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A Warranted Domain Theory and Developmental Framework for a Web-based Treatment in Support of Physician Wellness

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A Warranted Domain Theory and Developmental Framework for a Web-based Treatment
in Support of Physician Wellness

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
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Instructional Design, Faculty Physician, Wellness, Python

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Dedication

I dedicate this to my wife, Brenda: Thank you for your patience, understanding, and incredible resilience. Our time together has never known a night I was not working on this degree or fretting over something associated with it. I thank God for all that you are, and for blessing me with you. I would also like to thank my family and friends for all their support, and especially Steve Kurpis for his constant encouragement.

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Abstract

This study employed a design-based research methodology to develop a theoretically sound approach for designing instructional treatments. The instruction of interest addressed the broad issue of physician wellness among medical school faculty, with particular emphasis on physician self-diagnosis and self-care. The theoretically sound approach comprised a domain theory and design framework. The domain theory was posited subsequent to an examination of the literature, and subjected to expert examination through three cycles of instructional treatment development. The design framework for crafting the treatment was created from components of existing frameworks, and evolved with the cycles of development. The instructional treatment was designed to be delivered to a web browser from a server using a Python microframework to preserve the anonymity of the end user.

Experts in three relevant knowledge domains verified that the instructional treatment embodied the domain theory, and was suitable for use as a practical instructional treatment. Subsequently, a limited-time pilot deployment was initiated among practicing faculty physicians (N=273) to solicit user feedback. Responses were obtained through a survey instrument created for the purpose and hosted on a remote website. Although the response rate was low (12%), the responses were encouraging and useful for guiding future research and treatment development.

Chapter One: Introduction

Statement of the Problem

The problem of physician distress has been a topic of research and discussion for over 20 years. Numerous articles and studies have addressed the many negative components such as burnout, depression, various forms of substance abuse, and even suicide (Firth-Cozens, 1987; Taub, Morin, Goldrich, Ray & Benjamin, 2006). Drugs, drink, and depression are often collectively referred to as the three D's of physician impairment. Peisah and Wilhelm (2007) demonstrated that impaired older physicians may add a fourth D to that list: dementia. A focus on physician distress has been slowly giving way to more increased attention to physician self-care, or perhaps more appropriately, inattention to self-care. Fred Jones, a retired cardiologist and proponent of improving physician self-care, remarked: "One thing physicians traditionally do is not take very good care of themselves" (Weber, 2006, p. 16). That this has been a long-term concern in the medical community is evidenced by a quote attributed to the Greek physician Galen: "That the physician will hardly be thought very careful of the health of his patients if he neglects his own" (Ghosh & Joshi, 2008, p. 13). Some physicians do not even comply with the medical advice they direct at their own patients. For example, the CDC (2012) reports that for the 2011-2012 season, fewer than 67% of health care

personnel receive influenza vaccinations; an improvement from less than 50% a scant six years prior, but still far short of an acceptable level.

Part of the problem has been associated with physician self-treatment. The noted Sir William Osler is quoted as saying “The physician who treats himself has a fool for a patient” (McNerney, Andes, & Blackwell, 2007, p. 545). Just as attorneys are cautioned to not attempt to represent themselves in a court of law, physicians are cautioned to avoid acting as their own doctor; however, the practice persists. For example, Campbell and Delva reported in 2003 that a significant percentage of Canadian resident physicians self-diagnose, self-medicate, and perform the same services for friends and family. Lack of time was most often cited as the reason for not having a personal regular source of care (RSOC), but equally significant was the perception that a personal RSOC was not needed by knowledgeable physicians. In an earlier study, 34% of physicians surveyed reported not having regular access to personal health care, with 7% self-treating. Some specialties, such as internists and surgeons, had an even poorer showing (Gross, Mead, Ford, & Klag, 2000).

Surprisingly, Gross et al. found that physician neglect of self-care was strongly related to the belief that chance, rather than medical intervention, determines health (2000). Rosen, Christie, Bellini, and Asch (2000) reported 37% of U.S. resident physicians do not have a primary physician, and 12% indicated they act as their own physicians. Puddester and Donahue (2004) noted that the percentages of self-employed physicians not making use of a RSOC were too high, and indicated the need for studies to separate the question of *having* a RSOC from actually making use of one. Studies of

European physicians show a similar problem level (Töyry et al., 2000; Tyssen, 2007).

The addition of faculty responsibilities paints an even darker picture. A recent study by Reinhardt, Chavez, Jackson, and Mathews (2005) indicated a physician's status as full-time faculty and lack of a personal physician are strongly related to depressive symptoms, with 5% of those surveyed reporting self-medication with sedatives and hypnotics.

Lefebvre declares that “a culture of wellness at the faculty level is critical for physician health, trainee education, and, ultimately, good medical practice ” (2013, p. 10).

Traditionally, the focus has been on addressing physician problems to ensure patient safety, rather than out of concern for the physician. While the concept of personal wellness has been a long-standing aim for most of corporate America, it is only in the past two decades that we see a shift made to address physicians in the same manner. As recently as 2001, the Joint Commission on Accreditation of Healthcare Organizations mandated that all hospitals institute a process for addressing physician wellness, which must be kept separate from disciplinary processes (Spickard, Gabbe, & Christensen, 2002). However, the majority of the programs instituted, including the nation's best example at Vanderbilt University (<http://healthandwellness.vanderbilt.edu/work-life/faculty-physician-wellness/>), still focus on addressing physician problems rather than physician wellness; a reactive rather than a proactive approach. An examination of the programs listed at the website for the Federation of State Physician Health Programs (<http://www.fsphp.org/>) demonstrates the focus on physicians' illness or impairment rather than wellness.

Significant strides are being made to encourage personal wellness during the formative years of medical education, but little progress has been made to determine what may be done to assist physicians already in practice. Most traditional courses developed for medical students are lecture-based and intended to fit within a specific curriculum of studies, although even residency courses are having less positive impact than hoped for. A recent report of a six-year longitudinal study with medical school students indicates that more needs to be done to encourage personal health promotion practices (Kjeldstadli et al., 2006). But with an already packed schedule, it is perhaps not surprising that success has been limited. Despite these advances, burnout continues to be a problem with resident physicians (Lefebvre, 2012).

With the increased emphasis on physician wellness, several studies have been initiated to determine the attitudes and practices amongst medical students and physicians pertaining to personal wellness. Residents at the University of San Francisco indicated that privacy and confidentiality were the primary concerns when seeking personal medical attention (Dunn, Moutier, Green Hammond, Lehrmann, & Roberts, 2008). While many of the issues facing physicians are common to working professionals, there are unique aspects of medical education and medical working environments that serve to sufficiently separate this group from others that may have already been adequately addressed.

One key issue is that of time. Although we all seem to have little enough time to do all the things we would like, physicians must contend with excessive demands on their time, and with wildly variable schedules. Strides made to improve the working conditions

of residents may have had the opposite effect on practicing physicians. The limitation of resident working hours results in an increase of working hours for other hospital medical staff, creating greater concern over the potential impact of sleep deprivation on patient care (Taub et al., 2006). While limiting resident hours can be beneficial on a personal level, it is often perceived as a negative on a professional level, and does not seem to positively impact patient care as intended, which only serves to exacerbate environmental stress for the physician (Driscoll, 2008). Time pressure is often listed as the number one source of stress for practicing physicians, and a survey of university faculty physicians strongly suggests that they see this as a major issue (Fabri et al., 2005).

In addition, physicians tend to view any attempt to seek help as a sign of weakness. Therefore, they have a greater tendency to avoid situations that they perceive may present them in a bad light, to the point of ignoring potential problems rather than exposing themselves. As Dr. Pare states, “Doctors can’t be sick, because they’re the healers” (Bowman, 2005, Doctor as Orphan Patient, p. 1). Mental health care presents even more challenges. Worley (2008) concluded that physicians choose not to seek mental health care out of fear of the stigma attached; how it would be perceived amongst their peers and within the broader medical community.

Finally, physicians tend to see themselves as separate from other groups, and view any intervention not developed specifically for them as incapable of addressing their unique needs. All of these individual, organizational, and environmental concerns make for a unique problem area that has not been adequately addressed by existing approaches.

The College of Medicine at a large research university initiated a physician wellness program to augment their existing program for physicians who have been disruptive in the workplace. The new program was designed to include some means for educating and encouraging faculty physicians in the attributes and behaviors that make for personal well-being. The impetus was at least partly based on a needs analysis conducted jointly by representatives from the education, psychology, and medical programs, which included a number of recommendations for improving the wellness of faculty physicians (Fabri et al., 2005). Among them were recommendations to provide education and training to increase awareness and understanding of wellness attitudes and behaviors. Positive behaviors include some well-known healthy attributes: get plenty of rest, eat well, exercise, and see your doctor regularly. Fabri (2006) has noted that promoting positive behaviors would be difficult without concurrent education and promotion of individual attributes such as emotional-awareness, accurate self-assessment, and self-control.

For these reasons, this research study was developed with the goal of providing education and guidance to faculty physicians, focusing on behaviors and practices that were identified during the study, and with the aim of improving personal wellness. Due to the noted concerns of privacy and time constraints applicable to physicians in general, a technology-based approach was identified as a major component, although the flexibility of the design implementation permits other delivery methods to be employed as well.

Objective of the Study

Educational research has long been criticized for being poorly connected to practice. While some may contend that the search for knowledge is sufficient unto itself, this researcher is among those who believe that educational research must inform practice, else it is of little value. There has been a clarion call to “increase the relevance of research for educational policy and practice” (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006, p. 3). Historically, educational research has been focused on examining the impact of single variables under controlled, experimental conditions. However, the results of these studies have had limited success in translating to practical application (Reeves, 1995). Reeves would go so far as to say that “it depends” is likely to be the best response that instructional technology practitioners can expect from research conducted in the traditional manner (2006, pp. 62-63). As Cronbach noted, “when we give proper weight to local conditions, any generalization is a working hypothesis, not a conclusion” (1975, p. 125). Olson concurs: “In education, such simple causal relations do not obtain between teaching and learning; interactions are filtered through the goals, beliefs, and intentions of the teachers and learners” (2004, p. 25).

There are certainly many good examples of creative solutions to instructional problems, but as van den Akker et al. (2006) note, “...their understanding oftentimes remains implicit in the decisions made and the resulting design” (p. 4). There is a need for studies that provide the bridge between theory and practice, through establishing local instruction theories that are contextually relevant and empirically replicable. The term *local instruction theory* here is derived from the term adopted and promoted by

Gravemeijer and Cobb (2006), which "... consists of conjectures about a possible learning process, together with conjectures about possible means of supporting that learning process" (p. 21). For the purposes of this study, it also includes those elements of other applicable theories as needed to support the intended outcome, such as behavior-change theories. As noted by Michie, Johnston, Francis, Hardeman, and Eccles (2008) "... even with a theoretical framework, there is little information about how to develop theory-based interventions" (p. 662). Other than general instructional design guidelines, there has existed no theoretical framework applicable to the context of faculty physician wellness. Ritterband et al. (2003) concluded that some web-based treatments have been effective in eliciting behavior changes relating to health, but noted that a theoretical model for development was lacking. In one study assessing a web-based approach toward encouraging physical activity, engagement and retention were noted as two of the most significant problems (Leslie, Marshall, Owen, & Bauman, 2005). Although criticized as another media comparison study, it demonstrated that theoretical design frameworks were lacking for interventions aimed at behavioral change where compliance is not compelled.

The purpose of this study was to add to the knowledge base by developing an understanding of the complex interrelationships among the organization, individual, and environment. The study made use of mixed methods, with quantitative evaluation methods to inform and support the primarily qualitative focus. The process was emergent and iterative, and thus shares features in common with action research. This study has provided educational significance by providing practical assistance to the university in a

unique area that has seen limited examination. In addition, this study addressed the gap between theory and practice using a design-based research approach to address both the practical and the theoretical for this problem area.

Applicable Concepts

Design-based research studies tend to continue for very long periods of time, as the outcomes are refined and revised through multiple cycles of analysis, design, evaluation, and redesign. Progress evolves through several stages, which may be simplified to four long-term phases: preliminary research, prototyping, summative evaluation, and systematic reflection. In the preliminary research phase, the problem is analyzed in context, and a preliminary theory is developed using available literature and domain-specific data collection. Prototyping may have a number of sub-phases, with the purpose of establishing design guidelines, and creating and optimizing prototype treatments through cycles of design, analysis, and revision. Summative evaluation involves cycles of deployment to investigate issues of scaling and transferability to related contexts. This stage may also employ measures to address the effectiveness of the treatment. Systematic reflection involves the use of information obtained during summative evaluation to develop procedural design principles with appropriate linkages to the theoretical framework.

A typical design-based research study may take many years to reach the point of systematic reflection, which then cycles back to iterate as the outcome components are refined. Due to the time limitation inherent in doctoral student research, and the breadth of development required to address the identified problem, this study ended after the

prototyping phase and before the summative evaluation phase, with concomitant limitations in the outcomes produced. The four stages of design-based research align closely with the original four research goals from the United States Department of Education Institute of Education Sciences (IES) (IES, 2012). A fifth goal addresses the development and/or validation of measurement instruments, and may thus be associated with multiple DBR stages. The terminology of the IES goal structure has changed over the past five years, with the most significant being the reformatting of the fourth goal term from *scale-up evaluation* to *effectiveness*. The newer term is more directly relatable to DBR stages. The two stages addressed in this study align with the first two IES goals: *exploration*, and *development and innovation*.

Table 1: Mapping of DBR stages to IES goals

IES Goal	DBR Stage
Exploration	Preliminary research
Development & innovation	Prototyping
Efficacy & replication	Summative evaluation
Effectiveness	Systematic reflection
Measurement	(applicable to all stages)

Design-based research avoids the emphasis on isolated variables. Instead, the focus is on processes and product components within specific contexts, based on a collaboration of researchers and practitioners creating, studying, and refining theory-based innovative treatments. As this study followed the design-based research paradigm, the research questions align with the goals and objectives of this type of research.

Although design in conventional educational research is used as a means to test theories,

design in design-based research is crucial in the development of theories; theory and design are not distinct processes. Outcomes for design-based research fall into three categories: domain theories, design frameworks, and design methodologies. A research study may focus on one or more of these outcomes (van den Akker, 2006).

A domain theory is a contextually-relevant theory addressing the combination of learner, environment, and interaction. It is developed through the design process from problem analysis, and is a descriptive theory that characterizes the challenges associated with the identified design context. The domain theory is critical in providing a foundation for understanding the design context, that is a necessary first step towards developing a design framework. Where a warranted domain theory already exists, the researcher may utilize it to focus on a design framework. In the context of this study, a warranted domain theory did not exist, and thus was developed in concert with the design process.

At completion, documentation and publication in peer-reviewed research journals provides other researchers an opportunity to examine, evaluate, and extend the theory if deemed appropriate. Researchers may also use this domain theory to elaborate their own design frameworks for similar design contexts, extending the potential for generalization of the domain theory. Communication of the domain theory derived from this study will serve to extend the body of knowledge in educational research, and, in response to a long-standing criticism of conventional educational research practice, strengthen the bridge between theory and praxis.

A design framework is a specific design solution that provides a set of coherent guidelines for the design and development of treatments for a particular class of design

problem. Design frameworks are sometimes referred to as substantive design principles, and are thus prescriptive in nature. With a design framework, based on a warranted domain theory, a practitioner can implement instructional treatments for the associated class of design problems. Pragmatic design frameworks, theoretically-based, help to increase the relevance of educational research.

Construction of the domain theory was based on a focused study of existing literature and instructional frameworks in the fields of medicine, education, and psychology. Structural components include elements of behavioral change theories, theories applicable to instructional interventions, and theories applicable to organizational involvement. Together, the design framework and implemented treatment form the developmental framework of this document's title. Development and application of the treatment made use of the numerous theories of motivation, (many of which may be seen to directly inform some of the core behavioral change theories), instructional system design (ISD) models, and health program intervention planning models.

Over the past 20 years, organizations have shifted from a focus on the use of training to solve organizational ills to a broader approach emphasizing the improvement of performance, whether through training or other means. According to Geis (as cited in Pershing, 2006), human performance technology (HPT) is the "process of analysis, design, development, implementation, and evaluation of programs to most cost-effectively influence human behavior and accomplishment" (p. 7). HPT provides a comprehensive framework for examining education and training within organizational settings. For the instructional designer as HPT technologist, the focus is on finding

performance gaps and developing interventions, educational or otherwise, based on sound, scientific analysis of the situation. For example, an effective solution may incorporate a combination of approaches, such as web-based training, individualized counseling, and a recognition program (Reiser & Dempsey, 2002). Although typically associated with directly addressing organizational performance issues, HPT provides a general systematic development framework that may be viewed as a starting point for incorporation of other elements from other applicable frameworks:

- The ADDIE (analysis, design, development, implementation, evaluation) framework for instructional design is a well-researched, validated, generalized framework for developing instructional interventions, and includes elements that can augment the HPT starting point (Alessi & Trollip 2001).
- PRECEDE–PROCEED is a heavily commercialized model for health program planning that has been applied numerous times over many years, and founded on the principle that behavioral change is voluntary and thus requires empowering the individual for change (Green, Kreuter, Deeds, Partridge, & Bartlett, 1980).
- Intervention mapping (IM) is a recent development framework crafted specifically for health promotion programs, and drawing heavily on existing theory and empirical evidence (Bartholomew, Parcel, & Kok, 1998). Although IM does not introduce anything new, the reconceptualization and refocusing of prior frameworks, like ADDIE and PRECEDE–PROCEED, provides additional potential for addressing the development of design frameworks.

The ADDIE framework is the foundation for most implementations of HPT systematic frameworks, so this integration is natural. The combination of HPT, ADDIE, PRECEDE–PROCEED, and IM formed the basis for the first phase implementation of the design framework.

A wealth of information exists on theories and models to describe behavioral change across various domains. Within the domain of health behavior change (HBC), several stand out as being well-researched, applied to a variety of problem areas, and were used to form the core of the domain theory. They are social cognitive theory (SCT) (Bandura, 1977a, 1977b, 1986), the theory of reasoned action and planned behavior (TRA & TPB) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980; Ajzen, 1985), the transtheoretical or stages of change model (TTM) (Prochaska & DiClemente, 1984), and the health belief model (HBM) (Rosenstock, 1966, 1974a, 1974b; Becker, 1974; Rosenstock, Strecher, & Becker, 1988). Other theories that were investigated for applicability include protection motivation theory (PMT) (Rogers, 1975; Maddux & Rogers, 1983) and the theory of interpersonal behavior (TIB) (Triandis, 1980). Organizational support and cultural change theories provide a means for including the effects and impact of organizational involvement in the intervention.

There are several theories of motivation associated with participation in training and education. Expectancy theory is based on the unique human characteristic of adjusting present behavior based on anticipated future events. Developed by Vroom (1964), it has become one of the primary motivational theories in organizational

psychology (Jex, 2002). According to expectancy theory, employees will focus their efforts towards actions or behaviors when three things are true:

1. It is highly likely that they will be able to perform the action or behavior if they try
2. It is highly likely that the action or behavior will result in a favorable outcome,
3. The resultant favorable outcome has value to the employee.

These three elements are termed expectancy, instrumentality, and valence (Vroom, 1964). Expectancy theory forms the core for some behavioral change theories, such as HBM and SCT.

Goal-setting theory traces its roots back to Locke (1691), who ascribed motivational value to goals in three ways: directing attention and focusing effort; maintaining task persistence; and facilitating the development of task strategies. The attributes of goal-setting theory include goal difficulty, goal acceptance, goal specificity, and feedback.

The theory of reasoned action (Fishbein & Ajzen, 1975) has been used to explain individual voluntary behaviors, and provides for a complex pathway between general attitudes and specific behaviors. Of interest in motivating participation in training and education is the relationship between behavior, belief, intention, and attitude. This could include individuals important to the employee in question, or elements of the organization itself, such as supervisor support and peer support (Mathieu & Martineau, 1997).

As more organizations shift to computer-based technologies for distributing instructional programs, how and when motivational methods and techniques are applied to these programs becomes increasingly important. According to Keller (1987a, 1987b, 1987c), motivational methods and techniques may be designed into an instructional intervention in a systematic manner such that the maximum performance benefit might be realized.

A design methodology is a generalized set of design procedures that matches an appropriate set of procedures to a set of design goals and settings. These are sometimes referred to as procedural design principles, to contrast with substantive design principles. This study did not attempt to provide a design methodology as an outcome. However, contextually-relevant data in the development of the domain theory and design framework have been collected, in order that subsequent research may have a starting point for development of a design methodology. The context in this case is the use of a technology-based treatment delivered from a remote server in a pilot deployment of the completed treatment. As this study stopped short of developing a design methodology, publication of the results obtained from contextually-relevant inquiry, such as a pilot deployment, provides valuable information for follow-on research.

Research Questions

In pursuit of a local instruction theory, this study was used to seek answers to the following questions:

1. What is the component structure of a local instruction theory that has the potential to positively affect the attitudes and behaviors relating to personal wellness for faculty physicians at a Southeastern teaching hospital?

2. What is the constituent organization of a design framework based on a local instruction theory that has the potential to positively affect the attitudes and behaviors relating to personal wellness for faculty physicians at a Southeastern teaching hospital?
3. What are the perceptions of faculty physicians at a Southeastern teaching hospital of the deployed technology-based treatment with respect to:
 - a) potential impact on attitude and behavioral change regarding personal wellness
 - b) demonstration of organizational support for personal wellness
 - c) the potential for technology-based treatments to impact cultural change in an organization
 - d) protection of personal privacy and trusted use?

Delimitations of the Study

Although the hope is that the study results might be used to inform a much broader target population, this study specifically limited the development and application of the local instruction theory and resulting intervention to faculty physicians at a teaching hospital. Demographics were not used as variables in this study, beyond the primary delimiters identifying the target population. While design-based research projects may span considerable lengths of time and undergo numerous iterations, this study was specifically limited to three iterations. As the PI performed all design and development functions, there was no attempt to capture the level of effort as it was perceived to have little bearing on development time for a non-academic project.

Limitations

All studies suffer limitations that threaten the validity of the reported outcomes. It is incumbent on the researcher to identify limitations that may be associated with the study, and identify remediation methods if possible and applicable. The term *validity* is

well-defined for quantitative research; less so for qualitative research. Rather than introducing or employing disparate terms, validity will be used here to describe the potential threats to the credibility or trustworthiness of this research whether arising from qualitative or quantitative measures.

As this study made no attempt to draw inferences of causality, the primary concerns for validity were with instrument development and researcher involvement. Instrument development threats were mitigated by employing concepts derived from existing validated instruments from the literature, and the instruments were examined by experts prior to usage. Threats to validity associated with researcher bias were addressed through the strategy of reflexivity. The PI actively engaged in self-reflection about possible biases in all stages of the study. Descriptive validity was maximized through the use of audio recording to capture all input during observation and discussion sessions.

Definition of Terms

To minimize potential confusion, terminology used throughout this document that may have different meanings in other contexts is herein defined for ready reference.

Acronyms and initializations have been collected into a table in Appendix N.

design framework

a specific design solution that provides a set of coherent guidelines for the design and development of treatments for a particular class of design problem; sometimes referred to as substantive design principles

developmental framework

the combination of design framework and instructional treatment interactively developed

domain theory

contextually-relevant theory addressing the combination of learner, environment, and their interaction; the domain for this study was the combination of faculty physician, personal wellness practices, and affiliated organization

instructional treatment

the technical application designed to provide educational benefit to learners

local instruction theory

the combination of domain theory and developmental framework

regular source of care

personal physician to which at least 50% of ambulatory visits are made

residents

medical doctors who have completed medical school and an internship, and are in the learning phase of their selected specialty

Organization of Remaining Chapters

Chapter two provides a synthesis of literature applicable to this study, including sections on design-based research, wellness, theories and models of health behavior change, theories of motivation, and applicable development frameworks. Chapter three describes the research method employed, including details on participants, instruments, and design procedures. Chapter four provides the results of the study, and the final chapter summarizes the study with recommendations for further research.

Chapter Two: Literature Synthesis

This chapter provides a synthesis of the literature that was researched for this study. It begins with a section on design-based research, then introduces the literature associated with general concepts of wellness. The subsequent section reflects an examination of theories of motivation associated with education and training. This is followed by a section addressing theories and models of health behavior change, and finishes with a synthesis of applicable development frameworks.

Design-based Research

It has been suggested that the schism between theory and practice can only be bridged by transitioning from a theoretical focus to an experimental focus, and more specifically towards a design science rather than an analytical science (Collins, 1990, p. 1):

Technology provides us with powerful tools to try out different designs so that, instead of theories of education, we can begin to develop a science of education. However, it cannot be an analytic science, such as physics or psychology, but rather a design science, such as aeronautics or artificial intelligence. For example, in aeronautics the goal is to elucidate how different designs contribute to lift, drag, and maneuverability. Similarly, a design

science of education must determine how different designs of learning environments contribute to learning, cooperation, and motivation.

Brown (1992) wrote about her transition from a theoretical focus to a contextual experimental view, and in so doing, described the goals, ideals, and challenges involved in implementing design experiments:

Even though the research setting has changed dramatically, my goal remains the same: to work toward a theoretical model of learning and instruction rooted in a firm empirical base. I regard classroom work as just as basic as my laboratory endeavors, although the situated nature of the research lends itself most readily to practical application. In the classroom and in the laboratory, I attempt to engineer interventions that not only work by recognizable standards but are also based on theoretical descriptions that delineate why they work, and thus render them reliable and repeatable. (p. 143)

The problem with such design experiments is that changes made in one part of the system reverberate throughout, and one is often forced to conduct the multiply confounded experiments that are a nightmare for an experimental psychologist. (p. 144)

Although Brown (1992) adopted Collins' terminology of design experiments to describe this emerging experimental focus, and continues to be one of the most-cited

foundational members, numerous terms have been used to describe this approach with no clear consensus among researchers. It has also been referred to as development research (van den Akker, 1999), “use-inspired basic research” (Stokes, 1997, p. 73), and design research (van den Akker, 2006), among others. Although the names are different, there is some common ground in the various definitions used. One popular, albeit simplified definition given for developmental research is “the systematic study of designing, developing and evaluating instructional programs, processes and products that must meet the criteria of internal consistency and effectiveness” (Seels & Richey, 1994, p. 127). For the purposes of this study, the term *design-based research* has been selected, as it is less likely to be confused with *developmental research* as applied to early-childhood development, and it evokes the systematic nature of engineering processes. A commonly accepted definition by Barab and Squire (2004) is “a series of approaches, with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings” (p. 2). Figure 1 graphically illustrates the differences between empirical research and design-based research.

In contrast to randomized controlled experiments, design-based research does not provide for hypothesis testing. As Walker stated, “Design research is not done to test theories, even though its results can sometimes suggest weaknesses in theory. Rather, design research discovers ways to build systems based on theories and determine the effectiveness of these systems in practice” (2006, p. 11). The “appropriate product for design research is warranted theory” (Edelson, 2006, p. 101). The warranted theory

Edelson mentions can take one of three forms: domain theories, design frameworks, and design methodologies.

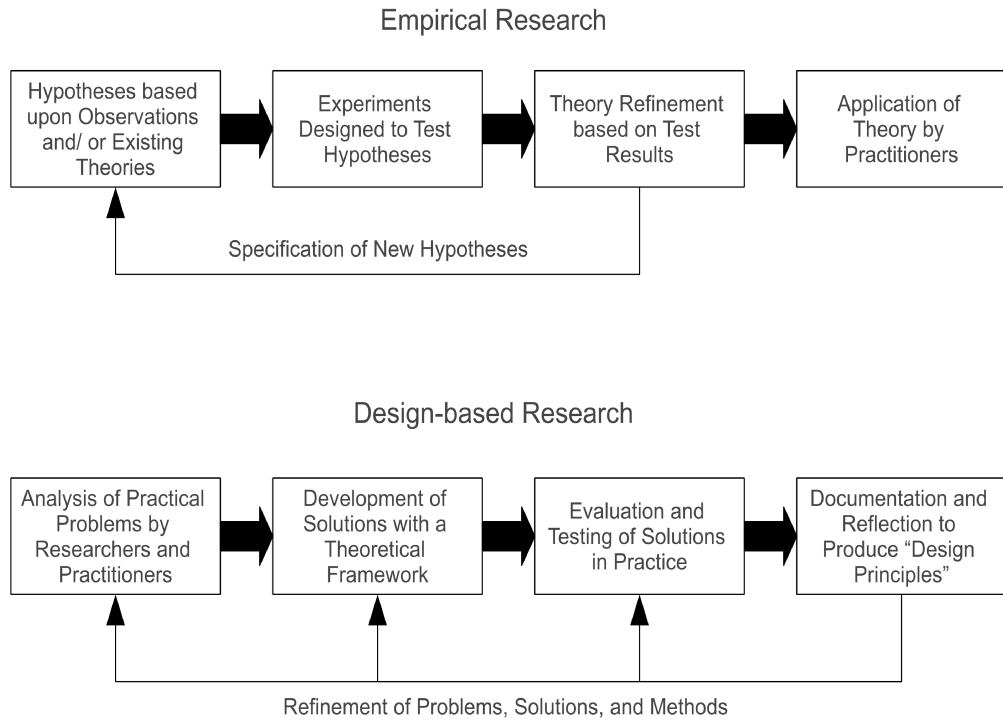


Figure 1: Contrasting Design-based Research with Traditional Empirical Research

Figure adapted from *Enhancing the worth of instructional technology research through “design experiments” and other development research strategies*. Paper presented by T. C. Reeves at session 41.29, “International Perspectives of Instructional Technology Research for the 21st Century”, a symposium sponsored by SIG/Instructional Technology at the Annual Meeting of the American Educational Research Association, 2000. New Orleans, LA. (p. 9).

Domain theories are either context theories (about the design setting) or outcome theories (describing the effects of interaction between environment and elements). These are the underlying theories that support design frameworks, which are specialized design solutions with guidelines for implementation. van den Akker also describes design

frameworks, which he calls *substantive* design principles, as being a product of design research (van den Akker, 1999). Design methodologies are generalized design procedures or *procedural* design principles, according to van den Akker (1999). In the terminology of design-based research, this study produced a domain theory and design framework. Additional research is required to validate the effectiveness of the domain theory for the intended purpose, which is supported by the validated instructional treatment that can be used as a research vehicle.

Concepts of Wellness

In order to understand the particular focus on wellness that was addressed in this study, it is first necessary to understand what wellness is. A review of the literature shows that numerous terms have been used interchangeably, including quality of life (QOL), well-being, happiness, subjective well-being, psychological well-being, objective well-being, life satisfaction, hedonic well-being, and eudaimonic well-being. According to the Oxford English Dictionary (1989) and Merriam-Websters Collegiate Dictionary (2005), the word *wellness* is a noun describing the state of being in good health or being well. However, even the Oxford English Dictionary indicates that the definition is not as settled as that of the word *illness*, which is commonly employed as an antonym. It is interesting to note that in dictionary definitions, *good health* and *being well* are used synonymously; a precursor to the overlap and variability of terms and definitions found in the available literature. The Oxford English Dictionary (1989) provides multiple definitions of health, including:

1. Soundness of body; that condition in which its functions are duly and efficiently discharged.
2. By extension, The general condition of the body with respect to the efficient or inefficient discharge of functions: usually qualified as good, bad, weak, delicate, etc.
3. Spiritual, moral, or mental soundness or well-being; salvation. arch.
4. Well-being, welfare, safety; deliverance.

The Oxford English Dictionary (1989) defines well-being as a state of being or doing well in life; a state indicating a happy, healthy, or prosperous condition. While there is no dictionary definition for QOL, and no consensus among researchers, the general nature of QOL descriptions are similar to those for well-being (Felce & Perry, 1995). Kahn and Juster (2002) used well-being and QOL interchangeably. Easterlin (2003) considered well-being, utility, happiness, life satisfaction, and welfare to be interchangeable. Kahneman (1999) used happiness and well-being interchangeably. In 1948, the World Health Organization (WHO, 1948) extended their definition of health to the following: “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (p. 100).

Fitzgerald (1994) referred to this highly desirable state of health as wellness. Breslow (1972) has consistently used the term *well-being* from the WHO definition to encourage health promotion programs. The American Medical Association (AMA) links health and wellness to medical ethics, but does not provide separate definitions for the two terms. In their code of medical ethics, section 9.0305, the AMA (2012) states: “To preserve the quality of their performance, physicians have a responsibility to maintain

their health and wellness, construed broadly as preventing or treating acute or chronic diseases, including mental illness, disabilities, and occupational stress.” Although Taub et al. (2006) developed a set of recommendations based on the AMA policy, they still viewed health and wellness as a conjoined pair, and never seemed to distinguish one from the other. Even though it has been historically focused on reactive methods to address negative health in some form, the AMA code can and has been broadly interpreted to be viewed as proactive as well.

Thus, definitions of wellness have been closely linked with positive health or well-being of mind, body, and spirit. In the context of medical studies and modern usage, a physician by the name of Halbert Dunn is often credited with first promoting the term *wellness*, and more specifically, *high level wellness* (1959). He defined high level wellness as “an integrated method of functioning which is oriented toward maximizing the potential of which the individual is capable” (as cited in Hattie, Myers, & Sweeney, 2004, p. 354). Hettler (1984) agreed with the definition of wellness as a process, and further refined the concept by breaking it down into six dimensions. This idea of health promotion and mastery was later picked up and amplified by Ardell (1985). However, most current conceptions of wellness consider it a state of being rather than a lifestyle or practice (Corbin & Pangrazi, 2001), which is consistent with dictionary definitions of wellness.

The period following the 1948 WHO definition of health saw a concomitant increase in the number of published articles on well-being and quality of life. Despite the numerous position papers and empirical studies published, a consensus in terminology

remains elusive. Hird, using the term well-being as a basis, concluded “There is no accepted, universally used definition of wellbeing [sic]” (2003, p. 3), but did develop a taxonomy based on a review of the literature, particularly that of Felce and Perry (1995). Spilker (1996) indicated that there is no universally accepted definition for quality of life, which Hird affirmed: “Definitions of quality of life that are available have often been derived from the content of instruments used to measure wellbeing [sic], rather than from conceptual models” (p. 9). QOL and well-being are related, but the degree and form of that relationship has been the subject of much discussion. Corbin and Pangrazi (2001) proposed a uniform definition of wellness that ties in with both well-being and quality of life: “Wellness is a multidimensional state of being describing the existence of positive health in an individual as exemplified by quality of life and a sense of well-being” (p. 1). This definition is in line with most conceptions of wellness as a state of being, and does provide an integrated framework, but stops short of defining well-being or quality of life.

According to Corbin and Pangrazi’s proposed definition, wellness is multidimensional, individual, positive, a sub-component of health, and described by well-being and quality of life, with the most commonly cited sub-dimensions being physical, social, intellectual, emotional (mental) and spiritual. Vocation and environment are also sometimes cited, but do not fit the individual nature of the Corbin and Pangrazi definition. Although the number of sub-dimensions employed seems to depend on the individual researcher, there still appears to be considerable overlap among them, with most researchers identifying anywhere from five to seven dimensions (Corbin & Pangrazi, 2001). Most of the dimensions used are also consistent with the dimensions

Hettler originally proposed: social, occupational, spiritual, physical, intellectual, and emotional. However, most of the frameworks or models designed to address wellness, well-being, and quality of life have not been empirically validated. Part of the problem is the lack of validated instruments for assessing all sub-dimensions of proposed models. One of the exceptions comes from the field of counseling psychology, which has produced a model of wellness organized around Adler's Individual Psychology (1964) called the Indivisible Self (IS) model of wellness.

The IS model is referred to as an evidence-based model of wellness because it was developed through empirical testing of an earlier theoretical model called the Wheel of Wellness (WOW) (Myers & Sweeney, 2005). The IS model includes the following factors: creative, coping, social, physical, and essential. Although further refined into 17 third-order factors, this model does seem to relate at the second-order level reasonably well with other models of wellness. When compared with the sub-dimensions cited by Corbin and Pangrazi (2001), it is evident that the physical and social factors are similar. By delving into descriptions of the third-order factors, it appears that the other sub-dimensions map reasonably well: IS factors *creative* and *coping* blending Corbin and Pangrazi (C&P) factors *intellectual* and *emotional*; IS factor *essential* maps with C&P factor *spiritual*. Table 2 illustrates this mapping. Another feature of the IS model is the inclusion of context relevance, recognizing that wellness at the individual level is different than wellness at the familial or organizational level, and provides for temporal relativity. Given that the interest in this study was wellness at the individual level, context

had already been fixed, but it is interesting to note that few models address context as a factor.

Numerous studies provide empirical support for the 17 third-order factors, which are the same in the IS model as they were in the WOW model (Hattie et al., 2004; Myers & Sweeney, 2005). The *Essential Self* has four subfactors: *spirituality* relates to one's "existential sense of meaning, purpose, and hopefulness toward life" (Myers & Sweeney, 2005, p. 273); *self-care* is identified with efforts and activities focused on healthy living (e.g. smoking cessation); *gender identity* and *cultural identity* are filters or lenses that affect the individual's perception of experiences, as well as how others respond to the individual. The *Creative Self* includes *thinking* and *emotions* that are shown to influence each other, *control* or perceived influence over events in the individual's personal life, *positive humor* (to include positive expectations), and *work*. The *Coping Self* comprises *realistic beliefs*, *self-worth* (which relates with self-efficacy), *stress management*, and *leisure* as a coping strategy. The *Social Self* is essentially a continuum ranging from *friendship* to *love*, with family relationships (biological or chosen) perceived to provide the social support most associated with social wellness. The *Physical Self* includes wellness factors traditionally associated with health promotion and often over-emphasized to the exclusion of other factors: *exercise* and *nutrition*. Studies are ongoing to continue assessment of the factor structure at the second level (Myers & Sweeney, 2005). The Duke Integrative Medicine website utilizes a wellness structure similar to the earlier Wheel of Wellness (<http://www.dukeintegrativemedicine.org/about-us/wheel-of-health>). Calling it the Wheel of Health, the Duke model incorporates similar physical,

spiritual, and relational constructs, then wraps them all within an outer layer of *professional care*. Although these additions seem reasonable, there are no studies to validate the elements or interrelatedness of the structure.

Table 2: Indivisible Self Wellness Factor Mapping

C&P Factors	IS Factors	IS Third-Order Factors
Spiritual	Essential	spirituality, self-care, gender identity, cultural identity
Intellectual Emotional	Creative	thinking, emotions, control, positive humor, work
Intellectual Emotional	Coping	realistic beliefs, stress management, self-worth, leisure
Social	Social	friendship, love
Physical	Physical	exercise, nutrition

The high-level factors of the IS model relate well with themes specifically identified as being associated with physician well-being. Shanafelt, Sloan, and Habermann (2003, p. 516) report that the most important themes identified with physician well-being are the following:

Relationships

Grasp the importance of protecting time to spend with family and significant other. Develop a sense of connection with colleagues. Pursue opportunities to reflect on and share with colleagues about the emotional and existential aspects of being a physician.

