisions. As Kutti (1996) stated, "Activities are not static or rigid entities; they are under continuous change and development. This development is not linear or straightforward but uneven and discontinuous. This means that each activity also has a history of its own" (p. 26). Thus, MCI should incorporate a flexible and generative quality that enables it to adapt as the learner progresses through the instruction.

The Use of Problems in Model-Centered Instruction

Once this complete model is understood, parts of it can be used to select, sequence, and pose problems related to the targeted part of the experience. Problems can be used to direct learner attention to system variables, cause-effect interactions and system states. Learners can construct their own mental models by engaging in this type of problem-solving activities.

Learners may require assistance in discovering and processing information in complex models. Instructional technologists can guide learners by introducing problems to be solved in a sequence that may be partially or fully determined by the learner. Gibbons (1998a) defines a problem as "any request for information about an incompletely known model" (p.19). Instructional designers can use problems to act as filters to focus learner attention on specific information in the models. Problems can also trigger processes that enable the learner to construct mental models. "As problems are solved in sequence, learners process more information and construct more comprehensive and useful mental models" (Gibbons, 2001, p. 524).

Summary: Part A, Model-Centered Instruction

The model structure described in this section, encompassing all the components and features of MCI, sets the stage for the contextual framework of the problem. With the increasing promotion of reality-centered projects, the presentation of contextual aspects of models becomes increasingly important. Whitson (1997) observed that "Contextualism holds that experience consists of events. Events have a quality as a whole. By quality is reant the total meaning of the event. The quality of the event is the resultant of the iteraction of the organism and the physical relations that provide support for the eperience" (Whitson cited in Kirshner and Whitson, p. 124).

Thus, this holistic view of a model, incorporated in MCI, facilitates the pesentation of a more extensive, realistic knowledge base than in traditional instructional rethodologies.

Part B: Health-Behavior Literature

Health-Behavior Literature Characteristics and Search Procedures

This section describes the characteristics of the literature used for the examination of the dependent variables: patient anxiety and patient compliance. These variables were used to classify the studies identified for this literature review. The information in this section is organized by articles that address (a) patient anxiety and (b) patient compliance.

Patient Anxiety

Investigators of several studies (Daltroy, Morline, Eaton, Poss, & Liang, 1998; Devine, E.C., 1995; Devine, 1992; Hathaway, 1986; Lin, Lin, & Lin, 1997; Moline, L.R., 2000; & Shuldham, 1999) have established the role that anxiety plays in the recovery of patients. High preoperative anxiety may impede patients' physiological recovery and highly anxious patients may require more anesthesia, thus increasing their risk of medical complications (Johnston, 1980). There is also evidence that pre-medical intervention anxiety levels are good predictors of post medical intervention recovery and "that procedures designed to reduce preoperative anxiety produce post-operative benefits" (Johnston, 1980, p. 145). Overall, the findings from research support "the notion that preprocedural education reduces the amount of anxiety felt by the patients" (Moline, 2000, p. 118).

Educating patients about what they might feel or experience is significant in anxiety reduction. Hartfield, Cason, and Cason (1981) reported that subjects who received education on the sensations they would experience during a procedure reported significantly less anxiety than those receiving information about the procedure itself. They stated, "One intervention that has research attention is providing the individual with preparatory information. . .The findings that cognitions play a major role in emotional response have led investigators to examine the effects of different types of cognitive input on such responses" (p. 202). In another study (Moline, 2000) the researchers stated that "*procedural* information does not appear to affect subject's anxiety level during the procedure, but *sensation* information may reduce emotional responses" (p. 118). Galczak (1980) reported that anxiety was the result of the "discrepancy between expectations maintained by subjects about the anticipated sensation and the actual experience" (p.9). Galczak described the critical factor that reduced anxiety was the preparatory information received by the subjects about the sensations they might experience. In addition, several researchers have reported that high levels of preoperative anxiety have been found to be associated with higher levels of postoperative anxiety, the increased use of pain medication, and longer hospital stays (Daltroy, et al., 1998; Devine, 1995, 1996, 1992; Hathaway, 1986; Moline, L.R. 2000; Roter, D.L., et al., 1998; Shuldham, 1999). In these studies, education provided significant beneficial effects of small to medium magnitude in decreasing anxiety levels.

Also, investigators have confirmed the importance of including cognitive, behavioral, and affective (sensory) components as well as procedural knowledge (Daltroy, et al., 1998; Devine, 1996, 1992; Hathaway, 1986; Moline, L.R. 2000; Roter et al., 1998; Shuldham, 1999). Johnston and Vogele (1993) cited findings from a study by Matthews and Ridgeway that document the fact that sensation information has been shown to be the more effective form of preparation.

In sum, the importance of patient education on the reduction of patient anxiety has been established. Sensory and procedural information have been shown to be valuable components. These findings pertain to the Health Belief Model (HBM) in that anxiety reflects an individual's feelings of being "out of control of his or her situation" which is part of the HBM's locus of control component and also a component of SCT.

Patient Compliance

Patient compliance, described as a person's behavior in following medical or health care instructions and recommendations, has been and continues to be a challenge in the health care system. Investigators of several studies (Brus, van de Laar, Taal, Rasker, & Wiegman, 1997; Daltroy, et al., 1998; Devine, E.C., 1995; Devine, 1992; Hathaway, 1986; Lewis, 1999; Lin, Lin, & Lin, 1997; Moline, L.R., 2000; Roter, Hall, Merisa, Nordstrom, Cretin, & Svarstad, 1998; & Shuldham, 1999; Sluijis,Kok, & van der Zee, 1993; & Theis, 1995) examined patient education in relation to its effects on patient compliance. These investigators monitored compliance with health care appointments, medication usage, and compliance with exercise regimens specified for rehabilitation (Brus, et al., 1997; Rasker, & Wiegman,1997; Daltroy et al., 1998; Devine, 1996, 1992; Lewis, 1999; Lin et al.,1997; Roter et al., 1998; Slujis, Kok, & van der Zee, 1993; & Theis, 1995). Wong and Wong (1985) examined compliance by measuring the effects of preoperative education with the "accuracy, regularity, and willingness that patients showed in execution of the prescribed activities after surgery" (p.105). With regard to compliance and medication, Brown and Levin (1998) stated:

> if patients lack faith or trust in the beneficial effects of their medication or fear side effects, they are less likely to comply with treatment. An interactive patient education/counseling session can result in the discovery and resolution of many of these concerns that can lead to medication noncompliance (p. 39).

Jones, Jones, and Katz (1988) pointed out that the HBM supports the analysis of patient compliance. They stated that, "Based on motivational theory, this mode (HBM) defines motivation as a differential emotional arousal that occurs in response to a health matter" (p. 1173). They also stated that, "The value of compliance is based on the probability that, in the patient's view, it will reduce the perceived threat and not be too costly in terms of, e.g., money, time, and emotional energy" (p. 1173).

In conclusion, with respect to the HBM, Sluijs et al. (1993) reported, "Generally, it appears that patients' beliefs and attitudes are related to compliance" (p. 772). Petty, Barden, and Wheeler, 2002, stated that "Because attitudes are a primary determinant of behavior, attitude change can be a central focus of any health promotion program" (p. 84).The findings from the research literature demonstrate the relationship between patient education, patient beliefs, and patient attitudes and varying aspects of compliance.

The following section describes the characteristics of the literature used for the examination of patient anxiety and patient compliance.

Literature Search Terms and Inclusion/Exclusion Criteria

Potential articles were located by electronic searches of MedLine, ERIC, Psychological Abstracts, and Google searches. Keyword terms included: patient education, patient compliance, anxiety, anxiety and medical procedures, scenarios and patient education, meta-analysis and patient education, meta-analysis and patient anxiety, meta-analysis and patient compliance, and psychoeducational care and patient education.

The authors of the articles identified for inclusion in this review examined the effect of pre-intervention instruction of adult patients on post-intervention outcomes. The reports of the research studies met the following criteria for inclusion in this review:

1. The studies were written in English
2. Pre-intervention instruction was an independent variable

3. Post-intervention outcome was a dependent variable and one of the outcome variables related to anxiety or patient compliance.
4. The subjects were adults

Underlying Theories of Health Behavior

Several health behavior theories, including the (a) Health Belief Model (HBM), (b) Social Cognitive Theory (SCT), and (c) the Transtheoretical Stages of Change Model describe patient health behaviors and are utilized in this study. These theories pertain to the individual's self-confidence and perception about his or her ability to control a situation and the stages that a patient moves through when he or she accomplishes behavioral change. These abilities, in turn, have been shown to reduce (a) patient anxiety and (b) increase compliance, thus facilitating patient recovery (Devine & Cook, 1986; Lau, 1997; Lin, et al., 1997; Tessier, 1983; Wong & Wong, 1985).

The Health Belief Model (HBM)

The model grew out of the field of social psychology in the 1950s and was introduced to focus on increasing the use of preventive services such as screening and immunizations. "It was originally developed to explain why persons engage in and predict why they will engage in specific preventive behaviors such as accepting a vaccine or participating in a tuberculosis screening procedure, . . . but has been expanded to predict illness and sick role behaviors"(Gochman, 1997, p. 43). The HBM evolved over time and in 1988, Kirscht (cited in Gochman, 1997) "demonstrated the model's value as a predictor of a variety of health actions and provided insights into its complexity and status" (p. 42). This new perspective on the HBM broadened its usefulness in understanding and promoting change in health behaviors. Bowling (1997) described the HBM as "used to understand people's use of preventive health measures and services, as well as their response to symptoms and adherence with pescribed therapies" (p.34).

The HBM is a value expectancy theory. Two major learning theories, stimulus — response and cognitive behaviors, contributed to the formulation of value expectancy theories (Strecher & Rosenstock, 1997). In the context of health care, Strecher and Rosenstock (1997) explained that, "When value expectancy concepts were gradually reformulated in the context of health-related behavior, the translations were (a) the desire to avoid illness or to get well (value) and (b) the belief that a specific health action available to a person would prevent (or ameliorate) illness (expectancy). The expectancy was further delineated in terms of the individual's estimate of personal susceptibility to and severity of an illness and of the likelihood of being able to reduce that threat through personal action" (p. 42).

With regard to research and implementation issues, the HBM is a value-added model. These components of the model affect each other and while none are singularly responsible for causing action on the patient's part, their combined effect can promote action.

The key variables of the Health Belief Model include (a) perceived susceptibility, (b perceived severity, (c) perceived benefits, (d) perceived barriers, (e) cues to action, and (f) self-efficacy. Self-efficacy, an individual's belief that he or she has the capability to produce an outcome (Bandura, 1986, 1997) is of particular importance to this current study because it affects the individual's behavior and thus affects specific health behavior outcomes.

Self-efficacy. Bandura (cited in Strecher & Rosenstock, 1997) defined self-eficacy as "the conviction that one can successfully execute the behavior required to poduce the outcomes" (p. 47). "A growing body of literature supports the importance o self-efficacy in helping to account for initiation and maintenance of behavioral change (Bandura, 1986; Strecher, DeVellis, Becker, & Rosenstock, 1986)" (cited in Strecher, Champion, & Rosenstock, 1997, p. 75).

The HBM can also work as a useful framework for designing intervention stategies. The most promising application of the HBM is providing guidance in developing messages that will promote changes in health behaviors. With regard to the implementation of the HBM , Strecher, et al. stated:

> It is timely for professionals who are attempting to influence health-related behaviors to make use of the health belief variables, including self-efficacy, in their program planning, both in needs assessment and in program strategies. Programs to deal with a health problem should be based, in part, on knowledge of how many and which members of a target population feel susceptible to a particular health-related outcome, believe the health-related outcome to constitute a serious health problem, and believe that the threat of having the health-related outcome could be reduced by changing their behavior at an acceptable psychological cost. Moreover, health professionals should also assess the extent to which clients possess adequate self-efficacy to carry out the prescribed actions(s), over a long period of time if necessary (1997, p. 89).

Social Cognitive Theory (SCT)

The SCT explains human behavior in terms of a "triadic, dynamic, and reciprocal model in which behavior, personal factors (including cognitions), and environmental influences all interact" (Baranowski, Perry, & Parcel, 1997, p. 153). The SCT is useful in implementing health care programs in that, "Health educators and behavioral scientists have used SCT ideas creatively to develop procedures or techniques that influence these underlying cognitive variables, thereby increasing the likelihood of behavioral change," (Baranowski , et al., 1997, p. 153).

The SCT has been used to explain the interaction among individuals, environments, and health behaviors. These interactions include (a) anticipating the oucomes to behavior, (b) learning by observing others' behavior, (c) developing confidence in one's own behavior, and (d) self-determining and reflecting on one's own behavior. These components of SCT are important aspects of personal health behavior determinants:

> They are particularly relevant to health education programs for three reasons. First, the theory synthesizes previously disparate cognitive, emotional, and behavioral understandings of human change. Second, the constructs and processes identified by SCT suggest many important avenues for new behavioral research and practice in health education. Third, SCT permits the application of theoretical ideas developed in other areas of psychology to health behaviors and to behavioral change, thereby benefiting from their insights and understanding. (Baranowski, et al., 1997, p. 156)

Self-confidence. Related to self-efficacy, Cousins (1989) discussed the need for patients to have self-confidence and a sense of some control over their health situation:

> Few things are more essential for the national future than the need for Americans to be reeducated about health: education about external and external mechanisms for warding off disease or coping with it, should it occur; education and the requirements of good health; education that can teach us that panic and defeat are the great multipliers of illness; education about the importance of confidence in repair, restoration, recovery, regeneration; education in the need for a partnership between patient and the physician; education in what is meant by the human healing system and how it works best; education in the value of putting our best effort toward maximizing what is possible; and, finally, education that can instruct us that what goes on in the mind can promote or retard health. It is in this sense that head comes first (p. 96).

These points that Cousins illustrated are related to the HBM and SCT in that they stress the importance of a patient having enough understanding and knowledge about his or her health to develop the ability to weigh pros and cons, or barriers, benefits, and susceptibility of his or her condition.

The Transtheoretical Stages of Change Model

This model specifies the behavioral and cognitive stages of change that individuals move through when accomplishing behavioral change (Prochaska, Norcross, & DiClemente, 2002; Prochaska, Redding, & Evers, 1997). These stages include:

1. Precontemplation: The individual does not feel that change is needed; the individual is beginning to gather information about his or her condition.
2. Contemplation: The individual is beginning to think that he or she needs to change and is gathering information.
3. Preparation: The individual has decided to change and is making preparations.
4. Action: The individual is taking action to change his or her behavior.

The research by Prochaska, Norcross, and DiClemente, 2002 and Prochaska, Rdding, and Evers, 1997 showed that individuals that successfully changed their health bnaviors moved through these stages in this order.

The Influence of Cognitive Processes on Behavior

The influence of cognitive processes on behavior has been described in psychology by many theorists including Chomsky, (1965), Festinger, (1957), and Winn and Snyder, (1996). Galczak (1980) described the mechanism of these processes as: "smuli reception, extraction of information contained in the stimuli, and evaluation of an exerience. It is these cognitive processes which are responsible for directing attitudes, erotions, and behavior" (p. 4). According to cognitive theorists, cognitive processes are reponsible for directing human behavior (Averill 1973; Chomsky, 1965; Johnson, 1972).

These processes can be an essential coping mechanism, particularly in stressful or hreatening situations. In the face of threatening conditions, inadequate control of beavior may result in an insufficient capacity to cope with the situation. Perceived strss combined with unsuccessful coping behavior has been shown to contribute to phsical illness (Cobb & Rose, 1973; Holmes & Rahe, 1967; Jenkins, 1971; Myers, Lindenthal, & Pepper, 1975).

Effective patient education has been shown to reduce patient anxiety and increase patient compliance with treatment protocols (Devine & Cook, 1986; Lin, et al.; 1997; Tessier, 1983; Wong & Wong, 1985). The presentation of sensory information has been shown to be particularly effective. Traditional approaches to patient education emphasize the use of static diagrams, text handouts or brochures, and fact sheets. However, these products typically fail to provide success and failure models of rehabilitation or experiential sensory information to the patient about the healing process (Moline, 2000).

Success and failure models of rehabilitation and experiential sensory information about the recovery process have typically been omitted from current patient education materials. Because the presentation of sensory information about what a patient might feel or experience is significant in anxiety reduction, Hartfield et al. (1981), this type of cognitive preparatory information should be made available to patients. "The findings that cognitions play a major role in emotional response have led investigators to examine the effects of different types of cognitive input on such responses" (p. 202). Moline (2000) found that sensory information was more significant than procedural information in reducing the emotional state/anxiety level of patients. Several other researchers have reported that experiments that "use sensory information to enhance cognitive control found that sensory information facilitates coping with threatening events, as measured by signs of distress, mood states, and performance" (Hill, 1982, p. 18).

Social Cognitive Theory (SCT), as previously discussed, has been used to explain the interaction among individuals, environments, and health behaviors. The opportunity to compare and contrast one's own behavior with that of others in a similar situation is an opportunity to explore realistic situational issues represented in the model.

This activity affects an individual's sense that they know about what is happening and that they have some control over a situation. Lebow and Wager (1994) stated that, "Carroll (1990) has suggested that in order to facilitate transfer, promote metacognitive and affective learning, support an adaptive motivational pattern to learning, and encourage a high degree of ownership and personal relevance, educators should provide training on real tasks" (p. 6).