Religious Beliefs/Spiritual Practice

Personal attentiveness to and nurturing of the spiritual aspects of self.

Work Attitudes

Finding meaning in work (Flow); Actively choosing and limiting type of medical practice. Examples: working part time, being involved in medical education, pursuing research interests, managing schedule, discontinuing unfulfilling aspects of practice.

Self-Care Practices

Actively cultivating personal interests and self-awareness in addition to professional and family responsibilities. Seeking professional help for personal physical or psychological illness as needed. Examples: reading, exercise, self-expression activities, fostering personal awareness, adequate sleep, nutrition, regular medical care, professional counseling.

Life Philosophy

Develop a philosophic approach to life that incorporates a positive outlook, identifying and acting on values, and stressing balance between personal and professional life.

Thus, the taxonomy of the Indivisible Self model was determined to provide the most comprehensive and well-studied basis for establishing the appropriate aspects of wellness to address in this study. A qualitative assessment of wellness-promotion practices used by physicians (Weiner, Swain, Wolf, & Gottlieb, 2001) provides empirical support for the factors in this framework in the specific context of this study. The primary practices associated with wellness noted in that study were relationships, religion or spirituality, self-care, work, and approaches to life. The first four can be readily mapped to the IS factors social, spiritual, and creative. The practice referred to as *approaches to life* was associated with significantly higher levels of psychological well-being, including “general philosophical outlooks such as being positive, focusing on success, maintaining a balance in life, and specific strategies on implementing such approaches” (Weiner et al., 2001, p. 22). However, this list maps across multiple factors of the IS model, including coping, creative, and essential, which could be perceived as support for the holistic approach of the IS model. It is evident that the social, spiritual, and coping factors are as important as the more well-researched physical factors when it comes to physician

wellness. Yet evidence derived from the current study suggests that prevailing opinions amongst physicians are in disagreement with these findings.

Theories of Motivation

There are many theories of motivation in psychology, but a few have been shown to be particularly relevant with respect to education and training. It has been suggested that individual personality differences could impact motivation. Dispositional theorists tell us that individuals possess relatively stable characteristics that affect their behavior and attitudes (Staw, Bell, & Clausen, 1986). As a variable of interest, disposition includes an individual's personality, which comprises traits, structure, value and affect or mood. Personality has an impact on attitudes, which affect motivation, which then leads to behavioral outcomes, according to dispositional theorists. Although intuitively appealing, the bulk of dispositional studies as they relate to organizational concerns such as training have been inconclusive, and critics point out the lack of agreement among researchers (Davis-Blake & Pfeffer, 1989).

Until recently, most of the research on job attitudes has been situational, with very few empirical studies linking personality with motivation in learning contexts. Naquin and Holton (2002) determined that some dispositional traits do have a direct impact on motivation to learn and to transfer learning in the workplace, but recognize that they operate in conjunction with situational influences. Furthermore, ethical concerns stop short any specific advice for using disposition as criteria for selection or implementation of training. Psychologists recognize five broad domains that characterize human personality: openness (insightful, imaginative, wide range of interests), conscientiousness

(thorough, methodical, organized), extraversion (energetic, talkative, assertive), agreeableness (kind, sympathetic, affectionate), and neuroticism (moody, tense). Rowold (2007) concluded that at least three of the Big Five personality variables have significant impact on motivation to learn and to transfer learning in the workplace, and prior research provides support for the other two variables. Although interesting, the practical application to interventions remains elusive, and there appear to be other motivational theories that have been shown to have more significant impact in this arena. Therefore, individual personality differences were not considered as part of the domain theory for this study.

Vroom's (1964) expectancy theory has enjoyed varying degrees of research support. Howard (1989) identifies expectancy theory as relevant to adult education in particular, though with mixed support from the research. The expectancy basis for motivation is supported, but the individual elements of the model are not consistently supported. He identifies three stages of learning, each with a different motivational focus: pre-learning, where motivating initial involvement is critical; learning, where motivation for continued involvement is the focus; post-learning, where learners must be motivated to apply what they have learned. Self-efficacy has been identified as an antecedent to motivation to learn, and it has been suggested that "training self-efficacy might well serve as a mechanism through which training motivation could be subject to the external influence of trainers" (Carlson, Bozeman, Kacman, Wright, & McMahan, 2000, p. 284). Similarly, Mathieu and Martineau (1997) identify three types of pre-training motivation: motivation to learn, self-efficacy, and valence-instrumentality-expectancy (VIE) beliefs.

Motivation to learn is identified as a specific desire by the trainee to learn the material, which is simple and straightforward, but says little about why some are more motivated than others, and also provides very little in the way of diagnostic information. VIE has also been termed *motivation through expectation* (Tharenou, 2001), and has been argued by Mathieu and Martineau (1997) to be superior to other pre-training motivation approaches. Expectancy theory has been used as the basis for a number of related theories and frameworks, as will be reviewed further on.

Motivation in education and training. Research in this area may be thought of as falling into one or more of the following categories: mandatory education or training, voluntary education or training, and self-directed learning. It appears from the literature that the term *education* is used most often when referring to formalized programs of study, which are usually administered by educational institutions and which are not specific to any particular organization. *Training* is identified as associated with a specific organization or industry (e.g. site safety training). *Self-directed learning* applies to intentional, non-formal learning practices directed toward improving knowledge for use in one's chosen vocation. The majority of studies on training involve mandatory training. Of the little research that exists on motivation and training, few even mention the potential confound of voluntary and mandatory training with respect to motivation. Tharenou (2001) indicates that training motivation is higher when the training is voluntary, though voluntary is not separated from mandatory in her research. In their study of continuing professional education (CPE) among educators, Livneh and Livneh (1999) allude to this distinction via the work of Ruder (1987), but do not include it in

their research. Furze and Pearcey (1999, p. 358), in their review of the literature in the field of nursing, indicate motivation is key in both mandatory and voluntary training:

Proponents of mandatory continuing education have argued that the need to produce evidence of CPE for re-registration will overcome the problems of 'laggards', patchy and unplanned provision, and barriers to uptake (Hogston, 1995; Hutton, 1987). Detractors from mandatory CPE argue the CPE has not been proven to have an impact on practice (Brown, 1988; Yuen, 1991) and that nurses who are not motivated to learn will be unlikely to gain anything (Brown, 1988). This viewpoint is held by Cervero (1985), who states that unless an individual is motivated to change, the most well-planned CPE programmes [sic] will not induce behaviour [sic] change.

Although studies were located with regard to voluntary employer training, and studies were found with regard to voluntary participation in continuing education, no studies were found addressing voluntary participation in formal educational programs within the framework of an organizational structure. It is reasonable to consider any instructional intervention for physician personal wellness to fit this definition. However, review of the literature in health behavior change seems to indicate that programs of this type are typically treated as informal training with either voluntary or mandatory participation. Further study is needed to address the question of differences regarding voluntary versus mandatory participation in HBC programs.

Motivational orientation for participation. Houle (1961) proposed that participants in adult education are action oriented, goal oriented, or learning oriented. Although a minimalist perspective, it spurred research interest in others, including Sheffield (1964) and Burgess (1971). From this prior work, Boshier (1971, 1977) created the Education Participation Scale (EPS) for determining why adults participate in education, especially in the context of lifelong education. The EPS recognizes seven factors that measure motivational orientation: social contact, social stimulation, professional advancement, communication improvement, educational preparation, family togetherness, and cognitive interest in a particular subject. The theory of reasoned action, a HBC theory discussed later in this document, has also been used as a basis for participation. Grotelueschen and Caulley (1977), who originated the theory, used it as the basis for the Participation Reasons Scale. Despite having been thoroughly studied (Becker & Gibson, 1998; Yang, Blunt, & Butler, 1994), the Participation Reasons Scale does not equate intention to participate with actual participation (Henry & Basile, 1994). Although appealing, it isn't clear how many of these factors remain when addressing participation in HBC instructional treatments. Again, assessment of voluntary versus mandatory participation is expected to impact motivational orientation.

Motivational models used in instructional design. The second phase of motivation in education and training, according to Howard's (1989) application of expectancy theory, involves the design, development, and delivery of the instruction. Notable models include Malone and Lepper's (1987) intrinsic motivation model, Taylor's (1986) value-added model, and Wlodkowski's (1999) time-continuum model. However,

in the area of instructional design (ID), Keller's (1987a, 1987b, 1987c) ARCS model dominates the literature.

Keller is credited with identifying four categories of motivational conditions that occur in learning situations: *attention*, *relevance*, *confidence*, and *satisfaction*. These four categories give rise to the acronym ARCS in the model name. The model provides methods or strategies intended to produce motivational outcomes. The first category addresses the need to gain or maintain the attention of the learner. The second relates to the learner's evaluation of the relevance of the environment with respect to his or her own particular needs. The third requirement relates to the learner's expectancy of success or failure, which has been shown to correlate with actual effort and performance. The final area deals with rewards gained because of the instruction, which may be positively impacted by recognition and feedback methods.

Research has shown that intrinsic motivation, such as identified in Malone and Lepper's model (1987), is more powerful than extrinsic motivators in facilitating learning. In Malone and Lepper's model, instructional features such as *challenge*, *curiosity*, *control*, and *fantasy* are identified as facilitating intrinsic motivation. A certain degree of overlap may be seen between this and the ARCS model. For example, attention and curiosity are related concepts. It has been proposed by Hardre (2001) that an integration of the two provides the optimal instructional design model. However, my research has failed to locate validation studies of an integrated model.

Effects of motivational elements in instructional design. The application of theories of motivation in ID is primarily concerned with improving the appeal of the

instruction or intervention, rather than address issues of behavioral change directly. Although application of these models can lead to improved motivational states for learning, there is an implicit assumption that the target audience already falls within an appropriate bound of *willing and able*. Keller's ARCS model is considered particularly attractive for ID because it provides a framework and systematic guidelines for developing instruction that positively influences learner motivation with respect to the instruction. Numerous authors support the viability of the ARCS model in the design phase (Chang & Lehman, 2002; Shellnut, Knowlton, & Savage, 1999; Song & Keller, 1999). One study by Lee and Boling (1999) outlines a framework for motivation in the screen design process. Of particular interest to practitioners is the breakdown of the screen design process into three domains: *instructional design*, *functional design*, and *formal design*. Instructional design is defined in this framework as the selection of strategies and tactics for delivering the content. Functional design describes the capabilities the program will have, and what will be under learner control. Formal design is the specifics of functional representation (for example: a pop-up owl on a branch for menus). An assessment tool called WebMAC was developed by Small (1997) to enable adult evaluators to benchmark a website for its motivational index or quotient. Its development was based on Keller's ARCS model and Taylor's value-added model.

A more recent research area in motivation is the development of adaptive motivational instruction. The concept is similar to that of adaptive testing, wherein questions are added or subtracted from the test based on prior responses. In this case, motivational features are added or deleted, dependent upon prior responses that are

interpreted to indicate levels of motivation. In one study, Song and Keller (2001) report positive results in their prototype development of a motivationally adaptive instruction method. The study compared the motivational effect of a motivationally adaptive instructional program to two others: one motivationally saturated and the other motivationally minimized. The minimized version was created first, with the saturated version adding motivational elements to the minimized version. In this way, the three treatments incorporated the same design with respect to all features save motivational elements. The test was performed on 60 tenth grade students taking a biology course from the same teacher. Motivational reports were incorporated in the treatments as surveys, based on Keller's Instructional Materials Motivation Survey (IMMS). The results were analyzed with one-way ANOVA for differences in motivation and continuing motivation, and MANOVA for the differences in the four elements of the ARCS model. Results support the assertion that an optimal motivational strategy in the design of the instruction produces the best results. However, among the four elements of the ARCS model, only *relevance* was fully supported with respect to adaptive motivation. There was no significant difference for the other three elements.

Health Behavior Change Theories

Health behavior change (HBC) theories are typically categorized as either a continuum model or stage model (Lippke, 2008a). It is common practice within the behavioral health community to use the term *theory* to also include framework, and model (Prochaska, Wright, & Velicer, 2008). Some HBC theories may reasonably use all three terms, but most are models for understanding health-related behaviors. When

discussed individually in this document, they will be appropriately identified as theory, framework, model, or some combination of the three.

Continuum theories. Continuum theories are based on the assumption that behavior change is the result of changes in the variables of a predictor equation that functions the same across a range that reflects likelihood of action. The underlying assumption is that change occurs in a linear fashion, and the predictor equation is valid across the range. It is also assumed that the sequence in applying interventions based on these predictor variables is not important; all changes lead to the same final outcome regardless of sequence. Examples include the health belief model (HBM), theory of planned behavior (TPB), and social cognitive theory (SCT).

Health belief model. One of the best-known and still much-used models for behavioral change in the medical community is the health belief model (HBM) (Becker, 1974; Rosenstock, 1966, 1974a, 1974b; Rosenstock et al., 1988). Developed and applied over many years, the HBM emerged primarily from expectancy theory. As previously mentioned, expectancy theory has become a primary theory of motivation in organizational psychology, with demonstrated ability to describe employee actions according to the belief that the identified outcome is desired, and that the behavior will produce the outcome. The HBM works along the same lines, with the belief that an outcome is desired (e.g. improved health), and that a particular behavior will produce the desired outcome. However, the HBM starts with the construct of perceived threat, which is the idea that the individual is susceptible to some undesired condition. This can be

considered the flip side of desired outcome in expectancy theory. The second strand is then very similar: belief that a particular behavior will reduce the perceived threat.

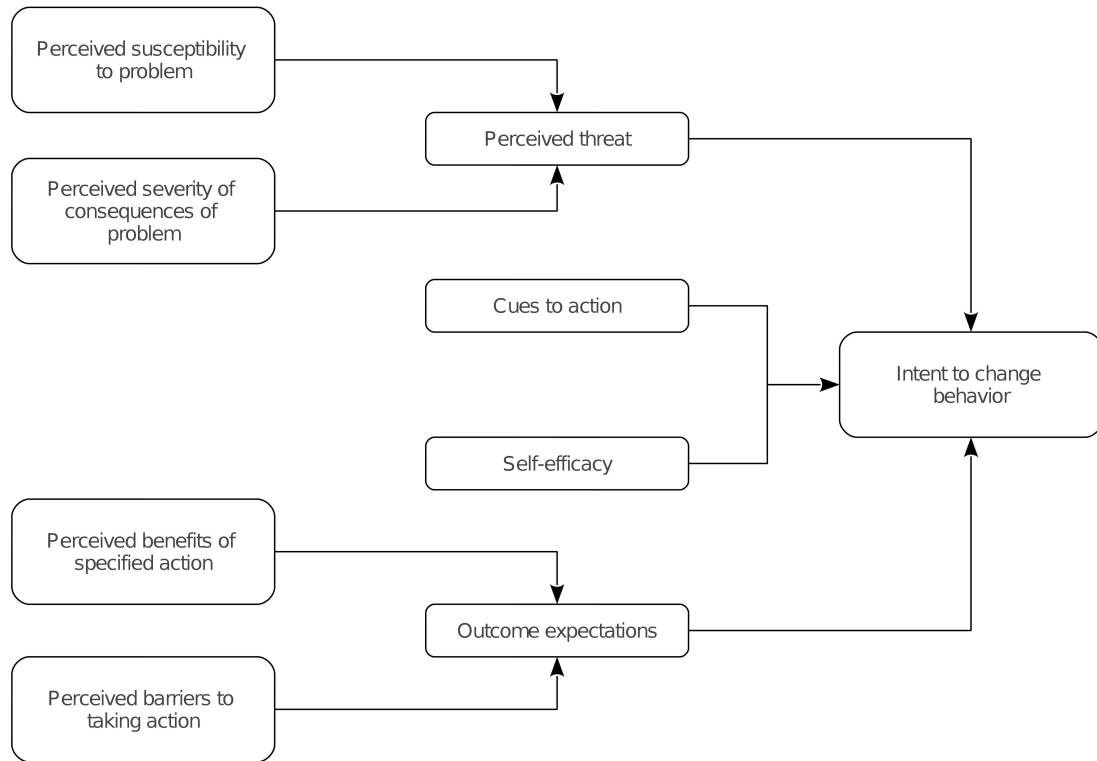


Figure 2: Health Belief Model Block Diagram

These concepts are further subdivided into four main constructs: perceived threat is composed of perceived susceptibility to the condition in question and the perceived severity of the condition; the outcome expectations are a result of the perceived benefits and perceived barriers of the identified action. To these four constructs are added self-efficacy and cues to action, as shown in Figure 2. Socioeconomic factors are specifically excluded from this representation of the HBM, as they are not applicable to this study. Cues to action can be anything internal or external that emphasize one of the four underlying constructs. For example, severe pain could heighten the perceived severity

enough to encourage some kind of response. Self-efficacy has been demonstrated as an essential component in any kind of behavioral change theory, and can be viewed here as being informed by the four underlying constructs that comprise perceived threat and outcome expectations (Nutbeam & Harris, 2004). The HBM is relatively simple, has a strong theoretical underpinning, and is of practical use for implementing interventions.

“However, it is important to remember that the HBM is a psychosocial model; as such it is limited to accounting for as much of the variance in individuals’ health-related behaviors as can be explained by their attitudes and beliefs”. (Becker, 1985, p. 544). It also does not account for the individual’s state of wellness relative to the health factor in question (Kersell & Milsum, 1985). While the HBM is a valid model for understanding the relationship between beliefs and behaviors, and research indicates that changing those beliefs can lead to positive changes in health-related behavior, it has not been demonstrated to be a useful framework for effecting behavioral change (Nutbeam & Harris, 2004).

Social cognitive theory. Social cognitive theory (SCT) (Bandura, 1986) shares a heritage with the HBM through expectancy theory. However, where the HBM focused on the individual level, SCT deals with the interpersonal level. Evolving from Bandura’s social learning theory (SLT) (1977b), SCT has been widely studied and applied to health promotion problems. Bandura posited that people learn from observing the actions (and benefits thereof) of others, as well as personal experience. Bandura introduced self-efficacy to this three-part model comprising environment, person, and behavior, and relabeled it SCT. The interaction process is termed *reciprocal determinism*, which simply

means that learning results from the reciprocal interaction of the three component sets. The theory can also be viewed as the interaction of expectancies and incentives. The former include expectancies about environmental cues, expectancies about behavioral outcomes or consequences, and expectancies about one's own ability to perform the behavior (self-efficacy). Incentives refer to the value or benefit of the outcome, and is also referred to as reinforcement. Thus, behavior is modified by expectancies associated with each of the three domains, and regulated by the individual's perception of the consequences of the behavior (Rosenstock et al., 1988).

Numerous health promotion interventions have made use of educational programs combined with changing the social and physical environments to effect behavioral change (Nutbeam & Harris, 2004). However, most studies attempt to understand how the model might predict an outcome of interest, rather than how it might be used to effect behavioral change. Apparently, the hope is that prediction power correlates with ability to influence. Palmeira et al. (2007) determined that 20-30% of weight change in their study of weight management was predicted by SCT, though the single greatest contributor was found to be weight management self-efficacy. Wang, Nieveen, and van den Akker (2006) found little to suggest SCT to be predictive of intention to use birth control, but self-efficacy as an individual construct was significant. Although SCT shares some of the same problems afflicting the HBM as a model for behavioral change, the introduction of self-efficacy in relation to behavior and environment makes this a potentially useful theory.

Theory of planned behavior. Fishbein and Ajzen (1975) introduced the theory of reasoned action (TRA) to explain voluntary human behavior, with the underlying assumption that people are rational beings who make predictable decisions when the circumstances are well-defined. The TRA models behavior as being entirely determined by behavioral intention, which is in turn influenced by attitudes towards the outcome and subjective social norms. The attitude portion is similar to the perceived barriers and benefits portion of the HBM. Subjective social norms encompass beliefs about what other people think should be done under the circumstances, and the desire to comply. A third influence, perceived behavioral control, was added and TRA was relabeled theory of planned behavior (TPB), as shown in Figure 3. Perceived behavioral control includes perceived power in a given situation, and beliefs about control over a behavior; conceptually very similar to self-efficacy.

Despite the intuitively appealing applicability of this theory, it has seen mixed results. One study determined that TRA explained 46% of the variance in participation intentions for CPE, with attitude being the strongest predictor of intention (Becker & Gibson, 1998). However, the study stopped short of investigating actual behavioral change. Conversely, another study was unable to find evidence to suggest TRA would predict intent to use birth control (Wang, Charron-Prochownik, Sereika, Siminerio, & Kim, 2006). Although the behavioral control component of TPB was not included in the second study, the findings contradict the former study with respect to attitude as a strong determinant. An examination of TPB studies found that the strongest factor influencing behavior change was past behavior, yet past behavior only accounts for 26% of the

variation; when TPB measures were added, only 7% additional variance was found (Skår, Sniehotta, Arajo-Soares, & Molloy, 2008). From this poor showing, we can conclude that the TPB alone is not a good theory for behavior change, although it remains popular and is likely to remain so. TPB studies do show the importance of social norms and short-term (versus long-term) consequences in influencing behavior.

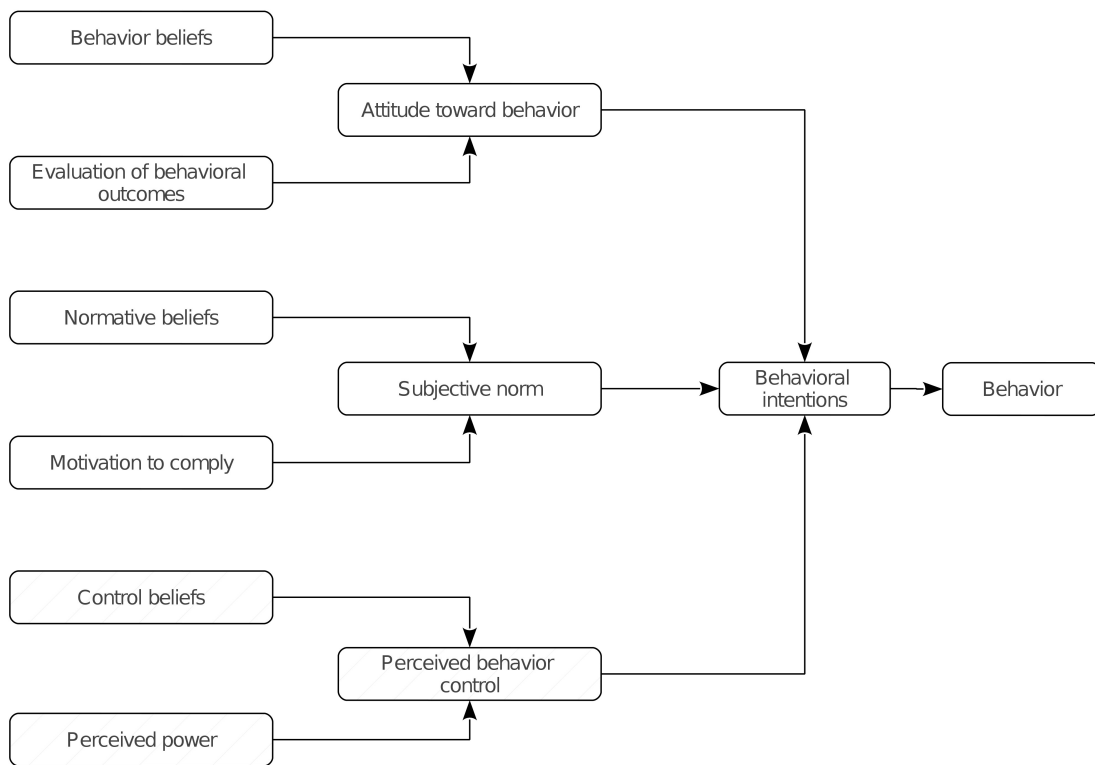


Figure 3: Theory of Reasoned Action / Planned Behavior Block Diagram

Figure adapted from the graphic copyright 2006 at Icek Ajzen's website and used with permission for non-commercial purposes. (<http://people.umass.edu/ajzen/tpb.diag.html>)

Protection motivation theory. Protection motivation theory (PMT) was originally developed by Rogers (1975) as a way to understand how appeals to human fears affected behavior, particularly with respect to health-related behaviors. PMT was later revised as a

more general theory of persuasive communication (Rogers, 1983; Maddux & Rogers, 1983), but the focus on fear and threat avoidance remained. The primary change was the inclusion of self-efficacy, raising the number of components to four (excluding the fear basis), which are considered a component of threat appraisal or coping appraisal. The addition of a cost-benefit assessment raised the total to six components.

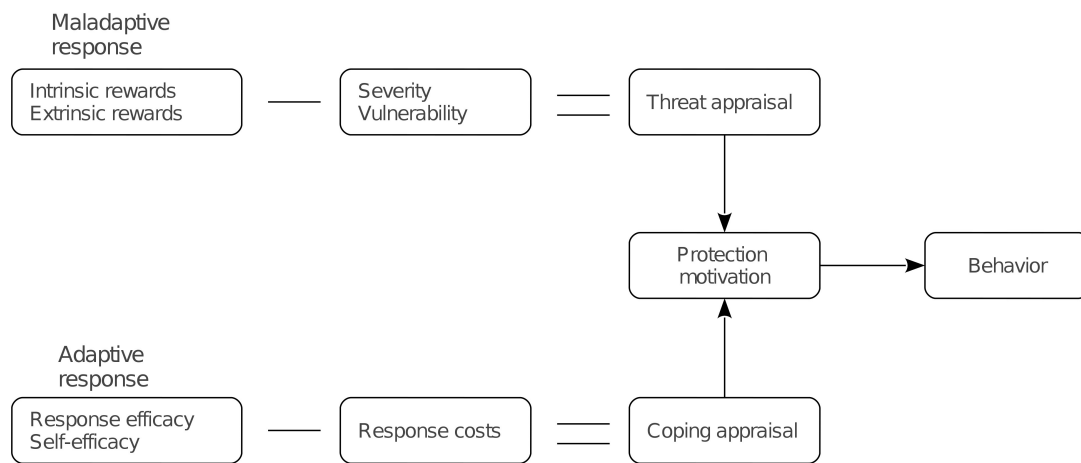


Figure 4: Protection Motivation Theory Block Diagram

Figure adapted from “Protection Motivation Theory”, 2005, by P. Norman, H. Boer, and E. R. Seydel, in *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, (P. Norman and M. Conner, Eds.), pg. 85.

Referring to Figure 4, threat appraisal includes perceived likelihood of the threat occurring (vulnerability), perceived severity of the threat, and perceived benefit to continuing the threat-related behavior. Coping appraisal includes perceived efficacy of

the response behavior, self-efficacy, and the perceived cost of the behavior for reducing the risk (Pechmann, Zhao, Goldberg, & Reibling, 2003). The individual engages these appraisal mechanisms using information obtained through prior personal experience, and information obtained through external persuasive communication. This results in an intention to positively adapt behavior, the source of the name *protection motivation*, or results in a maladapted response (e.g. avoidance).

If this all seems familiar, it is because PMT shares much in common with the HBM, including many similar criticisms. Some even view PMT as an advanced reworking of HBM. PMT is strictly focused on individual perceptions and beliefs, ignoring the effects of what other people do and how the environment might affect behavioral intentions. In addition, also common to the HBM, the PMT does not provide a mechanism to adapt for changing attitudes and beliefs (Schwarzer, 1992). The use of cognitive appraisal processes is also similar to the TPB and SCT.

The biggest criticism of PMT has to do with the focus on fear arousal. Available evidence suggests that appeals to fear may have a negative impact on intention formation, and that any positive effect of the persuasive communication is due to reassurance and precautionary information in the message (Ruiter, Abraham, & Kok, 2001). However, there is evidence to suggest that fear arousal in combination with an action plan does lead to behavior change in the desired direction (Michie & Abraham, 2004), so there is still potential use for this approach with some health behaviors. Witte and Allen (2000), in their meta-analysis of fear appeals, noted that strong fear appeals with high-efficacy messages produced the greatest positive change in the targeted behavior. Conversely, the

strongest defensive response correlated with strong fear appeals with low-efficacy messages.

Theory of interpersonal behavior. The theory of interpersonal behavior (TIB) (Triandis, 1980) is often compared with the TPB, as it makes use of many of the same behavioral determinants. TIB incorporates elements of prior experience (habit) and affect to create a three-level model that has been applied to a number of behaviors relating to computer technology (Facione, 1993). Habit, intention, and facilitating conditions directly affect the specified behavior. Affect, social factors, and perceived consequences impact habit and intention. Woon and Pee (2004) assessed its applicability to Internet abuse, and found all factors to be significant, with affect, social factors and habit having the greatest impact. Gagnon et al. (2003) analyzed the model's usefulness in explaining physician's intentions to use telemedicine, another technology-related application. Normative factors (social and personal norms) along with self-identity were found to have the strongest predictive value.

Stage theories. Stage theorists reject the notion that sequence does not matter, and have proposed a number of approaches based on qualitative stages of progression toward the final goal of behavioral change. Stage models posit stage-specific variable equations that predict movement into or out of a specific stage of development. The individual stages are intended to be qualitatively different and mutually exclusive, with the focus of interventions on exacting transitions for the current stage to the next. Thus, different individuals at different stages of development for a given behavior or class of behaviors would be provided with different intervention programs, based on their stage-

specific needs. As such, interventions can be very different, depending on the stage transition to be managed. The precaution adoption process model (PAPM) (Weinstein, 1988) and the transtheoretical model (TTM) model of behavior change (Prochaska & DiClemente, 1984) are the best known examples in this category.

Transtheoretical model. The transtheoretical model (TTM) of Prochaska and DiClemente (1984) is often referred to as the stages of change (SOC) model, though SOC is only the organizing framework for the model. The stages are one of five classifications to describe a discrete position on a path towards behavioral change. The stages are shown in Table 3.

Table 3: Stages in the Transtheoretical Model

Precontemplation	no intention to change in the next six months
Contemplation	intention to change in the next six months
Preparation	planning to change in the next 30 days
Action	made the behavior change within the past six months
Maintenance	sustaining the change past the six month mark

Relapse and termination have also been proposed as possible stages (Nutbeam & Harris, 2004), though they could be considered variations on the same stages already described. A meta-analysis of TTM studies applied to physical activity produced mixed results (Marshall & Biddle, 2001). One contributing factor is that most cited studies were cross-sectional, which does not provide the ability to examine behavioral change across the time frame of an intervention. Nutbeam and Harris (2004) criticize the TTM for being an individual-focused model that does not apply well to general health promotion

practice. However, Nutbeam and Harris exemplify reviews that only examine the temporal SOC framework, ignoring the processes of change (POC), decisional balance, and self-efficacy. The POC are ten cognitive and behavioral activities that individuals use to change their behavior and account for movement amongst the stages. Decisional balance is an evaluation of the pros and cons of engaging in the behavior. With self-efficacy and decisional balance, we can see distinct similarities with theories already discussed. Prochaska et al. (2008) provided a critical evaluation of the TTM that demonstrates it can be an effective tool in developing and evaluating HBC interventions, provided all the elements are carefully evaluated and included. In particular, stage-specific self-efficacy has been determined to be important in stage models, particularly in the initiation and maintenance stages (Lippke, 2008a).

Precaution adoption process model. The precaution adoption process model (PAPM) is another stage model of behavioral change, which identifies seven distinct stages ranging from ignorance to behavioral compliance (Weinstein, 1988; Weinstein & Sandman, 1992). The stages are presented in Table 4. Developed more recently than the TTM, the PAPM has nonetheless been applied to a wide variety of health behavior situations (Rimer & Glanz, 2005).

According to the theory, each of the above stages encompasses a different pattern of beliefs, experiences, and behaviors and that transition factors vary according to the transition in question. The similarity to the TTM is evident, but there are some distinct differences that should be noted. Unlike the TTM, this model incorporates the possibility that an individual may be unaware of an issue, providing an avenue for education as a

necessary first step in these situations. It also includes room for the idea that some people will choose to not act at all, despite being informed and engaged. The inclusion of these two stages potentially gives this model greater applicability in developing interventions.

Table 4: Stages in the Precaution Adoption Process Model

Unaware of issue
Aware of the issue but not personally engaged
Engaged and deciding what to do
Planning to act but not yet having acted
Having decided not to act
Acting
Maintenance

Deciding on a stage or continuum model for a particular application can be difficult. Simply assessing the viability of stage versus continuum approach can be daunting. There is still a tremendous amount of research being done to assess the validity of these models, but a lack of consensus does not need to impede practical application.

As Schwarzer (2008b) said,

... stage is a construct, not nature. We invent the notion of stages to help understand how people change, and to provide better treatment to those who have difficulties in changing their behaviors. We construct stages to open another window that allows for a different view on the change process. Thus, the question is not whether stages truly exist, but whether stage is a useful construct. (p. 85)

Stage models are certainly useful, as they provide a nice framework and development process for interventions. They also address some of the theoretical deficiencies of continuum models, namely the need to fit all participants to the same intervention approach, and the implication that change occurs in a linear manner (Schwarzer, 2008a). However, a stage model can only be truly useful if it can identify and provide methods for altering the factors that lead people to move from one stage to the next. All stage models share similarities, and may be reduced to a common set of three stages: preintention, intention, action. Recent studies have demonstrated stage-specific intervention methods, with positive support for the three common stages (Schèuz, Sniehotta, Mallach, Wiedemann, & Schwarzer, 2009). Schwarzer (2008a) recently suggested a model that could be continuous or stage-specific, depending on the perceived need. The Health Action Process Approach (HAPA) has generated a great deal of interest, however, there is scant evidence to support it at this time, and critics present valid arguments for comparing it with TPB (Sutton, 2008). Introducing action planning as a mediator of the intention-behavior gap has been examined, with results suggesting that developing strong intention is still the key (Wiedemann, Schèuz, Sniehotta, Scholz, & Schwarzer, 2009).

Organizational support theories. Training in organizations is influenced by a number of organizational characteristics. Noe (2005) lists top management support as key to establishing the right environment for learning to take place. Support includes providing the vision, promoting the vision, and providing the resources (e.g., faculty and facilities) to fulfill the vision. Goldstein and Ford (2002) identify organizational support

as crucial to the needs assessment phase, requiring the early establishment of relationship with top management as well as members of the organization. From their perspective, a clear agreement on organizational goals for training is the primary necessary element for a successful needs analysis.

Eisenberger, Huntington, Hutchison, and Sowa (1986) introduced the concept of organizational support theory, which uses the idea of perceived organizational support (POS) to identify the extent to which an organization supports employee efforts and needs. Rather than examine organizational support from the viewpoint of the organization, POS uses the perspective of global beliefs developed by employees “concerning the extent to which the organization values their contributions and cares about their well-being” (Eisenberger et al., 1986, p. 501). Greater POS is associated with greater employee effort towards meeting organizational goals, moderated by the strength of the individual employee’s exchange ideology; the value of trading individual effort for organizational rewards.

POS has been shown to be positively related to employee diligence, commitment, and innovation (Eisenberger, Fasolo, & Davis-LaMastro, 1990), employee favorableness with job conditions believed to be more readily controlled by the organization (Eisenberger, Cummings, Armeli, & Lynch, 1997), and employee retention (Eisenberger, Stinglhamber, Vandenberghe, Sucharski, & Rhoades, 2002). Rhoades and Eisenberger (2002) conducted a meta-analysis on POS studies, and concluded that there are three primary work-experience antecedents to POS: supervisor support, procedural justice, and organizational rewards and working conditions.

Supervisors act as agents of the organization, so are perceived by employees to reflect the organization's level of support, dependent upon the employee's perception of the supervisor's status in the organization and the employee's view of herself as part of a hierarchy (Eisenberger et al., 2002). Procedural justice refers to the fairness of the manner in which the organization determines how resources and rewards are distributed. Of the three antecedents, fairness showed the strongest correlation with POS (Rhoades & Eisenberger, 2002). However, Tharenou (2001) determined that perceived supervisor support was the strongest predictor of motivation to engage in organizational training.

Organizational rewards and working conditions encompass a broad range of possibilities, which may account for the weaker correlation with POS than the other antecedents. Training would generally fall within this area, as it is typically a discretionary activity under the control of the organization that indicates an interest in investing in the employee. Mandatory training, such as compliance training, would not fit in this category, and would therefore have little or no relationship with organizational support theory. Training that is not mandatory but also not in direct support of the primary work of the organization could go either way, depending on how it is implemented by the organization, and perceived by the employee. Health promotion programs would seem to naturally fit into this gray area.

Social marketing. Social marketing employs commercial marketing concepts and techniques to realize programs aimed at achieving some kind of social change. Kotler and Zaltman (1971) are credited with coining the phrase *social marketing*, although the concept goes back several decades further. Eventually, social marketing researchers

began to examine and adopt behavioral theories, such as social cognitive theory and diffusion of innovations (Fraze, Rivera-Trudeau, & McElroy, 2007), and protection motivation theory and the transtheoretical model (Cismaru, Lavack, Hadjistavropoulos, & Dorsch, 2008). Although the terminology differs, and the target audience has traditionally been large social groups, the application of social marketing to health behavior appears to be on a convergence course with the traditional health education field. Social marketing revolves around the four P's: product, price, place, and promotion. When applied to health behaviors, the product relates to the desired change in behavior. The price addresses the costs associated with changing or not changing behavior. The place identifies where and possibly how the product is implemented. And promotion covers everything from content to ad campaigns. Using these techniques, practitioners have implemented successful programs aimed at health behavior change (Meekers, Van Rossem, Zellner, & Berg, 2004; O'Brien & Forrest, 2008). The integrated models implemented by these programs, based on behavior change theories, provide valuable insight into the development of an integrated framework for this study. In addition, the integral concept of persuasive communication makes social marketing a valuable lens for examining methods to promote physician wellness.

Organizing Frameworks

Human performance technology. The path to developing successful technology-based interventions for behavioral change has been a rocky one, enjoying all the benefits and deficits of instructional technology growing pains, coupled with the unknowns in health behavior change theories. Where the intervention is provided and supported by

organizations, the use of human performance technology (HPT) as an overarching design framework seems appropriate.

The focus of HPT, alternately known as human performance improvement (HPI), is on improving the performance of a system that is made up of a number of individual people using tools and methods provided by professional experience and scientific study. It is the application of systematic procedures and processes to address systemic issues, grounded in the best available theory. HPT acts on three areas for performance improvement: the workplace (organizational level), the work (process level), and the worker (performer level). At the organizational level, key variables include organizational structure, strategy, goals, measurement, and management. In the context of health behaviors, the workplace and worker are most appropriate areas to examine. HPT incorporates elements of instructional system design (ISD) and learning psychology; structured development processes are adopted from ISD, notably based on the venerable ADDIE model. However, the focus for HPT is on job performance; the systematic approach has value for wellness issues, but the overall context is not a very good fit.

The name ADDIE comes from the first letters of each step in the model: analysis, design, development, implementation, and evaluation. The ADDIE model is at the heart of military ISD implementation, and is firmly entrenched in this and other industries. Clearly, this generic model may be applied to a variety of project types, and not strictly limited to instructional design. The software industry is one example that has made good use of the ADDIE approach in the past, but has moved on to other approaches in order to stay competitive. The primary issue necessitating this change in software development

was the reduction in design cycle time as the industry matured. However, there were other problems as well, and some of those were especially evident in instructional design.

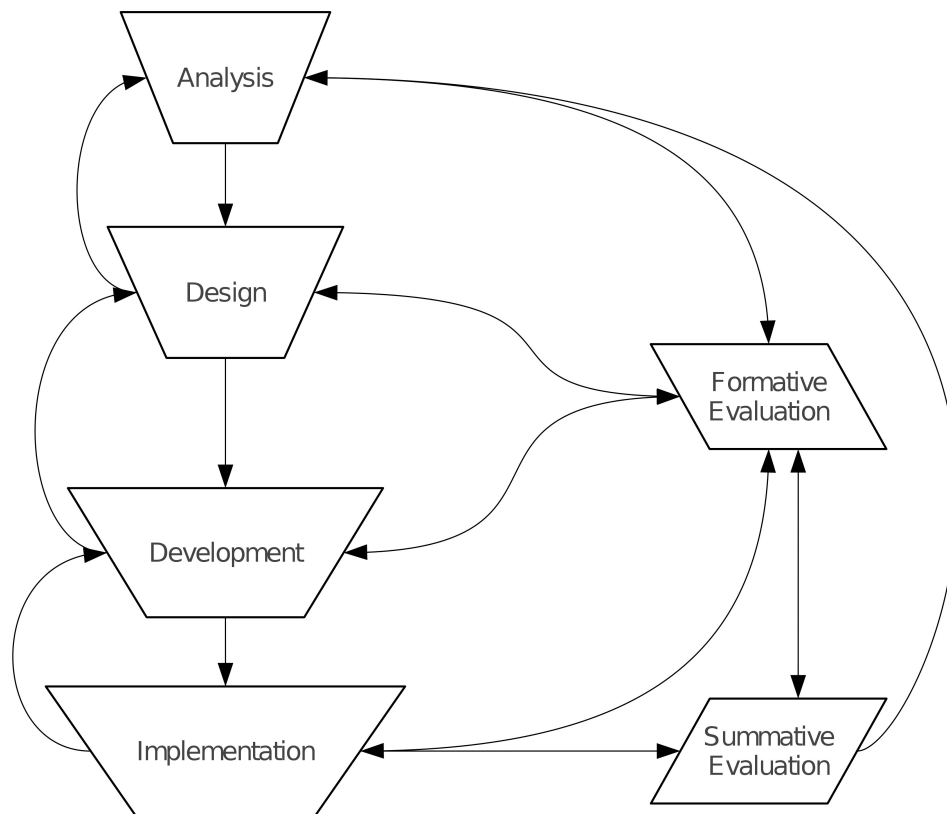


Figure 5: ADDIE Framework Block Diagram

The ADDIE model has received a number of criticisms over the years. It is considered by some to be too linear, too rigid, too constraining, and requires too much time for development. There is also concern that the rigidity of the approach promotes misalignment between customer needs and the final product. Arnold (2004) contends that lengthy schedules are due to the need for block reviews, as are typical with linear

project flow using milestone methods. Furthermore, these issues lead to budget creep, exacerbating an already costly approach.

Gordon and Zemke (2000) compiled a list of criticisms from industry experts, and condensed them into four main areas. The first is that the ADDIE model is slow and clumsy, which is consistent with criticisms from others. The second criticism with ADDIE is that there is no *There* there. By this, they mean that the model attempts to turn training from art into science, but that by making it algorithmic, the purpose is lost. The third criticism is that, “used as directed, it produces bad solutions” (p. 50). And finally, it is charged with clinging to the wrong. By this they mean that ISD assumes that the training need is capable of being well-characterized, and the approach should address it on the learning level assumed by the designers to be appropriate. However, the world has changed greatly over the past 50 years, and not only are training needs no longer as well defined, but the characteristics of the learners have altered considerably as well. Thus, training for the performance gaps varies considerably from individual to individual, and a training program designed using the ADDIE model, according to these critics, is poorly suited for addressing these needs.

Conversely, Bichelmeyer (2004) concludes that ADDIE is just a descriptor for a framework for instructional design, and not a model at all. While this may seem mere semantics, a model may be criticized for its shortcomings, but a framework can be adapted to fit varying needs. When viewed as a model, ADDIE can be argued to have some serious shortcomings. But when viewed as a framework, ADDIE can be seen as a generic form of design process flow found in every type of design. As such, it may be

unjustly accused. Regardless of the justification for the criticism, the perceived shortcomings of ADDIE led to the development of another process flow, primarily focused on reducing design time. Various terms have been employed to describe this approach, such as rapid development (RD), but the most common term is rapid prototyping (RP).

Rapid prototyping has been viewed many different ways. In the seminal article by Tripp and Bichelmeyer (1990), RP is conceptualized as an early modeling of the product. Other perspectives include RP as expert system, participatory design, formative evaluation, efficient production, user-centered design, context-sensitive design, tool for thought, and tool for usability testing (Boling & Bichelmeyer, 1998). Merrill called for its use when voicing his concerns over the state and direction of instructional technology (Zemke, 1998). Perhaps the simplest way to visualize RP is to compare and contrast it with the traditional ADDIE framework. In simple terms, ADDIE promotes a waterfall cycle, while RP promotes a spiral cycle. Figure 5 illustrates the cascading nature of ADDIE. Despite the feedback paths and the inclusion of formative evaluation, you really do not know what you have until you are nearly to the end. And this diagram is more progressive than standard ADDIE diagrams, which show no feedback paths at all.

In contrast to the waterfall approach, RP implements a spiral approach that repeatedly cycles through constructing and assessing prototypes to produce an ever-improving product as time progresses. Figure 6, adapted from Tripp and Bichelmeyer (1990), incorporates a cycle between the two middle blocks that is not explicitly shown.

The first two blocks should be familiar to any instructional designer, as they make up a part of the analysis block in the ADDIE framework.

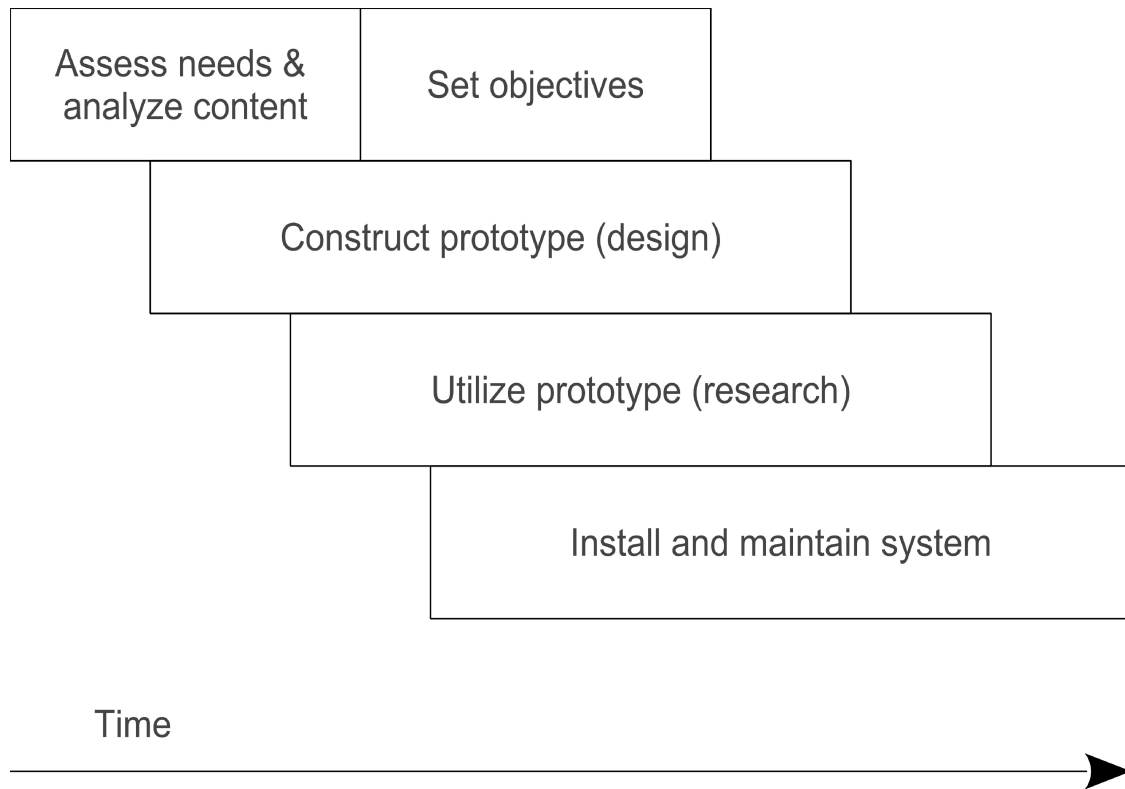


Figure 6: Rapid Prototyping Framework Block Diagram

Figure adapted from “Rapid prototyping: An alternative instructional design strategy,” by S. Tripp and B. Bichelmeyer, 1990, *Educational Technology Research & Development*, 38(1), p. 32.

In a true spiral framework, each of the formal development blocks (such as ADDIE) would be included in each successive level of the spiral. It is the basis for what Allen (2003) calls *successive approximation*: an iterative process for instructional design that prescribes backing up and redoing each stage of development as insights are gained. According to Tripp and Bichelmeyer (1990), “... rapid prototyping follows the pragmatic design principle of minimum commitment (Asimow, 1962; Wilson & Wilson, 1965) ,

that at each stage in synthesizing a design no commitment is made beyond what is absolutely necessary to solve the problem at hand” (p. 37). RP is particularly attractive as a development approach for design-based research treatments, as it intrinsically provides the feedback paths necessary.

PRECEDE–PROCEED. PRECEDE–PROCEED is a planning framework that was developed to provide a structured approach to creating health education and health promotion programs (Green et al., 1980). It originated with the PRECEDE part of the framework, which addresses the need to provide an educational diagnosis (needs analysis) as a prelude to intervention planning. The acronym stands for “Predisposing, Reinforcing, and Enabling Factors in Educational Diagnosis and Evaluation”. Predisposing factors include knowledge, skills, attitudes, beliefs, personal preferences, and self-efficacy. Reinforcing factors include rewards and deterrents that serve to reinforce the behavioral change. Enabling factors may be emotional/psychological such as motivation, or physical factors such as access to facilities. PROCEED stands for “Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development”. Added about ten years after PRECEDE, this part of the framework addresses the recognition that organizational factors may have a significant impact on the development and implementation of health promotion programs.

The PRECEDE–PROCEED framework is well-known amongst health-care practitioners; even more so than the HBM (Jones & Donovan, 2004). The factors listed come as no surprise instructional designers and organizational psychologists, but it does provide a handy mnemonic for remembering all the factors that can affect attempts to

develop health-promotion interventions in organizations. Although its use is promoted in the health care arena, it is often treated as a theoretical model or framework, comparable to the HBM or SCT (Ransdell, 2001). When used in conjunction with an appropriate behavioral change theory, it does present a useful approach for intervention planning.

Intervention Mapping. Intervention Mapping (IM) is a more recent development framework that is gaining increased attention in the field of health behavior planning (Bartholomew et al., 1998; Bartholomew, Parcel, Kok, & Gottlieb, 2006). In contrast with PRECEDE-PROCEED, IM provides an iterative framework wherein each step of the decision-making process is founded on applicable theory, and provides a list of potentially applicable theories for the practitioner to evaluate against his specific intervention. Thus, IM assists in two ways: providing a means for identifying behavioral and environmental determinants for a specific targeted health-related problem, and providing a means for selecting the most appropriate theoretical basis for methods and strategies to address the identified determinants. What marks this framework as very different from those previously mentioned is the attention towards determinants for behavioral *change*, as opposed to predictors of present behavior (Brug, Oenema, & Ferreira, 2005). The IM process flow is shown in Appendix B, as it is a fairly large figure. The theories associated with various steps of the process are described in Table 5 (Bartholomew et al., 2006, p. 82) (extracted from Table 3.1).

IM is not without its detractors. Michie et al. (2008) have issues with the selection of theoretical techniques identified in stages two and three, calling them evidence-inspired rather than evidence-based. The problem is that, despite the decades of research,

there are few behavioral theories that have been found to be significantly effective in enhancing behavioral change. Michie et al. (2008) specifically note enhancing self-efficacy and manipulating environmental contingencies as having been shown to be effective, with the remainder having limited or mixed support for their efficacy. Nonetheless, the IM framework provides a rational theory-based approach that may be used to develop health behavior interventions that can serve as studies for evaluating the efficacy of their use.

Table 5: Applying Theories to Intervention Mapping

Describe and select intervention groups	stages of change models diffusion of innovations theory agenda-building theory
Define behaviors	theories of self-regulation organizational development theory diffusion of innovations theory
Define environmental conditions	social cognitive theory theories of social support organizational development theory
Understand possible determinants of behavior and select intervention target	theory of planned behavior social cognitive theory health belief model
Choose methods to promote change and translate theoretical methods into practical strategies	persuasion communication matrix organizational development theory conscientization

Note: conscientization is a type of learning focused on perceiving and exposing social and political contradictions as defined by Paulo Friere

Summary

The application of design-based research to this study was a thoughtful attempt to address some of the criticisms and limitations of traditional educational research using

randomized control experiments. As an application-oriented theoretically-based method of inquiry, the available literature shows that design-based research has demonstrated potential for advancing the theoretical knowledge base and developing instructional interventions that are contextually relevant.

Examination of reliable theories of behavioral change showed some common ground: the importance of contextual environment and the key role of self-efficacy. It is also important to note that knowledge does not form the basis for any of these theories, and only plays a role in one model (PAPM). Thus, despite the development of an instructional treatment packed full of useful knowledge content, the primary transfer of information was based on persuasive communication, as exemplified by social marketing approaches. Organizational support, or lack thereof, has been shown to play a key role in influencing training, transfer, and behavioral change. Social marketing provides an additional lens to view the operationalization of behavior change theories. Although most effectively used at a higher level of abstraction, the focal elements of product, price, place, and promotion have been applied in this more focused application, with some benefit.

Literature on design frameworks demonstrates many common themes, but only the intervention mapping approach provides an introductory grouping of applicable theories within the specified framework. Despite the acknowledged gaps in evidence-based support, IM did provide a base process for developing an initial design framework for this study.

The rich literature base on motivation primarily informs and supports the various frameworks and models intended for development of behavior-change interventions. Expectancy theory, for example, undergirds many of the examined theories of behavioral change and motivation to learn. The theory of planned behavior and reasoned action has been applied to both educational and behavioral interventions. The primary direct application of theories of motivation was in the actual development of the intervention, primarily using the ARCS framework.

A great deal of opinion was found on the subject of wellness, but the evaluation of studies that address wellness has been hampered by lack of accepted terminology. The most comprehensive examination of wellness resides in those efforts associated with the evidence-based Indivisible Self model, so that framework and the associated terminology were used as the basis for all instructional content.

Physician wellness is of concern in the medical community, and physician self-care is of particular concern. Existing programs are not proactively focused on wellness, and have demonstrated difficulties overcoming issues of time, privacy, and confidentiality. The application of the developed technology-based instructional treatment built on an emergent theoretical framework has the potential to positively impact this problem area.

Chapter three describes the study methods implemented, including preliminary efforts initiated to provide focus and appropriate limits, participants and sampling methods, discussions of instruments and interventions, procedures followed, and methods of analysis employed with the resulting data.

Chapter Three: Method

Overview

This chapter provides an account of the methods employed over the course of this study, including descriptions of the participants, sampling methods used, instruments developed, and data collection methods employed. The purpose of this study was to develop a local instruction theory comprising a domain theory and design framework for implementing instructional treatments intended to positively influence the personal wellness behaviors of faculty physicians. Recall the research questions proposed for this study in pursuit of a local instruction theory:

1. What is the component structure of a local instruction theory that has the potential to positively affect the attitudes and behaviors relating to personal wellness for faculty physicians at a Southeastern teaching hospital?
2. What is the constituent organization of a design framework based on a local instruction theory that has the potential to positively affect the attitudes and behaviors relating to personal wellness for faculty physicians at a Southeastern teaching hospital?
3. What are the perceptions of faculty physicians at a Southeastern teaching hospital of the deployed technology-based treatment with respect to:
 - a) potential impact on attitude and behavioral change regarding personal wellness
 - b) demonstration of organizational support for personal wellness
 - c) the potential for technology-based treatments to impact cultural change in an organization
 - d) protection of personal privacy and trusted use?

The study outcome is thus threefold: domain theory, design framework, and prototype instructional treatment validated to adequately and accurately reflect the domain theory and utilize the design framework. The first two outcomes add to the theoretical and practical knowledge bases respectively, and the third provides a validated instructional treatment that may be used for practical intervention and continuing study.

Sampling. Participants representing the target population of interest were included in the pilot deployment of the final prototype treatment. As the same participants were used in all participant-related aspects of the study, the same sampling scheme applied to both qualitative and quantitative participants. Due to the narrowly defined population of interest, it was necessary for the sampling to be purposive (non-random). Using the sampling framework of Onwuegbuzie and Collins (2004), sampling may be viewed as a composite of three schemes: homogeneous, critical case, and convenience. As the participant selection was driven by organizational constraints and requirements, convenience sampling was the only possible approach. Since all participants shared specific characteristics of interest in this study, they also formed a homogeneous sample. From a mixed-methods perspective, the sampling scheme was identical, as it used exactly the same participants for both the qualitative and quantitative parts. Since the sampling scheme was convenience, it was not possible to say with any degree of certainty a priori what the sampling characteristics would be, beyond the defined population characteristics. Demographics were not controlled for, but some demographic information was collected to the extent that participants were willing to divulge the information. Participation was voluntary, and each participant was required to

accept notification of informed consent before proceeding with the response survey. In addition, participants were able to opt out at any time, and many did so.

Participants. The participants in this study fell into one (or more) of three categories: study sample, developers, and expert reviewers. The degree of participation varied with the phase of development. Developers and expert reviewers were active through all phases of the study up to the pilot deployment. The study sample was only active during the pilot deployment.

The target population for this study was faculty physicians at United States medical schools. As of May 2012, there were 136,887 faculty physicians in the United States with rankings of instructor, assistant professor, associate professor, or full professor. Of those, 37% were women (AAMC, 2012, Table 3): an increase from 34% in 2008. The accessible sample for this study were faculty physicians at the College of Medicine for a large Southeastern university with a Carnegie classification of RU/VH: Research University (very high research activity). At the time of the pilot deployment, there were 275 faculty physicians available for self-selection. Demographic information was not made available.

Expert assessment was provided by an expert in Instructional Technology, experts in Industrial and Organizational (I/O) Psychology, and an expert in Medicine who is also a Faculty Physician. These experts were selected on the basis of specific domain knowledge and interest in this study. There were two I/O Psychology experts involved, due to the untimely death of the first expert during the course of the study. Having more than one expert in each domain would have been enriching, but it proved too difficult to

find more than the one expert in each field that was both willing and able to contribute to this study. All experts were required to possess an earned doctorate in the associated field of study, with demonstrated work experience. All were also experienced educators.

Development was primarily provided by the principal investigator (PI), with content review by the medical SME. Organizational stakeholders were also called upon to provide their perspective in the early stages of development. Although separate development support could have been utilized, the PI chose to manage this alone for two reasons: actually implementing every element in the process provided invaluable insight to the degree of difficulty involved, which will be of great benefit in future work; being able to try various applications to determine which of the free and/or open-source programs available would be useful for other researchers and practitioners. A compilation of the tools used or discarded is included in the appendices. The PI has an earned Master's degree in Electrical Engineering, and many years of experience designing and developing hardware and software solutions to problems in industry, government, and research facilities. The PI managed the pilot deployment, but was otherwise dissociated from interaction with the study sample.

Ethical considerations. Note that the same ethical considerations applied to both the quantitative and qualitative procedures, as they were completely intertwined and applied to the same participants. To address the potential that participants in the study sample group might be concerned that data collected during the study may reflect personal information they would rather not have made known, all surveys were made anonymous, with respondents only identified by a unique tag assigned when the website

hosting the survey was accessed. The unique tag served to group all information from that participant, but did not identify him or her. As every participant received the same instructional treatment and access to information, distributive justice was naturally satisfied. Privacy and confidentiality were assured through a combination of secure application development, secure application web hosting, and anonymous survey methods.

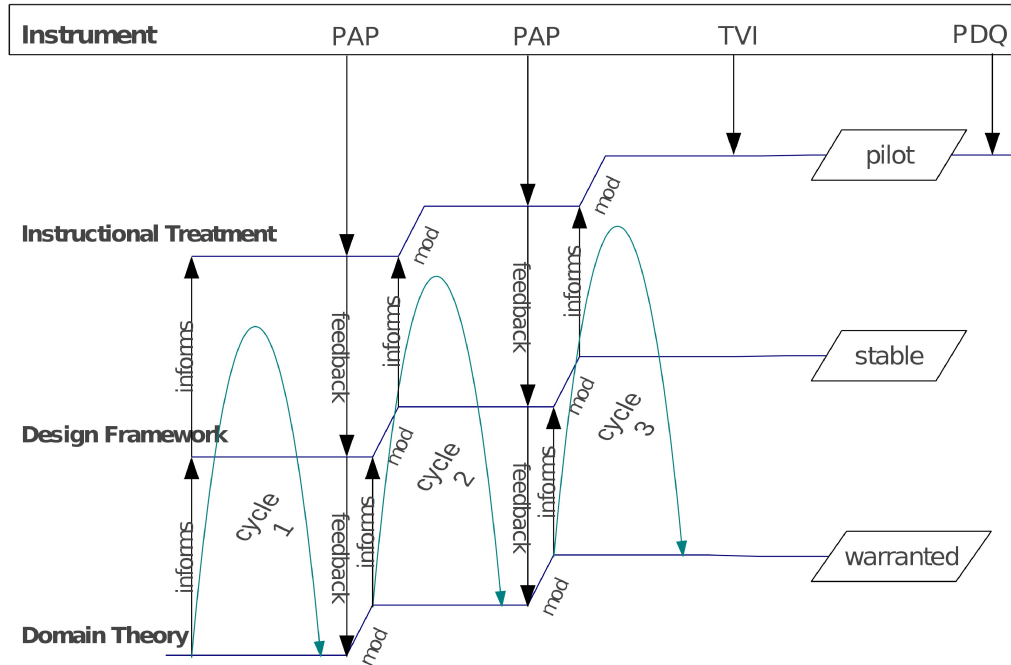
The Institutional Review Board (IRB) was contacted for study review at two stages in the process. The first stage was associated with the preliminary investigation described later in this document. A waiver of informed consent was requested and approved by the IRB. The second stage was associated with the pilot deployment and associated survey. IRB approval for a waiver of signed informed consent was requested and approved. Informed consent was managed as the first response in the survey, which was required in order to proceed. Results from the survey server suggest that many respondents chose to abandon the survey, rather than respond to the rather lengthy informed consent form.

Study design. The foundational research approach for this study is design-based research, using primarily qualitative approaches with support from some quantitative measures. The theoretical framework and resulting intervention were developed simultaneously, using the spiral approach associated with rapid prototyping. A total of three spiral cycles were employed, with the final cycle comprising a pilot deployment of the instructional intervention.

If the quantitative and qualitative portions of this study were to be studied independently, then the appropriate research paradigms would be post-positivist and constructivist, respectively. However, the PI chose to make the best use of what works from both quantitative and qualitative methods in order to provide some practical benefit to organizations and individuals working within them. As a result, this research used a mixed-methods approach, and made use of the pragmatist philosophy (Johnson & Christensen, 2004) as an overarching paradigm for all segments of the study. From a mixed-methods perspective, this study was a fully-mixed, sequential, dominant status design (F4) (Leech & Onwuegbuzie, 2007), with the qualitative part dominant. The primary interest was on development of a theoretical framework applicable to supporting faculty physician wellness. Both qualitative and quantitative methods were employed to focus and refine the research objective, develop the theoretical framework and intervention, and assess the results obtained.

The needs assessment conducted by Fabri et al. (2005) provided the impetus for the development of a faculty physician wellness program in the College of Medicine at a large southeastern university. In cooperation with the advent of that program, this study was conceived to provide the means to develop theoretically-based relevant interventions addressing wellness issues. The needs assessment indicated that the target audience was not as knowledgeable about personal wellness as expected, and as defined in the assessment. The PI initiated the study with the development of a process-style flowchart to identify the requisite inputs, processes, and resultant outputs that would lead to the desired end state. The flowchart occupies two pages, and may be referenced in Appendix

C. The first step involved searching and synthesizing the extant literature base, as described in Chapter Two, with the first required output being the components of a wellness taxonomy, which resulted in the selection of the Indivisible Self as the best taxonomy to use.



Notes:

PAP = prototype assessment protocol

TVI = treatment verification instrument

PDQ = pilot deployment questionnaire

Figure 7: Design Overview Showing Development Interaction

An alternative view of the development of the domain theory, design framework, and instructional treatment was captured in Table 6 and Figure 7. The table shows the breakdown of participants, instruments, data collection, analysis, and outcome presentation for each of the study outcomes. The graphic shows the interaction among the three development paths on a design cycle basis, and the point at which specific

instruments were used to assess development. The specifics of the instruments and assessment methods are explored more fully in subsequent sections.

Table 6: High-level Design Overview

	Domain Theory	Design Framework	Pilot Deployment
Participants	Three experts: IT, I/O, MD	Three experts: IT, I/O, MD	1. Three experts: IT, I/O, MD 2. Faculty physicians
Instruments	PAP	PAP	1. TVI 2. PDQ
Data	PAP: notes and recordings	weekly activity log PAP: notes and recordings	TVI: remote link for survey PDQ: remote link for survey
Analysis	qualitative: inductive; themes/patterns	qualitative: inductive; themes/patterns	quantitative: descriptive statistics qualitative: inductive; themes/patterns
Outcome Presentation	descriptive presentation in dissertation document	descriptive presentation of design framework	1. descriptive presentation in dissertation document 2. descriptive narrative of perceptions in dissertation document

Notes:

IT = instructional technology

I/O = industrial and organizational

MD = medical doctor

PAP = prototype assessment protocol

TVI = treatment verification instrument

PDQ = pilot deployment questionnaire

A key aspect of the design process was the maintenance of a log book to capture details of the study as it developed. From the onset of the study through the first cycle of development, log entries were made as events occurred. Beginning with the second cycle, entries were made on a weekly basis to provide a more regular assessment of technical development. Select entries from the log book may be found in Appendix F. At the conclusion of the study, the contents of the log book, which had been kept electronically, occupied 50 printed pages.

Preliminary Investigations

Although the needs assessment had indicated personal wellness education was appropriate, and examination of the literature revealed an appropriate taxonomy for wellness, some additional direction was required before development efforts could proceed. Chief among them was an initial domain theory upon which a design framework and instructional treatment could be developed.

From a practical perspective, the extent of the development needed to be restricted to a level consistent with doctoral study programs. In order to achieve an appropriate bound, the PI decided to provide superficial content coverage for 16 of the 17 IS subfactors, and deeper coverage of one subfactor. To determine which subfactor to focus on, an investigation of perspectives from the domain of faculty physicians was undertaken.

In addition to serving as a study vehicle, the treatment resulting from this effort was also intended to serve immediately as a practical instructional intervention. Organizational stakeholder buy-in was required to ensure the treatment could transition to

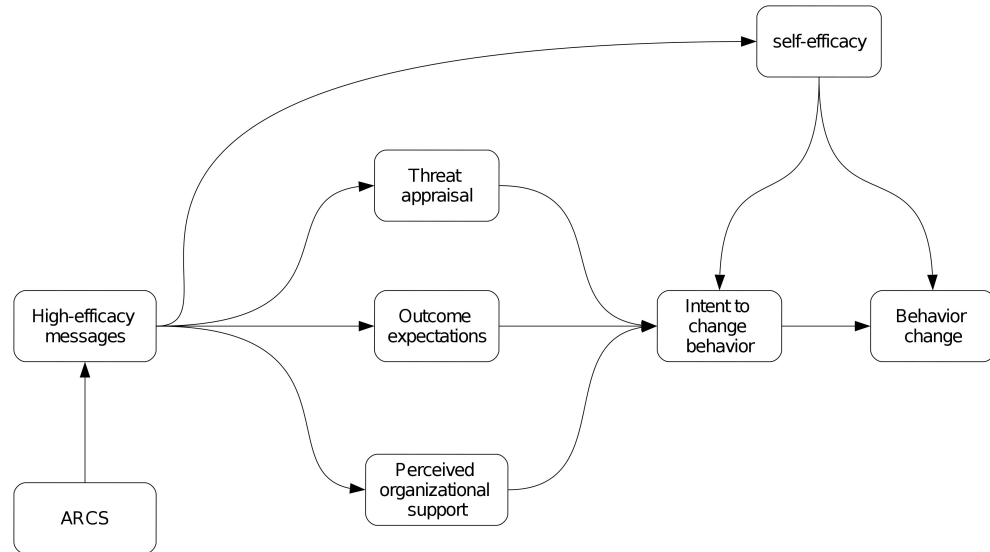
practice. Stakeholder discussions also provided focus for the design framework and support for the initial domain theory.

Initial domain theory concepts. Examination of the determinants of health behavior supporting the various health behavior change theories revealed considerable overlap. The literature synthesis suggested that the following determinants were most likely to have value in support of health behavior change:

1. self-efficacy (including concepts of perceived behavioral control)
2. outcome expectations (including behavior beliefs, response efficacy, response costs, perceived consequences, subjective norms, and social factors)
3. threat appraisal (including perceived threat, facilitators, and impediments)
4. perceived organizational support (including perceived supervisor support, procedural justice, organizational rewards, and working conditions)

In this study, the domain encompassed the target audience (faculty physicians), problem of interest (personal wellness), delivery approach (technology-based treatment), and delivery environment (web-based). The domain theory created for the first phase of development made use of these determinants, supported by high-efficacy messages, employing persuasive communication and cues to action, which are in turn informed by the ARCS motivational model. Figure 8 provides a graphical illustration of these determinants in relation to behavioral intent. Although it is behavior that we wish to influence, the linkage between intent and behavior remains illusive despite years of research. To be complete, behavior is included in the model, but it is only behavioral intent that is expected to be influenced directly by the determinants shown. Self-efficacy

is shown as influencing both behavior and intent, due to the aforementioned unknown linkage between the two.



Note:

ARCS = attention, relevance, confidence, satisfaction – Keller’s model

Figure 8: Phase 1 Domain Theory Block Diagram

Although the addition of stage-specificity would have been highly desirable, resource limitations required constraining the study to a more manageable level of effort. Therefore, the treatment in this study was developed as though all members of the population of interest fell within the preintention stage. Each of the determinants was examined throughout the development process, in relation to the behavioral change of

interest, and applied to the development of the treatment. Table 7 shows each of the determinants, along with the underlying concepts for each.

Table 7: Phase 1 Domain Theory Determinants

Determinant	Underlying Concepts
ARCS	attention relevance confidence satisfaction
high-efficacy messages	cues to action persuasive communication
outcome expectations	behavior beliefs response efficacy response costs perceived consequences subjective norms
threat appraisal	perceived threat facilitators impediments
perceived organizational support	supervisor support procedural justice organizational rewards working conditions
self-efficacy	perceived behavioral control
intent to change behavior	protection motivation

Domain practice perspectives. In order to determine which of the 17 subfactors in the IS model of wellness was the most appropriate to focus on for the treatment development, a survey of perspectives from the domain practice was undertaken. A survey instrument was created to elicit perspectives from each of three groups: medical college deans, leaders of teaching hospitals, and faculty physicians at teaching hospitals.

Members of the first two groups were determined by contacting the Association of American Medical Colleges (AAMC) and obtaining the membership list broken down into two groups: Council of Deans (COD), and Council of Teaching Hospitals and Health Systems (COTH). The third group was represented by the faculty physicians (FP) at the university College of Medicine under study. Based on discussions with academic and medical leaders at the college, the decision was made to keep the survey instrument as simple as possible, with one set of three questions for each of the 17 third-order factors identified in the IS. The questionnaire was reviewed by the medical SME and stakeholder prior to distribution. As previously mentioned, IRB approval was also sought and obtained before distributing the survey.

The first question addressed perceived importance of the subfactor with respect to physician wellness. The second questioned whether or not the subfactor was perceived to be a current problem area for physician wellness. If the second question generated a yes response, a follow-up question gathered perceptions of how the problem was being handled. Recall the intent of the survey was to provide focus for a single subfactor in the development of the treatment; there was no intent to draw conclusions or infer relationships from the results. The SME expected the response rate to be maximized using this very simple questionnaire, the results of which could then be used to inform how best to focus on wellness. This gave a total of three voices contributing to prioritizing and focusing a wellness intervention for this study: the extant body of literature, the wellness leadership at the university College of Medicine (as reported through the use of the original needs assessment), and the results of this survey.

The wellness survey was hosted on a webserver at the College of Medicine, and copies of the survey were mailed with cover letters to each name from the AAMC lists, which included 439 individuals from the COTH, and 144 from the COD. The cover letter provided the Internet address link to the survey with the intent of collecting all data through the survey software. Unfortunately, some respondents were unable to connect with the server, and it is not known whether the individual or the server had technical issues. Fourteen of those individuals returned the paper survey using the FAX number on the cover letter, and those responses were added to the database by hand. The use of regular mail was required due to the AAMC's insistence on providing the names on pre-printed mailing labels, and policy to not provide email addresses of its members. Furthermore, the AAMC requires a hefty payment for the address labels that are to be used only once. As soon as responses began to be received from these two groups, an email invitation was sent to 273 faculty physicians. The survey was kept active for 64 days; the intent was to keep it active for 30 days, but responses continued to trickle in until the last week, which prompted the closing. Results are disclosed in Chapter Four.

Organizational perspectives. With a draft domain theory and a proposed focus on physician self-care, the next step taken was to identify and interview key stakeholders in the College of Medicine, which provided feedback in the areas of organizational leadership perspectives, legal considerations, and personnel concerns. Stakeholder interviews were designed to be partially structured, using the interview guide approach as described by Patton (1987). Using this approach, an interview protocol was established with topics that could be reworded and reordered as needed or desired to facilitate

maximizing the information obtained. A total of seven stakeholders were identified and interviewed using the protocol shown in Table 8. The questions were derived from the research questions and initial domain theory concepts, as those constructs were proposed as the key determinants for the identified HBC issue.

Table 8: Stakeholder Interview Protocol

<p>The purpose of this interview protocol is to gain understanding of the determinants of physician self-care. In particular, the use of a regular source of care (RSOC) by physicians has been identified as a worthy area for study. The following questions may be treated as discussion points, and may be expanded on as little or as much as is deemed necessary.</p>
<p>Stakeholder Interview Protocol</p>
<ol style="list-style-type: none"> 1. What attitudes, beliefs, or preferences exhibited by physicians lead them to use or fail to use a RSOC? 2. Is there organizational support for this study, and if so, how could it be demonstrated to the faculty physicians? 3. Is there organizational support for the issue of physician RSOC, and if so, how is it or could it be demonstrated? 4. Are there any rewards or penalties that might be assessed for using or failing to use a RSOC? 5. Are there any other barriers or reinforcers to using a RSOC, whether personal, organizational, communal, or societal? 6. What other factors should be considered besides those shown in the proposed theoretical framework for this study? (list factors individually) 7. What methods might be employed to address concerns for privacy and confidentiality? 8. In what way do the factors represented in the Indivisible Self model of wellness coincide or diverge from the way physicians think of wellness?

Subject matter for the instructional treatment was not provided, and it became apparent rather quickly that acquiring appropriate content for the treatment would not be an easy task. Six of the seven stakeholders were identified as having the requisite

knowledge background to also be treated as subject-matter experts. Although they would not be available as SMEs throughout the study, they were able to provide some guidance on content in the beginning. In order to minimize the impact on these individuals, a combined interview was implemented, with the stakeholder portion and SME portion addressed independently and sequentially.

Table 9: SME Interview Protocol

<p>The purpose of this interview protocol is to acquire expert perspectives on intervention content for the subject of physician self-care. In addition to the general treatment of physician wellness, the use of a regular source of care (RSOC) by physicians has been identified as a worthy area for study. The following questions may be treated as discussion points, and may be expanded on as little or as much as is deemed necessary.</p>
<p>SME Interview Protocol</p>
<ol style="list-style-type: none"> 1. What is your perspective on the use of technology-based interventions to affect changes in attitude and behavior? 2. How might a technology-based intervention include elements to demonstrate organizational support? 3. What insights do you have on the design elements of the technology instrument, and content to address RSOC behavioral change? 4. What information or source of information would you suggest to address a) overall wellness, b) self-care, and c) regular source of care? 5. What high-efficacy messages could be used to promote RSOC use? 6. Do you have recommendations for available, respected authority figures who could participate in audio and/or video format? 7. Recommendations for delivery, format, and usability factors include use of the USF Health browser as the foundation, no less than 1024x768 screen resolution, and avoid the use of scroll bars. How would you expect the use of these elements to impact reception and utilization of the technology instrument, and what other elements would you suggest (e.g. operating system, browser, use of Java/Flash etc.)? 8. Were you surprised by anything I did not ask about?

A SME protocol was developed in a manner similar to that for the stakeholders, which may be seen in Table 9. Questions were designed to provide focus for the content-development process, which included eliciting perspectives on delivery systems, delivery methods, and presentation style to address the behavioral determinants of the preliminary theoretical framework. The PI scheduled an interview with each stakeholder at a location of his or her choosing. The interviews were private, and all interviewees permitted the use of audio recording, with the understanding that no attribution would attach to any interviewee.