Summary: Part B, Health-Behavior Literature

In sum, the principles of the HBM, the SCT, and the Stages of Change, with regard to aspects of patient recovery, have been studied extensively in controlled, clinical studies and resulted in several significant meta-analyses (Devine, 1992; Hathaway, 1986, Prochaska, et al., 2002). In particular, Jones, Jones, and Katz (1988) investigated the use of HBM principles in a study on patient compliance and anxiety. Findings from this study confirmed that patient education results in beneficial effects on self-efficacy and self-confidence, thus positively affecting recovery and reducing anxiety. In a meta-analysis, Devine (1992) updated and expanded the results of these original studies and found that, "Significant beneficial effects of small to medium magnitude were found on recovery, pain, and psychological distress" (p. 135). Patient education, also referred to as psychoeducational care, has been shown to be a significant aspect of patient recovery.

Participating in a health care situation can be viewed as a social activity. A basic tenet of the HBM is that the patient will not seek preventive health care unless he feels the health care problem will cause him bodily harm. In terms of illness, a patient will not seek health care unless he or she is experiencing symptoms of a disease. The intensity of the symptoms experienced by a person influences the decision to seek health care.

This component of the HBM is what Becker (1985) called the degree of perceived threat and is determined by the feeling of vulnerability to the specific illness, the perceived extent of bodily harm, the extent of possible disruption of social roles, the presence of symptoms, and past experience with symptoms.

> In the context of health care behavior, Strecher and Rosenstock (1997) explained a patient's actions in terms of their desire to avoid illness or get well and their belief that a specific health behavior action would be helpful to them. Bandura (1986) also described self-efficacy issues and patient locus of control as being critical to patient health behaviors.

Summary: Chapter II, Review of Literature

The MCI approach, because it presents a holistic view of emotions, behaviors, and experiences represented in the model, is consistent with findings from studies (Hartfield & Cason, 1982; Johnson, Kirchoff, & Endress, 1999) that have shown that providing patient with sensory instruction enables them to feel more in-control and have less anxiety in health care situations. These factors relate back to the HBM, SCT, and the Stages of Change, three theories that have been demonstrated to be effective in health behavior research (Bandura, 1986; Prochaska, Norcross, & DiClemente, 2002; Prochaska, Redding, & Evers, 1997; Strecher & Rosenstock, 1997). Patient education programs have been shown to support the overall welfare of the patient in terms of reduction of anxiety levels and an increase in patient compliance with medical instructions or recommendations (Devine & Cook, 1986; Lin et al., Wong & Wong, 1985). The value of compliance is based on the probability that in the patient's view, compliance will reduce the perceived threat and not be too costly in money, time, and emotional energy" (Becker, as cited in Tessier, 1983, p.18).

Anxiety has been shown to significantly affect a patient's compliance with his or her own assigned medical routines. Tessier, (1983) reported that "The anxiety experienced by the patient will influence his compliance to the hospital routines. The patient's compliant behavior can be increased if he has the knowledge base about what he is supposed to do and how he is supposed to perform" (p. 22).

With regard to patient education, MCI facilitates (a) an increased knowledge of the details of a working system, (b) opportunity for direct observation of outcomes and failure to comply, and (c) a better understanding of the larger social context and its mutual accountabilities.

The importance of patient education on recovery outcomes of the patient has been established. Also, sensory and procedural information have been shown to be valuable components. These findings pertain to the Health Belief Model in that anxiety reflects an individual's feelings of being "out of control of his or her situation" which is part of the HBM's locus of control component and also a component of SCT.

Based on the literature review, it is evident that effective patient education is a critical component to outcomes in patient care. Sensory, experiential instruction has been shown to be especially beneficial in training patients (Moline, 2000). Model-Centered Instruction (MCI) is proposed to be a more effective instructional design for this type of information than traditional patient education.

Given that these issues and behaviors are cognitive and emotional in nature, MCI appears to be an ideal instructional methodology for patient education and holds the potential for addressing the inadequacies of traditional patient education.

Chapter III outlines the methods used for the study. In this chapter, MCI design procedures are discussed. In addition, data collection techniques, the study sample and its characteristics, measures used in the analysis, and a description of the chosen procedures of statistical analysis are discussed.

CHAPTER III

METHODS AND PROCEDURES

Chapter Introduction

This project focuses on design study research and research into MCI and its application to patient education. Specifically, the instructional goal was to give the learner exposure to interacting with dynamic models of environmental, social, and physical/medical aspects of rehabilitation treatment. The methods employed in this study were based on (a) MCI design methods and (b) experimental research strategies found in reviews of health behavior literature and instructional technology and tested in a pilot study which was conducted in February, 2005. Some elements of the pilot methodology were found to be effective and were continued. Other aspects of the research design were revised, and some new elements were added as well, based on what was learned in the pilot study. This chapter outlines (a) the MCI design methodology, (b) the research project methodology, and (c) methods of analysis utilized in this project.

Part A: MCI Design Methodology

Historically, instructional design has been approached as a process of systematically dividing a project into manageable parts and developing timelines (Dick & Carey, 1990). In this approach, the designer breaks the larger problem into smaller subproblems. MCI takes a different tactic to instructional design.

MCI is a design theory for instruction that prescribes that the learner interacts with a dynamic, interactive model. The design theory for MCI does not specify a stepwise design path. Rather, this design process is iterative and cyclical and involves processes of design, implementation, evaluation, and redesign. Gibbons (2001) and Gibbons, Richards, Hadley, and Nelson, (2001) defined MCI in terms of the seven principles of MCI and the layers of design theory. This section elaborates on (a) the seven principles of MCI in the design methodology of this project, (b) the seven principles of the architecture of Design Layer Theory (DLT), (Gibbons, Richards, Hadley, and Nelson (2003)), used in the design methodology of this project, and (c) the ideal-case design order for model-centered instruction utilized in this project.

The Seven Principles of MCI in the Design Methodology of this Project

In defining MCI design, Gibbons (2001, p.514) outlined seven core principles:

1. Experience: Learners should be given maximum opportunity to interact for learning purposes with one or more systems or models of systems of three types: environment, system, and/or expert performance. The terms model and simulation are not synonymous; models can be expressed in a variety of computer-based and non-computer-based forms.

2. Problem solving: Interaction with systems or models should be focused by the solution of one or more carefully selected problems, expressed in terms of the model, with solutions being performed by the learner, by a peer, or by an expert.

3. Denaturing: Models are necessarily denatured from the real by the medium in which they are expressed. Designers must select a level of denaturing matching the target learner's existing knowledge and goals.

4. Sequence: Problems should be arranged in a carefully constructed sequence for modeled (other agent) solution or for active learner solution.

5. Goal orientation: Problems selected should be appropriate for the attainment of specific instructional goals.

6. Resourcing: The learner should be given problem solving information resources, materials, and tools within a solution environment (which may exist only in the learner's mind) commensurate with instructional goals and existing levels of knowledge.

7. Instructional augmentation: The learner should be given support during solving in the form of dynamic, specialized, designed instructional augmentations.

These seven principles include some general ideas about the overall instructional purposes, subject-matter content, and instructional strategies of model-centered instruction. Also a number of prescriptions for designing, selecting, and sequencing problems can also be derived from these principles.

While the adherence to the seven principles of MCI is central to the design methodology of MCI, the Design Layer Theory (DLT) is equally important.

The Design Layer Theory and Project Design Decisions

The architecture of model-centered instruction can be described in terms of layers. In Design Layer Theory, rather than decomposing the problem into subproblems, the designer decomposes the problem into its component layer and sublayer structures. Gibbons, Richards, Hadley, and Nelson (2003), published a set of prescriptions for MCI based on design layers that can aid instructional designers in designing, selecting, and sequencing problem sets. These architectural relationships are much like the components of a building; in a functioning structure, the parts (layers) of the structure are complimentary and resonant with each other. These relationships facilitate the subsystems, or layers, of an instructional design working together to meet the goals of the designer.

In the theory of design layers, instructional design decisions are organized into seven interconnected layers. This design strategy requires that the layers must be aligned properly, just as the subsystems of a building must be aligned in order to function Defining the layers enables the designer to address issues of alignment within and between the layers. The decisions in each layer are made using a common set of goals or purposes, design constructs, production tools, design processes, and design principles (Gibbons, Richards, Hadley, & Nelson, 2001, p. 12). Key decisions are related to design layers; layers allow the designer to see design problems in more detail and to work on sub-problem designs individually before combining them into the whole design.

The researcher selected five layers, shown in Figure 1, (Hadley, Gibbons, Richards, 2003, p. 2), to illustrate how decisions made in one layer of the design have an impact on the other layers.

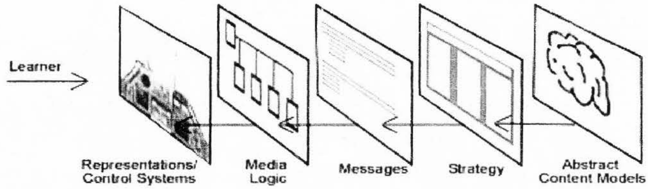


Figure 1. Interaction of Layers

Each project design decision with respect to layers and sublayers is described below using terms and definitions provided by Gibbons, Richards, Hadley, and Nelson (2003, pp. 8-9).

1. Content Layer. This layer consists of decisions that define how the subject-matter content will be organized or expressed and used in an instructional product. In model-centered instruction, content is expressed as models of systems, environments, and expert performances.

A. (Sublayer: Models-systems, environment, expert performances)

Instructional models in this layer are concerned with cause-effect systems and human performance models. The models that were defined for this project included (a) the Health Belief Model, (b) the Transtheoretical Stages of Change Model, and (c) the Social Cognitive Theory Model.

There are two primary methods to create problem structures related to model and task analysis. In one method, the three content models, (i.e., systems, environment, and expert performance), are aligned to form the problem structure. In another method, creating problem structures can help define the models.

To facilitate the development of problem structures, Gibbons and Nelson (1999) formulated the use of syntactic strings. In MCI, a syntactic string can be represented as a generic statement with problem variables represented within < > brackets. They proposed that the development of syntactic strings aids in the design and creation of problem-structure representation and events. In discussing the utility of syntactic strings, Hadley, Gibbons, and Richards, 2003, stated: "This strategy lends itself to database driven instruction because these syntactic strings contain environmental and system variables used to set beginning and runtime states. The expert performance variables provide a level of evaluation for learner comparison" (p. 4). Utilizing syntactic strings in the design approach facilitates the creation of databases and computational engines and also facilitates the creation of many events and scenarios. The development process generally went from specific→general→to specific. For example, one of the scenarios was:

1. Bob is worried about hurting himself at physical therapy.
2. Patient is <state> about <action> at <environment>.

- Bob is <worried> about < hurting himself> at <physical therapy>.
- Betty is <hesitant> to <ask questions> at <physical therapy>.
- Steve is <nervous> about the <exercises> at <physical therapy>.

This generative process can be used for many possible states and actions, depending on the instructional goals. Using the syntactic string approach enabled the designer to develop the many events necessary to create a rich, authentic instructional experience.

B. (Sublayer: Locations/Views) The model is seen by the learner through a "window" that the designer provides. The locations or views determined to be useful for this project were in the entire physical therapy system including (a) the facility, (b) the personnel who work there, and (c) the patient's social system (i.e., the patient's family, the patient's friends, and the patient's workplace). The models of environment were static; the models of expert performance and systems models were dynamic.

With regard to this layer, at every step of the way, the designer kept asking "Am I still focusing on the correct model?" This is a critical question to continue to ask during the entire design process.

2. *Strategy Layer.* Within the strategy layer, decisions are made about what type of instructional strategies might be used to teach the content, how these strategies could be effectively employed, and under what conditions their use would be necessary and appropriate. As previously mentioned, the main strategy in model-centered instruction involves problem-solving activities in which learners interact with models of systems, environments, and expert performances.

Once the content models were established, the instructional strategies were developed. As previously mentioned, layer development subsequent to the content model development was constantly checked against the adherence to the instructional goals and the content models.

At this point, the software engine began to take shape with regard to scenario development, database interactions, tracking learner movement, providing feedback, and message and user interface representation.

A. (Sublayer: Form & function) This sublayer targets the different instructional modes the model-centered product can carry out. The modes in this project were a practice mode and a test mode; both provided instruction.

B. (Sublayer: Target performance) The definition of the target performance involves deciding what learners will be asked to do in everyday life. In this case the target performance was to shape the learner's attitudes beliefs, and actions with regard to their healthcare behavior.

C. (Sublayer: Problem structure) The target performance dominated the model-centered design. This problem structure revealed all of the kinds of problems that were needed for the learner to achieve the target behavior and performance ability, i.e., shaping the learner's attitudes, beliefs, and actions with regard to their healthcare behavior.

D. (Sublayer: Problem sequence) The problems in this project were sequenced to conform to the predefined event structure and the progression of the Health Belief Models. Table 1 contains the Event Structure Diagram that illustrates the sequencing progression.

Stages	**Event Types**					
	1	2	3	4	5	6
Stage 1 (precontemplation)	Scenario Intro	Doctor	Friend	Family	Family	Self-dialogue
Stage 2 (contemplation)	Physical Therapist	Family	Friend	Work	Self-dialogue	
Stage 3 (preparation)	Physical Therapist	Work	Family	Friend	Self-dialogue	
Stage 4 (action)	Reward self	Physical Therapist	Family/ Friends	System to monitor progress		

Table 1. Event Structure Matrix

E. (Sublayer: Response mechanism) The response mechanism was the learner's choice of a thought or action based upon the scenario patient's behavior. The selections were made by using a mouse or the keyboard and clicking on a choice.

F. (Sublayer: Dramatic context) Since the target performance in this project was operations within an everyday setting that included people, and social relationships, a dramatic setting was useful to provide the scenario for observation and interaction. In this case, the learner was asked to help physical therapy patient select thoughts/actions in response to events that would advance his or her recovery.

G. (Sublayer: Information structure) The information is structured in the form of questions, responses, and feedback. The information given to the learner consisted of on-screen graphs that illustrated whether they were approaching the target behavior.

H. (Sublayer: Event structure) The events in the project were structured around the health belief models and the choices that the learner made.

I. (Sublayer: Setting/siting) The setting is post-surgery in the physical therapy facility

J. (Sublayer: Roles/goals) The role of the learner is to "help" their patient get to the state of compliance.

K. (Sublayer: Augmentations) The primary augmentations included visual feedback, coaching, and navigation information.

3. Control Layer. Decisions include design choices about how learners will interact or interface with the content and strategy elements. This may be as simple as page-turning mechanisms in text-based instruction, or fully functioning visual, aural, and kinesthetic mechanisms in high-end, simulation-based instruction. In model-centered instruction, the control layer defines how learners can input information into dynamic models in order to create a change within the model.

A. (Sublayer: Model controls) In this project, the learner conversed with the model by making selections and observing how the model responded. The invisible was made visible through the dynamic graphs.

B. (Sublayer: Strategy control) Strategy controls involve increasing learner choice. In this project, strategy control was minimal. The learner did not have a choice to manipulate augmentation functions, request more or less augmentation, influence goals, change roles or select amounts of practice and demonstration. The learner could repeat activities. In future versions of the instruction, the learner will have more choices.

4. *Message Layer.* In the message layer, decisions are made concerning the underlying information or meanings that are to be communicated to the learner from the models and the instructional augmentations. Conceptually, the message is considered to be separate from the symbol system in which the message is represented. The message layer deals with abstract concepts that are given a mediated form through decisions made in the representation layer. For example, for the learner to understand the abstract concept of "Stop," a number of symbols may be generated and communicated in a variety of forms: written words, verbal sounds, an upheld hand, a ringing bell, a red light, a stop sign, or any other agreed upon signal.

Hadley, Gibbons, and Richards, 2003 stated that Messages are constantly issuing from the model. In this product, every choice the learner made created a message in the form of graphic feedback regarding the state of the model.

A. (Sublayer: Message set) A standard set of messages were developed to present information to the learner. This message set was contained in the database.

B. (Sublayer: Message structure) The message structure was consistent and was a combination of graphics and text.

C. (Sublayer: Message generator) Messages were dynamically generated to fit current state of the system and progression to the target behavior. The messages were generated from values in the database.

5. ***Representation Layer.*** Representation layer decisions involve the encoding of messages into a specific, mediated format. This layer includes the rules for generating a set of symbols that communicate the information or meanings generated in the message layer. Representation layer rules also cover decisions about the selection of media through which message representations will be delivered

A. (Sublayer: Display controller) The display controller was designed specifically to manage the changing states in the model.

B. (Sublayer: Display views) The display views corresponded to the changing states in the model.

C. (Sublayer: Surface reps for models) The surface representation consisted of dynamic feedback of the components of the health belief models, i.e., severity susceptibility, barriers, benefits, and compliance.

D. (Sublayer: Data management) feedback graphs

The following figures show a representative selection of the screens that the participants viewed during the instructional interaction. Given that the instruction is generated dynamically, there is not a certain "set" of screens that the participant always sees.