Initial design framework concepts. The starting point for a design framework is the process flow for development. As discovered through the literature review, both PRECEDE-PROCEED and Intervention Mapping contain features applicable to developing treatments for health behavior change. The process flow for this study has already been introduced, and is shown in Appendix C. Although there are some elements in the process flow specific to the concerns of this study, such as the wellness survey, the overall flow and sequencing is applicable to most health behavior change projects. Specific structure item mapping from this process flow to the previously mentioned processes are as follows:

- *prioritized list of factors and objectives* ↔ *IM key determinants*
- *preliminary intervention content* ↔ *IM proximal program objective matrix*
- *observation and discussion protocol* ↔ *IM program and evaluation plan*

The Intervention Mapping (IM) block on theory-based methods and practical strategies is not shown explicitly in the process flow, as these elements are inherent in the

construction of the first prototype, and more effectively mapped in spreadsheet format. Due to the large size, the spreadsheet is shown in Appendix D. The mapping combines domain theory factors with results from the stakeholder and SME interviews to develop design concepts associated with specific program goals.

Additional interviews were conducted with physicians specifically involved with addressing the needs of distressed physicians, in what they refer to as the second tier of support, which are similar to employee assistance programs. The third tier of support involves potentially negative consequences, and is considered a final resort. The first tier is prevention, which they acknowledged does not get the attention required; they noted that only 3-6% of the population of interest is aided by their assistance program annually. Although their focus is on remediation and the focus of this treatment is on prevention, their feedback and insights were beneficial. They were also responsible for coining the acronym that would become the name of the instructional treatment: AVATAR – Accessing Viable Alternatives To Achieve Resilience. In addition, they offered to host the treatment on their servers for long-term delivery.

Content was built around the IS model of wellness, with minimal coverage of each of the 17 subfactors except for *self-care*, which received more detailed content. Permission was obtained from Dr. Jane E. Myer to include her IS model as part of the instructional content, under the condition that her wellness assessment not be included. In addition to the common educational content, this focus area included sections specifically addressing the need to use a RSOC for some things. The program was conceived by the SME to have a sort of Dickens Christmas Carol flow to it, to serve as a mental map for

the users. The treatment makes use of avatars to represent physicians and their behaviors in the past, present, and future. The intent was to present a well-recognized model to encourage self-reflection, combined with relevant instructional content and appropriate references to enable the target audience to revisit, reflect, and explore beyond the confines of the treatment.

Reflection on past bad behaviors was highlighted first, followed by scenarios that represented present choices. Reflection was not interactive, and the scenarios provided limited interactivity. The reflective past comprised five timed vignettes at one minute each. The scenarios in the second section, although interactive, proceeded in a linear manner and could be completed within five minutes. The intent of this section was to encourage thinking about the logical consequences of decisions, rather than assessing a score to the response; the treatment is not graded, but instead provides instructional and motivational feedback. The final section representing the future was to provide the majority of the instruction, and the entire application could be completed in 15 minutes. This section was not designed to be interactive, but provided the user free reign to explore any part of it.

A program flowchart was developed, shown in Appendix E, which shows each of the sections and means by which a user navigates through it. Content was created by the PI and reviewed by the SME at each stage of development. With the design framework in place, and content concepts prepared, the first prototype was ready to be developed.

Phase 1 Treatment Development

Thoughts about final implementation and deployment were ever present, as one of the objectives was to establish a process flow using free or open-source (FOSS) applications, and using the same application for every stage of development would certainly have been most efficient. This was due to a combination of the PI's philosophy of pragmatism and financial considerations: all costs incurred in this study were at the expense of the PI. As the PI had some previous interaction with Authorware, and considered it an appropriate tool for development work, a search was made for a similar FOSS tool that would also easily transition to web delivery methods. eXe is a cross-platform XHTML application that showed some promise, but the interaction was limited and it was not very appealing visually. The program also seems to have been discontinued by the original developers; potentially useful in the short term, but not for the long term. Xerte showed more developmental activity, but only runs under Microsoft Windows, had limited options for look and feel of the final product, and achieved interactivity using Flash. As no application was found that would provide for web delivery while simultaneously providing a simple development environment, the decision was made to push out the implementation decision to the next phase of development. For the first prototype, a simple *paper doll* approach using LibreOffice Impress (an OpenOffice variant and alternative to Microsoft Office PowerPoint) was determined to meet the objective for eliciting feedback from the expert assessors.

Design style guide. A preliminary style guide was created, although details were kept to a minimum anticipating change throughout the design process.

Table 10: Initial Design Style Guide

Screen resolution	800x600 min; scalable to support a variety of user needs	
File formats	Graphics Textual animated and video	PNG ASCII text Flash
Color depth	24-bit truecolor or better	
Branding	Organizational logos and color scheme to promote organizational support	
Colors	USF Web Green, Gold, Tan; black, white	
Text	Gold on Green; black, white, or Green on Tan and Gold	
Fonts	Verdana unless otherwise noted titles & headings (Bauhaus 93 or similar) subheadings body text menu prompt	48pt 36pt 18pt 12pt 12pt
Buttons	Rollover text or button text (not both)	
Navigation	Navigation menu in upper right back – lower left of window next – lower right of window quit – part of nav window menu – part of nav window site map – part of nav window help – part of nav window	
Writing style	APA 6th	

Storyboard. Although presentation software can provide for some level of interactivity, this first cycle of development was primarily static content, more in line with the building of storyboards for movies and interactive media. The initial splash screen was envisioned as a merging of logos from the three university colleges associated with the development of the application. This was followed by a few screens of

introductory information, per the design flowchart blocks in Appendix E. The *past* was then represented by five screens of clip art graphics to represent vignettes, one from each of the five higher-order IS factors. The vignettes were introduced by a graphic of an older physician as an avatar, to anchor the concept of *past*.

From the Creative Self factor, the vignette involved the concept of work evolving into workaholism and burnout. From the Coping Self, lacking in realistic beliefs leaves the physician unprepared to accept he might have heart disease. For the Physical Self, the physician had poor habits leading to poor physical condition and loss of credibility with his patients. With the Social Self, the emphasis was on ignoring relationship issues, leading to loss of relationship such as divorce. Finally, the Essential Self vignette focused on self-diagnosing and self-prescribing, leading to addiction. These five concepts were selected by the PI based on information gleaned from the literature synthesis and discussions with stakeholders.

Following the five vignettes was a younger doctor, representing the *present*, to introduce five interactive scenarios. The younger doctor was intended to be the same avatar at a different stage of development. Each scenario fed off the corresponding vignette, and provided the opportunity to make a choice as to how to respond in a particular situation. Two choices were presented, and the feedback provided depended on the choice made. Clip art continued to be used throughout this phase 1 prototype, as this was an inexpensive and easy method for showing concepts.

Following the five scenarios, both older and younger doctor avatars came together to introduce the *future*, which was a collection of information on wellness organized

around the IS wellness model. The organization of the content used the IS model graphic as a launch point for each of the five higher-order factors, with subfactors reached through the ensuing screen. Content at this stage of development was very limited, restricted in some cases to a simple explanation of what the subfactor meant. The subfactor self-care did contain more detail, having specific statements on behavior to encourage reflection of personal attitudes and entrenched ideas. It also contained statements by respected peers in the field of medicine to encourage changes in mindset that could lead to changes in behavior.

Development outcome. The following images are representative of the storyboard slideshow that resulted from the phase 1 development. The first shows the high-level menu or launch point for the instructional section of the treatment. It clearly shows the IS model orientation, simple graphics, and design elements detailed in the design style guide.

The second shows the screen as seen at the high-level factor of Creative Self. Links to subfactors are shown in the petals of the flower, and the menu structure is in the upper right corner as defined in the style guide. These two screens are used as representative of the progression throughout the cycles of development, and will be shown throughout the remainder of this chapter as they change in the subsequent design cycles.

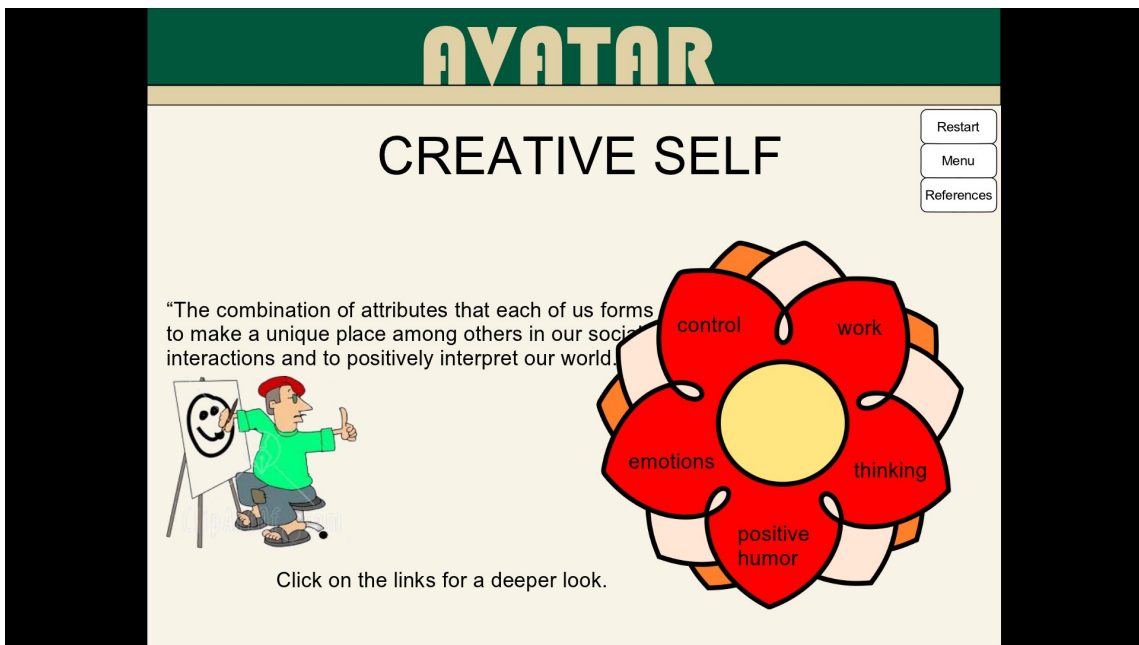
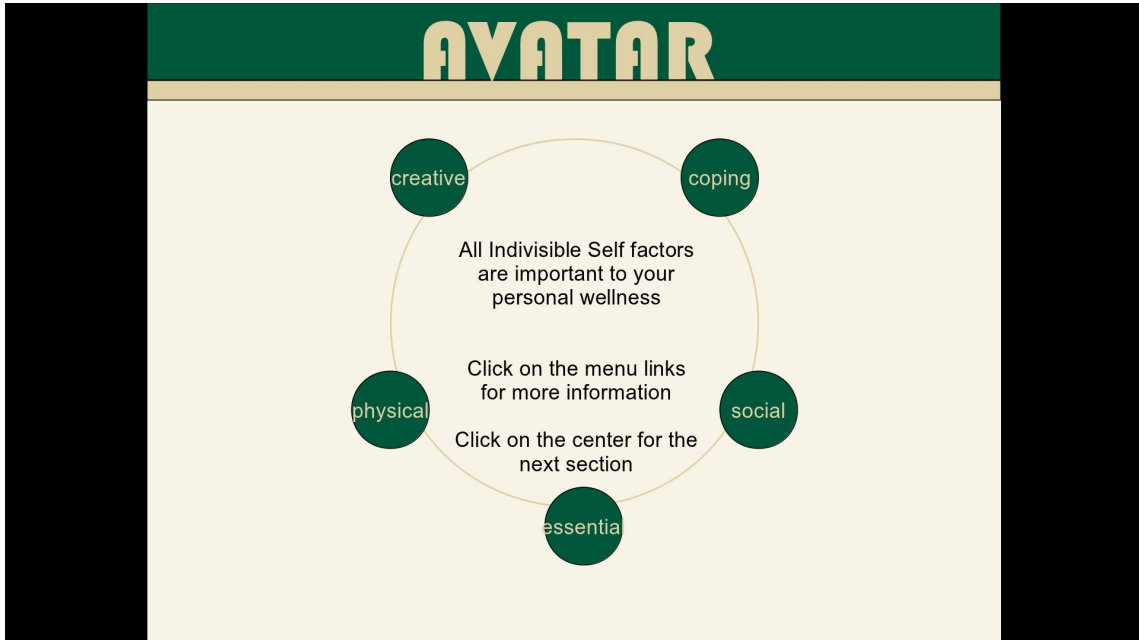


Figure 9: AVATAR Phase 1 – Screen Shots

Expert assessment. Expert assessment was conducted through observation, interaction, and discussion with experts in the fields of Instructional Technology (IT),

Industrial & Organizational Psychology (IOP), and medicine (MD). Assessment of the domain theory, design framework, and instructional treatment was conducted simultaneously through this interaction with the storyboarded phase 1 prototype treatment. Each expert was provided with a copy of the treatment and assessment protocol a minimum of one week in advance of the scheduled meeting with the PI. The Prototype Assessment Protocol (PAP) was developed by the PI to address the specifics of this unique theoretical framework. It incorporated questions on each of the major components of the domain theory to (a) assess how well the instructional treatment addressed those components, and (b) provide a framework for assessing potential limitations and possible changes to the domain theory. It also incorporated questions relative to the evolving design framework using standard concepts in web-based assessment to address both subject matter and design, such as those embodied in the WebMAC assessment instrument previously described. Due to its length, the PAP may be found in Appendix G.

The PI scheduled a one hour time frame with each of the three experts for the assessment. The IT and MD assessments were conducted in person, while the IOP assessment was conducted over the phone due to scheduling constraints. In each case, the expert assessor stepped through the storyboard slides of the treatment, and provided verbal and non-verbal feedback to the PI at each step. The verbal commentary was captured through audio recording, and the non-verbal captured through note-taking. Subsequent to the sequential review of the treatment, the PI then used the PAP as a guide to direct further inquiry and to ensure that all elements of theory and design had been

addressed. All questions, answers, and discussions were captured through audio recording for subsequent review and analysis.

Phase 2 Treatment Development

Although the results from the phase 1 assessment indicated no change required for the domain theory, the design framework and instructional treatment had to change significantly. It was at this point that important technical decisions had to be made, as they would impact development, deployment, extendability, and sustainability.

Technical implementation and deployment considerations. The first technical design involved the deployment issue. As prior stakeholder and SME feedback had indicated, hosting the treatment on a university server would not be adequate to meet the concerns of the target population for privacy and confidentiality. As the PI had an existing account with an external host server (Dreamhost), their options were first examined. At the time of this decision, Dreamhost provided PHP4 and PHP5 running as a CGI application with FastCGI support. They also supported Ruby 1.8.7 as a programming language running on Rails 2.3.5 as a server. The scripting language Python was also supported at version 2.5.2, and with some work, could support server frameworks such as Pylons, web2py, or TurboGears. The PI was also interested in Smalltalk as a programming language, which provides a server implementation called Seaside. Unfortunately, Seaside required a virtual private server, and the PI only had a shared hosting plan.

As the PI intended to craft all of the code required for the treatment, and as the PI had a limited programming background, he created a list of concerns associated with implementation and deployment to review.

1. programming language – not critical by itself, but may impact other criteria
2. libraries
3. tools (IDE, debugger, etc.)
4. community activity (aids in problem solving)
5. learning curve
6. usefulness for prototyping
7. security
8. local versus remote → trust and privacy

The last item was a nod to the possibility of delivering the content as an executable package. Examining the trust issue, there did not appear to be a benefit to local execution, and numerous development and sustainment issues associated with it. Therefore, the PI decided that web delivery from a remote server to a common set of browsers was the most appropriate delivery method for this situation.

With the delivery method resolved, the PI examined the various methods for developing the treatment. The use of programming languages is tracked a number of ways, including popularity, page counts, and lines of code. The PI chose to use the Tiobe index (<http://www.tiobe.com/index.php/content/paperinfo/tpci/index.html>) of programming language popularity as a measure of maturity and sustainability. The intent was to determine from the list of most popular programming languages, those that had shown a fairly stable usage over time, and met the PI's need to have a reasonable learning

curve. An alternative view of language popularity may be found at the PYPL site: <https://sites.google.com/site/pydatalog/pypl/PyPL-Popularity-of-Programming-Language>. Activity was reviewed through <http://gmane.org>, which showed that all of the major languages had adequate steady activity based on their respective mailing lists. Although Java and C were far and away the most popular languages, they did not meet the PI's requirements. Other languages in the top ten were deemed appropriate: PHP, Python, and Ruby. These languages were not only considered easier to learn, they were already supported by the PI's shared hosting plan and were commonly used to create web-based applications. Although the PI was familiar with Javascript, at the time of development it was strictly a client-side language, which did not meet the need to serve the application remotely. In addition, programming that runs on the client side creates a security and privacy concern, and the need to keep Javascript enabled in the user's browser added another level of complexity to its use. As a final review of possible languages, The Evan's Data Corporation (<http://evansdata.com>) report on scripting languages listed in order of highest satisfaction by users: PHP, Ruby, and Python. They listed highest performance according to users as: PHP, Perl, Python. The PI then ranked each of the primary languages (Java, PHP, Ruby, Python) on each of the previously identified concerns as a rubric. Although any of the four could be used, in addition to a few others like Perl, the need for long-term maintainability and security gave Python the edge.

The learning curve was strongly influenced by available development frameworks. As previously mentioned, Smalltalk has Seaside for web development, but

requires a dedicated server that makes its use untenable. Even so, the PI created an exemplar website using Seaside to use as a gauge for the ease of use with other frameworks. Ruby also only has one framework for web development, and in the interest of a fair assessment, the PI attempted to install Ruby 1.9.2 with Rails 3.0 on a system running Linux Mint 9. Unfortunately, the number of instabilities and dependency incompatibilities resulted in failure to run, much less build anything useful with it. This is likely to be improving over time, but was deemed too unstable to be used at the phase 2 stage of development.

Nothing was attempted with Java, as the learning curve was the steepest of all, and the PI has a personal dislike for the look and feel of Java applications, which left Python as the language of choice. There were a number of web development frameworks available for Python, ranging from mature platforms like Zope to relative newcomers like TurboGears. Zope, and derivatives like Grok and Plone, were not supported by shared hosting plans, which made them similar to Seaside/Smalltalk in that respect. Django was also considered mature at the time, and did fit with shared hosting plans. The PI found Django to be very capable, well-developed, and somewhat focused on CMS type of applications. Attempting to create something more flexible with Django was very difficult, and the existing documentation did not provide much support for out-of-the-box implementations. The PI also attempted to build an application using a lighter-weight framework called web2py that permitted building everything through a web-based interface, which would make maintenance and extension after deployment much easier. Unfortunately, web2py documentation was even sparser than that for Django. Tracking

down issues was extremely difficult, which became a problem as even the example website applications repeatedly crashed. As neither of the examined full-featured frameworks provided the simplicity and flexibility required for this implementation, the PI examined mid-level and micro frameworks as possible solutions. The partial-stack framework examined was *flask* (<http://flask.pocoo.org/>), and the micro framework selected was *bottle* (<http://bottlepy.org/docs/stable/>). Starting with bottle, the PI created a sample website and found it to be quick, easy, and stable. As flask did not appear to offer any other benefit, bottle was selected as the framework for development.

Where the heavyweight frameworks like Zope separate the python code from the implementation view, bottle incorporates python within the templates that generate the HTML code, making it similar to PHP in that respect. While this could be a maintenance problem for a very large application or website, the size of this instructional treatment fit well with the embedded approach, and greatly simplified the development cycle over alternative Python frameworks.

As the framework was provided by a single file, the developer could simply add the file to the other files in the development, and the Python interpreter would make use of it accordingly. This could be a consideration for long-term maintenance, as version changes are notorious for breaking compatibility in programming languages. For the purposes of this development, the PI chose to have the Python interpreter import the bottle framework directly, as versioning was under his control. The bottle framework included a SQLite interface, which was ideal for this application. SQLite is a relational database contained within a single file, which made database management relatively

easy. The framework also provided an embedded server, so development could be easily done on a local computer without the need for a higher-level server like Apache until it was time for deployment.

While this has many benefits for development, it created a problem for deployment. The PI did not attempt to create a bottle implementation on his Dreamhost server until the basic framework had been created on his local computer. Attempts to install on Dreamhost were unsuccessful. CGI was too slow, neither fastCGI nor passenger_wsgi worked properly, and mod_wsgi was not available. As a result, the PI looked elsewhere for a Python-friendly hosting platform to simplify the short-term development issues. Webfaction (<https://www.webfaction.com/>) was found to provide many of the required frameworks already installed, and were very considerate to work their server maintenance schedule around my needs during the pilot deployment so as not to interrupt user access.

Treatment implementation. Using the bottle framework Release 0.10.1, the PI created templates for rendering HTML for the various pages. A total of seven templates were created, with one serving as a common base for all the rest. This was a feature of the bottle framework: the ability to create hierarchical templates to reuse common information. The six templates making use of the common template covered the attention-grabbing introduction, basic information for the user (e.g. navigation hints), vignettes, scenarios and feedback, and the wellness knowledge section.

All content, including navigation information, was contained within a single SQLite Version 3 database file with multiple tables. One table was used for the scenarios

and another for the wellness section. The bottle templates and associates scripts are shown in Appendix I. A screenshot of the SQLite database using the Firefox SQLite Manager add-on has also been provided, showing the organization of the wellness section, which is reflected in the bottle templates. In addition to the CSS shown, the treatment also made use of two additional CSS scripts courtesy of Yahoo, which help limit compatibility issues. The reset-min scripts created a common starting point for all browsers, while base-min.css established a common base for general properties. All layout from the AVATAR CSS file relied on these two being in place first, else strange layouts resulted.

One difficulty encountered with this approach is lack of pagination. As all content was rendered on a per screen basis, and all content came from the database file on a per screen basis, each screen of content had to be carefully set up to ensure the appropriate amount of content. Some of the larger frameworks, like Django, include pagination as a feature, which is very helpful for web sites that have content changing fairly often. As the content for this treatment was static, the benefit would only be had during development and modification, which was expected to be limited.

With the Python script rendering the HTML at the server side, the client browser only ever receives HTML, which is more secure than allowing client-side scripting, but creates problems with cross-browser compatibility.

Once the development framework was working correctly, the greatest difficulty encountered was generating HTML using cascading style sheets (CSS) that worked the same on all browsers expected to be used. The organizational standard was to use Internet

Explorer (IE) 7, but it was clear that different end users had achieved different levels of upgrade, with some using IE8 and some using IE9. In addition, a number of user were found to prefer Firefox, and there were even a few using Apple products with Safari as their browser. Although it was only necessary to function properly with IE7, the PI made every effort to provide a treatment that would work on IE versions 8+, Firefox 5+, and Safari 5.1+. This became very challenging, particularly with respect to generation and deployment of video.

Several changes were made that reflect alterations to the original design guide. The design guide was not updated; rather, the design guide was transitioned to the CSS file used to establish the on-screen style, and changes were reflected in that document. Some of the more significant changes to design included:

1. screen view area increased to a fixed value of 1024x768 pixels
2. video formats increased to include MPEG2, MPEG4, OGV, and WebM

In addition to the changes made based on the phase 1 assessment, the PI introduced some additional changes, such as using black and white imagery for the reflective vignettes to contrast with the color imagery used in the scenarios; the intent was to provide a stronger mental model of past and present. Screenshots taken of the treatment demonstrate the significant changes made.


AVATAR
Access Viable Alternatives To Achieve Resilience


Home
Creative Self
Coping Self
Social Self
Essential Self
Physical Self
About

Wellness

This wellness knowledge base is built around a specific model of wellness. The Indivisible Self is an evidence-based model of wellness developed by Jane E. Meyers and Thomas J. Sweeney. According to Meyers and Sweeney, the "Indivisible Self provides an alternative perspective for viewing wellness across the lifespan, incorporating 17 separate wellness dimensions, five factors, and one higher order Wellness Factor". This model has been validated through extensive study, and evaluations based on it are currently in use. More information on this model can be found at [Dr. Meyer's UNCG website](#).

Although the IS model employs the concept of context in relation to the multi-factored model of wellness, the content in this section does not separate out context.



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AVATAR
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Home
Creative Self
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About

Creative Self

The Indivisible Self view of the Creative Self is derived from Adler's conception, which places the responsibility for an individual's personality in the hands of the individual: "Hereditly and environment provide the bricks, the final form of the building is up to us". The subfactors that make up the Creative Self are:

- Thinking
- Emotions
- Control
- Work
- Positive Humor




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Figure 10: AVATAR Phase 2 – Screen Shots

Content ideas were collected from the National Institutes of Health (NIH) website (<http://www.nih.gov/>), with some content used verbatim. This was possible because, in addition to the NIH providing credible content information, the information provided is public domain (with a few exceptions, which are carefully noted on the website). The images used included source attribution, as the PI was reluctant to pay for images that might not make the final cut. Three sites were used for images: <http://freedigitalphotos.net> allows you to use low-resolution images free with attribution; <http://featurepics.com> has free images with watermarks, and low-resolution images for low cost; <http://dreamstime.com> has a small selection of free images with no restrictions, and a very large database of images on a sliding scale of cost. The PI was able to find all the images needed for this treatment from these three sources.

Vignettes were created using a combination of tools to create movies using the Ken Burns effect. Of the numerous FOSS tools available, the PI was only able to locate two that were also cross-platform and provided the required functionality. PhotoFilmStrip V1.5 (<http://www.photofilmstrip.org/1-1-Home.html>) permitted the addition of images, creation of transitions, and creation of subtitles as part of the same video file. Audio could also have been included, but the level of effort required to generate audio for the vignettes placed it outside the bounds for this study. OpenShot Video Editor V1.4.1 (<http://openshot.org>) was used to combine video clips to create the introduction video. As previously mentioned, different browsers support different types of video capability. Apple products will not play Flash video, while Firefox browser will not play mp4. The solution was to transcode all video clips to provide four formats, of which one would

always work for the intended browsers. Handbrake V0.9.5 (<http://handbrake.fr>) was used to convert the MPEG-2 (.mpg) output from PhotoFilmStrip to MPEG-4 (.mp4), Flash as a last resort (.flv), and the emerging Internet standard for HTML5, WebM (.webm). Ogg Video (.ogv) was created using ffmpeg2theora for Firefox support. WebM plays very well with HTML5, and its use should simplify future development as all the major browsers (except Safari) are committed to supporting it in the future.

Expert assessment. Due to the feedback from phase 1, and subsequent alterations to the development of the treatment, the phase 2 assessment protocol was modified accordingly. The primary change was in the removal of questions pertaining to the use of a pre-intervention survey. The revised PAP may be seen in Appendix J.

As with the phase 1 assessment period, invitations were sent to the three expert assessors to schedule time to review the phase 2 treatment. Two of the interviews were conducted with minor issues; battery failure reduced two hours of observation and discussion to 51 minutes of recorded audio and PI notes. Fortunately, the PI recognized the failure and increased attention to note-taking to compensate. The third interview did not come about as planned, as the IOP expert committed to support this study passed away. A recommendation was made for a successor, who graciously agreed to step in as a replacement expert assessor. Due to his unfamiliarity with the study, greater time was spent providing background information to him before the face-to-face meeting for observation and discussion.

Phase 3 Treatment Development

Results from the phase 2 treatment indicated a number of design changes were necessary, as well as some modifications to some of the content and the way it was displayed.

Changes and challenges. The content associated with the subfactor *thinking*, which had been derived from common references for the general population, was determined by the SME to be inappropriate for the target audience. Instead, two specific references were identified that address the way physicians think (Groopman, 2007; Kahneman, 2011), which were then used to develop content specifically for physicians.

To provide a better sense of continuity in the wellness knowledge section of the treatment, all IS factor screens were provided a single graphic 275 pixels wide in the upper right of the content area. All IS subfactor screens included a single smaller 183 pixel wide graphic on the upper left portion of the content area. Width and location of the graphics was also expected to aid in navigation. The images of people used to populate the scenarios and vignettes were carefully chosen to balance the number of men and women cast in positive and negative light. Sensitivity to cultural and ethnic diversity was also a consideration while selecting appropriate images.

Although the intent of the vignettes was to present a dark mental image of negative consequences resulting from poor decisions, the images used in one vignette were determined to be too harsh. As suitable images were very difficult to find, the existing images were softened using image manipulation filters in the free (for non-

commercial use) program IrfanView (<http://www.irfanview.com/>). This is a Windows-only product that works well in Linux under Wine, and continues to be the PI's program of choice for simple image manipulation.

Vignettes in the second phase all used draft images in their creation; either watermarked or very low resolution. To create the final version of vignettes, 42 images were purchased and each vignette movie clip was recreated using the new images. PhotoFilmStrip was again used, and only MPEG format generated. Although the program does provide for other output formats, the PI determined that they were not rendered properly and secondary conversion methods were required. MPEG-4 format was generated by transcoding the MPEG-2 format using Handbrake with the original iPhone setting; the iPad/iPhone 4 setting produced artifacts with Safari on the PC. Flash and WebM were generated using ffmpeg version 0.9.1 (<https://ffmpeg.org/>), a cross-platform FOSS solution for video conversion. Note that Handbrake uses ffmpeg for the conversion, and provides a nice user interface that simplifies its use over the command line interface provided by the base program. Ogg video (.ogv) was transcoded using ffmpeg2theora version 0.28 (<http://v2v.cc/~j/ffmpeg2theora/>), a related cross-platform FOSS solution targeted at Ogg Theora video. OpenShot was again used for the introductory clip, as it provided sub-second timing needed for the quick transitions. The total video time worked out at 16 seconds for the introduction, and a total of 5:31 minutes for all the vignettes.

The layout of the entire treatment was changed significantly. All headers, footers, and content were constrained to be within the 1024 pixel wide format previously defined.

Although a footer was retained to mark the bottom of the content area, no additional features were applied there. Navigation features were moved to the top and right (as needed) to ensure that users would not overlook them, and managed through CSS. The top-level navigation bar was distributed across the top of the content area. Selecting a top-level block produced three effects: the screen changed to reflect the new location, the color of the text in the navigation block changed from white to green to show it had been visited, and the subfactor navigation bar was displayed below it (right-justified). Selecting the second-level navigation bar worked the same, with the exception that the next level of navigation was by page, and contained within individual content blocks in the SQLite database on an as-needed basis rather than managed as a CSS-level navigation feature. The overall effect is to provide a clearer indication of current location within the knowledge base, serving as both breadcrumb and sitemap without resorting to either.

One of the issues encountered during development of the phase 3 prototype was not easily solved, and created issues for maintainability. Numerous links to external websites were used throughout the wellness knowledge section. Some links were associated with specific tools or related content of interest, while others served as references for quoted material. During content review, the PI noted a number of links were already dead or outdated. In some cases, the higher-level website had moved the link to another location, and in others it had just disappeared. For the former case, the PI adjusted the links in the treatment to reflect the change. For the latter case, the PI had to modify treatment content and in some cases create new content based on reference links

that were still available. The problem is referred to as *link rot*, and is a problem for any document that links to another at a fixed Internet location.

Treatment implementation. The successful use of the bottle micro-framework was continued from phase 2. The hierarchical approach using a top-level template was discarded, as the approach reduced flexibility and obscured some information during debug and testing. With each screen generated from a single template using a single CSS file, management of the implementation was more efficient. Furthermore, it was determined that the use of the Yahoo reset and basic CSS scripts had created at least one compatibility problem. Therefore, the content from those two scripts that had been determined through testing to be appropriate for this implementation was incorporated into the single CSS file utilized. Thus, six templates were used with a single routing script and a single CSS file. The scripts are shown in Appendix K.

Web hosting by WebFaction was continued, as it provided the separation from organizational control deemed necessary to encourage trust with the end users, in addition to the relative ease at setting up and managing the remote server environment. At this stage of development, work was being completed by the PI on multiple development systems, which began to create a problem with maintaining the code base. Prior work had made use of a thumb drive to contain all the development files, which required the PI to keep the thumb drive with him at all times. After forgetting it one time too many, the PI set up an account on Bitbucket (<https://bitbucket.org/>), an online site that provides free repositories for maintaining code. Intended for collaborative, non-commercial development, the site originally supported only Mercurial

(<http://mercurial.selenic.com/>) distributed versioning system, and more recently added support for Git (<http://git-scm.com/>). The PI found Mercurial to be more intuitive to use, and successfully used this approach to “collaborate” from multiple locations. The success of this approach demonstrates the feasibility of maintaining the treatment without the need for developers to be co-located.

The screenshots of the third phase treatment show the layout changes made. Although not nearly as significant as the changes from phase 1 to phase 2, the changes made had a dramatic impact on usability. The screenshots were taken on a 1920x1080 pixel display to show how it would appear on screens with higher resolution settings than the minimum.

Treatment validation. As this study had been limited to three cycles or iterations of development, the treatment developed in this phase received the final verification assessments. Verification consisted of two levels of assessment. The first was a technical assessment using W3 online verification tools to determine the level to which the completed treatment met W3 standards for compliance. Both HTML code rendered by the bottle python framework and the CSS code developed for the treatment layout were assessed. The primary level of verification fell to the three expert assessors and the Treatment Verification Instrument (TVI) created for that purpose.

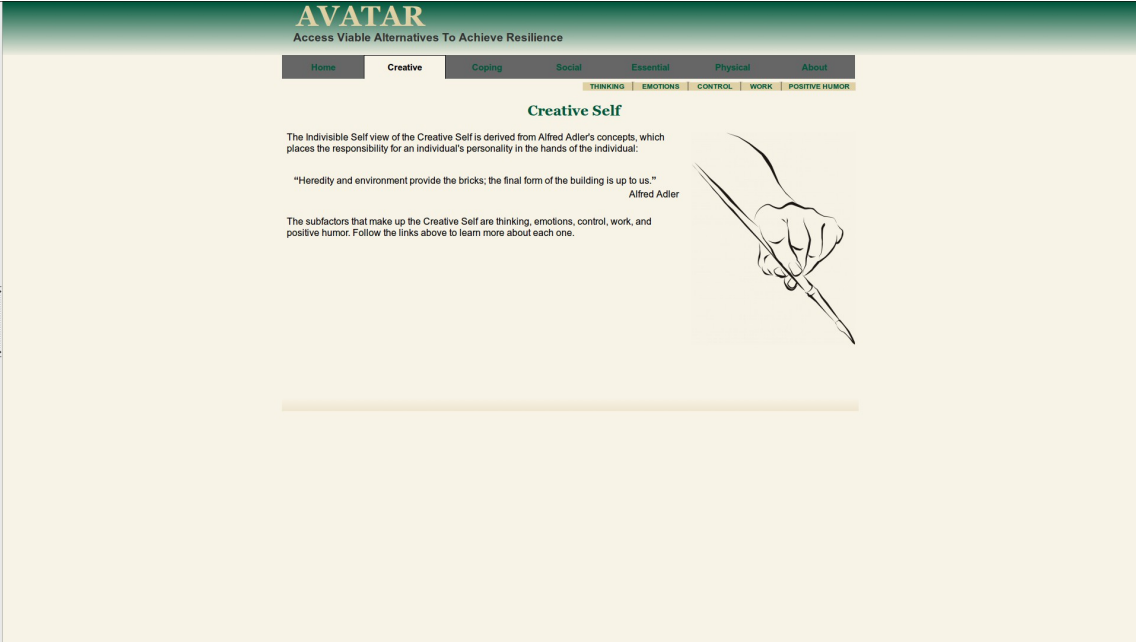
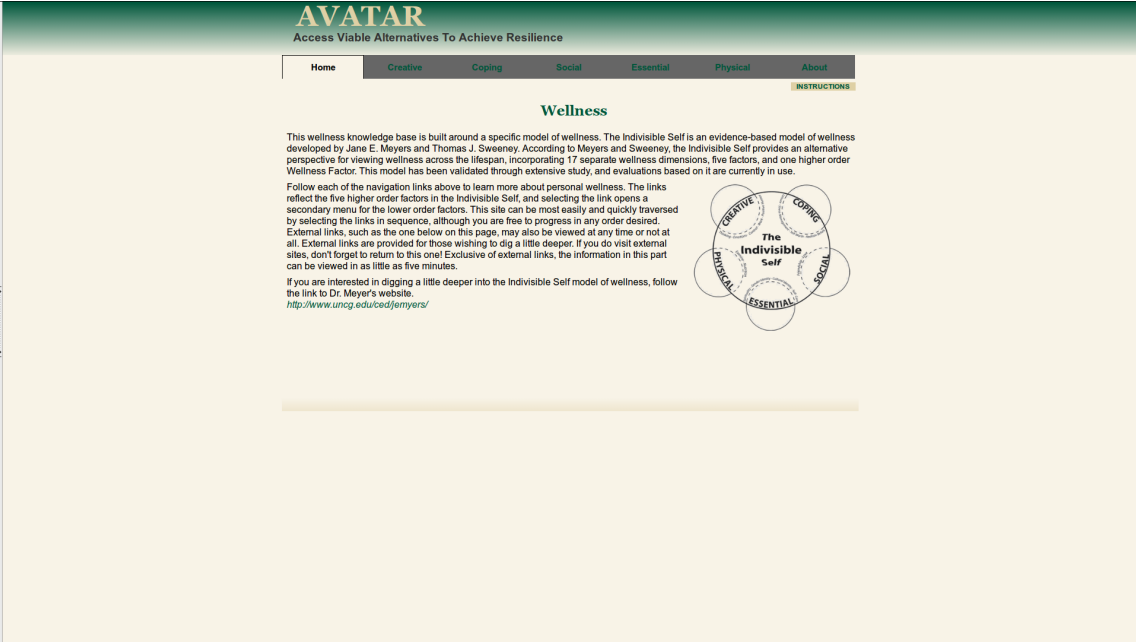


Figure 11: AVATAR Phase 3 – Screen Shots

The CSS file was uploaded to <http://jigsaw.w3.org/css-validator/>, which validated the file to CSS level 3. Selected pages were also checked for HTML5 compliance using the W3 validation service at <http://validator.w3.org/>. With the exception of a trick used to create the navigation bars, the pages were found to be compliant to HTML5. The trick used was to assign a CSS *id* within the list items that established the navigation bar that changed depending on whether that navigation item was selected or not. If selected, it had one id, and if deselected, it had no id. HTML5 requires the id to be set to some value. In retrospect, a second id could have been created and attributes associated with that id assigned to the specified list item.

The TVI was created for the purpose of validating the final instructional treatment against the domain theory and design framework that had emerged through the development process. The intent was to determine how well the treatment incorporated the elements from the theoretical framework, not to assess the validity of the framework. With a validated treatment, the theoretical framework could be declared warranted for this instance, and studies could commence using the validated treatment as a research vehicle to assess the validity of the theoretical framework. The TVI was therefore a more detailed assessment by the experts to validate that the PI has captured their inputs, and that the treatment adequately reflected their emergent, agreed-upon theoretical framework.