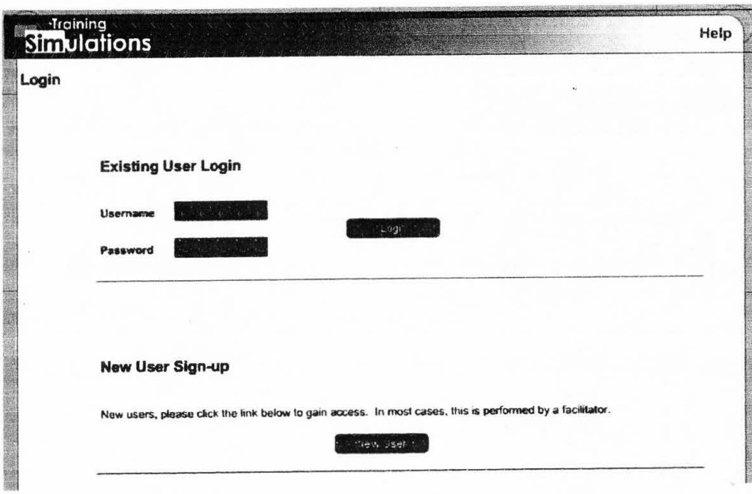


Figure 2. Login Page

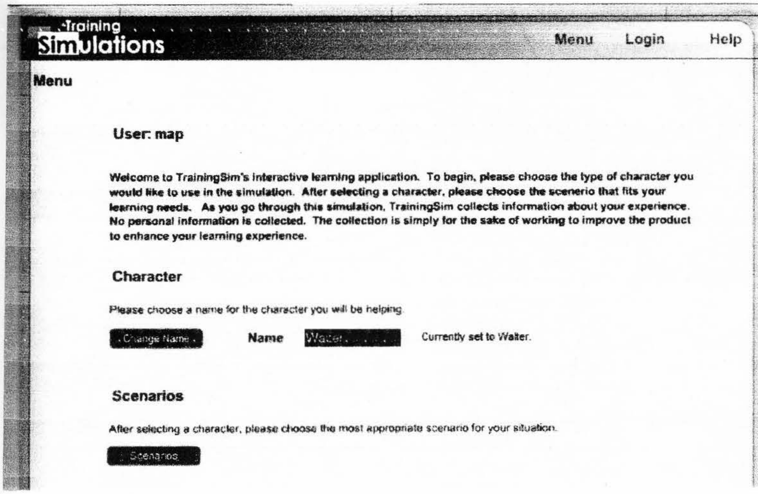


Figure 3. Scenario Character Page

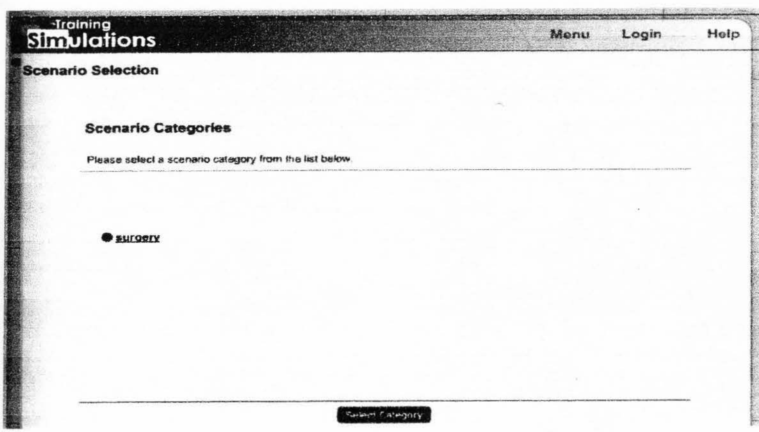


Figure 4. Type of Scenario Selection Page

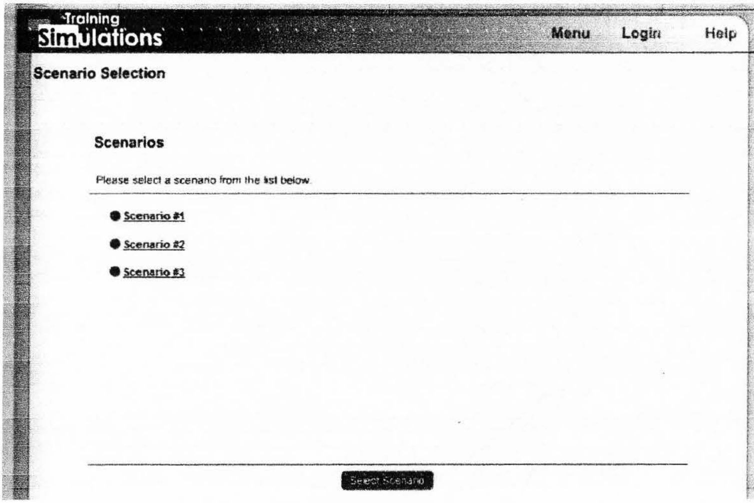


Figure 5. Scenario Selection Page

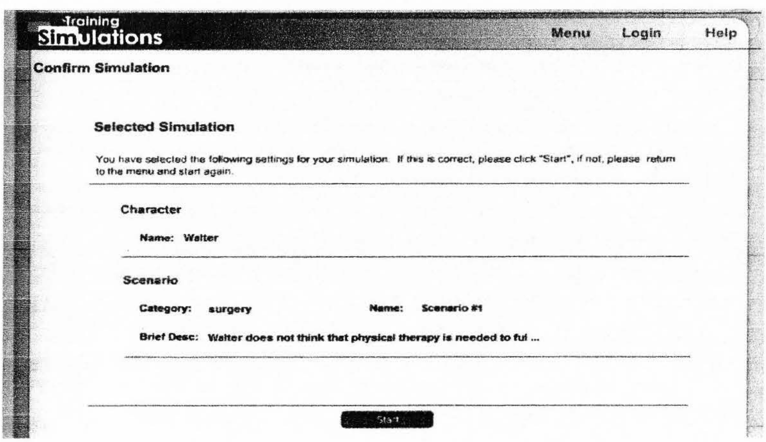


Figure 6. Description of Selected Scenario

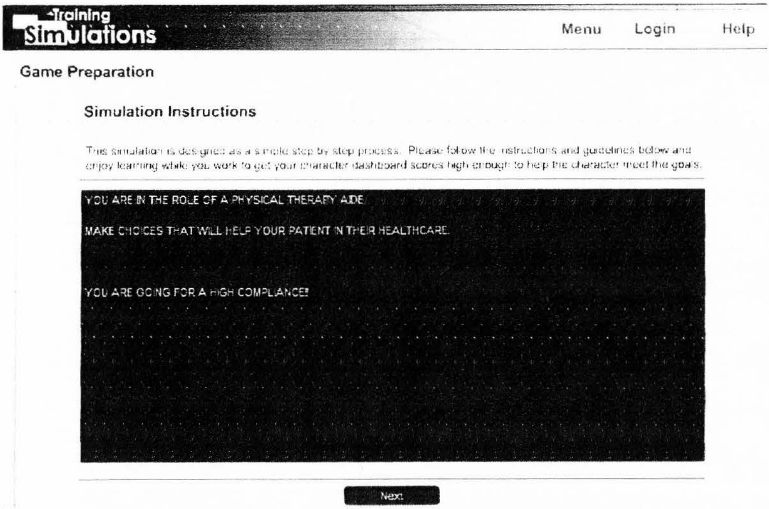


Figure 7. Simulation Instructions

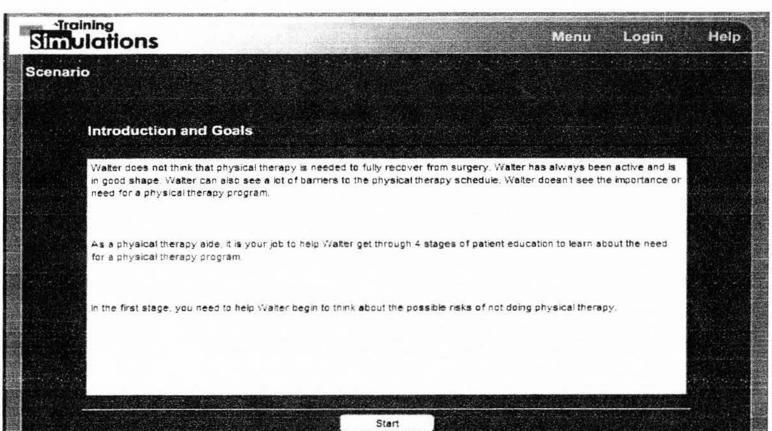


Figure 8. Scenario Introduction and Goals

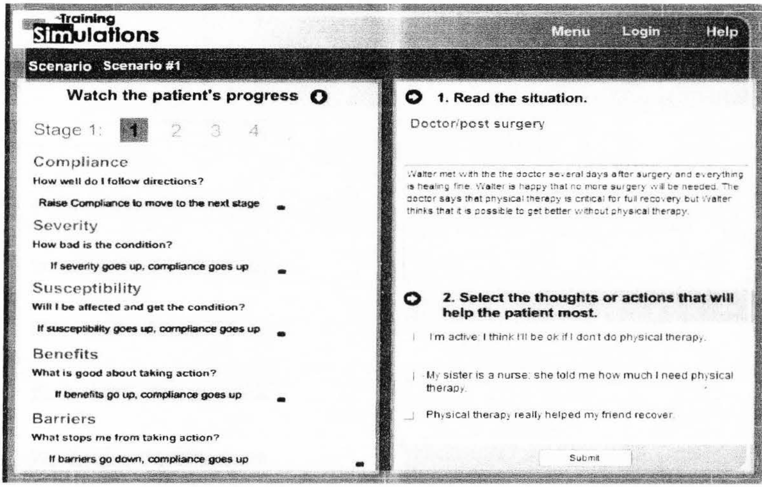


Figure 9. Scenario Interaction, (Stage 1)

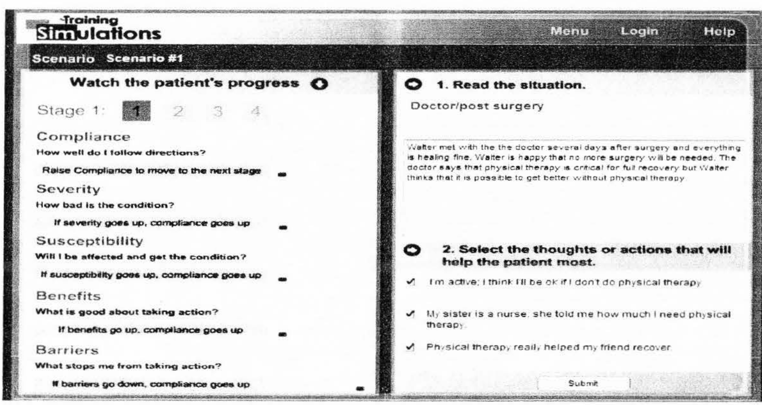


Figure 10. Interaction Screen; thoughts/actions checked

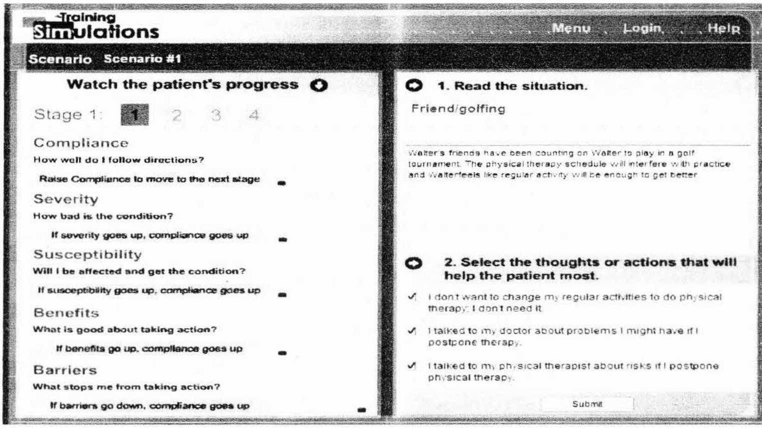


Figure 11. Interaction: Same Scenario, different event

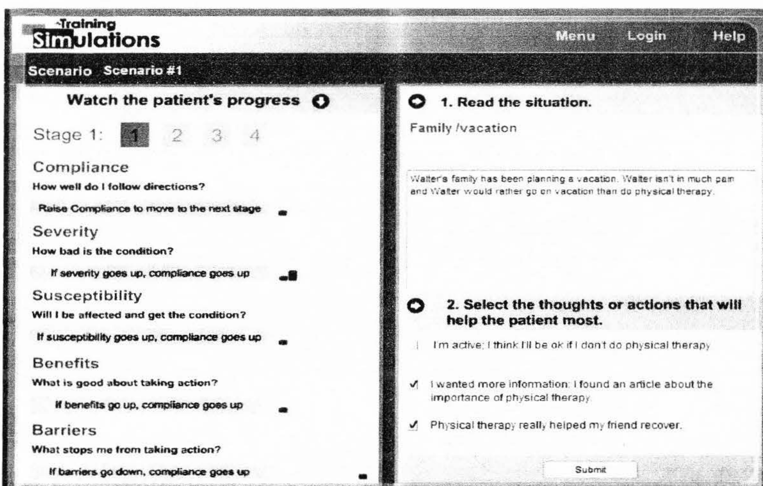


Figure 12. Interaction: Severity increase

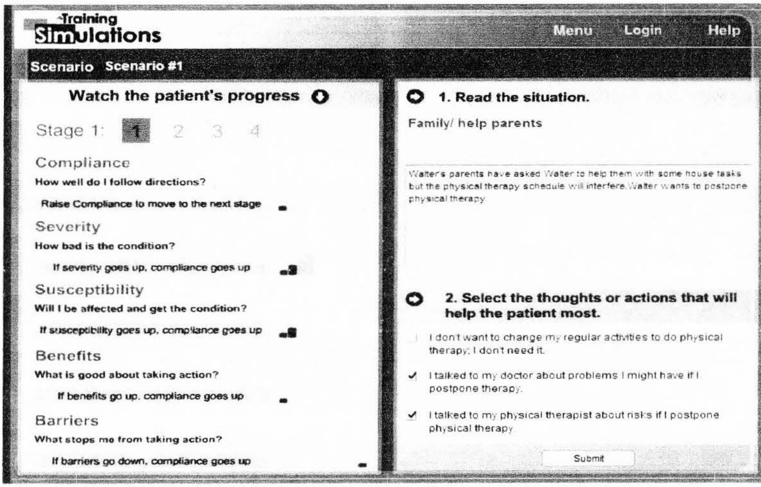


Figure 13. Interaction: Severity, Susceptibility increase

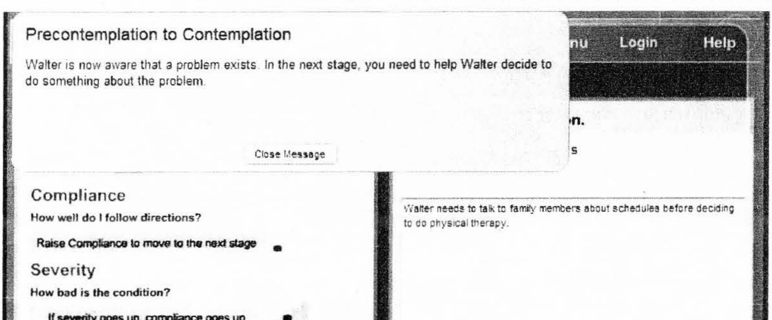


Figure 14. Participant successfully moved to next stage

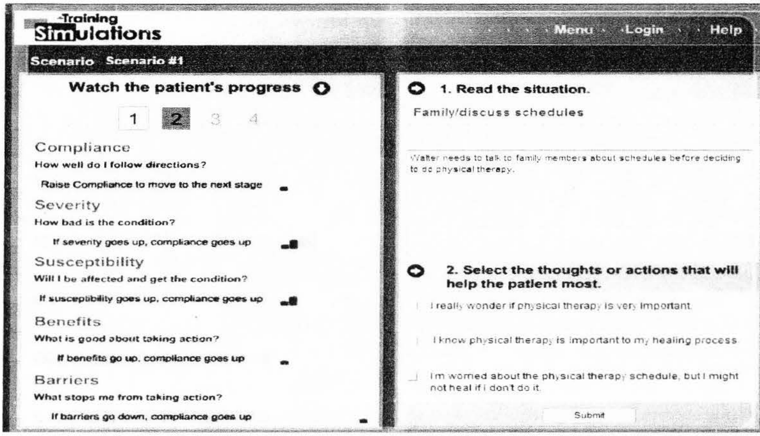


Figure 15. Interaction: Stage 2, Same Scenario

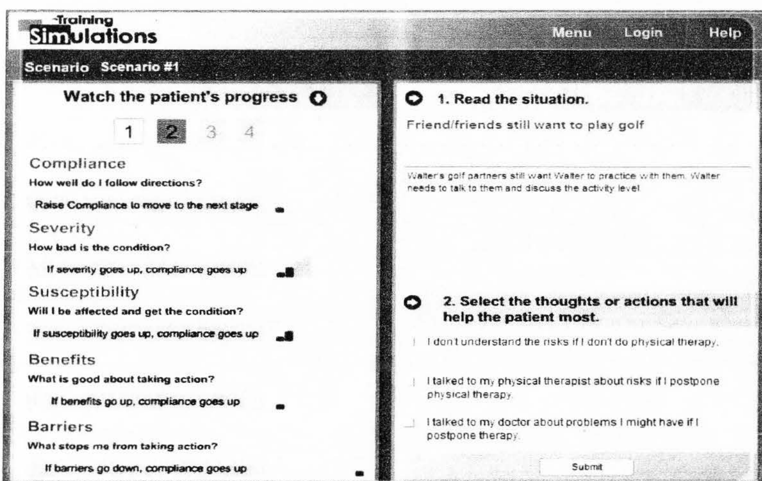


Figure 16. Interaction: Stage 2

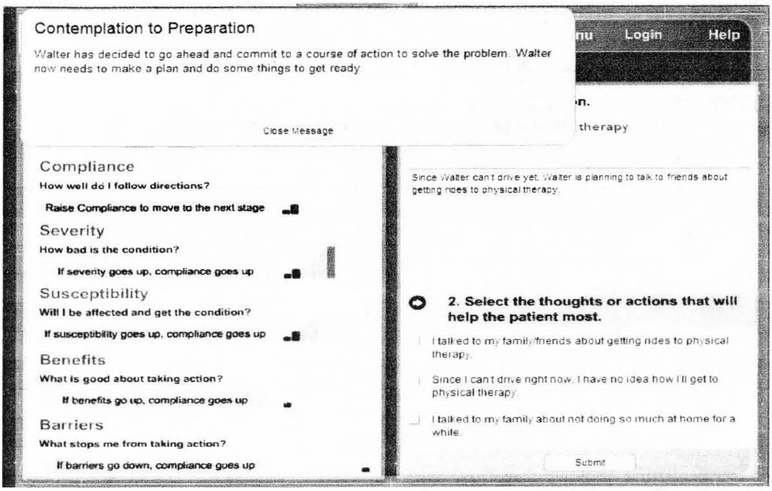


Figure 17. Participant moves to next stage

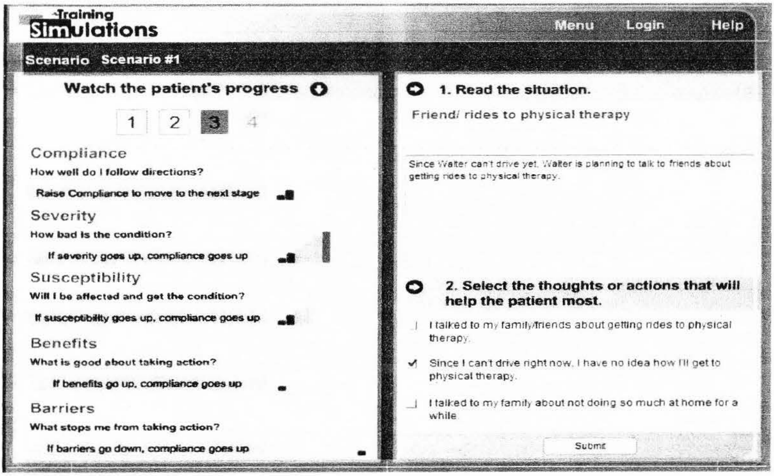


Figure 18. Interaction: Participant in Stage 3

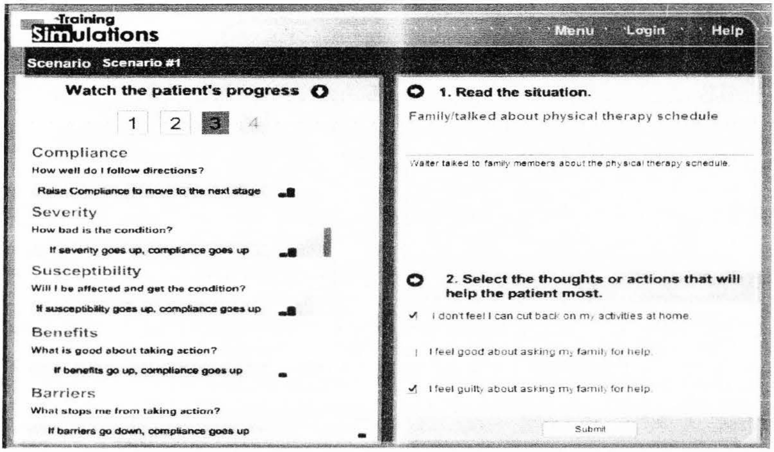


Figure 19. Interaction Screen: Stage 3

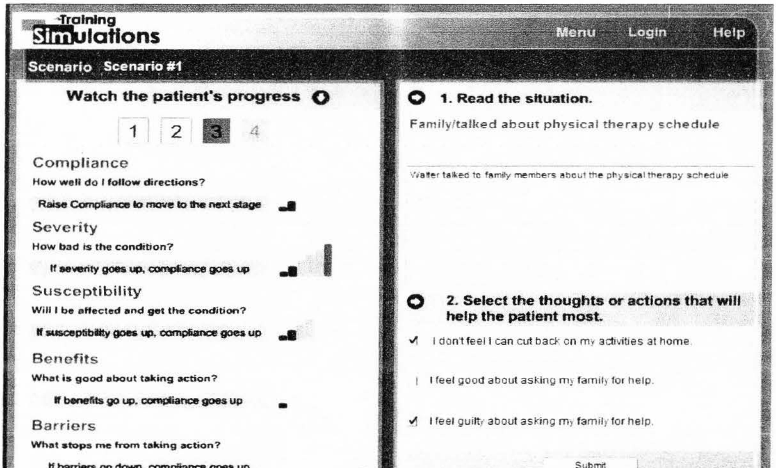


Figure 20. Interaction: Stage 3, Severity, Susceptibility increasing

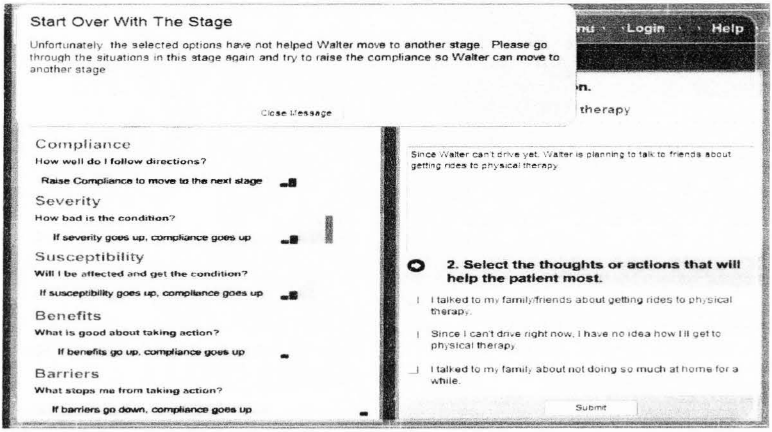


Figure 21. Participant repeats stage 3

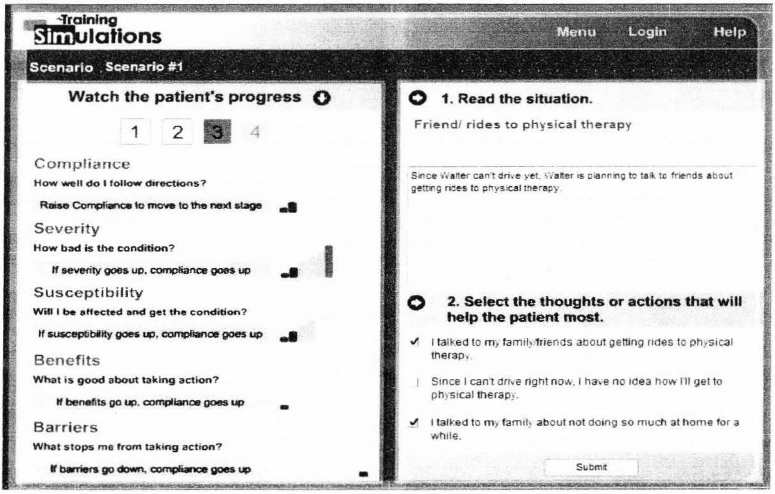


Figure 22. Stage 3 repeated

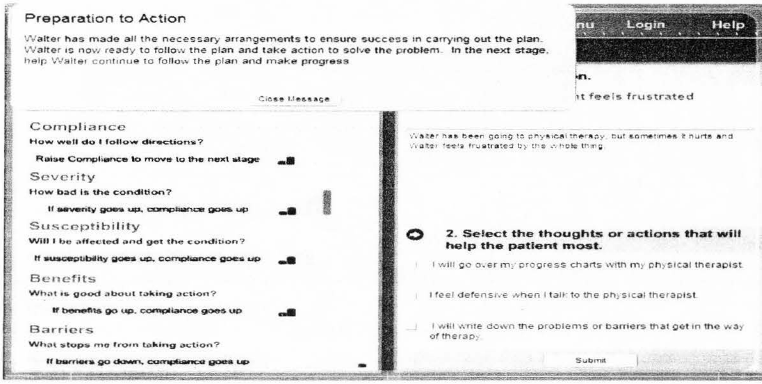


Figure 23. Participant has moved to Stage 4

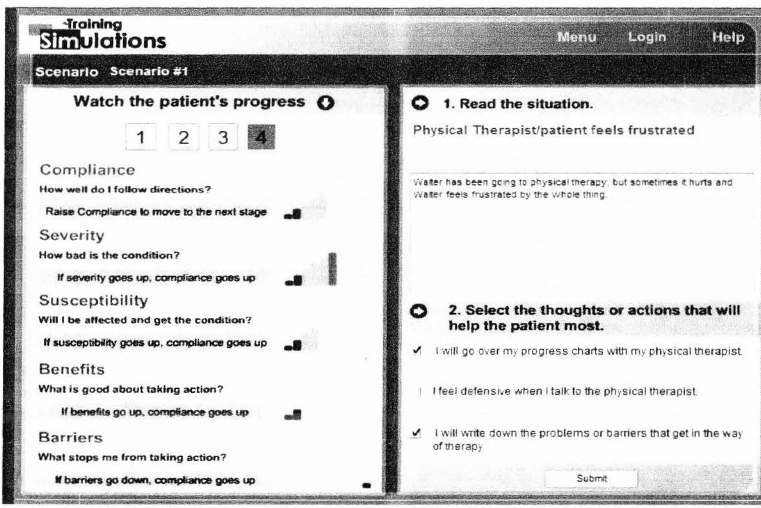


Figure 24. Stage 4: Compliance increasing, Severity, Susceptibility increasing

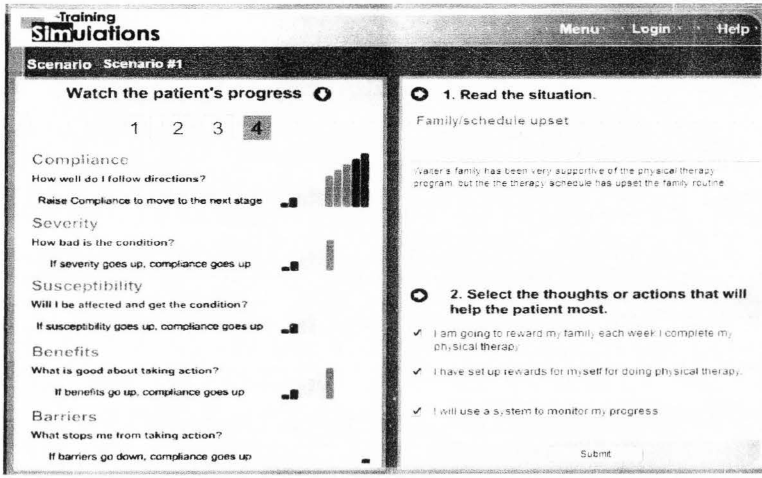


Figure 25. Stage 4: Full compliance

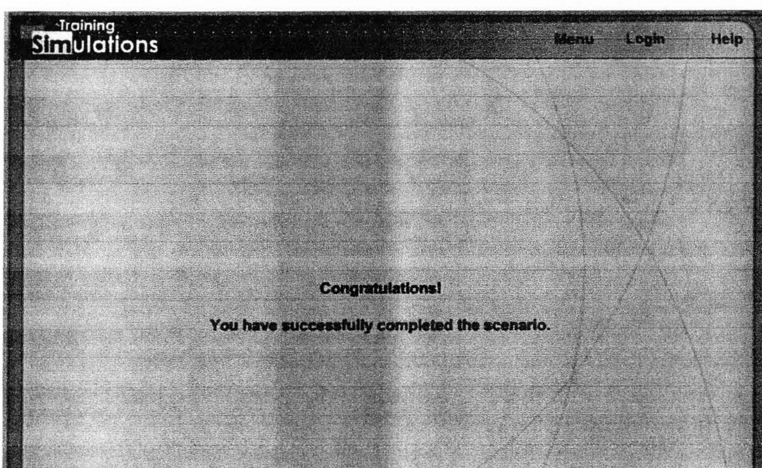


Figure 26. Note, Scenario Completion

6. *Media-Logic Layer.* The media-logic layer includes decisions related to the logic structures or rules used in the development of tools to carry out the design decisions or instructional actions planned by the instructional designer. In computer-based instruction, media-logic constructs such as logic branches, commands, objects, and applications are used to carry out design decisions from moment to moment as learners move through the instruction.

A. (Sublayer: Media representation) The media representation in this project was focused on providing graphical representation to the learner of the current state of the model.

7. ***Data-Management Layer.*** Data management decisions include how to collect, store, analyze, and communicate data to both the instructional designer and learner. Data may be collected before, during, and after an instructional event and be used to guide further instructional design decisions. Decisions in this layer are especially important in cases where interactive models or simulations are used, where instructional goals are negotiated with the learner during the instruction, or where dynamic, personalized instructional augmentations are delivered as part of the instruction.

A. (Sublayer: Data management) Data collection, storage, analysis, and reporting: The data management layer was defined in terms of the database system and the series of algorithms that drove the instructional engine. This data management system collected and analyzed current state data and produced appropriate, dynamic messages and feedback to the learner.

The Ideal-Case Design Order for Model-Centered Instruction

MCI is an instructional theory "based on the primary relationship between a learner and real or modeled: (a) environments, (b) cause-effect systems, and (c) expert behavior" (Gibbons, 2001, p. 511). MCI focuses initially on design decisions in the Content Layer and these three forms of models. These models, in turn, drive the design decisions for the Strategy and Message layers.

The entry point into a design determines the focus of subsequent design decisions and constraints. While there is not one absolute entry point into an instructional design, the ideal entry point into model-centered instruction is the content layer.

Figure 27, (Hadley, Gibbons, Richards, 2003, p. 6), illustrates the use of models and independent instructional augmentations.

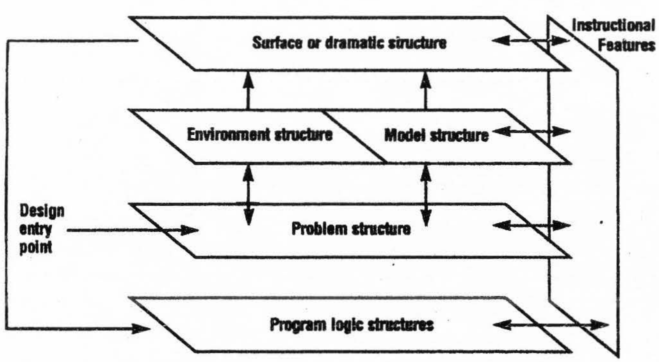


Figure 27. Design order of models/independent instructional augmentations

Focusing the design on the content models "yield instruction that emphasis thinking and problem solving in realistic situations" (Hadley, Gibbons, & Richards, 2003, p. 3). Therefore, the ideal-case is that the designer enters from the model/content layer and design decisions follow this order:

1. What is the appropriate cause-effect model (or system) the learner should interact with?
2. What is the appropriate level or denaturing (reduction in fidelity and granularity) of models for a given learner?
3. What sequence or set of probiems should the learner solve as a lens into or a mask on this model?
4. What resources and tools should be available as solving takes place?
5. What additional instructional augmentations should be supplied to support the solving of the problem? (Gibbons, Richards, Hadley, & Nelson 2003, p.6)

Hadley, Gibbons, and Richards, 2003, stated:

> Once content models have been analyzed and identified, the natural design entry point for the designer is into the strategy structure. Objectives, in the form of goals or problem statements, begin to shape the congruency of the other design layers such as logic structures and surface or dramatic features (p.6).

The design methodology in this study followed this ideal-case design order, entering at the level of the model/content layer and proceeding through the outlined design process.

Part A: Summary Design Methodology

The initial design perspective the designer uses affects the instructional integrity of the final product because it creates the priorities the designer uses in making design decisions. Quite often the delivery media or another constraint may be specified upfront. Although the designer must work within these constraints, designs that put content models at the center of the design yield instruction that put the focus on solving problems in realistic situations. Using this layered approach allows the designer to work within the project constraints to explore possible configurations of the design.

MCI specifies that interactions with the model are the framework of the experience. Developing syntactic strings with variable fields facilitates the creation of an infrastructure for the design of problems with respect to the model. Instructional features such as coaching and response messages, feedback and review, and expert performance modeling, presented during problem solving, become augmentations of the model. These augmentations contribute to the instructional experience. (Hadley, Gibbons, & Richards, 2003)

Utilizing MCI design methodology, incorporating the use of the seven principles and the design layer theory, and purposefully entering the design process at the model/content layer provides learners with experience interacting with cause-effect models and systems. This project utilized this design methodology.

Part B: Research Project Methodology and Analysis

This section outlines the methodology and data analysis procedures used in the study. For this study the investigator proposed that patient education in the form of MCI could provide instruction for patients in a physical therapy setting that would (a) decrease patient anxiety and (b) increase patient compliance over current instruction.

This research was accomplished by (a) recruiting volunteers for the study, (b) obtaining informed consent, and randomly assigning them to an experimental or a control group, (c) administering a pre-test of patient anxiety (State-Trait Anxiety Inventory) (STAI) to both the experimental and control groups, (d) administering a pre-test of patient attitudes to both the experimental and control groups, (e) administering the MCI instruction and a survey of instruction to the experimental group; the control group was given whatever instruction is normally available, (f) administering a post-test (STAI) to both the experimental and control groups, (g) administering a post-test of patient attitudes to both the experimental and control groups, (h) surveying the physical therapists regarding their perceptions of the patient's (all patients including both the control group and the experimental group) attitude toward physical therapy, compliance level, and anxiety level, (i) tracing the learner's navigation within the software, and (j) coding, entering, and analyzing the data and reporting the results.

This section outlines the research methods and experimental treatment that were used in the study including (a) the study sample, (b) the research design, (c) the variables, (d) the treatment, (e) the instrumentation and data collection, and (f) the statistical methods.

Research Methods and Experimental Treatment

Study Sample

Study participants were orthopedic surgery patients at the Mountain West Physical Therapy facility located at the Cache Valley Specialty Hospital in Logan, Utah. Because this research involved human subjects at the Cache Valley Specialty Hospital and the principal researcher was at Utah State University (USU), appropriate protection of human subjects was addressed by obtaining Institutional Review Board (IRB) approval from both institutions. Appendix A contains copies of the informed consent forms.