The PAP from the phase 2 development provided the starting point for the TVI. Unlike the PAP, the TVI employed Likert-like scales, was deployed from a remote web service to allow independent use, and was divided into three sections to reflect the

domains associated with the three expert assessors. Each of the three experts was considered the primary expert for one of the three sections: domain theory, design framework, and instructional content. Each of the assessors was sent links, via email, to the web-based instructional treatment, and web-based questionnaire, with instructions to complete by a specific date. Email being the unreliable medium that it is, two of the assessors required remediation emails when it became clear they had not acted on the first one. The PI was engaged in transmitting the TVI requests, and collecting and analyzing the responses as intended. It was also necessary for the PI to interact with the assessors due to a few questions being overlooked in the initial response.

As the TVI was adapted from the phase 2 PAP, the expert assessors were expected to be familiar with the concepts and language used. The TVI was sent to an expert in research methods for review; modifications were made in accordance with appropriate clarification provided. The final TVI text was then turned into an online survey using a new survey service.

The PI had created educational surveys prior to this using Survey Monkey, as it provided a means to create free surveys of up to 10 questions with up to 100 responses. While appropriate for many small student projects, the limitations prevented the use of this service as a free one for the TVI or the ensuing pilot deployment survey. Although several other services were found that provided some measure of free service, only one was found that was based on FOSS software, which would mean that a researcher could host her own survey service if desired.

The software is called LimeSurvey, and the selected service using it called LimeService (<http://www.limeservice.com/en/>). LimeService permitted the creation of surveys with unlimited questions and up to 25 responses for free. Beyond that, you simply pay for the responses you get, which works out to be much less expensive than the other sites. One of the benefits provided by the software was automatic output of data with an R script file, ready for analysis. The use of R is covered with the discussion on analysis. The survey software also supports export for SPSS and CSV file structures. Any organization with a computer department could host the FOSS software, and permit the development and deployment of surveys for a very reasonable cost. The TVI was used as a test case to determine if the service was acceptable for the pilot deployment survey.

Existing instruments had been examined for relevance, and a few were found to have something to add to this study. A study by Huang, Huang, Diefes-Dux and Imbrie (2006) that validated the ARCS IMMS survey provided evidence that elements of the IMMS could be used in this survey to assess the domain theory. Rating tools for educational sites by Harmon and Reeves (1998) and Arnone and Small (1999) were used to help establish appropriate questions for the design framework and instructional content. Rosen et al. (2000) was referenced for appropriate medical questions.

A five-point scale was employed, from *Strongly Agree* to *Strongly Disagree*. The PI found that the existing survey templates in place with LimeSurvey were not as desired, but there were mechanisms for creating unique templates, or modifying existing templates. The PI chose to use existing templates in a way that expressed the organization and layout of the questionnaire as reasonably close to what was desired as possible. The

PI also requested feedback from the expert assessors on the applicability of the service for use with the final pilot deployment. The items for the TVI questionnaire are shown in Appendix L.

Pilot Deployment

With the instructional treatment complete, the final step for completing this study was a trial run to assess the operational capability of the completed treatment in real-world deployment and with a sample of the study population. Recall that comprehensive summative evaluation and systematic reflection were beyond the scope of the study, hence the user feedback from the pilot deployment was for the purpose of answering the third of the three research questions.

The success with hosting the treatment on a remote website for the previous verification phase provided strong assurance that the same deployment would be a success with the pilot and any future deployments. The steps taken to launch and assess the pilot were as follows:

1. created Pilot Deployment Questionnaire
2. expert review of PDQ instrument
3. created PDQ survey on LimeService
4. added a link to the survey within the AVATAR treatment
5. submitted email request with links to the medical SME for distribution
6. collected utilization data from treatment host site and survey data at the end of the pilot period
7. analyzed the results

Pilot Deployment Questionnaire. The PDQ was designed to provide primarily quantitative assessments by representative end-users, with a final section to permit open-

ended qualitative feedback. Due to IRB requirements, the entire informed consent form approved by the IRB was used as the first page of the survey, with the requirement to acknowledge receipt of informed consent before moving on into the first section of the actual survey. The survey was divided into sections as follows: demographics, feedback on motivation, feedback on design, feedback on self-care, feedback on organizational perspectives, and open-ended feedback.

Demographics were limited to a few simple questions relating to gender, age, medical specialty, and length of medical experience. Age, and length of service as a physician and as a faculty physician were divided into six categories. Medical specialty used a drop-down list of the 26 specialties identified by the AAMC, plus an *other* category with the option to write in something different.

Motivation was assessed through four questions with the same Likert item format used in the TVI, ranging from *Strongly Disagree* to *Strongly Agree*. The questions posed were as follows:

1. I viewed the AVATAR application because I wanted to learn something of value to me.
2. I felt compelled to view the application for reasons other than my own personal interest.
3. Before viewing the AVATAR application, I expected to learn something of value.
4. I found personal relevance in some of the information presented.

Design feedback was provided through a series of six questions, with the first five using the Likert item format, and the final question having three possible responses, which are shown in square brackets below. They were:

1. The introduction was attention-grabbing.
2. The instructions were clear and easy to follow.
3. The design elements (colors, layout, imagery etc.) were visually appealing.
4. I feel confident that my privacy and confidentiality were protected while using this application.
5. The navigation was clear and easy to follow.
6. The level of interactivity was: [too little, just right, too much]

Five questions relating to self-care combined several types of responses, including the previously Likert item format, yes/no responses, conditional responses, and select-item responses. Responses are identified in square brackets for clarity.

1. I did receive the influenza vaccine within the past year. [yes, no]
2. It is important for me to have a regular source of care (RSOC). [Likert]
3. I do have a personal physician other than myself or a colleague (regular source of care). [yes, no]
4. I have met with my personal physician within the past 24 months. [yes, no | conditional if question 3 answered yes]
5. I do not have an RSOC or have not met with my RSOC within the past 24 months because: [time, money, don't need one, other (write-in) | conditional if question 3 answered no]

Three questions were posed to assess the organizational factors associated with the theoretical framework developed in this study. All three used the Likert item format as before:

1. It is clear the USF Health was involved with this study and application.
2. My belief that USF Health considers my personal wellness to be very important is stronger after viewing the AVATAR application.
3. My belief the USF Health considers use of a RSOC to be very important is stronger after viewing the AVATAR application.

The final section of the survey provided the opportunity for open-ended responses. Two questions solicited feedback on likes and dislikes associated with the instructional treatment. A specific number of likes and dislikes were requested based on SME suggestions that doing so would be much more likely to produce responses than simply asking for likes and dislikes.

1. Please list three aspects of this application that you particularly liked. Write as much as you would like; the text box will expand as needed.
2. Please list three aspects of this application that you did not like. Write as much as you would like; the text box will expand as needed.

The PDQ was reviewed by the medical SME as well as an expert in research methods for content and correctness. Once reviews were completed and any changes made to the survey, a link was added to the AVATAR treatment to provide a means to link directly from the treatment to the survey hosted by LimeService.

Deployment process. With the treatment and survey ready, the deployment was ready to launch. An email invitation was created to send to all faculty physicians at the university participating in the study. The email was sent to the medical SME, who forwarded it to the organizational stakeholder responsible for coordinating with the faculty physicians. This indirect approach was required from both an organizational perspective as well as a research study perspective; it was reasonable to expect that faculty physicians would be more responsive to requests for study support from their own organization than from some unknown PI.

Unfortunately, this indirect approach introduced errors that may have had some bearing on response rates and user attitudes. On the day that the email invitation was sent

and the treatment and survey became active, the PI noticed that the survey link embedded in the email invitation had become truncated at some stage in the forwarding process. An immediate request was passed along to provide an updated email invitation with the correct link, which was responded to within a day. To mitigate the damage, the PI added a note on the welcome page of the AVATAR application with the correct link information within an hour of identifying the error.

The treatment and survey were held open for a 30 day period, to ensure that all respondents had an opportunity to provide feedback. The study avoided a potential snag through the cooperation of the treatment host site Webfaction.com. As part of their regular maintenance, they had sent a notice to all users about impending switchover in equipment and associated downtime. As the timing could not have been worse, the PI requested the required maintenance be delayed until the end of the study period. Webfaction was gracious and courteous in their response, and agreed to wait until a mutually agreeable date and time. At the end of the 30 day period, the survey was closed and results exported for analysis.

Chapter Four: Results

This chapter presents the analysis and results from the preliminary investigations and multiple cycles of development described in the previous chapter. The chapter concludes with the results from the pilot deployment.

Preliminary Investigation Results

This section includes the analysis and results from the stakeholder and SME interviews on organizational and content perspectives, as well as those from the wellness survey for domain practice perspectives.

Domain practice perspectives. The wellness survey distributed to members of the AAMC and faculty physicians was completed and evaluated for guidance on selecting a wellness factor within the IS framework to focus upon. A total of 105 responses from 856 survey invitations (12.3%) were received with the response rate breakdown shown in Table 11. The FAX response rate was 20-25% of the actual responses, which raises the possibility that those respondents simply used the mechanism they were most familiar or most comfortable with. Although a 12.3% overall response rate seems low, it is comparable to the response rate experienced by other researchers using the same or similar database list (Fabri, et al., 2005).

Table 11: Wellness Survey Response Rate

Affiliation	Returned	Sent	RoR
COD	19	144	13.2
COTH	41	439	9.3
FP	45	273	16.5

Note:

COD = Council of Deans

COTH = Council of Teaching Hospitals

FP = faculty physicians

The responses were analyzed using the open-source statistical programming language R (<http://www.r-project.org/>), which is beginning to be taught at the university level as a suitable alternative to proprietary and expensive applications. In addition to the documentation available through the website, the PI found the books by Everitt and Hothorn (2006) and Dalgaard (2002) to be of particular value. Examination of the composite return was performed using measures of central value (median) and bar charts for an overall view. Because the responses to the first question were ordinal (rank) data, the Kruskal-Wallis test was performed to determine if there were any significant differences in responses among the three groups. Responses from the second and third question were addressed through the log-likelihood ratio test (G-test) to assess differences among the groups. It is similar to the Chi-squared test of independence, but far more popular within the field of medicine and requested by the SME due to familiarity.

Examination of the aggregate data revealed that nearly all of the 17 IS subfactors were considered important or very important, with three key exceptions. The responses

for the subfactors *cultural identity*, *spirituality*, and *gender identity* were clustered around the neutral response. This result is striking, as it appears to show a prevailing attitude among all three constituent groups that is not only at odds with the literature, but also at odds with the stated position of the medical school accrediting agency. In addition to being less important than other factors to these groups, the responses also seem to indicate that none of these wellness subfactors are considered to be problem areas, which is also in disagreement with available literature. It suggests that there could be a disconnect that could be addressed by the intervention developed through this study.

Examination of the group comparison data revealed a few potential differences, with one subfactor showing a strong difference among the groups. Although no claim is made that any of the results have statistical significance, statistical methods were used to create a dividing line between interesting and uninteresting differences; a p-value of 0.05 was selected for the dividing line. The strongest difference among the groups was found with the subfactor *self-care*, with the COD and COTH responses leaning towards identifying it as a problem area for faculty physicians, while the physicians leaned very strongly in the opposite direction. With weaker differences, yet still falling within the *interesting* category, the factors *emotions* and *stress management* showed trends similar to self-care, while *gender identity* seemed to have proportionately more COD individuals perceiving it to be a problem than either COTH or faculty physicians. While interesting, it is important not to read too much into these differences. The R scripting file and graphical presentation of the results discussed may be seen in Appendix H.

On a side note regarding the statistical methods used, it is common practice to treat Likert-like scale responses as interval data, and analyze them using one-way ANOVA. A common reference used in studies to support this is a quote from Jaccard and Wan (1996, p. 4): “for many statistical tests, rather severe departures (from intervalness) do not seem to affect Type I and Type II errors dramatically.” Results obtained from the first question using one-way ANOVA were not significantly different from those found using Kruskal-Wallis.

Examples of the emphasis on *self-care* from the literature synthesis include Gault’s call for physicians to be role models by getting a personal physician, getting a real physical exam and listening to the doctor (Weber, 2006). Reinhardt et al. (2005) called for “... interventions to engage physicians in primary care relationships (especially house staff)” (p. 7). Based on the body of evidence from the literature synthesis, and bolstered by the results of the wellness survey in the area of self-care, the decision was made to have the treatment focus on the IS subfactor of self-care and specifically as it applies to use of a person physician or regular source of care (RSOC).

Organizational and SME interview results. Each of the stakeholder and SME interviews had been scheduled for one hour, although all were permitted to run as long as the interviewee permitted. Most were completed within ten minutes of the allotted time, with one running under that and one running longer. The total for the seven interviews was seven hours, nine minutes, and 22 seconds of recorded audio. Each of the recordings was reviewed by the PI multiple times, using themes identified during the review to produce a weighted concept map for each interview; greater weighting was attached to

concepts that had greater emphasis during the interview. The approach is similar to the use of tag or word cloud maps for visual depiction of web content. Although the use of qualitative data analysis (QDA) software had been considered, the small number of inputs and the tremendous level of effort required to transcribe the audio rendered this approach untenable. Out of curiosity, the PI did transcribe a single hour of interview verbatim, and determined it would require almost 60 hours to transcribe the entire set. A composite map was then constructed from the individual mappings, obscuring attribution and emphasizing ideas and concerns that spanned multiple interviews.

Figure 12 shows the thematic elements most often mentioned during the interviews, which were strictly associated with the stakeholder perspective. Dashed lines show relationships between themes that were emphasized in the interviews, hence the value of a graphical depiction rather than a simple text list. SME interviews were less informing, although all agreed that the use of available existing content was appropriate, due to the limitations of funding and schedule for the study. Unfortunately, no specific instructional content, nor sources for instructional content, emerged from the interviews. However, due to the unique perspective of this study, development of new content was unavoidable.

The preliminary theoretical framework did not change as a result of the responses, although the common themes did show that a greater emphasis on threat appraisal might be more efficacious than emphasizing coping appraisal.

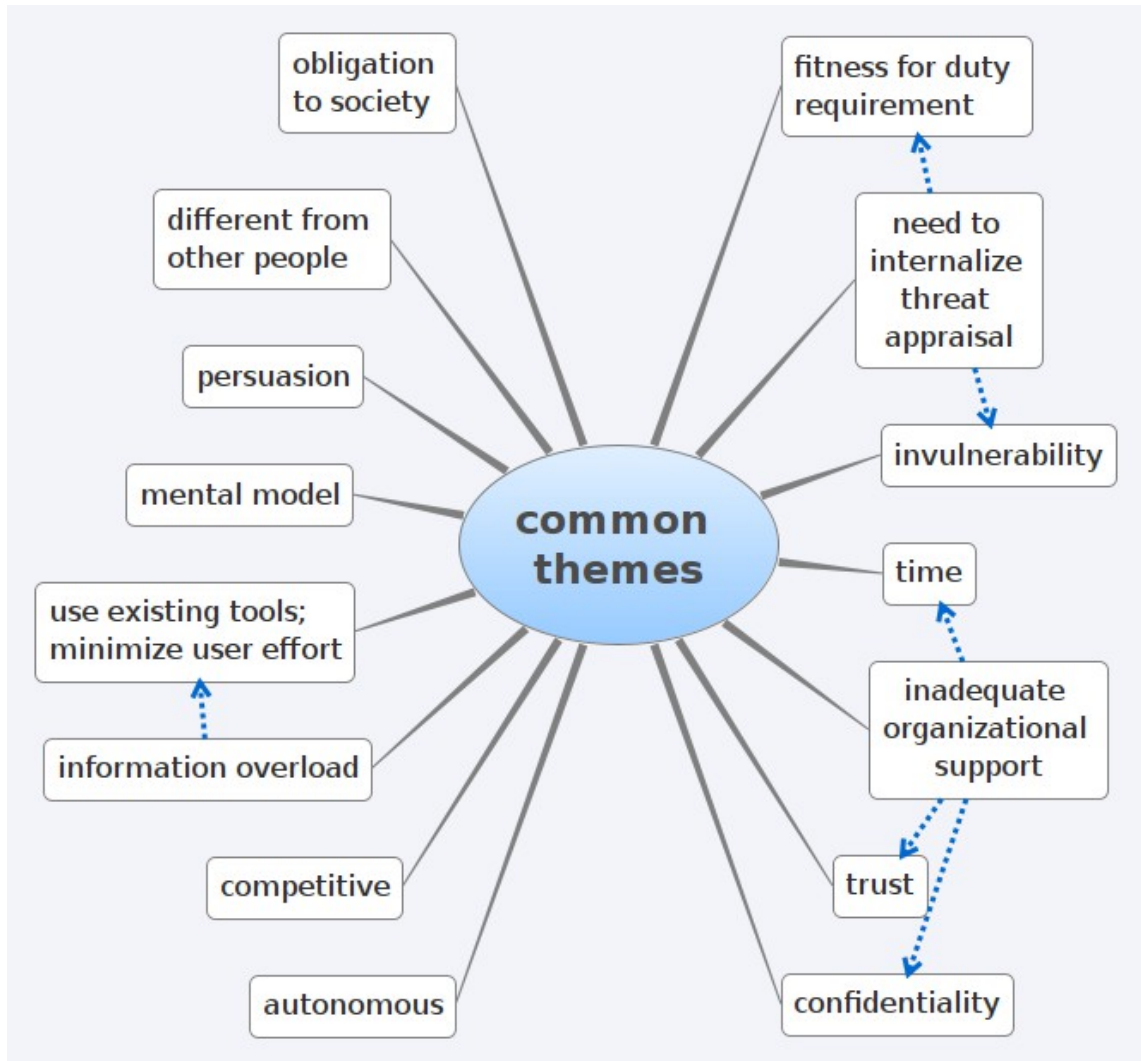


Figure 12: Stakeholder Perspectives – Common Themes

Phase 1 Assessment Results

The phase one prototype was evaluated by a SME within the College of Medicine, an IT expert, and an IOP expert using the aforementioned PAP for guidance. The interactions, observations, and discussions were captured by the researcher, with results collected into a series of action items for modification of the theoretical framework and prototype treatment.

The results of the expert assessments indicated that the domain theory was reasonable and did not need to change. All elements of the domain theory were supported by the experts, with the IOP expert providing one potential addition that could be included, although the IOP expert and PI agreed that such an addition was beyond the scope of this study. The IOP expert suggested that self-efficacy may not impact intention directly, but indirectly through moderation of threat appraisal. Feedback like this will be incorporated in recommendations for future study using the validated treatment from this study as a research vehicle.

The qualitative data captured through audio recording and note-taking were coded according to the constant comparative method of Glaser (1965), in conjunction with descriptions provided by stakeholders and other participants in the development process. The coded data were then combined in a matrix and assessed for patterns in order to create a list of actionable statements to inform modifications to the design framework and instructional treatment. To use the terminology in the development categories of Conchas (1992), origination and nomination were investigative and temporally iterative, while verification was rational and temporally iterative. Action items thus created from the phase one assessment are detailed in Table 12, grouped according to commonality. In some cases, clear actions had not been identified, as the questions raised required additional study to develop an appropriate action.

One interesting question raised during this assessment was identifying the appropriate point within the treatment for linking to the pre-intervention pilot study survey. If linking before any intervention elements, results were more likely to be

representative of user states and traits of interest, but response rate could have suffered. If linking was postponed until after the introduction designed to establish relevance and grab attention, the response rate was likely to be higher, but results would not have included the impact of the introduction, and could have reflected an already modified user perspective. The primary intent of the pre-intervention survey was to assess participant motivation prior to use of the treatment. After further discussion with experts in the field, the pre-intervention survey was dropped as it was determined to create confusion and was unlikely to add any meaningful results in the time frame provided.

Table 12: Phase 1 Assessment Comments and Action Items

Focus Area	Action Items
mental model	<ol style="list-style-type: none"> 1. ensure AVATAR acronym is clearly described in the beginning 2. reduce emphasis on acronym throughout the instrument 3. reverse avatar age progression and make the older avatar more positive 4. if possible, allow a choice of avatars
organizational support	<ol style="list-style-type: none"> 5. change USF Health to College of Medicine- emphasize support 6. host instrument outside of USF- emphasize privacy 7. determine if COM is willing to host a raffle prize to encourage use and show support
threat appraisal	<ol style="list-style-type: none"> 8. use shock and humor to introduce and engage early 9. adjust timing and pace to allow time to internalize message 10. subtle approach to get past guardedness
coping appraisal	<ol style="list-style-type: none"> 11. remove attempts to use competitiveness; unlikely to work 12. demonstrate positive results from personal wellness activities to enhance perceived consequences
content	<ol style="list-style-type: none"> 13. remove PSA testing as part of quality self-care; too controversial 14. use social marketing methods to demonstrate signs of affluence, power and contrast with negative consequences
design elements	<ol style="list-style-type: none"> 15. hyperlink references only; don't include in main material 16. improve user instruction and provide clearer cues 17. remove distinct separators between stage 1 and 2 18. use actors or image banks, not clip-art; not serious enough 19. don't use IS labels until the third section 20. provide feedback so the user knows what parts have been visited 21. clarify objective of the scenarios 22. make background environment consistent

Phase 2 Assessment Results

The phase 2 prototype treatment was assessed by two of the same experts from the first phase, and one replacement due to the loss of the first IOP expert. The qualitative data capture through note-taking and audio recording were coded in the same manner as the first phase data.

Table 13: Phase 2 Assessment Comments and Action Items

Focus Area	Comments and Action Items
organizational support	1. external hosting regarded as positive 2. no university branding at all; only color scheme reflects university support; regarded as acceptable
threat appraisal (relevance)	3. intro video clip grabs attention – they like this 4. vignettes do so as well – may be too extreme for them to internalize
coping appraisal (confidence /satisfaction)	5. encourage in the instructions – will take as little as 15 minutes; final section as little as five minutes 6. references – explain that they provide validation for the information presented; add to instruction in front; add which section each reference refers to 7. include which browsers are known to work well and if they need any plugins etc. 8. clearly explain that there is no right/wrong answer for scenarios – not being graded etc.
content	9. avoid strong declarative statements; use <i>could</i> instead of <i>should</i> etc. 10. avoid pedantry – put such statements in parentheses and condition them to offer as <i>extra</i> information 11. have an editor review it; too many commas misused 12. remove research project information 13. add credits and acknowledgments 14. users may not identify with vignettes as they are all extreme cases – tone down or identify as extreme at the beginning; vignette #4 in particular

Table 13 (continued)

Focus Area	Comments and Action Items
design elements	<ol style="list-style-type: none"> 15. instructions need to be clearer, more complete, and in multiple places to help the user move through quickly and easily 16. justified text does not look right, so tried ragged right instead 17. IE8 does not render correctly (nor does iPad, but that is less of an issue) 18. look and feel of wellness section is not consistent – try to revise so there is more similarity to ease assimilation 19. menu does not work well enough – too much time trying to find out what is next etc. which interrupts the flow; just lead them through it and provide a site map or something similar 20. links are not clear enough; put in as URL so it is obvious (and shows the URL in case there is a link problem) 21. outside links should include instruction to <i>return after reading</i> if opened in the same page; possible to open in new window? 22. reminder from first phase – tell them what to do, don't ask them! 23. reminder from first phase – clarify that scenarios are not graded, and they are asked to respond with what they WOULD do, not what they think the right answer is 24. consider moving nav buttons to top; if window not open fully, they may not show 25. <i>about</i> should be first... seems more natural and provides the means to give nav instruction 26. users want to know: where do I start, where am I, and how far do I have to go? 27. break up large blocks of text with images so they don't seem like so much 28. have some kind of common theme for images if possible 29. add an image for almost every section – e.g. something inspirational for <i>spiritual</i> 30. universal icons could be used in several places 31. make wellness graphic and nutrition chart larger; indicate how to get larger view with outside link 32. guide user through third phase as well – make it easy for them

The results of this coding were collected into a matrix that formed a new set of action items for modification of the treatment, as well as comments applicable to current development and future research studies. No change was required for the domain theory.

Table 13 contains the aggregated list of action items and comments applicable to changes made between the two phases of development. For example, university branding was removed from the treatment, to help improve the level of trust associated with it.

Phase 3 Assessment Results

The CSS file used in the treatment was validated by the W3 application to be compliant to CSS level 3. With the exception of a trick used to create the navigation bars, the selected pages checked by the W3 application were found to be compliant to HTML5. The trick used was to assign a CSS *id* within the list items that established the navigation bar that changed depending on whether that navigation item was selected or not. If selected, it had one id, and if deselected, it had no id. HTML5 requires the id to be set to some value. In retrospect, a second id could have been created and attributes associated with that id assigned to the specified list item.

The quantitative data collected from the TVI responses were examined for compliance with the stated intent of the testing. As can be seen in Table 14, no individual item response from any individual assessor in his or her primary domain scored less than three on the five point scale. The overall average for the three expert assessors was 4.16, exceeding the minimum score of 4.0 established as the threshold for declaring the development of the treatment and theoretical framework to be completed. The associated questions may be found in Appendix L.

The response to the use of LimeService was positive, meaning it would be suitable for use with the Pilot Deployment Questionnaire. Although the TVI results were

made available for analysis with R, the small number of item responses made it easier to do by hand, particularly as only the mean and minimum values were of interest.

Table 14: Expert Responses to Treatment Verification Instrument Questions

Question	Domain Theory	Design Framework	Content
1	5	4	4
2	4	4	5
3	5	4	5
4	4	4	4
5	4	4	5
6	4	4	5
7	4	4	5
8	4	4	5
9	4	4	5
10	4	4	5
11	4	4	5
12	4	4	4
13	4	5	
14	4	3	
15	4	3	
16	4	3	
17	3	4	
18	4		
19	4		
20	4		

Pilot Deployment Results

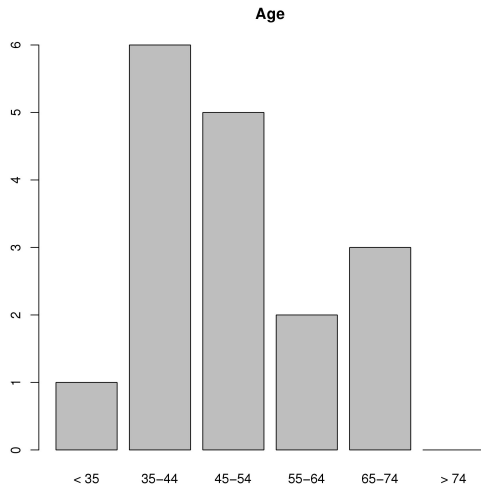
Simple metrics were collected during the 30 day period of the pilot deployment, to give some insight into the number of respondents and how the treatment was viewed. At the end of the study period, a total of 33 unique visitors were recorded over a total of 40 unique visits, indicating some had returned to the site or more than one person used the same IP address. Of those 33, all but four accessed the site within the first week, and

the last access was recorded the last day of the study. Despite having been given a deadline, it appears that some will always wait until the very last opportunity. Of those 33, only 17 made it through the vignettes and scenarios to begin to view the wellness section, and only seven looked at all the content.

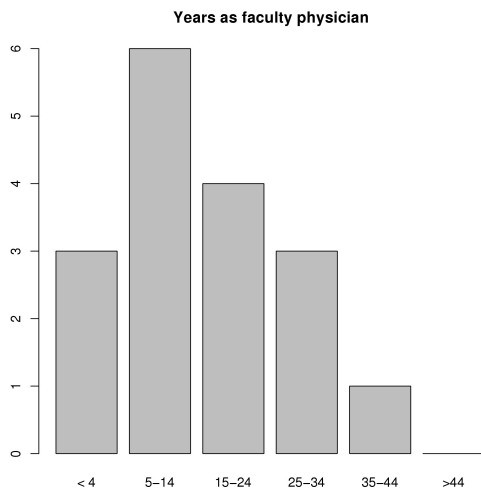
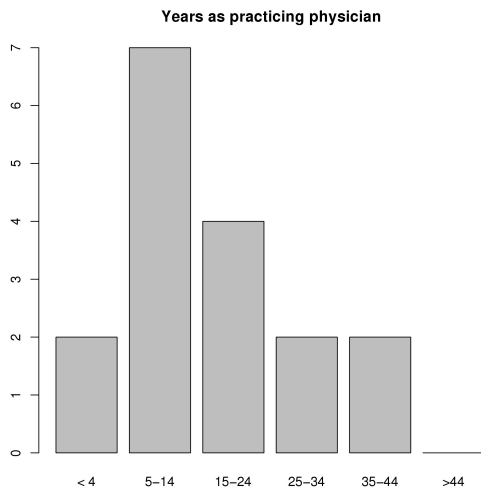
The response rate was lower than expected. The previously described issues with the invitation may have had some negative impact. In addition, the timing of the deployment placed the 30 day period in the middle of summer, which may have resulted in a number of potential respondents being lost to vacation or similar activities.

The survey data collected revealed that some of those who viewed the AVATAR application were unwilling to complete the survey. Of the 28 responses that showed some level of feedback, only 17 actually submitted the survey, which may indicate a technical issue with the survey mechanism. The remaining 11 survey responses were retained, but identified as incomplete; most showed nothing more than demographic responses provided. As these were anonymous responses, there was no provision for tying responses to specific individuals. Therefore, only the 17 that were completed were included in the analysis.

The survey data were exported from LimeSurvey for analysis with R, which included a file of comma-separated data and an R script file. The script file was modified to produce bar plots and tabular data from the data file, and is reproduced in Appendix M. Demographic responses have been captured and displayed in Figure 13.



Gender			
Male	Female	N/A	
11	5	1	count
65	29	6	%



Physician Specialization	
Allergy & Immunology	
Anesthesiology	
Colon & Rectal Surgery	
Dermatology	
Emergency Medicine	
Family Medicine	1
Medical Genetics	
Internal Medicine	3
Neurological Surgery	
Neurology	1
Nuclear Medicine	
Obstetrics & Gynecology	3
Ophthalmology	
Orthopaedic Surgery	
Otolaryngology	1
Pathology	1
Pediatrics	1
Physical Med & Rehab	
Plastic Surgery	1
Preventive Medicine	
Psychiatry	2
Diagnostic Radiology	
Radiation Oncology	
Surgery	3
Thoracic Surgery	
Urology	
Other Specialty	

Figure 13: PDQ Responses – Demographic Data

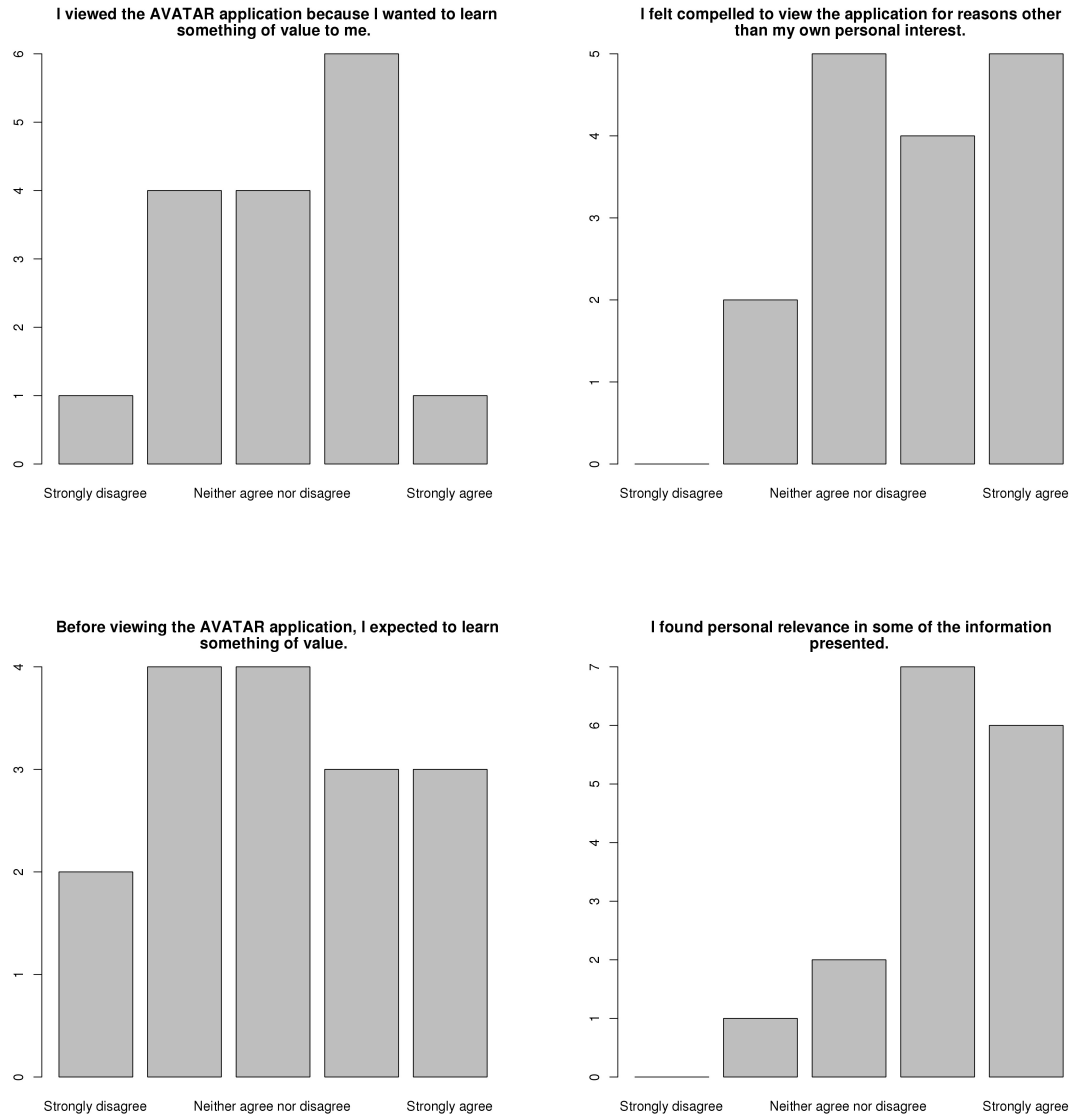


Figure 14: PDQ Responses – Motivational Aspects

The results from the Pilot Deployment Questionnaire (PDQ) section on user motivation are shown in Figure 14, and present some interesting perspectives. Of those who responded, most did express that there was a degree of organizational compulsion to their involvement. Despite this, most also expressed the desire to learn something through

the encounter, even though there was no strong expectation of doing so. Almost all respondents reported taking away something of value from the information provided in the treatment.

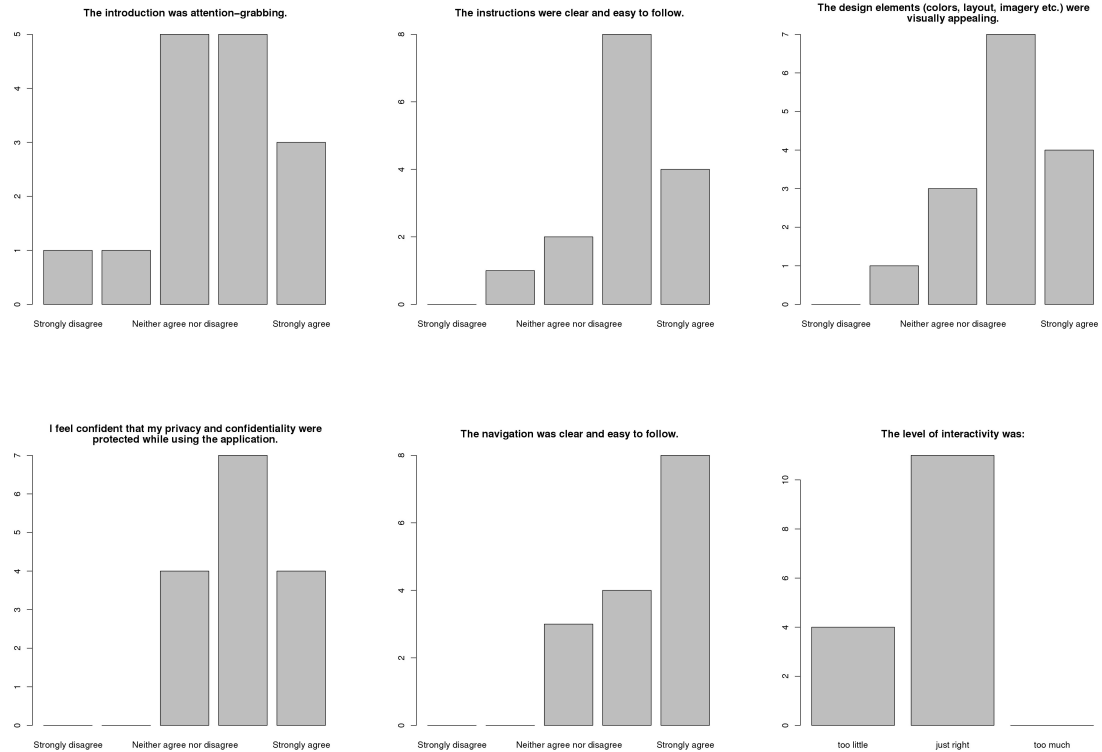


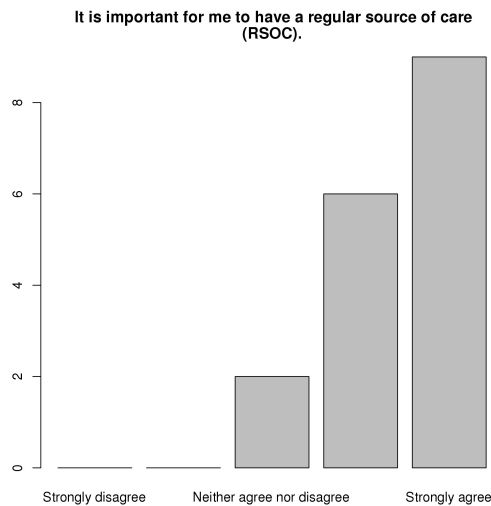
Figure 15: PDQ Responses – Design Aspects

The responses to questions relating to design aspects of the treatment are shown in Figure 15. Design questions were primarily related to the user interface, but also included a question that was intended to elicit a response on the user’s level of comfort from a security and privacy perspective. Most of the responses seem to affirm the choices made from a design perspective.

Responses to the questions on self-care are reflected in Figure 16. Of those responding, all received the influenza vaccine as suggested by the CDC. They also reported that having a RSOC is important, yet some number of them still do not have one or do not make use of the one they have. Reasons given for not having or using a RSOC included (lack of) time and the belief that it isn't needed.

I did receive the influenza vaccine within the past year.

Yes	No
17	0



I do have a personal physician other than myself or a colleague (regular source of care).

Yes	No	No Answer
14	2	1

I have met with my personal physician within the past 24 months

Yes	No	No Answer
14	0	3

I do not have a RSOC or have not met with my RSOC in the past 24 months because:

Time	Money	Don't need one	Other
1	0	1	0

Figure 16: PDQ Responses – Use of Regular Source of Care

Responses to the questions on organizational interest and involvement were much more varied than responses in the other areas. Some responses indicate that it was not at all clear that their organization had been involved in the study and/or application.