Target Population

The target population included out-patient knee and shoulder orthopedic surgery patients that met the following criteria: (a) ages 18 or older, (b) males or females from all ethnic groups, (c) had out-patient orthopedic knee or shoulder surgery within 2 weeks of starting physical therapy, (d) were able to speak and read English, and (e) had not participated in a physical therapy program in the last 2 years.

Accessible Population

The accessible population consisted of patients at the Mountain West Physical Therapy facility that met the selection criteria for inclusion in the study.

Selection Rules

Participants had to meet the selection criteria, listed above, to be invited to be included in the study. The recruitment of participants for the study was accomplished by:

How many refusals?

1. The physical therapist identified possible study participants. The American Health Insurance Portability and Accountability Act of 1996 (HIPAA) is a set of rules to be followed by health plans, doctors, hospitals and other health care providers. HIPAA took effect on April 14, 2003. In the health care and medical profession, the great challenge that HIPAA has created is the assurance that all patient account handling, billing, and medical records are HIPAA compliant. In accordance with the HIPAA, patients that the physical therapist felt might meet selection criteria specifications were asked to first sign a consent form that allowed the principal researcher to discuss the research study with them. This form was not an agreement to participate in the study; it was a preliminary agreement to allow the principal researcher talk to the patient. Appendix A contains a copy of this document.

2. Once given this written permission, the principal researcher reviewed the informed consent document with the patient. Appendix A contains a copy of this document.

3. The patient was given the opportunity to volunteer to be in the study. The patient did not know whether he or she would be in the experimental treatment or control group when they agreed to participate in the study.

This sample represents typical out-patient knee and shoulder orthopedic surgical patients in a physical therapy setting.

Research Design

The research design was a Pretest-Posttest Control Group quasi-experimental research design, shown below using Campbell and Stanley's notation (1963, p. 8):

Pretest-Posttest Control Group Design

R O X O

R O   O

R= Random assignment, O=Observation, X= Experimental treatment

Treatment Groups

The sample was one of convenience and participants were randomly assigned to either the experimental or control group. Since the participants were not randomly selected, the experiment is technically a quasi-experimental design. To start the assignment process, a coin was flipped to get the first number, either a (1) or a (2). As each participant enrolled in the study, he or she received either a 1 (experimental group) or a 2 (control group) designation. For example, every other enrollee received a "1." There were 20 participants in the control group and 20 participants in the experimental group. Once informed consent was received, participants were asked several initial questions to document the following variables:

1. Patient demographics (age, gender)
2. The patient education received about physical therapy prior to physical therapy
3. The physical therapist assigned to the patient

Features of the Treatment

Research Setting

Patients were seen at the Mountain West Physical Therapy facility at the Cache Valley Specialty Hospital. This hospital is an inpatient and outpatient surgical specialty hospital that houses a physical therapy rehabilitation facility and ancillary services including an emergency department, diagnostic imaging, and lab services.

Experimental Treatment

The treatment module, designed and developed utilizing MCI principles, consisted of 3 scenarios developed with a problem-solving format. Table 1, Page 40 illustrates the generic event structure of the 3 scenarios. The scenarios contained instruction regarding (a) patient anxiety, (b) patient compliance with a physical therapy regimen, and (c) patient skills and responsibilities. These scenarios were designed so that the patient played the role of a physical therapy aide and worked with simulated patients to help them get through their physical therapy. The instructional goal was to give the learner exposure to interacting with dynamic models of environmental, social, and physical/medical aspects of rehabilitation treatment. The modules included the following: (a) learner selection of a scenario, (b) presentation of a problem, (c) a selection of statements for the learner to select from that represented thoughts or actions that would help or hinder the "patient," (d) feedback in the form of a graphical interface, and (e) feedback moving from stages in the transtheoretical stages of change model.

Schedule of Intervention and Measurement

Gibbons (2004) described several characteristics of intervention patterns. "Intervention patterns can be described with reference to stages of progress toward a targeted outcome; each state may be characterized in terms of measure on the same or on different sets or parameters" (p. 2) Observation of states at intermediate points emphasizes the principles of "dynamic scoping and goal trajectories and causes us to see instruction as a process that can possess and gain momentum" (p. 3).

Figure 28 illustrates the intervention schedule of this project which includes multiple, measured intervention points. The line entering from the left represents the regular process of patient education that all patients receive. The diagram illustrates the intentional intervention and measurement points

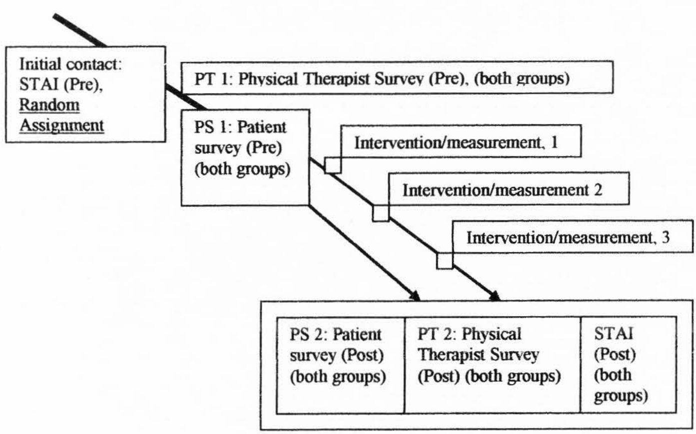


Figure 28. Intervention and Measurement Points

Pre-test

The State-Trait Anxiety Inventory

The STAI was used to measure pre-rehabilitation/post-rehabilitation anxiety in patients. The STAI (Spielberger, 1983), widely used in assessing clinical anxiety in research and in medical, surgical, psychosomatic, and psychiatric patients, was administered (Appendix B contains a copy of this instrument). The STAI is comprised of separate self-report scales for measuring state and trait anxiety (Chaplin, 1984). The use of the STAI was described by Durso-Cupal (1997):

> As a self-report instrument, it differentiates between general feelings of anxiety (trait anxiety, STAI-T) and current feelings of anxiety (state anxiety, STAI-S). Each scale contains 20 items for a total of 40 items. Items are rated on a scale from "1" (not at all) to "4" (very much so). A higher score on either subscale reflects a higher level of anxiety. The STAI is the most widely used outcome measure for measuring changes occurring as a result of treatment for anxiety (p.68).

The STAI has been normed on adults in clinical and research settings. The stability of the STAI scales was assessed on male and female samples of high school and college students for test-retest intervals ranging from 1 hour to 104 days. The magnitude of the reliability coefficients decreased as a function of interval length. For the Trait-anxiety scale, the coefficients ranged from .65 to .86, whereas the range for the State-anxiety scale was .16 to .62. This low level of stability for the State-anxiety scale is expected since responses to the items on this scale are thought to reflect the influence of whatever transient situational factors exist at the time of testing.

Every participant took the STAI inventory before beginning physical therapy. The researcher documented all patient education material that the patient received at the time the patient entered into the control or experimental group.

The Patient Survey

The Patient Survey was administered (a) pre-therapy and post- instruction to the experimental group and (b) pre-therapy and approximately 2-3 into therapy weeks for the control group. This survey was designed to gather information regarding a patient's feelings and attitudes toward their recovery and physical therapy program. This survey consists of 13 Likert Scale questions. Reliability was examined in a pilot test in February, 2005 to finalize development of this study instrument. In the pilot test, all of the survey instruments and MCI instruction was initially administered to 2 receptionists and 1 physical therapy aide at the Mountain West Physical Therapy facility. These individuals had more literacy regarding the healthcare system than the average patient. These individuals indicated that they couldn't understand 2 of the questions. After their input was incorporated, the surveys were administered to 4 patients at the Mountain West Physical Therapy facility. These patients indicated that they didn't understand 4 of the questions. The investigator reworded the questions and adjusted the literacy levels of the questions. Appendix B contains a copy of this instrument.

Treatment

Control Group

This group consisted of participants that did not receive the MCI. No effort was made to change or influence the material that the doctor or physical therapist gave the patient. The researcher documented the patient education material that the patient received at the time the patient entered into the control group and during the duration of the patient's time in the study.

Experimental Group

This group consisted of participants that received the MCI. The MCI treatment was was delivered on the internet. Model-centered instruction is media independent, but computer-based instruction was chosen because many patients prefer using the computer to receive information (Lewis, 1999) and a nurse or patient education facilitator is not needed to deliver the material. In addition, the material was created for a literacy level of 6th grade (Nielsen-Bohlman, Panzer, & Kindig, 2004) so that most of the participants could understand the material.

Participants in the experimental group were asked to complete the sections of the MCI instruction during the first 2 to 3 weeks of their physical therapy regimen. This time period was chosen based on information from an experienced physical therapist at Mountain West Physical Therapy (Larry Hunter, personal communication, November 10, 2004). Mr. Hunter indicated that patients generally begin to be noncompliant after the first 2-3 weeks of physical therapy. Participants completed 3 sessions of instruction at the Mountain West Physical Therapy Facility. This instruction required approximately 20 extra minutes, minimum, per session. When the participant completed the instruction, he or she was asked to fill out an Instruction Survey that examined changes in his or her attitudes and beliefs as a result of the instruction. Participant movements in the software were traced to examine patterns of use. The Instruction survey also contained questions regarding participant satisfaction with (a) the instructional format (i.e., computer based simulation and role play), (b) ease of use, and (c) the delivery medium (i.e., internet computer technology). Appendix B contains a copy of the Instruction Survey instrument that was used each time a participant accessed the instruction.

The control group patients did not have access to the treatment material. The researcher instructed the experimental group that they were not to discuss aspects of their instruction with other patients for confidentiality purposes.

Posttest. Posttests were given to all patients after they had been in their physical therapy program for 2 to 3 weeks. These posttests included a second STAI survey and a second Patient Survey. These instruments were the same as the instruments used in the pretest and are shown in Appendix B.

Physical Therapist Survey. The physical therapist was given a survey shortly after the patient started their physical therapy program and after the patient had been in the physical therapy program for approximately 3-4 weeks. This Physical Therapist Survey gathered information about the patient's compliance. Appendix B contains a copy of this survey.

Summary: Part B, Research Project Methodology and Analysis

This study was conducted at the Mountain West Physical Therapy Facility. Forty patients that had recently had orthopedic shoulder or knee surgery were randomly assigned to participate in the study. The study utilized a quasi-experimental design and divided the participants into two groups, an experimental group and a control group, to test the implementation of the model-centered instruction.

Table 2 summarizes the measurement instruments administered to both the control and experimental groups.

Table 2. Intervention and Measurement Events

Event	Experimental Group	Control Group
Informed Consent	Y	Y
STAI, Patient Survey 1	Y	Y
PT Survey, 1	Y	Y
Intervention/Measurement 1	Y	N
Intervention/Measurement 2	Y	N
Intervention/Measurement 3	Y	N
STAI, Patient Survey 2	Y	Y
PT Survey 2	Y	Y

Summary: Chapter III, Methods and Procedures

Instructional designs that put content models at the center of the design yield instruction that focuses on problem-solving in authentic situations. Using the layered approach to instructional design allows the designer to work within the project constraints to explore possible configurations of the design.

MCI specifies that interactions with the model are the framework of the experience. Developing syntactic strings with variable fields facilitates the creation of an infrastructure for the design of problems with respect to the model. Instructional features such as coaching and response messages, feedback and review, and expert performance modeling, presented during problem solving, become augmentations of the model. These augmentations contribute to the instructional experience (Hadley, Gibbons, & Richards, 2003).

This study was conducted at the Mountain West Physical Therapy Facility. Forty patients that had recently had orthopedic shoulder or knee surgery were randomly assigned to participate in the study. The study utilized a quasi-experimental design.

Participants were selected from a convenience sample and were randomly assigned to an experimental group or a control group. The target population included out-patient knee and shoulder orthopedic surgery patients that met the following criteria: (a) ages 18 or older, (b) males or females from all ethnic groups, (c) had out-patient orthopedic knee or shoulder surgery within 2 weeks of starting physical therapy, (d) were able to speak and read English, and (e) had not participated in a physical therapy program in the last 2 years. The accessible population consisted of patients at the Mountain West Physical Therapy facility that met the selection criteria for inclusion in the study. The participants that received the MCI treatment were asked to go through a web-based scenario story involving a scenario character and possible thoughts or actions that this character could take. Once the participant completed a scenario, he or she was asked to fill out an instruction survey that asked them about their own thoughts about the story and the character in the story. The physical therapists were surveyed with regard to all of the participants' compliance and all of the participants were surveyed with their impressions about their healthcare.

In sum, utilizing MCI design methodology by incorporating the seven principles of MCI and the design layer theory, and purposefully entering the design process at the model/content layer provides learners with experience interacting with cause-effect models and systems. This project utilized this design methodology.

CHAPTER IV

RESULTS

Chapter Introduction

The methods described in the previous chapter were used in order to focus on differences in learner interaction between MCI patient education and traditional patient education. It was hypothesized in Chapter 1 that there would be statistically significant differences in (a) anxiety levels and (b) compliance between the groups of patients using MCI-based patient education and traditional patient education. The results presented in this section confirm both of the hypotheses.

This chapter presents the results of the study including (a) Part A, a discussion of the results of the Model-Centered Instruction design process and (b) Part B, the results of the experimental study on MCI and patient education.

Part A: Results of the MCI Design Process

The MCI design activities used in this project followed the design process prescribed by Gibbons, Richards, Hadley, and Nelson, 2003. Five general activities guided the project design and the results are described below.

Results of the MCI Design Activities

Activity #1: Choosing the appropriate cause-effect model (or system) with which the learner should interact.

Results #1: Choosing the most appropriate models proved to be one of the most challenging aspects of this project. Initially, the designer approached the model definition from the aspects of the desired model to be interacted with; subsequently, the designer switched to the perspective of designing to the target performance using the previously described syntactic strings approach. One of the strategies used to get at the correct model was to look at the problems specified by the target performances. In this case, the desired target performances were changes in behaviors and belief systems in patients in his or her healthcare in the healthcare system.

The researcher developed a set of mathematical formulas to assign values to the thought/action choices on the part of the learner and the subsequent changes in the values of the variables. In order to capture the models, the researcher conducted interviews with physical therapists and individuals not involved professionally the healthcare system.

An instance of the problem was designed; usually following the order of general-specific-general. An Excel spread sheet was used to present prototype scenarios to the pilot study participants and allow the participants to make decisions regarding attitudes, actions and beliefs. Figure 29 shows a small portion of this spreadsheet. The elements in the spreadsheet were generated from the Event Structure Matrix, Table 1.

Figure 29. Representative scenarios

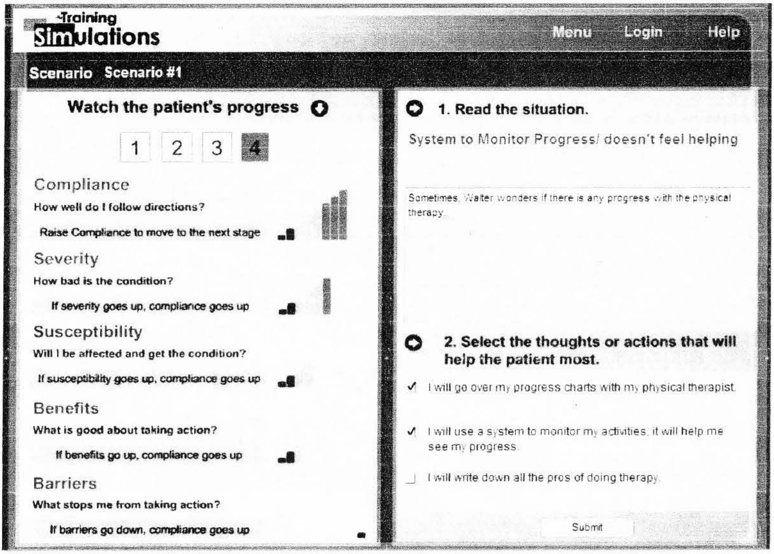
C	D	E	F	G	H	I
Statement	**T/A**	**Sev**	**Sus**	**Bar**	**Ben**	**Stage**
Initial State						
Goal State						
Precontemplation						
Consciousness Raising						
My doctor says that therapy is really important for my recovery	T	6	4	1	3	1
I found an article about how successful therapy can be	A	6	4	1	3	1
My friend told me about her therapy and how much it helped her	T	6	4	1	3	1
My friend told me about his therapy and how much it helped him	T	6	4	1	3	1
My sister is a nurse and she told me how much physical therapy will help me recover	T	6	4	1	3	1
My neighbor works at the hospital and he told me how much physical therapy helps	T	6	4	1	3	1
I'm active; I can get better without physical therapy	T	6	4	3	0	1
I generally exercise a lot. I can get better without therapy	T	6	4	3	0	1
I think if I just take it easy, my knee will get better without therapy	T	6	4	3	0	1
I think my knee will get better without therapy	T	6	4	3	0	1
This therapy schedule is inconvenient; I can't do this	T	6	4	3	0	1
Therapy is going to hurt; I don't think I'll do it	T	6	4	3	0	1
I'm afraid to talk to my physical therapist about any of my concerns.	T	6	4	3	0	1
My doctor says that I won't get better without therapy	T	10	10	0	0	1
Dramatic Relief						
I am worried about whether physical therapy will make my knee hurt a lot.	T	5	6	5	0	1
I am anxious about not being able to do the exercises in physical therapy.	T	5	6	5	0	1
I am anxious that I won't be able to keep up with the exercise routine.	T	5	6	5	0	1
I am anxious about physical therapy	T	5	6	5	0	1
I am worried about swelling and what I can do about it	T	5	6	5	0	1
I am worried about pain and what I can do about it	T	5	6	5	0	1

In this preliminary product design and implementation, there are 200 statements categorized in the stages of change model available in the database. These statements are available to the software engine to use to generate presentation of scenarios and events to the participant.

The formulas that calculate the presentation of information to the participant were developed from extensive research into the Health-Belief Model and the Transtheoretical Stages of Change Model. When these formulas are executed, this set of rules modifies system variables that have been stored and calculated in the database. This activity allowed the researcher to test individual system variables and watch their state changes.

As the participant reached thresholds at specific stages in the process, the software moved the participant through levels of accomplishment; the patient could watch this progression with respect to the target behavior variables of anxiety and compliance. The participant also received feedback on these variables. Figure 30 contains a representative feedback screen that the participants were shown.

Figure 30. Feedback Screen



It is significant to note that all of the elements shown here are generated separately and presented as a whole on the screen. Also, there is no specific path of presentation. The elements are generated at the time of use and calculated by the engine in the software. Participant movements are also tracked for further analysis after the instruction is finished.

Activity #2: Selecting the appropriate level of (reduction in fidelity and granularity) of models for a given learner

Results #2: As previously stated, in many cases, it is not possible to give the learner direct experience with the real system. Cost, danger, or accessibility to the system may require that the learner interact with a replica or model of the real system. The level of denaturing in this research was set to a level appropriate for the target audience determined to be persons with (a) a 6^{th} grade literacy level, (b) limited computer use skills, and (c) limited knowledge (if any) about physical healing systems, the physical therapy environment, or social or emotional systems associated with the physical therapy rehabilitation process.

Activity #3: Selecting the sequence or set of problems the learner should solve that will act as a lens into or a mask on the model

Results #3: The sequence and problem set in this iteration of the project was determined by an matrix shown in Table 1, page 40. This matrix was developed based on the health-behavior models, the design of the problem, and on input from subject matter experts (Larry Hunter, Julie Gast, personal communication, Feb. 2004).

Activity # 4: Selecting the resources and tools that should be available as solving takes place.

Results #4: Instructional control systems may initiate performance feedback or provide additional resources. The instructional control systems in this instructional product primarily consisted of user input mechanisms (a mouse or a keyboard).

Activity #5: Selecting additional instructional augmentations that should be supplied to support the solving of the problem.

Coaching and feedback can be done during problem solving or after a problem solving activity is completed. One of the more helpful instructional features for simulation-based instruction is coaching. (Collins et al., 1987) defined coaching as "observing students while they carry out a task and offering hints, scaffolding, feedback, modeling, reminders and new tasks aimed at bringing their performance closer to an expert's performance" (p.18)

Results #5: In order to provide effective feedback, student performance must be assessed against expert performance. Recording learner behavior enables the designer to adjust the instruction and feedback to the learner's performance. This tracking also provides the learner feedback within the process of the models. This product tracked the learner performance and adjusted the presentation of instruction accordingly.

Feedback was one of the most prominent instructional strategies utilized in this instructional product. Participants were shown (graphically) their progress toward their goal or were directed to repeat the previous section. This movement, forward or backward, was determined by the software engine behind the databases.

Part A: The MCI Design Process Summary

Gibbons and his colleagues, in numerous articles, book, and presentations, have proposed a theory of MCI and prescriptions for designing MCI. The first research question examines the use of these theoretical principles and prescriptions for capturing and demonstrating the design process of an MCI product. The main objective of this design portion of this project was to demonstrate and capture the design, production, and evaluation of an MCI product utilizing MCI design principles and test established guidelines for MCI design. The design activities were documented in written format. Finally, the instruction was experimentally tested for instructional results.

The content for the project focused on patient education in the physical therapy setting. The content scope was limited to thoughts and beliefs that patients may have with regard to their own healthcare. The audience consisted of patients and healthcare professionals who would benefit from transferring these complex cognitive skills to a wide variety of environments within the healthcare industry.

The project constraints primarily had to do with working within the healthcare system, i.e., time allotted to deliver instruction and the schedules of patients and physical therapists. Participants had limited time to utilize the instruction and discuss their feelings with the researcher.

The first design activity was to analyze and capture the expert-performances, cause-effect systems, and environmental models needed to create the instruction. The researcher used the syntactic string approach to develop these models and the scenarios and events needed for learner interaction with the model. Once the content models were established, the instructional strategies were established. Instructional features including coaching and feedback were developed. The researcher constantly reviewed the content-model to ensure fidelity to the instructional goal.

An engine to track learner interactions and give customized feedback was developed. This enables adaptivity in the MCI product in that it responds to the state system with regard to the interaction between the learner and the instruction. The instruction is based upon cause-effect interactions between the learner and the instruction. The sequence of instruction is dependent on the actions of the learner, the instruction that is presented is appropriate for the state of the problem solving activity, and the movements of the learner are traced to monitor the progress and model-interaction activities of the learner. All instruction is sequenced and presented by calculations in the equations in the engine that drives the simulation.

The researcher created scenarios to capture realistic events of the patient experience in everyday life. Using the syntactic string approach enabled ease of development of these scenarios and events.

The development of the MCI instruction proceeded in a formative manner including the following steps:

1. Designing an instance of the problem was designed following the order of general→specific→general.
2. Developing a prototype of the instruction with excel spreadsheets.
3. Testing the prototype
4. Collecting and analyzing data on the on the prototype
5. Revising the prototype
6. Repeating the process

The instructional design activities used in this project were appropriate and effective for the MCI design and development.

Part B: Research Project Methodology and Results of the Data Analysis

This section outlines the methodology and data analysis procedures used in the study. For this study the investigator proposed that patient education in the form of MCI could provide instruction for patients in a physical therapy setting that would (a) decrease patient anxiety and (b) increase patient compliance over current instruction.

This research was accomplished by (a) recruiting volunteers for the study, (b) obtaining informed consent, and randomly assigning them to an experimental or a control group, (c) administering a pre-test of patient anxiety (State-Trait Anxiety Inventory) (STAI) to both the experimental and control groups, (d) administering a pre-test of patient attitudes to both the experimental and control groups, (e) administering the MCI instruction and a survey of instruction to the experimental group; the control group was given whatever instruction was normally available, (f) administering a post-test (STAI) to both the experimental and control groups, (g) administering a post-test of patient attitudes to both the experimental and control groups, (h) surveying the physical therapists regarding their perceptions of the patient's (all patients including both the control group and the experimental group) attitude toward physical therapy, compliance, and anxiety, (i) tracing the learner's navigation within the software, and (j) coding, entering, and analyzing the data and reporting the results.

This section outlines the research methods and experimental treatment that were used in the study including (a) the study sample, (b) the research design, (c) the variables, (d) the treatment, (e) the instrumentation and data collection, and (f) the statistical methods.

Results of the Analysis of the Data

The methods described in Chapter 3 were used in order to focus on differences in learner outcomes with patient education systems. It was hypothesized in Chapter 1 that the MCI group would experience less anxiety and increased patient compliance during their physical therapy treatment. This next section features (a) a demographic description of the participants, and (b) a restatement of each research question, a statement of the null hypothesis, a description of the analysis and variables used to address each one, and a presentation of the empirical results.

The participants were randomly assigned to both groups. In the case of gender, the control group and experimental group had unequal distribution in the groups. With regard to age, the control group and experimental group had similar Ns in the 18-39 category, but unequal distributions in the 40-49 and 50-69 age groups. Tables 3 and 4 present a summary of the demographic information for the control and experimental groups.

Table 3. Demographic Gender Information

	Control Group		Experimental Group	
N	Males	Females	Males	Females
Gender	15	5	5	15

Table 4. Demographic Age Information

Age	Control Group	Experimental Group
(18-39)	10	9
(40-49)	7	4
(50-69)	3	7
Total N	20	20

Research Question 2

Is there a difference in anxiety levels of orthopedic surgery patients who get MCI and those who get traditional patient education as measured by pre-post gain scores on the State-Trait Anxiety Index (STAI-S)?

Null Hypothesis: There is no difference between the anxiety levels of the group that receives traditional patient education vs. the group that receives MCI patient education.

Recall from Chapter 3 that a commonly used instrument to measure anxiety in medical patients is the State-Trait Anxiety Index (STAI). The STAI, widely used in assessing clinical anxiety in research and in medical, surgical, psychosomatic, and psychiatric patients, was administered to both the experimental and control groups (Appendix Bcontains a copy of this instrument). The STAI is a self-report instrument that differentiates between general feelings of anxiety (trait anxiety, STAI-T) and current feelings of anxiety (state anxiety, STAI-S). Each scale contains 20 items for a total of 40 items. Items are rated on a scale from "1" (not at all) to "4" (very much so). A higher score on either subscale reflects a higher level of anxiety. The STAI is one of the most widely used outcome measure for measuring changes occurring as a result of treatment for anxiety (Durso-Cupal, 1997, p.68). While both trait anxiety and state anxiety were measured, only the pre-test/post-test gain in state anxiety is used in the analysis. This variable was recomputed using (pretest STAI-S – posttest STAI-S=STAIGain). The test for trait anxiety (STAI-T) is used to compare the anxiety characteristics of both groups.

The descriptive statistics, mean, median, mode, and SD, are reported below. The t-test assesses whether the means of two groups are statistically different from each other. An independent samples two-tailed t-test was run to determine if there were any group differences. Since there was no hypothesis in advance of data collection which mean would be larger, the two-tailed t-test was used. The results show that for the experimental group, the anxiety levels went down from the pretest to posttest STAI-S and for the control group, the anxiety levels went up from the pretest to the posttest STAI-S. The results, sig. =.02, df=38, p<.05, show that the difference between the means is statistically significant and support rejection of the null hypothesis.

(Pre-STAI) – (Post STAI) = STAIGain	N	Mean	Median	Mode	SD
Experimental	20	3.45	3.00	3.00	6.71
Control	20	-1.60	-2.50	-3.00	6.66

Table 5. T-Test Results for Question #2

Research Question 3

For the experimental group, is there a difference in anxiety levels between male and female orthopedic surgery patients as measured by pre-post gain scores on the STAI-S?

Null Hypothesis: There is no difference in the STAI-S anxiety scores, pretest and posttest, between males and females in the experimental group.

The STAIGAIN variable is used in the analysis. This variable was recomputed using (pretest STAI-S – posttest STAI-S=STAIGain). The mean and SD for both genders in the experimental group are reported below. An independent samples t-test was run to determine if there were any group differences. The results, sig.087, df=18, p<.05, show that the difference between the means is not statistically significant and support acceptance of the null hypothesis.

The results show that for the experimental group, the anxiety levels were not statistically different between males and females with regard to the STAIGain scores. This shows that for this analysis, gender was not indicated as a factor.

(Pre-STAI) – (Post STAI)=STAIGain	N	Mean	SD
Male	5	-1.00	6.04
Female	15	4.90	6.43

Table 6. T-Test Results for Question #3

Research Question 4

For the experimental group, is there a difference in anxiety levels of orthopedic surgery patients as measured by pre-post gain scores on the STAI-S among participants aged 18-39, 40-49, and 50-69?

Null Hypothesis: For the experimental group, there is no difference in STAIgain scores measuring anxiety levels between participants aged 18-39, 40-49, and 50-69.

The (pretest STAI-S – posttest STAI-S=STAIGain) is used in the analysis. This variable was recomputed using (pretest STAI-S – posttest STAI-S=STAIGain). The ANOVA is used to compare means of multiple groups. A one-way ANOVA was run to determine if there were group differences. The results, Sig. = .848, p<.05, do not support rejection of the null hypothesis and show that the differences between the means is not statistically significant. The null hypothesis is accepted.

The results show that for the experimental group, STAI-S anxiety levels were not statistically different among age groups with regard to the (pretest STAI-S – posttest STAI-S=STAIGain) scores.

(Pre-STAI) – (Post STAI)=STAIGain	N
Group 1 (18-39)	9
Group 2 (40-49)	4
Group 3 (50-69)	7

F	Sig.
.166	.848

Table 7. ANOVA Test Results for Question #4

Research Question 5

Is there a difference in compliance levels of orthopedic surgery patients who get MCI and those who get traditional patient education as measured by pre-post gain scores on the physical therapist survey?

Null Hypothesis: There is no difference in scores measuring compliance levels between a group of orthopedic surgery patients who get MCI and a group who get traditional patient education.

The gain in compliance was computed by measuring the (pre-compliance score – the post-compliance score=CompGain) from the physical therapist survey . The mean, median, and SD are reported below. An independent samples t-test was run to determine if there were any group differences. The results, sig.=.000, p<.05, df=38, support rejection of the null hypothesis and show that the difference between the means is statistically significant.

The results support rejection of the null hypothesis and show that the difference between the means of (pre-compliance score – the post-compliance score=CompGain) is statistically significant.

(Pre-Compliance) – (Post- Compliance) =CompGain	N	Mean	Median	SD
Experimental	20	5.65	2.0	8.54
Control	20	-4.70	-3.0	7.13

Table 8. T-Test Results for Question #5

Research Question 6

For the experimental group, is there a difference in compliance levels between male and female orthopedic surgery patients as measured by pre-post gain scores on the physical therapist survey?

Null Hypothesis: For the experimental group, there is no difference in (pre-compliance score – the post-compliance score=CompGain) scores measuring compliance levels between males and females?

The mean and SD are reported below. An independent samples t test was run to determine if there were any group differences. The results, sig=.219, $p<.05$, df=18, do not support rejection of the null hypothesis and show that the difference between the means is not statistically significant. The null hypothesis is accepted.

The results support acceptance of the null hypothesis and show that the difference between the means of the (pre-compliance score – the post-compliance score=CompGain) scores with respect to gender is not statistically significant.

(Pre-Compliance) – (Post-Compliance)=CompGain	N	Mean	SD
Male	5	9.8	11.8
Female	15	4.26	7.13

Table 9. T-Test Results for Question #6

Research Question 7

For the experimental group, is there a difference in compliance levels of orthopedic surgery patients as measured by pre-post gain scores on the physical therapist survey among participants aged 18-39, 40-49, and 50-69?

Null Hypothesis: For the experimental group, there is no difference in (pre-compliance score – the post-compliance score=CompGain) scores measuring compliance levels between participants aged 18-39, 40-49, and 50-69?

A one-way ANOVA was run to determine if there were any group differences. The results, Sig. = .483, $p<.05$, support acceptance of the null hypothesis and show that the differences between the means is not statistically significant.

The results support acceptance of the null hypothesis and show that the difference between the means of the (pre-compliance score – the post-compliance score=CompGain) scores with respect to age is not statistically significant.

(Pre-Compliance) – (Post-Compliance)=CompGain	N
Group 1 (18-39)	9
Group 2 (40-49)	4
Group 3 (50-69)	7

F	Sig.
.761	.483

Table 10. ANOVA Test Results for Question #7

The pilot study consisted of administering the instruction and the survey instruments to five people who were outside of the study. Based on this input, 4 questions were revised on the patient survey. The revisions related to making the questions easier to understand. After these minor revisions were made, the researcher gave the instruction and the surveys to two patients. These two patients also recommended some minor changes to 2 questions on the patient survey. Once these revisions were completed, the instruments were ready to use in the study.

During the research period, four of the participants in the study dropped out during the first week:

1. A woman who had knee surgery and fell down her stairs three days later reinjuring herself
2. A man who was a student at USU and went home for the summer
3. A woman who lived outside of Logan and decided to continue therapy at another facility
4. A man that was not mentally competent to participate in the study.

In addition to the anxiety and compliance scores, a separate Patient Survey was administered to both groups regarding their feelings about their healthcare experience. The questions asked the participants to rate their behavior along a scale, e.g., from "Not Likely" to "Very Likely". The mean pre-post gain scores are noted in Table 11, as well as the component of health behavior referred to by the question and the desired direction of the score. In some cases, a negative score is more desirable than a positive score. The explanations of each score are shown in the table.

Table 11. Patient Survey

Question	Variable	Control	Exp	Explanation
Q1: (Severity) Indicate how serious you feel your health condition is with regard to your recent surgery.	Severity Change	-3.0	.15	Desired positive: A positive score indicates that the patient's perception of severity is increasing
Q2: (Susceptibility) Indicate how likely you feel you are to reinjure yourself or not heal properly from your recent surgery.	Susceptibility Change	-.20	-.15	Desired positive: A positive score indicates that the patient's perception of susceptibility is increasing
Q3: (Barriers) Indicate the approximate number of barriers or problems you think you will have with your physical therapy program.	Barriers Change	-2.0	.15	Desired positive: A positive score indicates that the patient's perception number of barriers is decreasing
Q4: (Barriers) Indicate how much you feel these barriers or problems might negatively affect your physical therapy program.	BarriersAffect Change	-1.3	0	Desired positive: A positive score indicates that the patient's perception of effect of barriers is decreasing
Q5: (Benefits) Indicate the approximate number of benefits you think you will have with your physical therapy program.	Benefits Change	-.05	-4.0	Desired negative: A negative score indicates that the patient's perception number of benefits is increasing
Q6: (Benefits) Indicate how much you feel these benefits might positively affect your physical therapy program.	BenefitsAffect Change	-.05	-.4	Desired negative: A negative score indicates that the patient's perception of effect of benefits is increasing
Q7: (Self-Control) Indicate how much control you feel you have over your health care.	ControlChange	-.05	-.8	Desired negative: A negative score indicates that the patient's perception of their own control is increasing
Q8: (Self-Control) Indicate how much you understand about the purpose of the exercises and treatments at physical therapy.	Understand Change	.5	-1.0	Desired negative: A negative score indicates that the patient's perception of their understanding is increasing
Q9: (Self-Control) Indicate who you feel has the responsibility for your health care?	Responsibility Change	.15	0	Desired negative: A negative score indicates that the patient is feeling that they have more responsibility for their own health care
Q10: (Self-control) Indicate how comfortable you are asking your physical therapist or doctor questions.	Comfort Change	.15	-.40	Desired negative: A negative score indicates that the patient is feeling more comfortable talking to their doctor/physical therapist
Q11: (Self-Control) Indicate how comfortable you are asking your friends or family for help at this time.	ComfortFriend Change	1.0	-1.6	Desired negative: A negative score indicates that the patient is feeling more comfortable asking friends/family for help

Table 11 (cont.)