Responses were more neutral as to whether the organization was encouraging the use of a

RSOC, and seemed fairly negative as to the organization’s interest in their personal wellness. The potential implication of these results will be discussed in the next chapter.

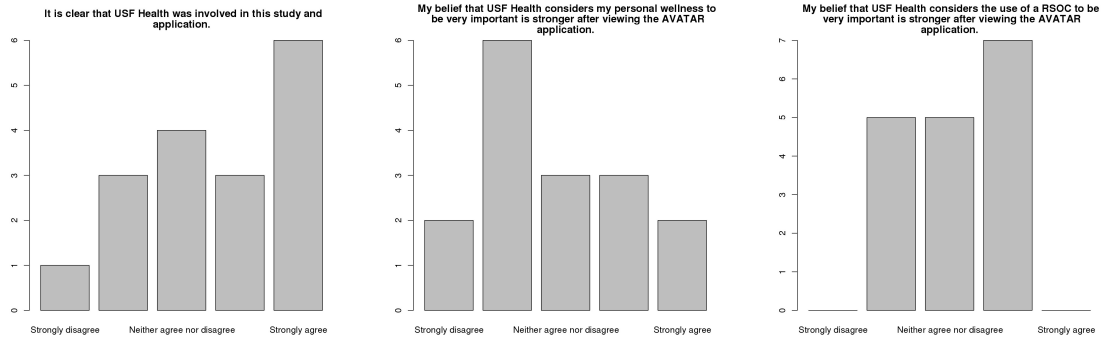


Figure 17: PDQ Responses – Organizational Aspects

The final section of the PDQ provided the opportunity for open-ended responses, and some obliged with both positive and negative criticisms. The PI was also contacted via email by some who had initially been unable to access the survey due to the previously mentioned survey link problem. Those responses were quite positive, but have not been included here as they were not submitted as part of the survey process. However, the additional comments provided the PI with additional encouragement for those aspects of the treatment and theoretical framework that seemed to have worked well.

As the number of responses to the final section were even more limited, they have been reproduced in their entirety in Table 15. Comments have been randomized, so sequential comments were not provided by the same individual.

Table 15: PDQ Responses – Likes and Dislikes

<p>Please list three aspects of this application that you particularly liked. Write as much as you would like; the text box will expand as needed.</p>	<p>Please list three aspects of this application that you did not like. Write as much as you would like; the text box will expand as needed.</p>
<p>“well done scenarios” “Non threatening” “easy access” “the questions at the end with the positive comments afterwards” “Clear” “Interactive nature” “Sections on hemotions [sic], friendship and love.” “Someone really put a lot of work in and I gained insight from this exercise. [sic]” “Organizing areas of wellness.” “quality of the video” “Interactive” “relevant content” “I always knew how long each page would take to complete” “concise” “Relevant topics” “Section on self-care. These sections helped focusing on areas, the importance of which was personally clearly understood but not necessarily translated into consistent actions.” “It showed a lot of insight into physicians lives at little cost of time.” “Encouraging physicians to personalize advice to patients.” “Easy to maneuver” “model upon which it is built” “non-judgmental content” “relevant” “Appropriate recommendations” “I found the information on physicians' personal challenges as these relate to coping (or not) to stress very disturbing. I realize how blessed I was in that the early phase of my professional career allowed me to dedicate much quality time to my wife and daughters during their formative years.” “I liked the subtle psychological pressure applied to encourage me to be more healthy in my activities.” “Having physicians step back and realize the effect of various cultures, particularly the culture in which they trained, on current behaviors.”</p>	<p>“I watched this to help with the study only and would not have watched it otherwise.” “videos tend seem to run slowly” “no sound” “informed consent was too long.” “I could not find elements of dislike.” “Print should be larger and pictures more colorful to get message across.” “after intro less clear how to use the site” “Too much redundancy in table of emotions. Most of the secondary terms were repeated in the the [sic] tertiary column.” “unless i missed it, there was no associated narration” “the beginning vignettes were too numerous at the beginning (overkill)” “I was unclear how tghis [sic] important information would be used.” “at times seemed a little staged or theatrical” “the beginning was a huge downer - no positive anything”</p>

Chapter Five: Discussion and Recommendations for Future Research

This chapter begins with a review of the goals and objectives for this study. This is followed by discussions of the design and development process and results obtained. An examination of the outcomes from the pilot deployment of the AVATAR instructional treatment follows. The chapter concludes with recommendations for future development and research, and a summary of this study document.

Study Goals

The primary objective of this study was to add to the knowledge base in multiple ways, and produce a practical instructional treatment that could be used by practitioners with little or no modification. Knowledge was increased through developing an understanding of the complex interrelationships among the organization, individual, and instructional environment applicable to faculty physicians. A secondary objective of the study was to advance understanding of the challenges associated with implementing practical studies using the design-based research method. DBR was used to develop a local instruction theory applicable to instructional treatments that could enhance physicians' personal wellness. These goals were accomplished by developing a domain theory through literature research, data collection, and expert assessment in coordination with the development of a representative instructional treatment. Although not explicitly stated as a research objective, the PI also sought to employ only free or open-source

software applications in the course of this study, with the intent of providing information on them for use by practitioners.

The resultant domain theory was warranted as appropriately represented in the developed instructional treatment. The process flow, tools and methods employed, and lessons learned form the emergent design framework that may now be applied to development of similar treatments. Recall that DBR is a continuing process, and the outcome from this study should not be construed as the end point for development. The treatment developed serves not only as an example implementation and useful application, but also as a vehicle for further study.

The research questions posed and answered with this study were:

1. What is the component structure of a local instruction theory that has the potential to positively affect the attitudes and behaviors relating to personal wellness for faculty physicians at a Southeastern teaching hospital?
2. What is the constituent organization of a design framework based on a local instruction theory that has the potential to positively affect the attitudes and behaviors relating to personal wellness for faculty physicians at a Southeastern teaching hospital?
3. What are the perceptions of faculty physicians at a Southeastern teaching hospital of the deployed technology-based treatment with respect to:
 - a) potential impact on attitude and behavioral change regarding personal wellness
 - b) demonstration of organizational support for personal wellness
 - c) the potential for technology-based treatments to impact cultural change in an organization
 - d) protection of personal privacy and trusted use?

The first question was answered by the domain theory developed, unchanged from the original proposed component structure shown in Figure 8. This outcome adds to the theoretical knowledge base. The second question was answered by the components of the design framework that emerged, comprising the process flow shown in Appendix C, specific implementation tools and methods described in Chapter Three, and lessons learned that were provided in the form of results and discussions in Chapter Four. This outcome provides useful methods and tools for practitioners to develop similar instructional treatments. The third question was answered by the responses to the PDQ survey provided by a sample of faculty physicians. This outcome provides a starting point for subsequent studies.

Discussion of the Design Process

A discussion of the steps and missteps taken along the way must begin with the initial interest in the subject matter. Recall that the first step, a needs analysis, was conducted prior to this study (Fabri, 2005), and leveraged in initiating this study. At that time, several investigators had plans to collaborate on this study, with two IOP doctoral candidates addressing both content and organizing theory, while this PI would focus on the treatment implementation. As with many grand plans, this one did not survive; the other researchers found other studies of interest they could focus on alone. At about the same time, the PI was introduced to design-based research, and had already become personally invested in physician wellness, thus leading to the continuation of the study alone and with a DBR methodology. In retrospect, it seems clear that the scope of the task was well beyond what should have been undertaken, but descopeing the study would

also have meant limiting the potential usefulness of the outcome, which the PI was reluctant to do. The result took many years to bring to completion, but only a few of the desired capabilities had to be sacrificed along the way.

After the initial literature searches and synthesis, which is mostly a solitary endeavor, a significant amount of time passed attempting to coordinate schedules between the PI and stakeholders. The PI is a working professional with limited flexibility in schedule, which undoubtedly contributed to the extended development schedule. Some scheduled interviews fell through without sufficient notice, leaving the PI to find out after a long drive to the interview location that an email had been sent to cancel it. The lesson learned was to not rely on email. Subsequent meetings were scheduled with phone and email, and the cell phone became critical in obtaining last-minute notices. Reminders via phone and email prior to the meeting also served to reduce the frequency and impact of missed appointments. Coordination of this sort can become a significant issue for RP studies, as there tends to be more interaction among collaborators as they iterate through design cycles. Furthermore, the longer the delay between cycles of interaction, the more difficult it seemed to be able to coordinate meetings between the PI and collaborators, suggesting an increase in detachment from the project between cycles.

Another area of external interaction that bears mention is IRB approval. Due to the length of the study and varying types of data collected, the IRB review was required before the proposal phase, which complicated the interaction. IRB review of the approved proposal study proved more difficult, as new processes put in place did not function as smoothly as expected. As the method of interaction relied on email for notification, the PI

was often unaware of requests for additional information until much time had elapsed. In all, the process to obtain IRB approval took five months, which had a negative impact on the study. Although the new process is apparently an improvement over the older process in general, in this case it took five times as long as the previous process. The PI recommends that researchers check with the IRB frequently, as the notification methods may not be depended upon. Furthermore, if requests for additional information for the purpose of clarification are forthcoming, the PI recommends that a phone meeting request be made in order to short-circuit the cycle of requests that could lead to lengthy delays.

The domain theory that coalesced from the literature synthesis and early investigations remained unchanged through the multiple cycles of examination. Recall that this study was limited to the first two stages of DBR: preliminary research, and prototyping. There was no attempt to validate the construct of the domain theory, only that the developed instructional treatment adequately operationalized the domain theory and design framework. As the treatment serves as research instrumentation, one of the outcomes of this study is a verified treatment that may be used to test the articulated domain theory. There were two suggestions for possible adjustments to the domain theory, which did not present an argument strong enough to warrant modification during this study. Both will be described and discussed later in this chapter under recommendations for future research.

The design framework that resulted from this study has both specific and general characteristics. The general characteristics relate to the process flow, which may be applied to the design of instructional treatments of other types. The specific

characteristics relate to the design elements, design tools specific to the deployment method, and architecture of the treatment. The flowchart in Appendix C provides a general framework for practitioners to design an instructional treatment to the pilot study stage. As such, it can be used independently of specific framework elements. Specific elements that are applicable to a more narrow range of instructional treatments with characteristics similar to the AVATAR application include:

- design style guide and use of CSS for easy modification of web-based treatment look/feel
- tri-part structure employing a past/present/future mental model
- server-side scripting using python and the bottle microframework
- SQLite database storage of all content, including images

Although the use of clip art in the phase one prototype was only intended as a place holder, it became clear from discussions with the experts that the days of instructional use of even high-quality clip art for professional instruction was on the decline. Another surprising outcome was the elimination of the use of competitiveness as a motivational tool. It had been clearly identified by all the stakeholders as a defining characteristic of individuals within the target population, and examination of the literature suggested that competition had been used to good effect within some health promotion programs. However, expert review of the first prototype revealed that the intended use might have just the opposite effect; although competitive, their motivations for competing are not likely to be compelled by the instructional treatment.

The second phase introduced the actual method of implementation, and the assessment results were understandably skewed towards technical implementation. Elements of style that were proposed included elimination of university branding, shifting from the use of justified text to ragged right, and developing a more consistent look and feel to the third section of the application. As the application made use of a cascading style sheet (CSS) for layout, modification would only require changes to the one script file. The most significant change was the alteration of the navigation elements. Many instructional treatments employ navigation items in the corners of the window, and the phase two prototype was similarly laid out. The next button was in the lower right, the back button on the lower left, and the navigation menu in the upper left.

Although this arrangement seemed natural to the PI, observing others interacting with the application revealed that the lower navigation buttons might not be noticed, while the left-side navigation bar opening up across the page proved to be awkward and annoying to some. An entirely new approach was created that kept all navigation across the top of the page, and made use of text color changes in the navigation bars to mark pages as visited with the menu hierarchy providing visual feedback of location within the application structure. Graphic images and photos were selected and sized according to the hierarchical location; recall this was organized around the Indivisible Self taxonomy. The second-level page views showed a small, contextually relevant graphic on the left side. The top-level page views showed a larger graphic on the right side. The use of both size and location of the graphic provided immediate visual feedback as to the depth of the location in the hierarchy.

The strongest theme resulting from observing the experts use the application was the need to simplify the user interface and guide the user through the application. While interactivity may support capturing and maintaining interest, too much in the way of required interactivity was deemed offputting for the population of interest. Feedback from the sample population following the pilot deployment illustrated this learned lesson.

Verification of the instructional treatment following the modifications of the third cycle of development made use of an online survey instrument. The instrument was derived from the observation and discussion protocol and made use of the same terminology. As the respondents were party to those observation and discussion sessions, there was an expectation that the terminology and phrasing would be clear to the respondents. This was the case for the majority of the questions posed. However, each respondent had one or two questions that were either unclear or misunderstood. None of the problem questions were common among the respondents, indicating that terminology in particular was creating a minor issue with the responses. Note that this was still the case after expert review of the instrument. This suggests that additional clarification was needed for some of the potentially ambiguous or vague concepts being explored with the instrument, which translates into lengthier statements and explanations as part of the question being posed. The PI proposes to use both expert and naive reviews in the future to mitigate this effect. Expert reviewers will discern potential validity issues, whereas naive reviewers will question everything they do not understand.

Discussion of the Pilot Deployment

As mentioned in the results section for the pilot deployment, there was a a problem with the invitation soliciting volunteers from within the sample population to engage with the instructional treatment and provide feedback. The PI made use of an open-source survey program called LimeSurvey, and chose to pay for a hosted implementation (LimeService) rather than setup and run his own. The TVI was hosted the same way, which served as a test case for the PDQ. Online survey applications such as this provide the capability of sending invitations directly, but this was not an option for this study. The sample could only be reached through a representative, which served to isolate the PI from the invitation process. This also served to ensure that the PI had no knowledge of who any of the potential respondents could be, thus assuring their anonymity. The invitation was provided to the sample by the representative via email. The PI and the SME collaborated on the wording of the invitation by email, and the result was passed along to the representative by email. Somewhere along the line, one of the email clients truncated the URL link to the survey site, and it went unnoticed out to the sample population. The PI was informed of the error, and promptly addressed the problem in two ways. A request was made for the representative to send out a correction email, and the PI added the link to the first document page of the AVATAR application. Although this was done very quickly, it is possible that some potential respondents were excluded due to the broken link.

In addition to the broken link problem, the timing of the pilot deployment may have had an effect on the number of participants. The pilot deployment ran for the entire

month of July, and as the sample population are all faculty members, it is possible that some were taking time away from work and did not receive the invitation until after the survey was closed. The PI was also informed by one of the stakeholders that faculty physician response to studies has been disappointingly low, so it is possible that the response rate is not especially worse than what is normally experienced with this sample population. Nearly all of the responses occurred in the first week of the survey, indicating that of those who were responsive did so in a timely manner. What was more disappointing for the PI was the large percentage who started the survey, but provided no responses. Although the PI has pondered and discussed this with others, he remains uninformed as to what, if anything, he could do differently to improve the response rate. The general approach has been to simplify the survey to boost the number of responses, but that produces less in the way of informative results. The survey provided was developed to be a balance to optimize the return of useful information.

The number of responses relating to audio narration make it clear that audio was expected. This has implications for future development, but also informs the development of explanatory preface material and application support information. Had it been clearly noted at the introduction of the AVATAR application that audio was not provided, the questions would not have been raised, and any distractions associated with trying to get audio that wasn't there to begin with would be eliminated.

One of the more significant outcomes from the Pilot Deployment Questionnaire (PDQ) feedback relates to organizational support. It was quite clear that the respondents felt compelled to participate in the study, and at least one stated he or she would not have

done so if not required to. In order for instruction to be effective, it must first be assimilated, and if faculty physicians treat this and similar applications as forms of mandatory training, then additional efforts must be made to overcome the negative baggage that comes with compulsion. It was also evident that, for those responding, the AVATAR application did not have any effect in improving perceptions of organizational support for either personal wellness in general or a RSOC in particular. The PI did not expect to see significant changes overall in this area due to the instructional treatment alone, as there was no concrete evidence introduced to demonstrate the strength of commitment on the part of the organization. During the early stakeholder discussions, a number of potential motivational approaches were discussed, and most involved time, money, or both. None of these can be provided by an instructional treatment. However, if the organization did have some extrinsic motivation approach, the information could be incorporated in instructional treatments as concrete evidence of organizational support.

Recommendations for Future Development and Research

Although the AVATAR application met the design objectives for the instructional treatment, and was generally well received by faculty physicians and domain experts, there are several facets of the application that could be improved prior to its use as a research instrument. Some users reported slow loading of video, which could be attributed to network connectivity and size of the video. While there is little that can be done to reduce video size further without reducing playing time, network connectivity could be improved through the use of a host environment that is more localized to the end user. One of the organizations that works with faculty physicians has already agreed to

host the application on their servers, and doing so might provide better video response. Prebuffering of the video using client-side scripting (e.g. Javascript) could also be used to improve video load times. As this would require the user to trust the application developer, and it is likely that some would not. One possible approach would be to provide the user with the option of allowing such scripting while clearly explaining the pros and cons.

As the PI developed all the content, and technical implementation, adding another cycle of development using qualified experts in content development, programming, and video creation would be very likely to result in an improved application. The addition of audio narration to the vignettes, and possibly the scenarios as well, could provide significant impact in delivering the content message and retaining the users' interest. Of the video provided, the least positive response was with regard to the introductory sequence, which was intended to grab the user's attention and heighten interest in what was to come. The concept used was a compilation of image sequences from the vignettes, which were then flashed on the screen for a brief period of time; the tempo of the image time on-screen increasing over the 16 second total time. While attention-grabbing from a visual perspective, it appears from user responses that they did not quite know what to make of it, so it did not have as much impact as desired. The introduction of audio, and perhaps textual cues, could be used to make the introduction much more effective.

Careful consideration was given to developing the application with a fixed view window size, as the technical difficulties associated with providing a flexible view window were too difficult for the PI to address. Changing the view width and/or height

caused the entire layout to change, which altered the intended visual impact. Furthermore, changing the view altered how much text could be placed on one screen, which introduced the requirement to have pagination capability. At the time of development, the bottle microframework did not have this capability. It is possible that a more qualified programmer would be able to overcome the pagination issue, though the visual impact issue would remain.

The next logical step would be to develop studies for summative evaluation and systematic reflection. Subsequent investigations would then be of the more traditional experimental variety with the purpose of validating the domain theory and its components. Future studies could also introduce and examine two concepts that were raised as possible extensions to the domain theory. The first adds stage-specificity as described in the section entitled *Stage theories*. The second adds the possibility to test for direct or indirect effect of self-efficacy; it is possible that self-efficacy moderates the relationship between threat appraisal and intent, rather than impacting intent directly, or it could be a combination of the two.

The instructional treatment was specifically designed to provide the means to readily experiment with organization of the content, variations in design elements, and changes in hosting environment. As the framework uses Python for scripting, the sequencing of the vignettes can be easily changed and even randomized. The same is true for the sequencing of the scenarios, and a more substantial selection of choices and responses could be easily integrated. All layout and design elements were built into a cascading style sheet (CSS) file, which makes experimentation with different designs

greatly simplified; one simply needs to call a different CSS file to present a different layout with the same content.

The question of how to address organizational support may be a subject for a complete, independent study by itself. The results of such a study could be incorporated into the AVATAR application as a research instrument and an end-product, under the assumption that the results support the inclusion of organizational support in the domain theory.

Summary

This chapter brings this report to its conclusion. It started with a review of the study objectives and research questions to be addressed. A discussion of the findings from the design and development process followed, along with a discussion of the outcomes from the pilot deployment. The chapter concluded with recommendations for future development and research. The AVATAR instructional treatment has been validated to represent the intended theoretical framework, and is therefore a suitable instrument for future research studies. Some modifications may be introduced to provide a more polished application without invalidating the outcome. The design framework that emerged from this study may serve practitioners interested in developing similar instructional treatments.

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Appendices

Appendix A: Wellness Survey Instrument

Wellness Survey

Check the box that identifies your organizational affiliation:

COTH COD USF Faculty

Part 1.

Rate the importance of each factor as it applies to physician wellness by selecting the appropriate button.

	very unimportant		neutral		very important
	1	2	3	4	5
1. cultural identity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. spirituality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. leisure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. self-worth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. realistic beliefs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. thinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. self-care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. friendship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. love	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. emotions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. nutrition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. stress management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. positive humor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. gender identity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Wellness Survey

Part 2.

Choose the appropriate response for each factor as it relates to physician wellness.

	Is this factor currently a problem?		If 'yes', is this problem:		
	yes	no	being addressed	corrected	neither
1. cultural identity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. spirituality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. leisure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. self-worth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. realistic beliefs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. thinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. self-care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. friendship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. love	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. emotions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. nutrition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. stress management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. positive humor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. gender identity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B: Intervention Mapping Process Flow

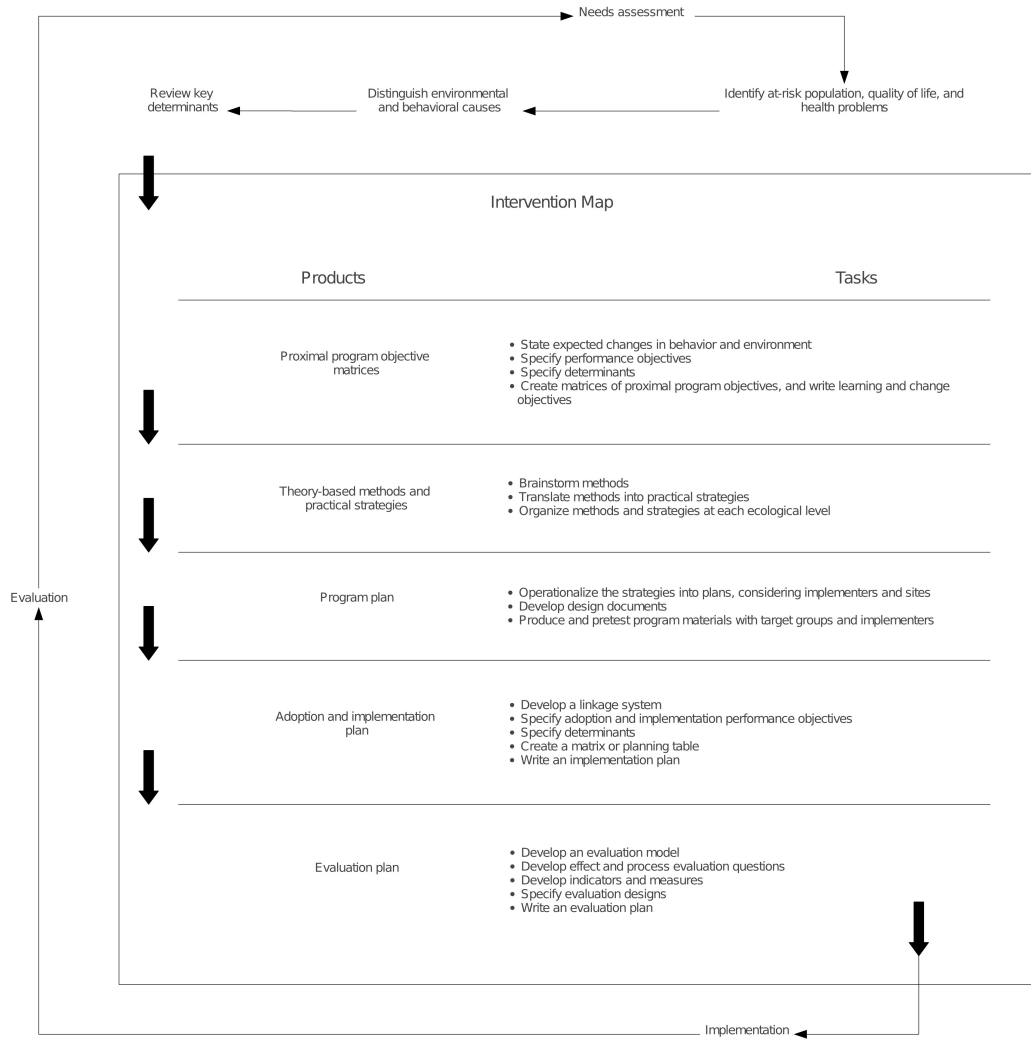
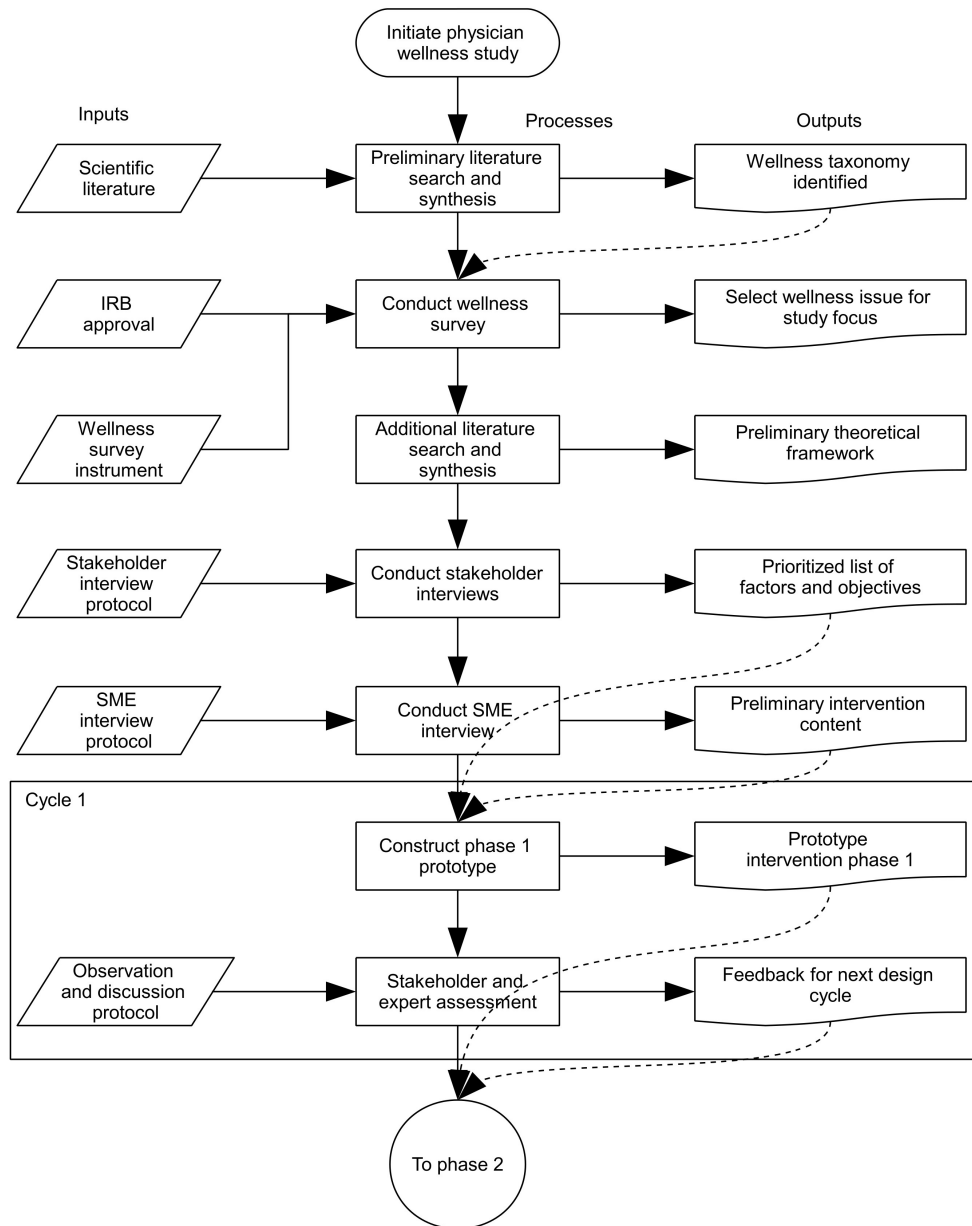
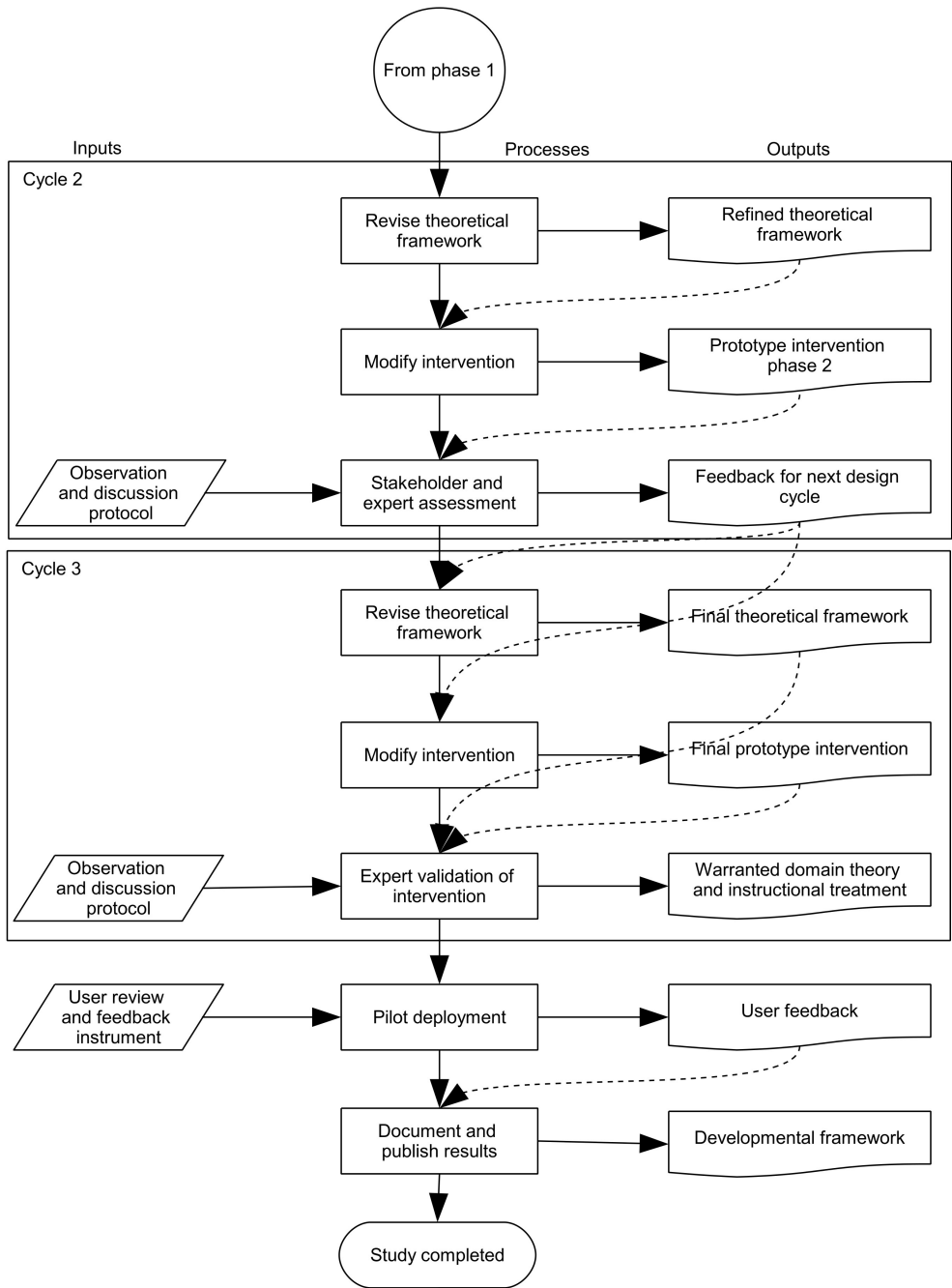


Figure adapted from “Intervention Mapping: A process for developing theory and evidence-based health education programs”, 1998, by L. K. Bartholomew, S. G. Parcel, and G. Kok, in *Health Education & Behavior*, pg. 548.

Appendix C: Study Process Flowchart





Appendix D: Theoretical Framework to Design Mapping

Theoretical framework		source	common themes	Program goal	design concepts
ARCS	includes attention relevance confidence satisfaction	ARCS	mental model	engage user	avatar model relates to threat appraisal relates to coping appraisal and self-efficacy relates to coping appraisal and POS
high-efficacy messages	cues to action Persuasive communication		persuasion		notice/email from department is first cue; introductory avatar walk-through introduces the need Multiple - through various scenarios with interaction and module content delivery
threat appraisal		PMT	need to internalize	alter unrealistic self-assessment	compare with general population
	perceived threat = perceived susceptibility to problem; perceived severity of consequences facilitators	HBM/PMT	invulnerability		
	impediments	SCT/TIB	fitness for duty obligation to society different	increase focus on social obligations alter unrealistic self-assessment	oath/quotes to reinforce; possible 'leader' statement/story in scenarios and modules compare with general population
coping appraisal		PMT			
	behavior beliefs	TRA/TPB			
	response efficacy	PMT			
	response costs	PMT			
	perceived consequences	TIB			
	subjective norms	TPB	competitive	Re-educate on peer perspectives	introduce concept that colleagues think in terms of wellness, so it isn't out of the ordinary
	social factors	TIB			
	cost/benefit analysis	PMT			see if org is willing to sponsor a 'see your doc' competition with reward = year's worth of parking space
perceived organizational support	supervisor support	POS	inadequate org support	improved identification of existing organizational support	identify what steps the individual can do to influence this and encourage improvement
	procedural justice		confidentiality		identify success of prior and existing programs
	organizational rewards		trust	convince docs that negative consequences won't follow	comes with time? Unsure how this can be influenced
	working conditions		time		personal choice... how to address this?
self-efficacy		PMT/HBM/SCT			
	perceived behavioral control	TPB	autonomous information overload	enhance self-efficacy	provide tools to facilitate delivery of this information limit to desktop; through browser if possible; allow for short overview with depth as time permits and interest allows; make it as easy as possible for the user
			use existing tools		
intent		HBM/TPB/TIB			
	protection motivation	PMT			

**Theoretical
framework**

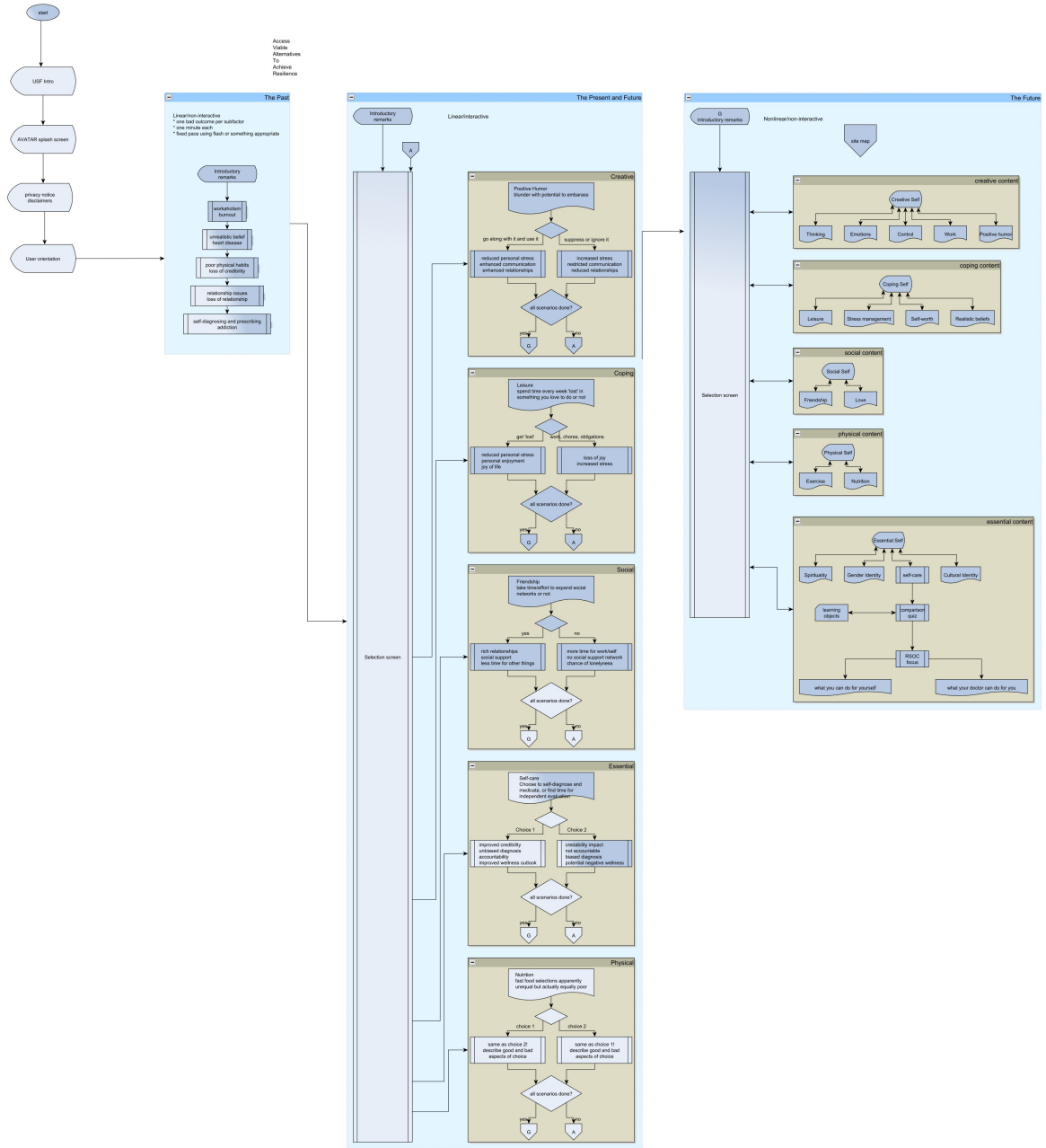
common themes

Program goal

design concepts

behavior change	<i>includes</i>	<i>source</i>	desired behavior? Personal assessment using standardized method followed by regular visit to address areas they shouldn't do on their own	introduce standardized methods as a kind of appendix – what exists now?
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Appendix E: AVATAR Program Flowchart



Appendix F: Selected Entries From the Study Log Book

2009-06-20

- Testwell has online tests available free
 - based on Hettler's model, so not as complete as IS
 - 5FWEL on self-care correlated well with Testwell:self-care and CRI:total coping
- Coping Resources Inventory is an assessment for how well you handle stress
 - also called the CRIS
- can use the idea of simple 'quizzes' to jump to the next section with different responses
 - e.g. use a Likert-like scale or simple yes/no with physical activity questions
 - and after the jump, present a response consistent with their selections.
 - ... perhaps even use images to create examples to choose from
 - e.g. someone bicycling for fun, a couch potato, and a body-builder
- using the IS model as the framework for the content
 - see the flowchart for factors and subfactors
 - only going to cover the basics for each subfactor, except for self-care
 - self-care to include:
 - smoking and cessation
 - sun protection (applicable to Florida)
 - seat belt use
 - illegal use of drugs and alcohol
 - use of an RSOC
 - include survey of items that should be covered by doctor
 - like pap smears, mammograms, prostate exams etc.

using OO Impress to create phase 1

2010-02-27

decided not to contact the marketing professor; too much input already, and this needs closure

- map theoretical framework to
 - common themes from interviews
 - design elements
 - design decisions (answer the 'why?')
- map out program concept (ID)
 - overall concept design
 - flowchart elements
- identify how the technology instrument will be evaluated against the theoretical framework
 - general design practices
 - ARCS
 - theory instantiation/implementation (how is this done?)