Question	Variable	Control	Exp	Explanation
Q12: (Compliance) Think about all the things you do in your regular daily, weekly, and monthly schedule. Given all of these activities, indicate how likely it is that you will make it to all of your physical therapy appointments at the physical therapy facility.	Compliance FacilityChange	-1.75	. 5	Desired positive: A positive score indicates that the patient is feeling that they will keep their appointments at the PT facility
Q13: (Compliance) Think about all the things you do in your regular daily, weekly, and monthly schedule. Given all of these activities, indicate how likely it is that you will do your physical therapy schedule at home	Compliance HomeChange	-1.65	.4	Desired positive: A positive score indicates that the patient is feeling that they will keep their up their PT schedule at home

Questions 1 and 2 in the Patient Survey data support the findings that the control group was generally more anxious during their physical therapy regimen. The data also shows that the control group felt they had more barriers that would negatively affect their recovery and less benefits of coming to physical therapy that would be positive aspects than the experimental group (questions 3-6). The control group felt they had less control over their own healthcare and less general understanding of their physical therapy regimen than did the experimental group (questions 7-8). The control group also felt they had less responsibility for their own healthcare than did the experimental group (question 9). The control group felt less comfortable asking friends and family for assistance than did the experimental group (questions 10-11). The control group felt that given all of their day-to-day obligations they would be less likely to comply with their physical therapy program at home and at the facility than the experimental group (questions 12-13).

The Instruction Survey (shown in Appendix B) was administered to all of the participants that received the instruction. Each participant received the survey when they finished each of the three modules of instruction.

It is significant to note that these questions were posed in the context of asking the participant how he or she felt with regard to these issues. The participants answered the questions in the first person and the researcher observed that they were able to internalize the question and relate the experience to their own situation.

These results are qualitative. Participants were asked, but not required, to answer the questions. The responses summarized below are grouped into similar statements; the shown statements are representative of the total pool of responses.

<u>Instruction Survey Question 1:</u> I can relate to the characters in the story regarding my feelings about (a) the benefits of physical therapy (47%), the

inconveniences/hassles of physical therapy (44%), (b) the inconveniences/hassles of physical therapy (44%), (c) cutting back on my activity at home or at work (35%), and (d) the pain in physical therapy (44%).

Instruction Survey Question 2: The story made me feel that I could change or control my feelings about (a) the inconveniences of physical therapy (47%), the benefits of physical therapy (44%), the pain in physical therapy(30%), and the participant's responsibility to participate in their own healthcare (30%).

The survey also asked the participants about their feelings with regard to changes in their thoughts or attitudes. The following replies are representative participant comments.

N	Representative Comment
2	Reinforce the need for me to follow PT schedule
3	I feel I should take a more active part in my return to health
2	At first I was very apprehensive about PT- I had heard some horror stories. I put the therapy off 1 week. Should have started it sooner. Has worked out great!
4	I felt the same way when I had to start PT. I know I cannot get better without PT
2	I need to listen to the doctors and therapists
7	I see myself as the character and can make the changes as well
4	This just reminded me how important therapy is for my recovery
3	The character has a lot of the same thoughts and attitudes that I have

Table 12. Instruction Survey Question 3: Please explain any specific thoughts or attitudes that have changed for you as a result of this story

N	Representative Comment
8	Seeing the character come around to the benefits of PT made me think of myself
2	When the character decides to do PT I can relate
3	The scenarios are realistic and like what I'm going through
5	I enjoyed helping the character make the decision to change
2	This is how people really feel
1	The choices available to the character were for his benefit even though he didn't always see that; that's the same way I feel
4	None
1	I liked how she learned to listen; I need to do that too
1	I liked helping the character get through some of his feelings

Table 13. Instruction Survey Question 4: What part of the story did you like the most?

N	Representative Comment
2	The excuses we all make
1	I can relate to the character's discouragement
2	PT works; I just need to work harder
2	The story changed my mind
1	The story was real to me
6	Frustration, inconvenience, hassle of crutches at home, imposing on others, need to reschedule my life, made plans to have my brothers help w. farming, meds make me sick to stomach, hindrance on whole family, brace is uncomfortable, stairs-impossible, the whole family needs to participate; reschedule trip, etc. emphasize need to do PT; these are things I can relate to
5	I liked helping the character
1	Relative to life I live; I can relate to all of these parts of the stories
2	That the character did change his feelings about PT; so did I
1	That the character realized how important therapy is and I did too
4	Not sure
1	Repetitive questions on how important it is; it helps me understand
2	That I need to keep going
2	I liked the whole story

Table 14. Instruction Survey Question 5: What part of the story did you learn the most from?

The nature of the responses to questions 3, 4, and 5 indicate the participants were able to relate to the scenario characters and in turn, relate the choices available to the characters to their own situations.

N	Representative Comment
4	None
8	It's too easy; make it harder
9	Make the bars change faster
6	Show the bars change on every click
6	Make the BENEFITS change faster
2	I Liked the interface
3	The story and game were too easy; this was just dumb
9	Make it easier to read; use larger print

Table 15. Instruction Survey Question 6: What part of the story could be improved?

When asked about the satisfaction with the instruction itself, the responses to this question several significant issues emerged. Again, these responses are representative of the pool of responses.

1. The participants wanted the feedback to be more prominent and visible. They wanted the graphs on Severity, Susceptibility, Barriers, Benefits, and Compliance to change every time they selected a thought/action.
2. The participants wanted the game to get "harder" faster. They wanted the game to get progressively more challenging faster.
3. Some of the participants had visual difficulties. They requested larger print with more contrast.

Summary: Part B, Results of Research Project Methodology and Data Analysis

The fundamental purpose of this section of the study was to examine the results of the project methodology and data analysis in relation to MCI and patient anxiety levels and compliance levels. Statistically significant differences were noted in anxiety levels of orthopedic surgery patients who received MCI as measured by pre-post gain scores on the State-Trait Anxiety Index (STAI-S). In the experimental group, gender and age did not play a part in anxiety levels as measured by pre-post gain scores on the STAI-S.

Statistically significant differences were also noted in compliance levels of orthopedic surgery patients who received MCI measured by pre-post gain scores on the Physical Therapist Survey. In the experimental group, gender and age did not play a part in compliance levels as measured by pre-post gain scores on the Physical Therapist Survey. The results supported the hypotheses that patient education in the form of MCI could provide instruction for patients in a physical therapy setting that would (a) decrease patient anxiety and (b) increase patient compliance over the levels in instruction that is currently available.

In addition, the supplemental data, gathered from the Patient Survey and the Instructional Survey, indicated that participants in the experimental group generally reported that they were less anxious about their physical therapy regimen than the control group. The experimental group also felt that they had fewer barriers that would negatively affect their recovery and more benefits of completing physical therapy than the control group. The experimental group also felt that they had more control over their own healthcare and were more willing to ask their friends and family for assistance. All in all, the experimental group indicated that they would be more likely to complete their physical therapy regimen, both at home and at the physical therapy facility, than the control group that did not receive the MCI instruction.

As previously stated, the responses on the Instruction Survey indicated that the participants that received the MCI were aware of their feelings regarding (a) the benefits of physical therapy, (b) the inconveniences/hassles of physical therapy, (c) cutting back on activity at home or at work, (d) the pain in physical therapy, and (e) their responsibility to participate in their own healthcare.

With regard to the scenarios, the participants generally enjoyed seeing the "character" in the scenario realizing the importance of physical therapy or understanding the need to work out the problems with physical therapy.

With regard to the instruction, there were some clear recommendations for changes to the design of the MCI. Feedback, in particular, needs to occur more frequently and be more specific to the learner movement.

Summary: Chapter IV, Results

The primary purpose of this portion of the study was (a) to evaluate the MCI design process and (b) to evaluate the instructional efficacy of an MCI product. The content for the project focused on patient education in the physical therapy setting. Both the evaluation of the MCI design process and the evaluation of the instructional efficacy have produced some results that warrant further investigation into MCI as an alternative approach to Patient Education. Chapter V presents summary information, conclusions, and proposes some suggestions for future research.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Chapter Introduction

While medical technology, intervention, and treatment continue to advance, patients find themselves increasingly involved in a health care system for which they have had no training to successfully navigate or participate in to their best advantage. In order to be successful in this system, patients need skills and knowledge that enable them to be a partner and participant in their own health care (Ornstein, 2001). Partnership and participation in the health care system fosters compliance by patients, that is, following health care advice and instruction, thus facilitating patient recovery (Koop, 1996).

According to Gibbons (2001), "The central premise of MCI is that the most effective and efficient instruction takes place through *experiencing* real systems or models in the presence of instructional augmentation designed to facilitate learning from the experience" (p.512). Experience using these models is focused through carefully selected and sequenced problems. The learner can either solve these problems or observe them being solved. The MCI provides patients the opportunity to (a) experience interactions with issues concerning patient compliance, (b) examine success and failure aspects of the physical therapy process, and (c) learn what to realistically expect during recovery.

This project had two primary objectives. The first objective was to capture and demonstrate the design process of an MCI product. The goal was to design, produce, and evaluate a product developed using established guidelines for MCI design. The second objective of the project was to test the efficacy of the instruction.

This chapter presents the summary, conclusions, and recommendations with respect to (a) the design research in MCI and (b) the research experimental study to evaluate the efficacy of the instruction.

Part A: Summary, Conclusions, and Recommendations of the MCI Design Research

Summary

MCI provides the learner experience using models that is focused through carefully selected and sequenced problems. The learner can either solve these problems or observe them being solved. In the area of patient education, these activities build knowledge and self-efficacy skills in the patient and encourage patient compliance and positive interaction with the health care system by building patient confidence and reducing patient anxiety (Ridgeway & Mathews, 1982).

Purpose of the MCI design research study

The purpose of this component of the project was to capture and demonstrate the design of an MCI product. The goal was to design, produce, and evaluate a product developed using established guidelines for MCI design

Statement of the Problem for MCI Research

While MCI design theory is well-developed, there is a lack of MCI products that have been experimentally designed, produced, and evaluated using a content base. The traditional approaches to patient education emphasize the use of static diagrams, text handouts or brochures, or fact sheets. However, these products typically fail to provide success and failure models of rehabilitation or experiential sensory information to the patient about the healing process (Moline, 2000). Given this need in the area of patient education, the need to test the MCI product in context, and the researcher's interest in patient education, the research of this MCI product was developed using this content area. Model-Centered Instruction (MCI), by the nature of its design, holds the potential for addressing the inadequacies of traditional patient education. This research study investigated the design, production, and evaluation of an MCI product that adheres to established MCI design theory.

Research Procedures for MCI

This project represents design study research and research into Model-Centered Instruction (MCI) and its application to patient education.

MCI is a design theory for instruction that prescribes that the learner interacts with a dynamic, interactive model. The design theory for MCI does not specify a stepwise design path. Rather, this design process is iterative and cyclical and involves processes of design, implementation, evaluation, and redesign. Gibbons (2001) and Gibbons, Richards, Hadley, and Nelson, (2001) defined MCI and MCI design theory in terms of the seven principles of MCI and the layers of design theory. This design project utilized (a) the of the seven principles of MCI, (b) the of the seven principles of layers of architecture of instructional design in the design methodology of this project, (c) the ideal-case design order for model-centered instruction, and (d) a problem-structure development strategy using syntactic strings.

Gibbons (2003) outlined a basic design process for MCI including: (a) definition of the model and the selection of problems to present to the learner, (b) design of the instructional features and supports, and (c) design of the interface.

The initial design activity was to analyze and capture the expert-performance, cause-effect system, and environmental models needed to create the instruction. The critical models to define were the cause-effect systems and human performance models defined by the target performances. The desired target performances in this project involved changing attitudinal, behavioral and belief systems in patients in the healthcare system. The environment consisted of everything besides these two types of models that could influence the targeted cause-effect systems and human performances. The models in this project were captured and expressed by analyzing target performance decision rules and giving quantitative values to the relationships between actions, behaviors, and beliefs. This project design grew from the inside out; i.e. from the content model to the outermost layers.

In order for the learner to interact with the model, the researcher developed scenarios, using the syntactic string approach, to capture realistic events of the patient experience in everyday life. This approach enabled ease of development of these scenarios and events.

Once the content models were established, the instructional strategies were developed. Instructional features including coaching and feedback were developed. The researcher constantly reviewed the content-model to ensure fidelity to the instructional goal. An engine to deliver instruction, track learner interactions, and give customized feedback was developed. The learner success criteria for this project included (a) reducing anxiety and (b) achieving compliance. The learners received feedback on their progress toward these success criteria.

Design considerations included constraints on available resources, design criteria to fit into the healthcare system, i.e. the time allotted to deliver instruction and the schedules of patients and physical therapists and the designer's knowledge of options for design decisions.

Many design alternatives were considered and weighed against the defined constraints. Again, the process followed the design stages outlined in Gibbons, Richards, Hadley, and Nelson (2003). Once the initial structures, described previously, were determined and fixed, they constrained subsequent levels of design decisions. Firm design decisions were not made until numerous options were considered.

Conclusions of MCI Design Research

This project, an early first step toward clarifying or adding knowledge of MCI to the field of Instructional Technology, represents a case-level exploratory study in MCI design theory and its application to the design, production, and evaluation of a piece of instruction. Based on the case-study project, the following conclusions were made.

Instructional designers have long relied on a standard approach to instructional design that involves decomposition of the instructional goals, e.g. the ADDIE Model. MCI design theory is vastly different than traditional ISD processes. Traditional instructional design models specify a linear, lock-step approach to instructional design. MCI presents an alternative view that divides design problems into layers and sub-layers and displays to the designer the alignment and interaction of the layers.

The design process in this research followed the prescriptions and recommendations made by Gibbons and his fellow researchers. Another observation of the design process is that these design procedures are sufficiently defined to use as a preliminary prescriptive process to guide the design of MCI instruction.

In addition, the researcher felt that the most significant and most difficult portion of the design process was to correctly identify the content model that the learners should interact with. While Gibbons, et al. have outlined processes that facilitate this content model identification, including the use of syntactic strings and model analysis methods, this process was still tedious and difficult. The researcher estimates that 50% of all time devoted to this project design was directed toward the identification of the appropriate content model. While the content model selection process was difficult, it clearly facilitated the problem selection, sequencing, and posing activities. Once the syntactic strings were developed and tested using the prototype Excel spread sheet, the other components were apparent. The design procedure facilitated a holistic, contextual design rather than a segmented, partitioned design. This procedure also facilitated the use of the components of instruction in all aspects of the instruction including the necessary instructional augmentations. The problem sequencing was directed by the use of the Health-Belief Model and the Transtheoretical Stages of Change model; both of which specify an order of presentation of instruction. A method of posing the problems was specified by the target skill goals of the instruction. It is significant to note that (a) there were many options for the implementation of posing the problems, (b) the selected strategy was partially constrained by the resources available, e.g., time, funding, skill level of the researcher, and (c) instructional evaluation was based on the specific instruction given.

Given that the backbone of MCI design is interaction with the experience, this case study project demonstrated that MCI is an important design method that can be used give the learner the opportunity to (a) interact with and experience a model and (b) receive instructional augmentations.

Recommendations for MCI Design Research

This exploratory case study highlighted the need for further research and development in the areas of problem definition, problem generation, and the structure and problem-generation methodology applied to the design of model-centered problems. Also, further elaboration in the areas of sequencing and posing problems is needed.

Another area of need is the development of tools that facilitate the production of MCI products. The development of the product software in this project was laborious and not economical in time or other resources.

Participants noted that they wanted feedback to be more precise and occur faster. They wanted to see right away what their choices meant. Another interesting observation that was made by the researcher was that the participants engaged in a lot of "self-talk." This amounted to the participants carrying on a "conversation" with the scenario character while they were engaged in the simulation. For example, one participant said "Oh, I had a hard time getting a ride here today too." Or another participant said, "Oh Walter, [the scenario character] get with the program and don't be lazy." This dialogue was not prompted or even suggested by the researcher, it just happened as the participants reflected on the situations and related them to their own situations. A tape recording of the session could yield more information on this type of dialogue in future studies.

While MCI design theory holds much promise, without research and elaboration in the above areas, it is out of reach for most instructional designers.

Part B: Summary, Conclusions, and Recommendations: Efficacy of Instruction

Summary

The purpose of this component of the project was to evaluate an instructional product developed using established guidelines for MCI design

Statement of the Problem for the Instructional Product Research and Analysis Study

The traditional approaches to patient education emphasize the use of static diagrams, text handouts or brochures, or fact sheets. However, these products typically fail to provide success and failure models of rehabilitation or experiential sensory information to the patient about the healing process (Moline, 2000). Specifically, with regard to patient education, anxiety and patient compliance are known to be associated with patient recovery. This portion of the project, research into MCI's application to patient education, was designed to measure the instructional efficacy of an MCI product using the content base of health behavior and patient education.

Research Procedures for the Instructional Product Research and Analysis Study

This was a quasi-experimental study that used the State-Trait Anxiety Inventory (STAI) and several other survey instruments. The Institutional Review Boards from the Cache Valley Specialty Hospital and Utah State University approved this study.

A total of 40 patients participated in this study. Study participants were orthopedic surgery patients at the Mountain West Physical Therapy facility located at the Cache Valley Specialty Hospital in Logan, Utah. The target population included out-patient knee and shoulder orthopedic surgery patients that met the following criteria: (a) ages 18 or older, (b) males or females from all ethnic groups, (c) had out-patient orthopedic knee or shoulder surgery within 2 weeks of starting physical therapy, (d) were able to speak and read English, and (e) had not participated in a physical therapy program in the last 2 years. The accessible population consisted of patients at the Mountain West Physical Therapy facility that met the selection criteria for inclusion in the study.

The research design was a Pretest-Posttest Control Group experimental research design. The sample was one of convenience and participants were randomly assigned to either the experimental or control group. There were 20 participants in the control group and 20 participants in the experimental group.

Study participants were seen at the Mountain West Physical Therapy facility at the Cache Valley Specialty Hospital. The treatment module, designed and developed utilizing MCI principles, consisted of 3 scenarios developed with a problem-solving format. The scenarios contained instruction regarding (a) patient anxiety, (b) patient compliance with a physical therapy regimen, and (c) patient skills and responsibilities. These scenarios were designed so that the patient played the role of a physical therapy aide and worked with simulated patients to help them get through their physical therapy. The intent was to give the learner exposure to interacting with dynamic models of environmental, social, and physical/medical aspects of rehabilitation treatment.

This experimental research was accomplished by (a) recruiting volunteers for the study, (b) obtaining informed consent, and randomly assigning them to an experimental or a control group, (c) administering a pre-test of patient anxiety (State-Trait Anxiety Inventory) (STAI) to both the experimental and control groups, (d) administering a pre-test of patient attitudes to both the experimental and control groups, (e) administering the MCI instruction and a survey of instruction to the experimental group; the control group was given whatever instruction was normally available, (f) administering a post-test (STAI) to both the experimental and control groups, (g) administering a post-test of patient attitudes to both the experimental and control groups, (h) surveying the physical therapists regarding their perceptions of the patient's (all patients including both the control group and the experimental group) attitude toward physical therapy, compliance, and anxiety, (i) tracing the learner's navigation within the software, and (j) coding, entering, and analyzing the data and reporting the results.

Conclusions of Instructional Product Research and Analysis Study

The fundamental purpose of this section of the study was to examine the results of the project methodology and data analysis in relation to MCI and patient anxiety levels and compliance levels. Statistically significant differences were noted in anxiety levels of orthopedic surgery patients who received MCI as measured by pre-post gain scores on the State-Trait Anxiety Index (STAI-S). In the experimental group, gender and age did not play a part in anxiety levels as measured by pre-post gain scores on the STAI-S. Statistically significant differences were also noted in compliance levels of orthopedic surgery patients who received MCI measured by pre-post gain scores on the Physical Therapist Survey. In the experimental group, gender and age did not play a part in compliance levels as measured by pre-post gain scores on the Physical Therapist Survey. The results supported the hypotheses that patient education in the form of MCI could provide instruction for patients in a physical therapy setting that would (a) decrease patient anxiety and (b) increase patient compliance over the levels in instruction that is currently available.

In addition, the supplemental data, gathered from the Patient Survey and the Instructional Survey, indicated that participants in the experimental group generally reported that they were less anxious about their physical therapy regimen than the control group. The experimental group also felt that they had fewer barriers that would negatively affect their recovery and more benefits of completing physical therapy than the control group. The experimental perceived that they had more control over their own healthcare and were more willing to ask their friends and family for assistance. All in all, the experimental group indicated that they would be more likely to complete their physical therapy regimen, both at home and at the physical therapy facility, than the control group that did not receive the MCI instruction.

The Instruction Survey results indicated that the participants that received the MCI were aware of their feelings regarding (a) the benefits of physical therapy, (b) the inconveniences/hassles of physical therapy, (c) cutting back on activity at home or at work, (d) the pain in physical therapy, and (e) their responsibility to participate in their own healthcare.

With regard to the scenarios, the participants generally enjoyed seeing the "character" in the scenario realizing the importance of physical therapy or understanding the need to work out the problems with physical therapy. In reference to the instruction, there were some clear recommendations for changes to the design of the MCI. Feedback, in particular, needs to occur more frequently and be more specific to the learner movement.

This project was a preliminary step in producing and testing an alternate approach to patient education and health behavior. Based on the case-study project, the following conclusions were made.

As previously stated, the traditional approaches to patient education emphasize the use of static diagrams, text handouts or brochures, or fact sheets, but typically fail to provide success and failure models of rehabilitation or experiential sensory information to the patient about the healing process (Moline, 2000). The results of the research indicate patient education designed using MCI principles can be useful in reducing patient anxiety and increasing patient compliance.

While the study results were promising, there were several threats to validity that must be considered. First, the sample size was small. Given that there were only forty participants in the study, a larger group of participants is needed to further test the instructional efficacy. Next, while the participants were randomly assigned to the study, the number of males and females in the control group (15 male, 5 female) and experimental group (5 male, 15 female) was not equally distributed. This factor could have influenced the results. A future follow-up study that matched groups on age and gender could shed some light on whether these factors affect the outcomes of the MCI patient education. Another threat was the Hawthorne effect. Just by participating in the study, the participants may have been more serious and compliant about their physical therapy. The study may have also presented some novelty effect.

Other factors that need to be considered were the time available to interact with the participants to deliver the instruction and the facilities in which the instruction was delivered. Some of the participants arrived late and were hurried during the delivery of the instruction so that they could start their physical therapy. Also, the participants were required to receive the instruction at a desk in the reception area of the physical therapy facility. While the facility and staff were accommodating, some of the patients, given their current physical state, couldn't sit for any period and had some pain and difficulty receiving the instruction. This limited the amount of time that the researcher could interview them. A more ideal situation would be to deliver the instruction during the time the patients are in the exam rooms and are able to recline. This would necessitate the delivery of instruction on a different kind of internet connection which poses security risks for the healthcare environment. Given the significance of these factors, these issues must be considered in any follow-up studies.

Summary: Chapter V, Summary, Conclusions, Recommendations

This study produced some interesting and promising results both in the areas of (a) MCI design and (b) the application of MCI to patient education. The MCI design process illustrated that the work of Gibbons, et al., is both theoretical and prescriptive in the development of instructional products that utilize MCI design. While the researcher successfully utilized this methodology, there were many areas of the design process that stood out as difficult and laborious and beyond the daily scope of most instructional designers. Notably, model selection and model development are particularly difficult. Also, selection, sequencing, and posing of problems remain a challenging task. Lastly, it was clear, based on the participant response, that the feedback design and implementation was inadequate and would need to be revised before further research could take place with this product.

As far as the measurement of the instructional efficacy goes, there were several issues of validity including sample size, the Hawthorne effect, and participation in the study in general. In this particular setting, these are significant risks to the experimental process.

This research represents a preliminary step toward further understanding of the MCI design process in the field of Instructional Technology and points to several areas of future research.

Recommendations for Future MCI and Patient Education Research

As previously mentioned, this study represented a small case-study project. Future research needs to include a larger sample and also should include an investigation with samples matched on age and gender. Also, future research should address the aforementioned threats to experimental research validity and the issues regarding instructional design. Treatment delivery issues in the healthcare setting are significant and must be addressed. These are pertinent recommendations for future MCI and patient education research.

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APPENDICES

Appendix A: Informed Consent

Informed Consent to Discuss a Clinical Research Study

Study Title: Model-Centered Instruction and Patient Education

You are being asked to give your permission to learn about the research study because your doctor and your physical therapist has determined that you need physical therapy for a recent surgery. The purpose of this study is to evaluate the effectiveness of an experimental method for providing the patient education you receive during physical therapy.

This consent form only gives your physical therapist permission to have the researchers discuss your potential participation in the study with you; it does not enroll you in the study.

I understand that my signature on this document does not enroll me in the research study, but only gives my permission for the project researchers to tell me about it during my post-operative physical therapy appointment, so that I may consider my enrollment in it. I also understand that my physical therapist's signature on this document signifies that he/she feels that I will be a suitable candidate for this research study.

I, ____, hereby authorize Mountain West Physical Therapy to disclose the following protected health information to the project researchers: name, age, date of surgery.

____	______________
Signature of Patient or Personal Representative	Date
____	______________
Name of Patient or Personal Representative	Date
____	______________
Description of Personal Representative's Authority	
____	______________
Signature of Physical Therapist	Date
____	
Date/Time of Post-Operative Physical Therapy Visit	

Date Created: Aug. 17, 2004

INFORMED CONSENT
Research Title: Model-Centered Instruction in Patient Education

Introduction/Purpose: Professor Byron Burnham and Mary Ann Parlin, Ph.D. student, are conducting research to investigate the efficacy of providing patient education in the form of Model-Centered Instructional Simulations as opposed to traditional patient education model (pamphlets, videotapes, etc.). This information will be prepared for a group of orthopedic patients recovering from knee surgery. The results of this research may provide new methods for patient education as it relates to patient recovery and costs to the health care system.

Procedures: All participants must be 18 years of age or older. You may be randomly selected to participate in this research and asked to complete a 10 minute survey before you begin your therapy. You may also be asked to watch a Video (approximately 3 sessions of 15 minutes each) that contains information about physical therapy. Your physical therapy will not be any different than if you hadn't watched the Video. At the end of your therapy, you will be asked to fill out a questionnaire (approximately 10 minutes) about your therapy and your feelings toward your recovery. This research will be done at Mountain West Physical Therapy.

Risks: There is minimal risk to participate in this study.

Benefits: Patient education programs can help physicians and organizations control costs. It helps patients understand when to seek medical attention and where to seek it. Researchers have confirmed the many benefits of patient education including decreased anxiety, faster recovery, and reduced length of hospital stays. This study may be very beneficial in helping the medical community learn how to provide more effective patient education.

Voluntary Nature: Participation in this study is strictly voluntary. You may refuse to participate or withdraw at any time without any consequence or loss. You may be withdrawn from the study without your consent by the investigator if any of your healthcare providers feel it is inappropriate for you to be included in the study.

Date Created: Aug. 17, 2004

INFORMED CONSENT
Research Title: Model-Centered Instruction in Patient Education

Confidentiality: Your information will remain confidential throughout this process. Only the researchers and the healthcare providers that work with you will have access to your records. You will be assigned an ID# and information obtained will be referred to only by ID#; therefore, your name will not be used in any reports or publications. This information will be kept in a locked file cabinet at Mountain West Physical Therapy and only their personnel will have access to the data. After approximately three years, the collected information will be destroyed. There is a possibility that the Food and Drug Association may inspect these records

IRB approval: Both the Institutional Review Board (IRB) for the protection of human subjects at the Cache Valley Specialty Hospital and at Utah State University, have reviewed and approved this research study.

Investigator Statement: I certify that the research study has been explained to the individual by me, and that the individual understands the nature and purpose, the possible risks and benefits associated with taking part in this research study. Any questions that have been raised have been answered.

Copy of Consent: I have been given two copies of this Informed Consent. I have signed both copies and retained one copy for my files.

Thank you for your participation in this research.

Signature of PI: ______________________________ Date: ________
Byron Burnham, Ph.D.
Instructional Technology, Utah State University, (435)797-2694

Signature of co-PI/ Student Researcher: ____________________ Date: ________
Mary Ann Parlin, Student Researcher
Instructional Technology, Utah State University, (435)797-5592

Signature of co-PI/Assistant Researcher: ____________________ Date: ________
Mike Staheli, Hospital Director
Cache Valley Specialty Hospital

By signing below I agree to participate:

______________________________ **Date:** ____________
Signature of Participant

Appendix B. Survey Instruments

MODEL-CENTERED INSTRUCTION PATIENT EDUCATION PROJECT

Name: ____

ID #: ____

Study Group 1 2

Patient Information

Name:

Gender: M F

Age: ______________

Date started physical therapy: ________________________

Physical Therapist: ________________________________

Patient Education:

SELF-EVALUATION QUESTIONNAIRE

Developed by Charles D. Spielberger
in collaboration with
R. L. Gorsuch, R. Lushene, P. R. Vagg, and G. A. Jacobs

STAI Form Y-1

Name ______________________________ Date __________ S ____

Age __________ Sex: M ____ F ____ T ____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

Consulting Psychologists Press, Inc.
3803 E. Bayshore Road • Palo Alto, CA 94303

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name ______________________________ Date ______________

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	1	2	3	4
22. I feel nervous and restless	1	2	3	4
23. I feel satisfied with myself	1	2	3	4
24. I wish I could be as happy as others seem to be	1	2	3	4
25. I feel like a failure	1	2	3	4
26. I feel rested	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29. I worry too much over something that really doesn't matter	1	2	3	4
30. I am happy	1	2	3	4
31. I have disturbing thoughts	1	2	3	4
32. I lack self-confidence	1	2	3	4
33. I feel secure	1	2	3	4
34. I make decisions easily	1	2	3	4
35. I feel inadequate	1	2	3	4
36. I am content	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

Instruction Survey

Regarding the patient education modules:

1. I can relate to the characters in the story regarding my feelings about: (check all that apply)
    a. the severity of my health condition
    b. the susceptibility (likelihood) that I might reinjure myself or not heal properly
    c. the inconveniences/hassles of physical therapy
    d. the benefits of physical therapy
    e. cutting back on my activity at home or work
    f. talking to people who are on my healthcare team (i.e., doctors, physical therapists, anyone else in the healthcare system)
    g. the pain in physical therapy
    h. the physical therapist
    i. how much control I have in my own healthcare
    j. my responsibility to participate in my own healthcare
2. The story made me feel I could change or control my feelings about: (check all that apply)
    a. the severity of my health condition
    b. the susceptibility (likelihood) that I might reinjure myself or not heal properly
    c. the inconveniences/hassles of physical therapy
    d. the benefits of physical therapy
    e. cutting back on my activity at home or work
    f. talking to people who are on my healthcare team (i.e., doctors, physical therapists, anyone else in the healthcare system)
    g. the pain in physical therapy
    h. the physical therapist
    i. how much control I have in my own healthcare
    j. my responsibility to participate in my own healthcare

3. Please explain any specific thoughts or attitudes that have changed for you as a result of this story:

4. What part of the story did you like the most?

5. What part of the story did you learn the most from?

6. What part of the story could be improved?

    a. The overall way the story looks/the display of the story
    b. How easy it is to use the mouse
    c. The colors and the print used in the display
    d. The story itself
    e. The length of the story
    f. The information in the story
    g. The way the story keeps track of what stage you're in
    h. The way the story display lets you know how you're doing

Patient Survey

1. On the scale below, place a mark on the line indicating how serious you feel your health condition is with regard to your recent surgery.

Not serious 1 2 3 4 5 6 7 8 9 10 Very serious

2. On the scale below, place a mark on the line indicating how likely you feel you are to reinjure yourself or not heal properly from your recent surgery.

Not likely 1 2 3 4 5 6 7 8 9 10 Very likely

3. On the scale below, place a mark on the line indicating the approximate number of barriers or problems you think you will face with your physical therapy program.

No barriers (0) A few (1-3) A moderate amount (4-7) Many (8-or more)

4. On the scale below, place a mark on the line indicating how likely you feel these barriers might negatively affect your planned therapy schedule.

Not likely 1 2 3 4 5 6 7 8 9 10 Very likely

5. On the scale below, place a mark on the line indicating the approximate number of benefits you think you will face with your physical therapy program.

No benefits (0) A few (1-3) A moderate amount (4-7) Many (8-or more)

6. On the scale below, place a mark on the line indicating how likely you feel these benefits might positively affect your planned therapy schedule.

Not likely 1 2 3 4 5 6 7 8 9 10 Very likely

7. On the scale below, place a mark on the line indicating how much control you feel you have over your health care.

No control 1 2 3 4 5 6 7 8 9 10 Much control

8. On the scale below, place a mark on the line indicating how much you understand about the purpose of the exercises and treatments at physical therapy.

No understanding 1 2 3 4 5 6 7 8 9 10 CompleteUnderstanding

9. On the scale below, place a mark on the line indicating who you feel has the responsibility for asking and answering questions?

Only Doctor/PT	Mostly Doctor/PT	Equally Shared	Mostly Myself	Only Myself
I	I	I	I	I

10. On the scale below, place a mark on the line indicating how comfortable you are asking your physical therapist or doctor questions.

Very uncomfortable 1 2 3 4 5 6 7 8 9 10 Very comfortable

11. On the scale below, place a mark on the line indicating how comfortable you are asking your friends or family for help at this time.

Very uncomfortable 1 2 3 4 5 6 7 8 9 10 Very comfortable

12. Think about all the things you do a part of your regular daily, weekly, and monthly schedule. On the scale below, place a mark on the line indicating how likely it is that you will make it to all of your physical therapy appointments at the physical therapy facility.

Very likely 1 2 3 4 5 6 7 8 9 10 Not at all likely

13. Think about all the things you do a part of your regular daily, weekly, and monthly schedule. On the scale below, place a mark on the line indicating how likely it is that you will do all of your prescribed home physical therapy program.

Very likely 1 2 3 4 5 6 7 8 9 10 Not at all likely

Physical Therapy Survey

1. **This patient doesn't think they need physical therapy to heal properly.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

2. **This patient understands the importance of physical therapy to heal.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

3. **This patient just wants me to "fix" them.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

4. **This patient seems comfortable participating in their own health care.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

5. **This patient seems ready to really commit to their physical therapy program.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

6. **This patient has been making arrangements in their life to accommodate their physical therapy program.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

7. **This patient focuses on the barriers to their physical therapy program.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

8. **This patient realizes the benefits of their physical therapy program.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

9. **This patient goes over their progress charts with me/the physical therapy aide.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

10. **This patient is compliant with their physical therapy program at the facility.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

11. **This patient is compliant with their physical therapy program at home.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

12. **This patient comes to their appointments regularly.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree

13. **This patient asks me questions about their therapy program.**
Strongly Disagree Disagree No Opinion Agree Strongly Agree