2010-04-24

ID concepts

revitalize the 'ghost' model

- past : 10 minute timed non-interactive scenarios of bad outcomes
- one from each of the 5 areas
- creative - work -> workaholism
 - respected by peers
 - admired by organization
 - bad outcome?
 - burnout
 - loss of relationship at home
 - work quality suffers
- compare to drug

- coping - realistic beliefs -> is/not the same as other people (I'm special)
 - compare burnout with other professions
 - compare physical with general population
 - heart disease
 - cancer
 - obesity
 - diabetes
 - bad outcome?
 - perhaps show a doctor getting something that is common with other people
 - e.g. burnout/stress/etc. leading to emotional/mental problems
- physical - obesity
 - more likely to promote physical activity if actively involved
 - bad outcome?
 - lack of credibility with patients
- social - friendship -> isolation
 - 'no time' for relationships
 - workaholism
 - ego
 - bad outcome?
 - divorce/family loss due to all the behaviors
- essential - self-care -> self-diagnosing and self-prescribing
 - already know all the answers
 - looked to as authority figure
 - can't go anywhere else
 - don't have the time
 - bad outcome?
 - overlook or misdiagnose and might lead to chemical dependency
- present: self-paced scenarios (5) with a little 'what would you do?' interaction for each

- future: self-paced instructional section on self-care
- what you can do for yourself
- what your doctor can do for you
- keep to 15-20 minute range

2011-03-05

completed writeup of phase 1 assessments
proposal ready for committee

ideas

- as part of one vignette, make it clear that the doctor is trusting to 'chance' for good health
- in pre-survey, be sure to ask for years of professional service, to address maturation issue
- in post-survey, include sufficient qualitative feedback potential to address the novelty effect
- limit number of on page/screen content to xxx words... need some definitive limit for this
- narrowing down to web2py for server-side framework
 - easier than Django
 - less restrictive
 - Python more likely to be supported than Smalltalk
 - PHP looks to be a mess to support long-term
 - only real drawback is the number of people who know python vs PHP
 - except... some people hate python because the formatting is part of the code... is that a problem?

2011-06-11

Having spent a week attempting to generate a basic web page (with CSS) using web2py, and also with Django, I begin to appreciate the steep learning curve mentioned in several blog posts. Unless generating a very simple CMS-type system, like a blog or a wiki, creating flexible applications with either of these development systems is a lot of work. web2py has a limited number of pre-built applications, and some of those don't work right. Although they claim they have never broken backwards compatibility, attempting to following one of the basic tutorials produced errors that were not readily understandable. If a tutorial generates errors, it does not bode well for doing something new with it. I also tried installing a basic CMS based off web2py, well, two actually. One (kpax) was created by the web2py author, and it was ugly! Walking through the video tutorial with the author generated an unrecoverable error. The second, InstantPress, is really just a blog application. You can add article pages, take comments, and assign the pages to categories for search purposes... and that's about it. It's not bad for that use, but just too limited for this application.

I have also fallen afoul of the Python formatting problem I have heard other CS types complain about. I used to think it was not such a big deal, but after wasting so much time trying to find out what went wrong, only to find it was a indentation issue, I begin to understand why formatting should be separated from programming. Since I will be doing the majority of the programming, my rationale (and rubric) will have to change accordingly. Although it would be nice to have the best of all possible worlds, the first consideration must be the ability to get up to speed quickly (learning curve), and build prototypes quickly. Therefore, I am adding a weighting function to the rubric, and adding Smalltalk back into the mix. Also, my impressions have changed, so the table is not going to look the same as the last one!

Recall the selected criteria (my criteria, my personal opinion! this is just a way to help me decide an appropriate approach):

- development platform - availability and capability
- libraries- availability and do they meet the need
- selection and capability of tools (IDE, debugger, etc.)
- community activity (aids problem solving)
- learning curve (5=low, 1=high)
- rapid prototyping capability
- maintainability
- security

- scale 1 to 5; 1 = very poor, 5 = very good
- weight in parentheses

| language | platform (5) | libraries (5) | tools (3) | community (3) | learning curve (5) |
 prototyping (5) | maintainability (3) | security (5) | Factored Total |h

Java	5 5 5 5 1 3 4 3 127
PHP	4 4 5 5 4 4 4 1 127
Ruby	3 4 4 4 2 3 3 3 108
Python	5 5 5 5 3 4 4 4 147
Smalltalk	4 5 5 4 4 3 5 5 147

So, for me, Python and Smalltalk are both viable approaches. Since I tried building simple sites with Django and web2py (Python), it is reasonable to spend a little time doing the same with Smalltalk. Smalltalk has a web app development framework available called Seaside, which I will use to do something simple. There is also a basic CMS available: Pier, built on Seaside. However, I'm not sure after the issues I've had that a CMS is not just too restrictive. There are several other tools which may become important later on, but for now I'll stick with Seaside and Pharo Smalltalk (since Seaside is built from Pharo, then ported to other Smalltalk dialects).

Appendix G: Phase 1 Prototype Assessment Protocol (PAP)

The following format is used to guide observation and discussion of the instructional instrument in relation to the proposed local theory framework and related design practices.

Phase 1 Prototype Assessment Protocol

1. Assess the use of ARCS strategies
 - a) Does the instrument gain and keep user/learner attention through perceptual arousal (novelty, surprise, etc.), inquiry arousal (stimulate curiosity with problems or questions), and variability (use a variety of methods)?
 - b) Does the instrument answer the question “What’s in it for me?” by introducing familiarity (content presented in understandable ways), goal orientation (objectives and purpose presented), and motive matching (objectives matched to needs)?
 - c) Does the instrument establish expectancy for success in completing the instruction, learning, and applying? (relates to self-efficacy below)
 - d) Does the instrument provide opportunities for use (natural consequences), positive feedback (positive consequences), and equity (consistent standards and consequences)?
2. Assess the use of high-efficacy messages
 - a) Does the instrument make effective use of cues to action with respect to self-care?
 - b) Does the instrument make effective use of persuasive communication?
3. Assess the threat appraisal implementation for self-care and RSOC
 - a) Does it enhance the perceived threat?
 - b) Does it alter unrealistic self-assessment?
 - c) Does it alter/improve a sense of social obligation?
 - d) Does it address fitness for duty?
 - e) Does it use statements from respected leaders for positive impact?
4. Assess the coping appraisal implementation for self-care and RSOC
 - a) Does the instrument enhance the user’s competitive nature with respect to use of RSOC?

- b) Does the instrument express positive use of RSOC by peers?
- 5. Assess the implementation approach for perceived org support
 - a) Does it identify what individual can do using organizational resources?
 - b) Does it provide knowledge of available systems of support?
 - c) Does it address and enhance trust of/for the organization?
 - d) Does it address time constraints?
 - e) Does it address the impact on making the tradeoff among trust, time, and personal self-care?
- 6. Assess concepts implemented to support self-efficacy; link success to personal ability rather than external sources
 - a) Does the instrument support user autonomy?
 - b) Does the instrument limit information overload?
 - c) Does the instrument use existing platforms (reduce extraneous cognitive load)
- 7. Discuss intent to change behavior
 - a) Plan to use pre-post survey to assess intention. Should the survey be integrated with the instrument, linked from the instrument, or autonomous?
 - b) Should an existing personal 'wellness' assessment be part of the survey?

Assess design approach against a subset of 'best practices' as deemed appropriate for this study.

Subject matter:

1. Is the information accurate?
2. Is the information current?
3. Is the information stable or subject to change?
4. Does the information have adequate scope (depth and breadth)?
5. Is the information presented clearly?

Design:

1. Is the navigation user-friendly, underconstrained, or overconstrained?
2. Does the design effectively integrate media?
3. Is an effective site map implemented?
4. Is a 'help' function implemented effectively?
5. Would you consider this to be a good web design?
6. Is the implementation compatible with required equipment?

7. Is the implementation usable across multiple types of platforms?
8. Does the implementation protect the confidentiality of the user?
9. Does the instrument provide for interactive exploration?
10. Does the instrument provide for some degree of user configuration (screen size, color scheme, etc.)?
11. Does the instrument include unimportant information that should be excluded?
12. Is the content well-written to the level of the intended audience?

Appendix H: Wellness Survey Analysis Scripts and Graphical Results

The following scripts were used with the open-source statistical program R, which may be obtained at <http://www.r-project.org/>. The scripts were designed to work with version 2.11 which was released in 2008. The scripts have been tested to work with the latest version for 2012, which is 2.15.2. The use of Rstudio is strongly recommended as it provides an integrated work environment that simplifies use.

```
# survey1.all.R
# script to read, parse, and generate basic statistics on Wellness survey data
# David Donnelly
# created: 7/1/2008
# updated: 7/19/2008
# updated: 8/13/2008 changes histograms to barcharts
# updated: 8/15/2008 broke into hierarchical blocks to simplify changing approaches
#
# load nonstandard libraries
library(doBy) # might simplify summaries by factor
library(moments) # provides skewness and kurtosis
library(lattice) # enhanced graphing capability
library(sfsmisc) # provides for multiplot handling
library(Hmisc) # provides many S-type plotting features
library(car) # companion to applied regression
#
# load nonstandard functions
source("load_func.R")
#
# load data sources
source("load_data.R")
#
# attach the dataframe to make some things easier
attach(survey1.data)
#
# populate various constants to make some tasks easier
# note that this step requires the data be attached first
source("load_const.R")
#
#####
#
# start with composite results
# redirect output to files for storage
# text
sink("survey1.all.out")
#
sum.all <- summary(survey1.data)
sum.all
#
media <-
c(median(Q1.1), median(Q1.2), median(Q1.3), median(Q1.4), median(Q1.5), median(Q1.6), median(Q1.7),
median(Q1.8), median(Q1.9), median(Q1.10), median(Q1.11), median(Q1.12), median(Q1.13), median(Q1.14),
median(Q1.15), median(Q1.16), median(Q1.17))
mod1a <-
as.numeric(c(Mode(Q1.1), Mode(Q1.2), Mode(Q1.3), Mode(Q1.4), Mode(Q1.5), Mode(Q1.6), Mode(Q1.7),
Mode(Q1.8), Mode(Q1.9), Mode(Q1.10), Mode(Q1.11), Mode(Q1.12), Mode(Q1.13), Mode(Q1.14), Mode(Q1.15),
Mode(Q1.16), Mode(Q1.17)))
media
mod1a
#
# close file
sink()
#
# graphics
pdf("survey1.all.pdf")
#
source("plot_bar_all_9.R")
# close graphic file
dev.off()
#
```

```

#
#####
#
# now look at responses as a function of affiliation
# redirect output to files for storage
# text
sink("survey1.byAff.out")
#sum.1 <-
summaryBy(Q1.1+Q1.2+Q1.3+Q1.4+Q1.5+Q1.6+Q1.7+Q1.8+Q1.9+Q1.10+Q1.11+Q1.12+Q1.13+Q1.14+Q1.1
5+Q1.16+Q1.17~Aff, data=survey1.data, FUN=c(Mode,quantile))
#sum.1
#sum.2 <-
summaryBy(Q2.1+Q2.2+Q2.3+Q2.4+Q2.5+Q2.6+Q2.7+Q2.8+Q2.9+Q2.10+Q2.11+Q2.12+Q2.13+Q2.14+Q2.1
5+Q2.16+Q2.17~Aff, data=survey1.data, FUN=c(quantile),na.rm=TRUE)
#sum.2
#sum.3 <-
summaryBy(Q3.1+Q3.2+Q3.3+Q3.4+Q3.5+Q3.6+Q3.7+Q3.8+Q3.9+Q3.10+Q3.11+Q3.12+Q3.13+Q3.14+Q3.1
5+Q3.16+Q3.17~Aff, data=survey1.data, FUN=c(Mode,quantile))
#sum.3
#
source("KW1.R")
source("FE2.R")
source("FE3.R")
# close file
sink()
#
# graphics
source("plot_bar_aff_9_a.R")
#
# close plot file
dev.off()
#})

```

```

# load_func.R
# Various functions and function calls
# David Donnelly
# created: 8/15/2008
#
#
source("g.test.r")
#
# define any new functions here
# have to define Mode if needed; doesn't seem to vary much from median with this dataset,
but might be useful
Mode <- function(var) rownames(table(var))[which.max(table(var))]
#
# define a version of median to ignore NA
medianNA <- function(var) median(var, na.rm=TRUE)

```

```

# load_data.R
# script to read and parse Wellness survey data
# David Donnelly
# created: 8/15/2008
#
# Survey data is downloaded from USF Checkbox Reports using export feature
# export mode = standard CSV
# csv options = none (alias would be desired, but have to be implemented BEFORE the
survey is released)
# detailed user information is not required for this survey (start/stop time, IP address,
etc.)
# results in 53 columns of data with the first column supporting a responseID number
unique to the response for this system
# 51 question results + affiliation + responseID
# because this data is from a Likert-like scale, use quartiles to describe distribution
and barcharts or dotplots for graphical representation
#
# create a dataframe with all the data
online.survey <- read.csv("csvExport.csv", header=TRUE, na.strings="")
paper.survey <- read.csv("FAX_responses.csv", header=TRUE, na.strings="")
survey1.data <- rbind(online.survey,paper.survey)

```

```

#
# replace the default variable names (equal to entire questions) with simple ones
names(survey1.data) <- c("ID","Aff",
"Q1.1","Q1.2","Q1.3","Q1.4","Q1.5","Q1.6","Q1.7","Q1.8","Q1.9","Q1.10","Q1.11","Q1.12","Q
1.13","Q1.14","Q1.15","Q1.16","Q1.17",
"Q2.1","Q3.1","Q2.2","Q3.2","Q2.3","Q3.3","Q2.4","Q3.4","Q2.5","Q3.5","Q2.6","Q3.6","Q2.7
","Q3.7","Q2.8","Q3.8","Q2.9",
"Q3.9","Q2.10","Q3.10","Q2.11","Q3.11","Q2.12","Q3.12","Q2.13","Q3.13","Q2.14","Q3.14","Q
2.15","Q3.15","Q2.16","Q3.16","Q2.17","Q3.17")
#
# the . can be replaced by _ if this needs to go to SAS as well
# this would have been unnecessary if the alias feature had been used (presumably)
#
#Q1 <- survey1.data[3:19]
#Q2 <- survey1.data[seq(20,52,by=2)]
#Q3 <- survey1.data[seq(21,53,by=2)]
#
# organize for easier processing
attach(survey1.data)
Q1 <-
rbind(Q1.1,Q1.2,Q1.3,Q1.4,Q1.5,Q1.6,Q1.7,Q1.8,Q1.9,Q1.10,Q1.11,Q1.12,Q1.13,Q1.14,Q1.15,Q1
.16,Q1.17)
Q2 <-
rbind(Q2.1,Q2.2,Q2.3,Q2.4,Q2.5,Q2.6,Q2.7,Q2.8,Q2.9,Q2.10,Q2.11,Q2.12,Q2.13,Q2.14,Q2.15,Q2
.16,Q2.17)
Q3 <-
rbind(Q3.1,Q3.2,Q3.3,Q3.4,Q3.5,Q3.6,Q3.7,Q3.8,Q3.9,Q3.10,Q3.11,Q3.12,Q3.13,Q3.14,Q3.15,Q3
.16,Q3.17)

```

```

# load_const.R
# Various constants defined
# David Donnelly
# created: 8/15/2008
#
#
# create a vector with labels for questions
qlab=c("cultural identity","control","spirituality","leisure","self-worth","realistic
beliefs","thinking","self-
care","friendship","work","love","exercise","emotions","nutrition","stress
management","positive humor","gender identity")
# create vectors for labels and placing plots
split1 <- c(1,1,3,3)
split2 <- c(2,1,3,3)
split3 <- c(3,1,3,3)
split4 <- c(1,2,3,3)
split5 <- c(2,2,3,3)
split6 <- c(3,2,3,3)
split7 <- c(1,3,3,3)
split8 <- c(2,3,3,3)
split9 <- c(3,3,3,3)
xlab1="Importance"
xlab2="Problem Status"
xlab3="Solution Status"
label1 <- c('1','2','3','4','5')
label2 <- c('no','yes')
label3 <- c('addressed','corrected','neither')
label4 <- c('COD','COTH','USF')
colors1 <- gray.colors(5)
colors2 <- gray.colors(2)
colors3 <- gray.colors(3)
position <- 'topleft'
inset <- c(0.01,0.01)
lsize <- 0.7
#
# correct some known order problems with the data, and simplify the level label
levels3 <- c("addressed","corrected","neither")
levels(Q3.1) <- levels3
levels(Q3.2) <- levels3
levels(Q3.3) <- levels3
levels(Q3.4) <- levels3
levels(Q3.5) <- levels3
levels(Q3.6) <- levels3
levels(Q3.7) <- levels3

```

```

levels(Q3.8) <- levels3
levels(Q3.9) <- levels3
levels(Q3.10) <- levels3
levels(Q3.11) <- levels3
levels(Q3.12) <- levels3
levels(Q3.13) <- levels3
levels(Q3.14) <- levels3
levels(Q3.15) <- levels3
levels(Q3.16) <- levels3
levels(Q3.17) <- levels3
levels(Aff) <- c("COD", "COTH", "USF")
#

```

```

# plot_bar_all_9.R
# Plot composite results using barplot and 9 per page
# David Donnelly
# created: 8/15/2008
#
#
par(mfrow=c(3,3)) # 9 per page (any more makes them too small)
sfsmisc::mult.fig(9, main = "Wellness Survey Composite Response - Importance")
barplot(summary(as.factor(Q1.1)),main=qlab[1],xlab="")
barplot(summary(as.factor(Q1.2)),main=qlab[2],xlab="")
barplot(summary(as.factor(Q1.3)),main=qlab[3],xlab="")
barplot(summary(as.factor(Q1.4)),main=qlab[4],xlab="")
barplot(summary(as.factor(Q1.5)),main=qlab[5],xlab="")
barplot(summary(as.factor(Q1.6)),main=qlab[6],xlab="")
barplot(summary(as.factor(Q1.7)),main=qlab[7],xlab="")
barplot(summary(as.factor(Q1.8)),main=qlab[8],xlab="")
barplot(summary(as.factor(Q1.9)),main=qlab[9],xlab="")
sfsmisc::mult.fig(9, main = "Wellness Survey Composite Response - Importance")
barplot(summary(as.factor(Q1.10)),main=qlab[10],xlab="")
barplot(summary(as.factor(Q1.11)),main=qlab[11],xlab="")
barplot(summary(as.factor(Q1.12)),main=qlab[12],xlab="")
barplot(summary(as.factor(Q1.13)),main=qlab[13],xlab="")
barplot(summary(as.factor(Q1.14)),main=qlab[14],xlab="")
barplot(summary(as.factor(Q1.15)),main=qlab[15],xlab="")
barplot(summary(as.factor(Q1.16)),main=qlab[16],xlab="")
barplot(summary(as.factor(Q1.17)),main=qlab[17],xlab="")
par(mfrow=c(2,3)) # 6 per page for these so labels aren't lost
sfsmisc::mult.fig(6, main = "Wellness Survey Composite Response - Problem Status")
barplot(summary(na.omit(Q2.1)),main=qlab[1],xlab="")
barplot(summary(na.omit(Q3.1)),main=qlab[1],xlab="")
barplot(summary(na.omit(Q2.2)),main=qlab[2],xlab="")
barplot(summary(na.omit(Q3.2)),main=qlab[2],xlab="")
barplot(summary(na.omit(Q2.3)),main=qlab[3],xlab="")
barplot(summary(na.omit(Q3.3)),main=qlab[3],xlab="")
sfsmisc::mult.fig(6, main = "Wellness Survey Composite Response - Problem Status")
barplot(summary(na.omit(Q2.4)),main=qlab[4],xlab="")
barplot(summary(na.omit(Q3.4)),main=qlab[4],xlab="")
barplot(summary(na.omit(Q2.5)),main=qlab[5],xlab="")
barplot(summary(na.omit(Q3.5)),main=qlab[5],xlab="")
barplot(summary(na.omit(Q2.6)),main=qlab[6],xlab="")
barplot(summary(na.omit(Q3.6)),main=qlab[6],xlab="")
sfsmisc::mult.fig(6, main = "Wellness Survey Composite Response - Problem Status")
barplot(summary(na.omit(Q2.7)),main=qlab[7],xlab="")
barplot(summary(na.omit(Q3.7)),main=qlab[7],xlab="")
barplot(summary(na.omit(Q2.8)),main=qlab[8],xlab="")
barplot(summary(na.omit(Q3.8)),main=qlab[8],xlab="")
barplot(summary(na.omit(Q2.9)),main=qlab[9],xlab="")
barplot(summary(na.omit(Q3.9)),main=qlab[9],xlab="")
sfsmisc::mult.fig(6, main = "Wellness Survey Composite Response - Problem Status")
barplot(summary(na.omit(Q2.10)),main=qlab[10],xlab="")
barplot(summary(na.omit(Q3.10)),main=qlab[10],xlab="")
barplot(summary(na.omit(Q2.11)),main=qlab[11],xlab="")
barplot(summary(na.omit(Q3.11)),main=qlab[11],xlab="")
barplot(summary(na.omit(Q2.12)),main=qlab[12],xlab="")
barplot(summary(na.omit(Q3.12)),main=qlab[12],xlab="")
sfsmisc::mult.fig(6, main = "Wellness Survey Composite Response - Problem Status")
barplot(summary(na.omit(Q2.13)),main=qlab[13],xlab="")
barplot(summary(na.omit(Q3.13)),main=qlab[13],xlab="")
barplot(summary(na.omit(Q2.14)),main=qlab[14],xlab="")
barplot(summary(na.omit(Q3.14)),main=qlab[14],xlab="")

```



```

barplot(summary(na.omit(Q2.15)),main=qlab[15],xlab="")
barplot(summary(na.omit(Q3.15)),main=qlab[15],xlab="")
sfsmisc::mult.fig(6, main = "Wellness Survey Composite Response - Problem Status")
barplot(summary(na.omit(Q2.16)),main=qlab[16],xlab="")
barplot(summary(na.omit(Q3.16)),main=qlab[16],xlab="")
barplot(summary(na.omit(Q2.17)),main=qlab[17],xlab="")
barplot(summary(na.omit(Q3.17)),main=qlab[17],xlab="")
par(mfrow=c(1,1)) # restore plot frame
#

```

```

# KW1.R
# Kruskal-Wallis for question 1
# David Donnelly
# created: 8/15/2008
#
# for Q1, use Kruskal-Wallis rank sum test since we're dealing with ordinal numbers from
a Likert scale
kr1 <- kruskal.test(Q1.1,Aff)
kr2 <- kruskal.test(Q1.2,Aff)
kr3 <- kruskal.test(Q1.3,Aff)
kr4 <- kruskal.test(Q1.4,Aff)
kr5 <- kruskal.test(Q1.5,Aff)
kr6 <- kruskal.test(Q1.6,Aff)
kr7 <- kruskal.test(Q1.7,Aff)
kr8 <- kruskal.test(Q1.8,Aff)
kr9 <- kruskal.test(Q1.9,Aff)
kr10 <- kruskal.test(Q1.10,Aff)
kr11 <- kruskal.test(Q1.11,Aff)
kr12 <- kruskal.test(Q1.12,Aff)
kr13 <- kruskal.test(Q1.13,Aff)
kr14 <- kruskal.test(Q1.14,Aff)
kr15 <- kruskal.test(Q1.15,Aff)
kr16 <- kruskal.test(Q1.16,Aff)
kr17 <- kruskal.test(Q1.17,Aff)
krall <-
rbind(kr1,kr2,kr3,kr4,kr5,kr6,kr7,kr8,kr9,kr10,kr11,kr12,kr13,kr14,kr15,kr16,kr17)
kr <-
rbind(kr1$p.value,kr2$p.value,kr3$p.value,kr4$p.value,kr5$p.value,kr6$p.value,kr7$p.value
,kr8$p.value,kr9$p.value,kr10$p.value,kr11$p.value,kr12$p.value,kr13$p.value,kr14$p.value
,kr15$p.value,kr16$p.value,kr17$p.value)

```

```

# FE2.R
# Fisher's exact test for question 2
# David Donnelly
# created: 8/15/2008
#
# for Q2, use Fisher's exact test- more accurate than Chi-squared or G-test (log-
likelihood)
fisher.test(Q2.1,Aff)
fisher.test(Q2.2,Aff)
fisher.test(Q2.3,Aff)
fisher.test(Q2.4,Aff)
fisher.test(Q2.5,Aff)
fisher.test(Q2.6,Aff)
fisher.test(Q2.7,Aff)
fisher.test(Q2.8,Aff)
fisher.test(Q2.9,Aff)
fisher.test(Q2.10,Aff)
fisher.test(Q2.11,Aff)
fisher.test(Q2.12,Aff)
fisher.test(Q2.13,Aff)
fisher.test(Q2.14,Aff)
fisher.test(Q2.15,Aff)
fisher.test(Q2.16,Aff)
fisher.test(Q2.17,Aff)
#

```

```

# FE3.R
# Fisher's exact test for question 3
# David Donnelly
# created: 8/15/2008
#
# for Q3, use Fisher's exact test- more accurate than Chi-squared or G-test (log-
likelihood)
fisher.test(Q3.1,Aff)
fisher.test(Q3.2,Aff)
fisher.test(Q3.3,Aff)
fisher.test(Q3.4,Aff)
fisher.test(Q3.5,Aff)
fisher.test(Q3.6,Aff)
fisher.test(Q3.7,Aff)
fisher.test(Q3.8,Aff)
fisher.test(Q3.9,Aff)
fisher.test(Q3.10,Aff)
fisher.test(Q3.11,Aff)
fisher.test(Q3.12,Aff)
fisher.test(Q3.13,Aff)
fisher.test(Q3.14,Aff)
fisher.test(Q3.15,Aff)
fisher.test(Q3.16,Aff)
fisher.test(Q3.17,Aff)
#

```

```

# plot_bar_aff_9_a.R
# Plot results by affiliation using barplot and 9 per page
# plots put affiliation results side by side
# David Donnelly
# created: 8/15/2008
# plot barcharts
#
# setup postscript driver- unable to setup pdf driver with portrait orientation
postscript("survey1.byAff.eps",horizontal=FALSE)
# page 1
par(mfrow=c(3,3)) # 9 per page (any more makes them too small)
sfsmisc::mult.fig(9, main = "Wellness Survey Response by Affiliation")
#
barplot(table(Q1.1,Aff),beside=T,ylab=qlab[1])
legend(position,label1,fill=colors1,inset=inset,cex=lsize)
barplot(table(Q2.1,Aff),beside=T)
legend(position,label2,fill=colors2,inset=inset,cex=lsize)
barplot(table(Q3.1,Aff),beside=T)
legend(position,label3,fill=colors3,inset=inset,cex=lsize)
barplot(table(Q1.2,Aff),beside=T,ylab=qlab[2])
barplot(table(Q2.2,Aff),beside=T)
barplot(table(Q3.2,Aff),beside=T)
barplot(table(Q1.3,Aff),beside=T,xlab=xlab1,ylab=qlab[3])
barplot(table(Q2.3,Aff),beside=T,xlab=xlab2)
barplot(table(Q3.3,Aff),beside=T,xlab=xlab3)
#
# page 2
par(mfrow=c(3,3)) # 9 per page (any more makes them too small)
sfsmisc::mult.fig(9, main = "Wellness Survey Response by Affiliation")
#
barplot(table(Q1.4,Aff),beside=T,ylab=qlab[4])
legend(position,label1,fill=colors1,inset=inset,cex=lsize)
barplot(table(Q2.4,Aff),beside=T)
legend(position,label2,fill=colors2,inset=inset,cex=lsize)
barplot(table(Q3.4,Aff),beside=T)
legend(position,label3,fill=colors3,inset=inset,cex=lsize)
barplot(table(Q1.5,Aff),beside=T,ylab=qlab[5])
barplot(table(Q2.5,Aff),beside=T)
barplot(table(Q3.5,Aff),beside=T)
barplot(table(Q1.6,Aff),beside=T,xlab=xlab1,ylab=qlab[6])
barplot(table(Q2.6,Aff),beside=T,xlab=xlab2)
barplot(table(Q3.6,Aff),beside=T,xlab=xlab3)

```

```

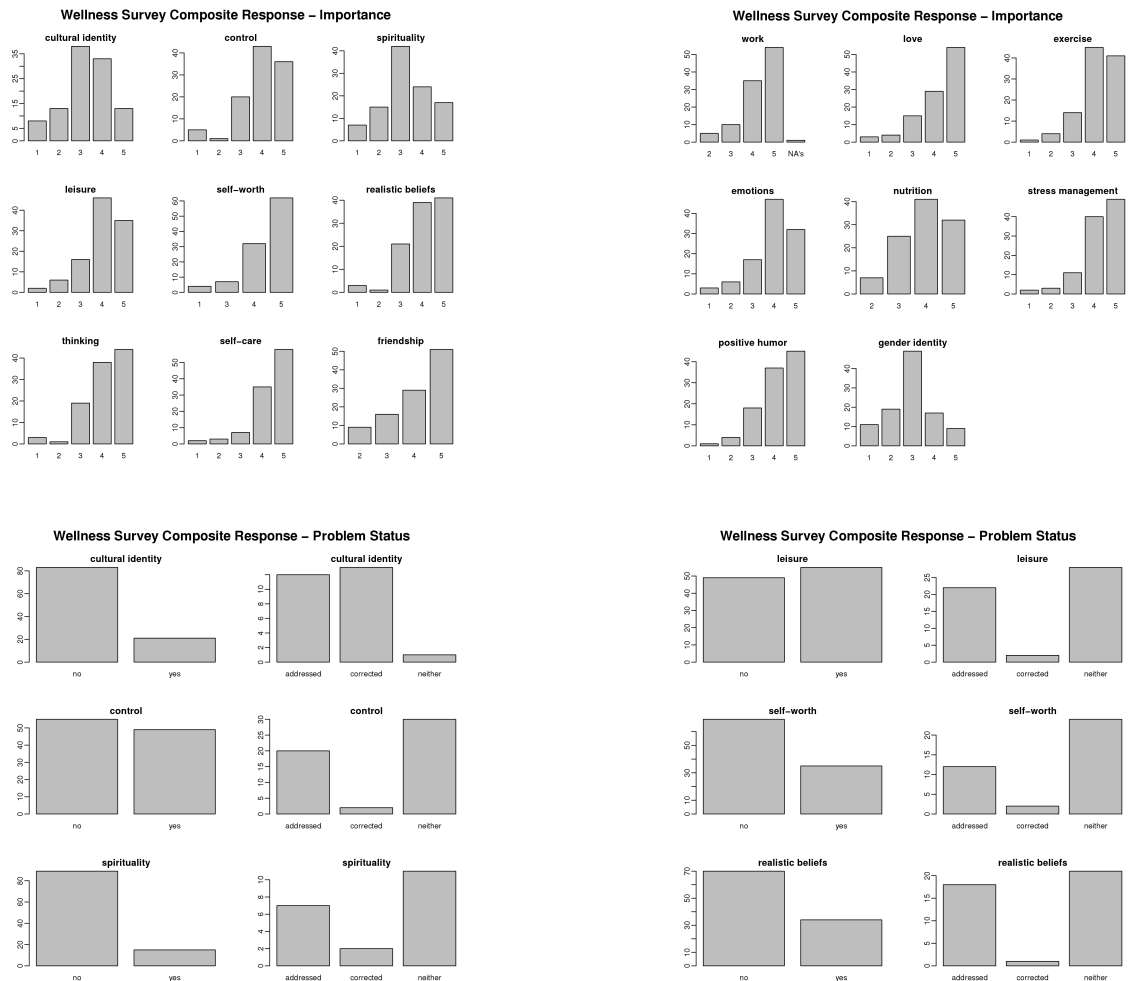
#
# page 3
par(mfrow=c(3,3)) # 9 per page (any more makes them too small)
sfsmisc::mult.fig(9, main = "Wellness Survey Response by Affiliation")
#
barplot(table(Q1.7,Aff),beside=T,ylab=qlab[7])
legend(position,label1,fill=colors1,inset=inset,cex=lsize)
barplot(table(Q2.7,Aff),beside=T)
legend(position,label2,fill=colors2,inset=inset,cex=lsize)
barplot(table(Q3.7,Aff),beside=T)
legend(position,label3,fill=colors3,inset=inset,cex=lsize)
barplot(table(Q1.8,Aff),beside=T,ylab=qlab[8])
barplot(table(Q2.8,Aff),beside=T)
barplot(table(Q3.8,Aff),beside=T)
barplot(table(Q1.9,Aff),beside=T,xlab=xlab1,ylab=qlab[9])
barplot(table(Q2.9,Aff),beside=T,xlab=xlab2)
barplot(table(Q3.9,Aff),beside=T,xlab=xlab3)
#
# page 4
par(mfrow=c(3,3)) # 9 per page (any more makes them too small)
sfsmisc::mult.fig(9, main = "Wellness Survey Response by Affiliation")
#
barplot(table(Q1.10,Aff),beside=T,ylab=qlab[10])
legend(position,label1,fill=colors1,inset=inset,cex=lsize)
barplot(table(Q2.10,Aff),beside=T)
legend(position,label2,fill=colors2,inset=inset,cex=lsize)
barplot(table(Q3.10,Aff),beside=T)
legend(position,label3,fill=colors3,inset=inset,cex=lsize)
barplot(table(Q1.11,Aff),beside=T,ylab=qlab[11])
barplot(table(Q2.11,Aff),beside=T)
barplot(table(Q3.11,Aff),beside=T)
barplot(table(Q1.12,Aff),beside=T,xlab=xlab1,ylab=qlab[12])
barplot(table(Q2.12,Aff),beside=T,xlab=xlab2)
barplot(table(Q3.12,Aff),beside=T,xlab=xlab3)
#
# page 5
par(mfrow=c(3,3)) # 9 per page (any more makes them too small)
sfsmisc::mult.fig(9, main = "Wellness Survey Response by Affiliation")
#
barplot(table(Q1.13,Aff),beside=T,ylab=qlab[13])
legend(position,label1,fill=colors1,inset=inset,cex=lsize)
barplot(table(Q2.13,Aff),beside=T)
legend(position,label2,fill=colors2,inset=inset,cex=lsize)
barplot(table(Q3.13,Aff),beside=T)
legend(position,label3,fill=colors3,inset=inset,cex=lsize)
barplot(table(Q1.14,Aff),beside=T,ylab=qlab[14])
barplot(table(Q2.14,Aff),beside=T)
barplot(table(Q3.14,Aff),beside=T)
barplot(table(Q1.15,Aff),beside=T,xlab=xlab1,ylab=qlab[15])
barplot(table(Q2.15,Aff),beside=T,xlab=xlab2)
barplot(table(Q3.15,Aff),beside=T,xlab=xlab3)
#
# page 6
par(mfrow=c(3,3)) # 9 per page (any more makes them too small)
sfsmisc::mult.fig(9, main = "Wellness Survey Response by Affiliation")
#
barplot(table(Q1.16,Aff),beside=T,ylab=qlab[16])
legend(position,label1,fill=colors1,inset=inset,cex=lsize)
barplot(table(Q2.16,Aff),beside=T)
legend(position,label2,fill=colors2,inset=inset,cex=lsize)
barplot(table(Q3.16,Aff),beside=T)
legend(position,label3,fill=colors3,inset=inset,cex=lsize)
barplot(table(Q1.17,Aff),beside=T,ylab=qlab[17])
barplot(table(Q2.17,Aff),beside=T)
barplot(table(Q3.17,Aff),beside=T)
#

```

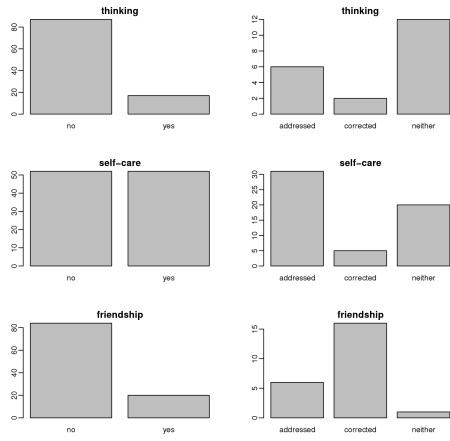
The complete listing of survey1.all.out is too wide to fit within the confines of this space, so a small section of the listing is provided for reference. The complete results in graphical form are provided in the section following this one.

Q1.1		Q1.2		Q1.3		Q1.4	
Min.	:1.000	Min.	:1.000	Min.	:1.000	Min.	:1.000
1st Qu.	:3.000	1st Qu.	:4.000	1st Qu.	:3.000	1st Qu.	:4.000
Median	:3.000	Median	:4.000	Median	:3.000	Median	:4.000
Mean	:3.286	Mean	:3.990	Mean	:3.276	Mean	:4.010
3rd Qu.	:4.000	3rd Qu.	:5.000	3rd Qu.	:4.000	3rd Qu.	:5.000
Max.	:5.000	Max.	:5.000	Max.	:5.000	Max.	:5.000

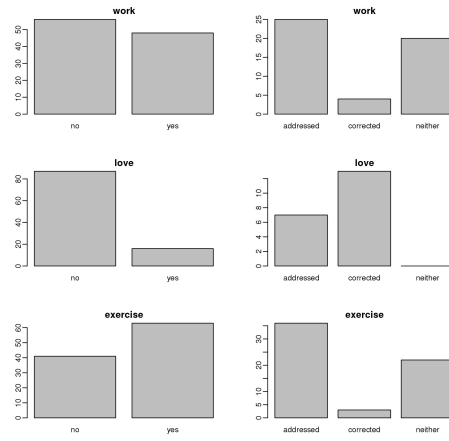
The script was designed to produce PDF output for inclusion with a LaTeX-based file-creation system. The output file was converted to scalable vector graphics (SVG) format to include within this document as image files. Using the open-source program Inkscape, it is as easy as opening the PDF file, selecting the page to import, then saving as plain SVG format. Each image is one page from the eight page output file. The following are plots of all responses aggregated across the three response groups.



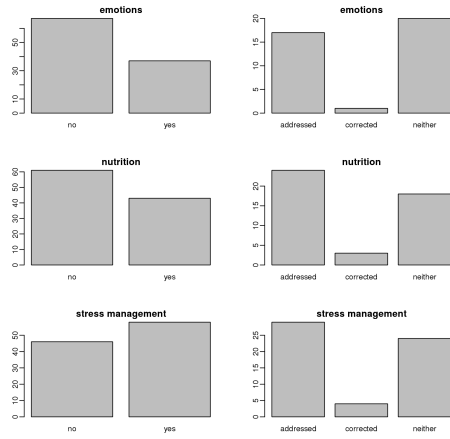
Wellness Survey Composite Response – Problem Status



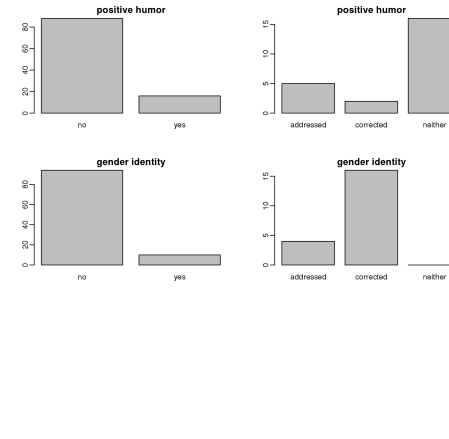
Wellness Survey Composite Response – Problem Status



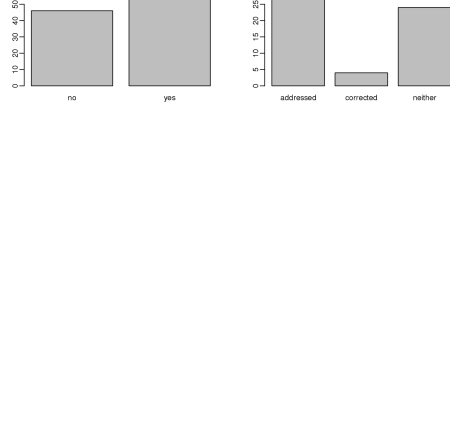
Wellness Survey Composite Response – Problem Status



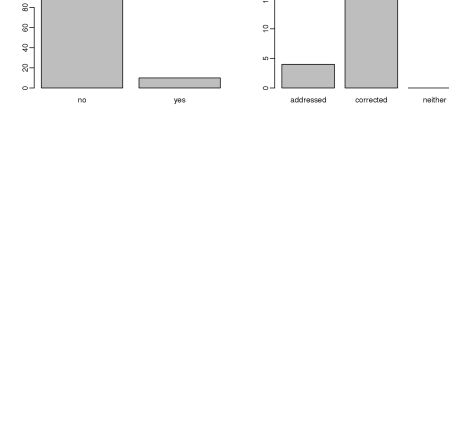
Wellness Survey Composite Response – Problem Status



Wellness Survey Composite Response – Problem Status

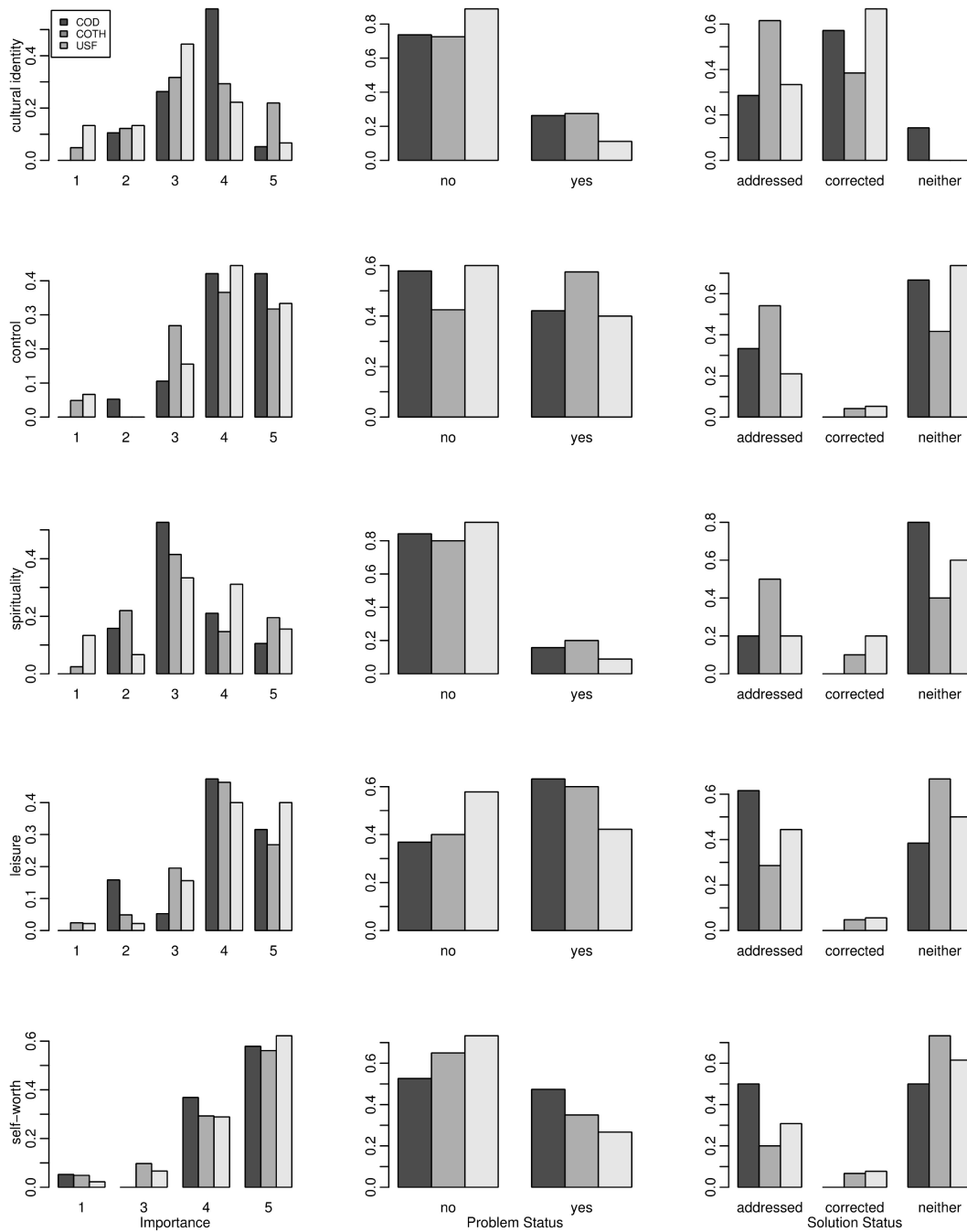


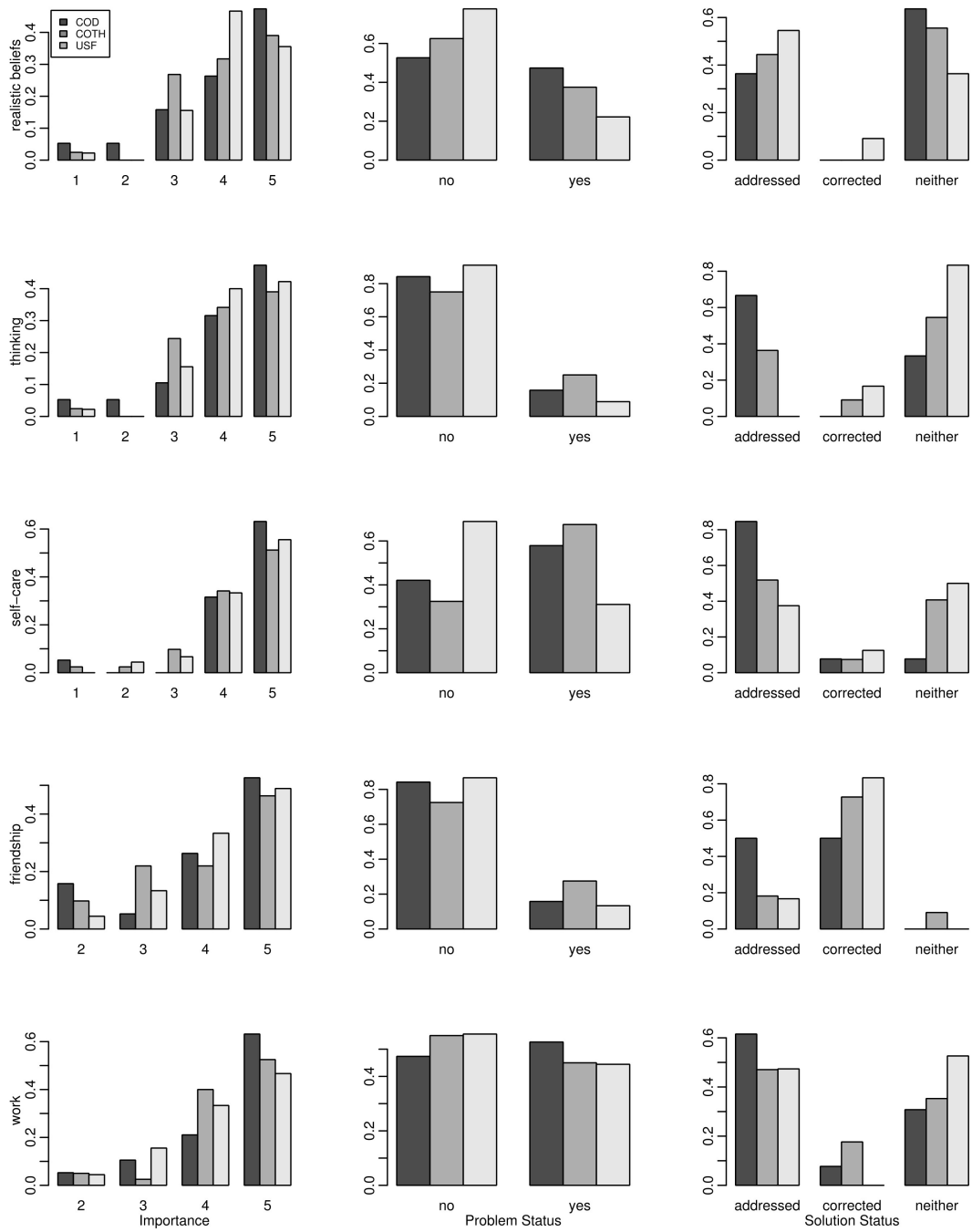
Wellness Survey Composite Response – Problem Status

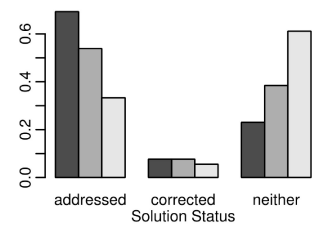
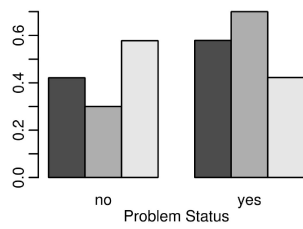
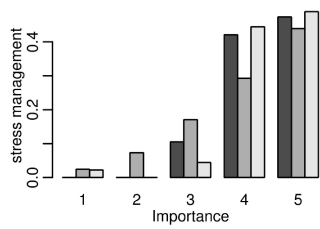
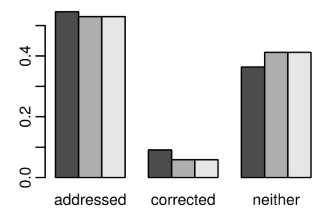
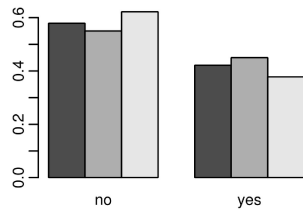
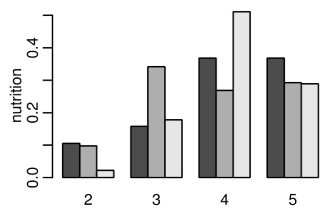
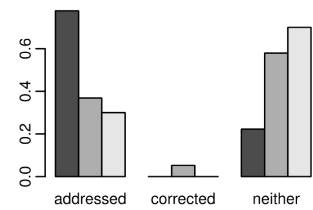
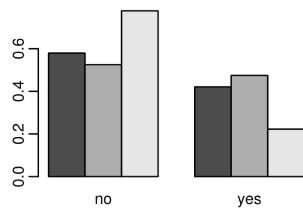
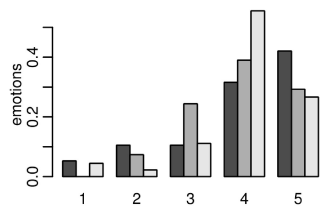
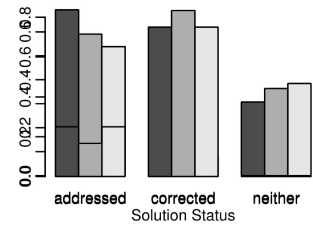
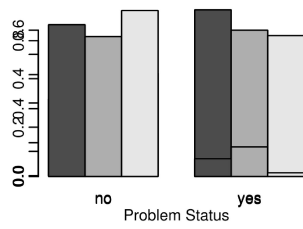
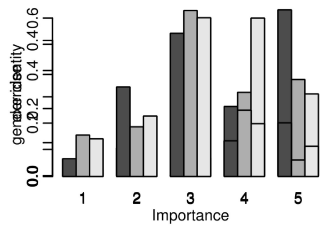
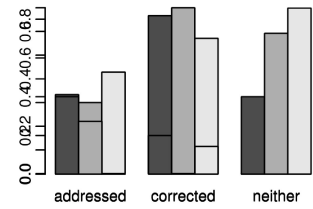
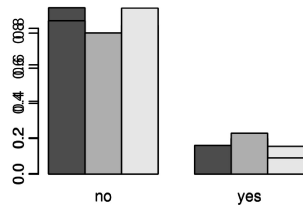
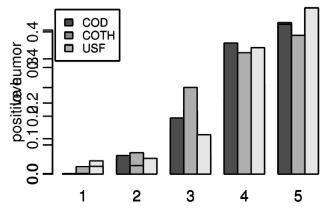


The following are plots of all responses by affiliation with the three response groups.

Wellness Survey Response by Affiliation







Appendix I: Phase 2 Implementation Templates and Scripts

Bottle templates are called from the main routing program, which in this implementation was served by Apache2 using WSGI.

```
# Filename: avatar.wsgi
# Author: David Donnelly
# Created: 2011-07-07
# Modified: 2011-07-18 dsd dropped bottle.sqlite plugin
#
# bottle microframework implementation of the AVATAR application
# developed using the built-in local server and uses sqlite3 db
# intended for deployment on servers using Apache and mod_wsgi
#####

import os,sys,bottle,sqlite3,time
ver = sys.version

# wsgi hook for deploying with apache
def application(environ, start_response):
    return bottle.default_app().wsgi(environ,start_response)

# add the current directory to the path
cmd_folder = os.path.dirname(os.path.abspath(__file__))
if cmd_folder not in sys.path:
    sys.path.insert(0, cmd_folder)

# Change working directory so relative paths (and template lookup) work again
os.chdir(os.path.dirname(__file__))

from bottle import route, run, install, template, request, validate, error, static_file,
debug, get, post, request

# the following permits catching python errors in apache logs
bottle.app().catchall = False

# route support for error handling
@error(403)
def mistake403(code):
    return 'The parameter you passed has the wrong format!'
@error(404)
def mistake404(code):
    return 'Sorry, this page does not exist!'

# Main method for local development
# do not use bottle.run() with apache!
if __name__ == "__main__":
    # debug(True)
    # run(reloader=True)

# routing to serve static files (css, js, images) for development server
#@route('/static/css/:filename')
#def server_css(filename):
#    return static_file(filename, root='static/css')
#@route('/static/images/:filename')
#def server_images(filename):
#    return static_file(filename, root='static/images')
#@route('/static/video/:filename')
#def server_video(filename):
#    return static_file(filename, root='static/video')

#####
# static filenames
# video clips
vid_info = (
    '/static/video',
    '/vignette-1',
    '/vignette-2',
    '/vignette-3',
    '/vignette-4',
```

```

'/vignette-5'
)

#####
# the base address will launch the splash introduction collage
@route('/')
def intro():
    return template('intro.tpl')

# after the introductory scenes, the information page will be presented
@route('/info')
def info():
    return template('info.tpl')

#####
# route to run through the video vignette section
@route('/vignette/:id#[0-5]#')
def vignette(id):
    return template('vignette.tpl', result=id, vid_info=vid_info)

#####
# route to click through the scenario section
# using a database to store all the content
@route('/scenario/:id#[0-5]#')
def scenario(id):
    if request.GET.get('choices','').strip():
        choice = request.GET.get('choices','').strip()

        conn = sqlite3.connect('avatar.db')
        c = conn.cursor()
        if choice == 'Choice1':
            c.execute("SELECT id, feedback, choice1_image FROM scene WHERE id LIKE ?",
(id))
        else:
            c.execute("SELECT id, feedback, choice2_image FROM scene WHERE id LIKE ?",
(id))

        row = c.fetchone()
        c.close()
        return template('scenario_response', result=row)

    else:
        conn = sqlite3.connect('avatar.db')
        c = conn.cursor()
        c.execute("SELECT id, question, response1, response2, scene_image FROM scene
WHERE id LIKE ?", (id))
        row = c.fetchone()
        c.close()
        return template('scenario', result=row)

# route to handle the feedback for the scenarios using the same database
# to store the content; requires separate route due to different template
#@route('/scenario/:id#[1-5]#', method='POST')
#def response(id):
#    choice = request.GET.get('choices')
#    conn = sqlite3.connect('avatar.db')
#    c = conn.cursor()
#    c.execute("SELECT id, feedback FROM scene WHERE id LIKE ?", (id))
#    row = c.fetchone()
#    c.close()
#    return template('scenario_response', result=row, choice=choice)

#####
# routing for wellness knowledgebase
#
# setup global variables for page navigation
# The following nav mapping includes user-friendly URL 'slugs'; they have no
# bearing on the actual navigation, which uses the preceding number, but could
# impact how the user perceives the site.
#
nav_menu = (
'/wellness/0/menu',
'/wellness/1/creative-self',
'/wellness/6/thinking',
'/wellness/7/emotions',

```

```

'/wellness/8/control',
'/wellness/9/work',
'/wellness/10/positive-humor',
'/wellness/2/coping-self',
'/wellness/11/leisure',
'/wellness/12/stress-management',
'/wellness/13/self-worth',
'/wellness/14/realistic-beliefs',
'/wellness/3/social-self',
'/wellness/15/friendship',
'/wellness/16/love',
'/wellness/4/essential-self',
'/wellness/17/spiritual',
'/wellness/18/gender-identity',
'/wellness/19/cultural-identity',
'/wellness/20/self-care',
'/wellness/5/physical-self',
'/wellness/21/exercise',
'/wellness/22/nutrition',
'/wellness/29/about'
)
#
# may not use this, but here are python dictionaries for the five factors
# since I can't find a way to pull variables out of the database, I may have
# to resort to coding page links in this way and tie to nav_menu above.
IS_factors = (
'Home',
'Creative Self', 'Thinking', 'Emotions', 'Control', 'Work', 'Positive Humor',
'Coping Self', 'Leisure', 'Stress Management', 'Self-Worth', 'Realistic Beliefs',
'Social Self', 'Friendship', 'Love',
'Essential Self', 'Spirituality', 'Gender Identity', 'Cultural Identity', 'Self-Care',
'Physical Self', 'Exercise', 'Nutrition',
'About'
)
#
# these could be extended to build submenus for each of the subfactors
#

# route to manage all the educational content; uses a separate database table
# due to requiring a different structure
# routes on just the number or number + slug, even though slug is not use
# in the actual routing... it's just there for the user experience
# the order is important; if the base route (with id only) is placed first,
# calling id+slug produces an error
@route('/wellness/:id#[0-9]+#/:slug')
@route('/wellness/:id#[0-9]+#')
def wellness(id,slug=""):
    conn = sqlite3.connect('avatar.db')
    c = conn.cursor()
    c.execute("SELECT id, title, slug, content, last, next FROM wellness WHERE id
LIKE ?", [id])
# have to use [id] instead of (id) when more than one character, else crashes
    row = c.fetchone()
    c.close()
    return template('wellness', result=row, nav_menu=nav_menu, menu_name=IS_factors)
#     return str(row)

#####
# the following provide support for database management
# using the web browser; should help make corrections etc.
# easier after deployment

@route('/showscene')
def db_list1():
    conn = sqlite3.connect('avatar.db')
    c = conn.cursor()
    c.execute("SELECT id, question, response1, response2, image, feedback FROM scene")
    result = c.fetchall()
    c.close()
    return template('make_table', rows=result)

@route('/item:item#[1-5]#')
def show_item(item):
    conn = sqlite3.connect('avatar.db')
    c = conn.cursor()
    c.execute("SELECT question FROM scene WHERE id LIKE ?", (item))
    result = c.fetchall()

```

```

        c.close()
        if not result:
            return 'This item number does not exist!'
        else:
            return 'Question: %s' %result[0]

@route('/showwellness')
def db_list2():
    conn = sqlite3.connect('avatar.db')
    c = conn.cursor()
    c.execute("SELECT id, title, slug, content, last, next FROM wellness")
    result = c.fetchall()
    c.close()
    return template('make_table', rows=result)

@route('/newwellness', method='GET')
def new_item():
    if request.GET.get('save','').strip():
        new_title = request.GET.get('title','').strip()
        conn = sqlite3.connect('avatar.db')
        c = conn.cursor()
        c.execute("INSERT INTO wellness (title, slug, content) VALUES (?,?/?)",
("test", "", ""))
        new_id = c.lastrowid
        conn.commit()
        c.close()
        return '<p>The new content was inserted into the wellness database, the ID is
%s</p>' % new_id
    else:
        return template('new_task.tpl')

@route('/edit/:id#[0-9]+#', method='GET')
@validate(id=int)
def edit_item(id):
    if request.GET.get('save','').strip():
        edit_title = request.GET.get('title','').strip()
        edit_slug = request.GET.get('slug','').strip()
        edit_content = request.GET.get('content','').strip()
        edit_last = request.GET.get('last','').strip()
        edit_next = request.GET.get('next','').strip()
        conn = sqlite3.connect('avatar.db')
        c = conn.cursor()
        c.execute("UPDATE wellness SET title = ?, slug = ?, content = ?, last = ?, next
= ? WHERE id LIKE ?", (edit_title, edit_slug, edit_content, edit_last, edit_next, id))
        conn.commit()
        return '<p>The item number %s was successfully updated</p>' % id
    else:
        conn = sqlite3.connect('avatar.db')
        c = conn.cursor()
        c.execute("SELECT id, title, slug, content, last, next FROM wellness WHERE id
LIKE ?", [id])
        curr_data = c.fetchone()
        return template('edit_task', old = curr_data)

```

```

<!doctype html>
<!--

```

```

    Filename: layout.tpl
    Author: David Donnelly
    Created: 2011-06-20
    Modified:

```

This is the basic layout used in all views for the AVATAR application. It is incorporated with other views, to reduce redundant scripting. This basic view provides placeholders for the title, a container for the screen view, the header at the top of the screen, and links for basic CSS files. It is also the place for setting up the necessary CSS files, which may have to change for different browsers.

Note - require doctype before comments, else IE goes into quirksmode
-->

```

%av_doc_home = ""
%av_css_home = av_doc_home + "/static/css"
%av_css_fname1 = av_css_home + "/reset-min.css"
%av_css_fname2 = av_css_home + "/base-min.css"

```

```

%av_css_fname3 = av_css_home + "/AVATAR_styles.css"

<head>
  <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
  <title>AVATAR</title>
  <style type="text/css">
    a { text-decoration:none }
  </style>

  <!-- CSS style sheets: reset all, add basic setup, add custom setup -->
  <link rel="stylesheet" type="text/css" href={{av_css_fname1}} />
  <link rel="stylesheet" type="text/css" href={{av_css_fname2}} />
  <link rel="stylesheet" type="text/css" href={{av_css_fname3}} />

</head>

<body>
  <div id="header">
    <div id="title">
      <h1><a href="/" title="AVATAR">AVATAR</a></h1>
      <h2>Access Viable Alternatives To Achieve Resilience</h2>
    </div>
  </div>

  <div id="container">
    %include
  </div>
</body>
</html>

```

```

<!doctype html>
<!--
  Filename: intro.tpl
  Author: David Donnelly
  Created: 2011-10-03
  Modified:

This is just to launch the introductory video clips.

Note - require doctype before comments, else IE goes into quirksmode
-->

```

```

%av_doc_home = ""
%av_css_home = av_doc_home + "/static/css"
%av_css_fname1 = av_css_home + "/reset-min.css"
%av_css_fname2 = av_css_home + "/base-min.css"
%av_css_fname3 = av_css_home + "/video.css"

%fname = "/static/video/avatar_intro"
%vid_fname1=fname+".mp4"
%vid_fname2=fname+".ogv"
%vid_fname3=fname+".webm"
%vid_fname4=fname+".flv"
%swf_fname="/static/video/player.swf"
%nextref="/info"

<head>
  <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
  <title>AVATAR</title>
  <style type="text/css">
    a { text-decoration:none }
  </style>

  <!-- CSS style sheets: reset all, add basic setup, add custom setup -->
  <link rel="stylesheet" type="text/css" href={{av_css_fname1}} />
  <link rel="stylesheet" type="text/css" href={{av_css_fname2}} />
  <link rel="stylesheet" type="text/css" href={{av_css_fname3}} />

</head>

<body>
  <div id="container">

```

```

        <div class="largeTextbox" id="video_content">
            <video width="800" controls="true" autoplay="true" >
                <source src="{{vid_fname1}}" type="video/mp4" />
                <source src="{{vid_fname2}}" type="video/ogg" />
                <source src="{{vid_fname3}}" type="video/webm" />
                <object width="800" height="600" type="application/x-shockwave-
flash" data="{{swf_fname}}">
                    <param name="movie" value="{{swf_fname}}"/>
                    <param name="flashvars"
value="autostart=true&amp;controlbar=over&amp;file={{vid_fname4}}"/>
                </object>
            </video>
        </div>

        <div id="footer">
            <div id="nav1" class="footoff">
                <a href=" " title=" " ></a>
            </div>
            <div id="nav2" class="footnav">
                <a href={{nextref}} title="Next">next</a>
            </div>
        </div>
    </div>
</body>
</html>

```

```

<!--
Filename: info.tpl
Author: David Donnelly
Created: 2011-06-20
Modified: 2011-10-03 changed name from 'index' to 'info'

```

```

This is the screen layout for the main/start page for the AVATAR application.
It provides basic information and nominal navigation help.
-->

```

```

%rebase avatar_layout

```

```

<!-- navigation is simple and fixed for this page -->
%backnav="footoff"
%backref="/info"
%nextnav="footnav"
%nextref="/vignette/0"

```

```

        <div id="progress">
        </div>

        <div class="largeTextbox" id="full">
            <p class="section_title">Welcome to AVATAR!</p>
            <p>This program has been designed to provide physicians with tools for
improving personal wellness. Developed around the Indivisible Self empirical model of
wellness, AVATAR has been specifically created for physicians, using the collaborative
talents of instructional designers, I/O psychologists, and physicians.</p>
            <p>Navigation is straightforward: Next and Back buttons will be green-lit
when forward and back navigation is available. When the knowledge base is reached, a menu
will appear to simplify access to the various sections. If you need additional help, or
have any questions regarding the application, the web developer will accept all inquiries
at ddonnell@mail.usf.edu.</p>
        </div>

        <div id="footer">
            <div id="nav1" class={{backnav}}>
                <a href={{backref}} title="Back">back</a>
            </div>
            <div id="nav2" class={{nextnav}}>
                <a href={{nextref}} title="Next">next</a>
            </div>
        </div>

```

```

<!--
Filename: vignette.tpl
Author: David Donnelly
Created: 2011-06-22
Modified:

This is the screen layout for the vignettes shown in the AVATAR application.
It includes all the information from the base page, and sets up a central area
for displaying the vignette videos. As the intent is to just move through them,
there is no need for user navigation expected.
-->
%rebase avatar_layout

%doc_home = ""
%img_home = doc_home + "/static/images"

%id = int(result)
%nextid = id+1
%lastid = id-1

%fname = vid_info[0] + vid_info[id]
%vid_fname1=fname+".mp4"
%vid_fname2=fname+".ogv"
%vid_fname3=fname+".webm"
%vid_fname4=fname+".flv"
%swf_fname="/static/video/player.swf"

<!-- set navigation the same for all vignettes -->
%backnav=nextnav="footnav"
%backref="/vignette/"+ str(lastid)
%nextref="/vignette/"+ str(nextid)
<!-- now change backnav/ref for the first, nextref for the last -->
%if id == 0:
%   backref="/info"
%elif id == 5:
%   nextref="/scenario/0"
%end

    <div id="progress">

    </div>

    %if id == 0:
    <div class="largeTextbox" id="full">
        <p class="section_title">Looking Back</p>
        
        <p>Let me take you on a journey...</p>
        <p>The situations depicted, and the consequences that result, are not
uncommon for those in our profession.</p>
    </div>
    %else:
    <div class="largeTextbox" id="video_content">
        <video width="800" controls="true" autoplay="true" >
            <source src="{{vid_fname1}}" type="video/mp4" />
            <source src="{{vid_fname2}}" type="video/ogg" />
            <source src="{{vid_fname3}}" type="video/webm" />

            <object width="800" height="600" type="application/x-shockwave-
flash" data="{{swf_fname}}">
                <param name="movie" value="{{swf_fname}}" />
                <param name="flashvars"
value="autostart=true&amp;controlbar=over&amp;file={{vid_fname4}}" />
            </object>
        </video>
    </div>
    %end

    <div id="footer">
        <div id="nav1" class={{backnav}}>

```

```

        <a href={{backref}} title="Back">back</a>
    </div>
    <div id="nav2" class={{nextnav}}>
        <a href={{nextref}} title="Next">next</a>
    </div>
</div>

```

```
<!--
```

```

Filename: scenario.tpl
Author: David Donnelly
Created: 2011-06-22
Modified:

```

```

This is the screen layout for the scenarios shown in the AVATAR application.
It includes all the information from the base page, and sets up several areas
for the scenario question, responses, and an area for an image of some kind.
Selecting a response is the only navigation included.
-->

```

```
%rebase avatar_layout
```

```

%id = int(result[0])
%nextid = id+1
%lastid = id-1

```

```

%doc_home = ""
%img_home = doc_home + "/static/images/"
%rounext="/scenario/response/"+str(id)

```

```
<!-- set navigation for all scenarios -->
```

```

%if id == 0:
%   backnav=nextnav="footnav"
%   backref="/vignette/0"
%   nextref="/scenario/1"
%else:
%   backnav="footnav"
%   backref="/scenario/"+ str(lastid)
%   nextnav="footoff"
%   nextref="/scenario/"+ str(id)
%end

```

```

    <div id="progress">
    </div>

```

```

%if id == 0:
    <div class="largeTextbox" id="full">
        <p class="section_title">Daily Choices</p>
        {{!result[1]}}
    </div>
%else:
    <div id="scene_image">
        %fname=img_home+result[4]
        <img src={{fname}} alt={{fname}} width=100% />
    </div>

    <div class="largeTextbox" id="scene_question">
        {{!result[1]}}
    </div>

    <div class="largeTextbox" id="choice1">
        <form action="/scenario/{{id}}" method="get">
            <input type="submit" name="choices" value="Choice1">
        </form>
        {{!result[2]}}
    </div>

    <div class="largeTextbox" id="choice2">
        <form action="/scenario/{{id}}" method="get">
            <input type="submit" name="choices" value="Choice2">
        </form>
        {{!result[3]}}
    </div>
%end
<div id="footer">

```



```

        <div id="nav1" class={{backnav}}>
            <a href={{backref}} title="Back">back</a>
        </div>
        <div id="nav2" class={{nextnav}}>
            <a href={{nextref}} title="Next">next</a>
        </div>
    </div>

```

```

<!--
Filename: response_page.tpl
Author: David Donnelly
Created: 2011-06-22
Modified: 2011-10-03 added footer for continuity

```

This is the screen layout for the scenario responses in the AVATAR application. It includes all the information from the base page, and sets up a central area for displaying the responses. The user will land here after choosing a scenario option, and feedback information will be provided. Only 'forward' nav will be provided, to go on to the next scenario or next section. If some bug occurs, it will route back to the beginning of the application

```

-->

%rebase avatar_layout

%doc_home = ""
%img_home = doc_home + "/static/images/"

%id = int(result[0])
%nextid = id+1
%lastid = id-1
%backnav="footoff"
%backref="/response/"+ str(id)
%nextnav="footnav"
%if id < 5:
%   nextref="/scenario/"+ str(nextid)
%elif id == 5:
%   nextref="/wellness/0/menu"
%else:
%   nextref="/"
%end

    <div id="progress">
    </div>

    <div class="largeTextbox" id="full">
        %fname=img_home+result[2]
        <img src={{fname}} alt={{fname}} width=30% align="left"/>
        {{!result[1]}}
    </div>

    <div id="footer">
        <div id="nav1" class={{backnav}}>
            <a href={{backref}} title="Back">back</a>
        </div>
        <div id="nav2" class={{nextnav}}>
            <a href={{nextref}} title="Next">next</a>
        </div>
    </div>

```

```

<!--
Filename: wellness.tpl
Author: David Donnelly
Created: 2011-07-02
Modified:

```

This is the screen layout for the knowledge section of the AVATAR application. It includes all the information from the base page, adds a menu on the left, nav buttons on bottom (back/next within sections), and a large content area.

```

-->
%rebase avatar_layout

```

```

<div id="navigation">
  <ul class="top-level">
    <li><a href={nav_menu[0]} >{menu_name[0]}</a></li>
    <li><a href={nav_menu[1]} >{menu_name[1]}</a>
      <ul class="sub-level">
        <li><a href={nav_menu[2]} >{menu_name[2]}</a></li>
        <li><a href={nav_menu[3]} >{menu_name[3]}</a></li>
        <li><a href={nav_menu[4]} >{menu_name[4]}</a></li>
        <li><a href={nav_menu[5]} >{menu_name[5]}</a></li>
        <li><a href={nav_menu[6]} >{menu_name[6]}</a></li>
      </ul>
    </li>
    <li><a href={nav_menu[7]} >{menu_name[7]}</a>
      <ul class="sub-level">
        <li><a href={nav_menu[8]} >{menu_name[8]}</a></li>
        <li><a href={nav_menu[9]} >{menu_name[9]}</a></li>
        <li><a href={nav_menu[10]} >{menu_name[10]}</a></li>
        <li><a href={nav_menu[11]} >{menu_name[11]}</a></li>
      </ul>
    </li>
    <li><a href={nav_menu[12]} >{menu_name[12]}</a>
      <ul class="sub-level">
        <li><a href={nav_menu[13]} >{menu_name[13]}</a></li>
        <li><a href={nav_menu[14]} >{menu_name[14]}</a></li>
      </ul>
    </li>
    <li><a href={nav_menu[15]} >{menu_name[15]}</a>
      <ul class="sub-level">
        <li><a href={nav_menu[16]} >{menu_name[16]}</a></li>
        <li><a href={nav_menu[17]} >{menu_name[17]}</a></li>
        <li><a href={nav_menu[18]} >{menu_name[18]}</a></li>
        <li><a href={nav_menu[19]} >{menu_name[19]}</a></li>
      </ul>
    </li>
    <li><a href={nav_menu[20]} >{menu_name[20]}</a>
      <ul class="sub-level">
        <li><a href={nav_menu[21]} >{menu_name[21]}</a></li>
        <li><a href={nav_menu[22]} >{menu_name[22]}</a></li>
      </ul>
    </li>
    <li><a href={nav_menu[23]} >{menu_name[23]}</a></li>
  </ul>
</div>

```

```

<div id="progress">
</div>

```

```

<div class="smallTextbox" id="main">
  <p class="section_title">
    {result[1]}
  </p>
  {result[3]}
  %if result[0] > 0:
  %  if result[0] < 6:
  %    <ul id="inlinemenu" >
  %      if result[0] == 1:
  %        for j in range(2,7):
  %          <li><a href={nav_menu[j]} >{menu_name[j]}</a></li>
  %        end
  %      elif result[0] == 2:
  %        for j in range(8,12):
  %          <li><a href={nav_menu[j]} >{menu_name[j]}</a></li>
  %        end
  %      elif result[0] == 3:
  %        for j in range(13,15):
  %          <li><a href={nav_menu[j]} >{menu_name[j]}</a></li>
  %        end
  %      elif result[0] == 4:
  %        for j in range(16,20):
  %          <li><a href={nav_menu[j]} >{menu_name[j]}</a></li>
  %        end
  %      elif result[0] == 5:
  %        for j in range(21,23):
  %          <li><a href={nav_menu[j]} >{menu_name[j]}</a></li>
  %        end
  %    </ul>
  %  end
  %end

```

```

    % end
  %end
</div>

<div id="footer">
%if not result[4]:
% navclass='footoff'
% navref="/wellness/"+str(result[0])
%else:
% navclass='footnav'
% navref="/wellness/"+str(result[4])
%end
  <div id="nav1" class={{navclass}}>
    <a href={{navref}} title="back">back</a>
  </div>
%if not result[5]:
% navclass='footoff'
% navref="/wellness/"+str(result[0])
%else:
% navclass='footnav'
% navref="/wellness/"+str(result[5])
%end
  <div id="nav2" class={{navclass}}>
    <a href={{navref}} title="next">next</a>
  </div>
</div>

```

SQLite Manager - /home/david/Downloads/avatar2/avatar.db

Database Table Index View Trigger Tools Help

Directory (Select Profile Database) Go

Structure Browse & Search Execute SQL DB Settings

Avatar.db

Master Table (1)
Tables (3)
 scene
 sqlite_sequence
 wellness
Views (0)
Indexes (0)
Triggers (0)

id	title	slug	content	last	next
0	Wellness	wellness	<div class="image">...		
1	Creative Self	creative-self	<div class="image">...		
2	Coping Self	coping-self	<p>The Coping Self is...		
3	Social Self	social-self	<div class="image">...		
4	Essential Self	essential-self	<div class="image">...		
5	Physical Self	physical-self	<div class="image">...		
6	Thinking	thinking	<p>Thinking invokes ...		
7	Emotions	emotions	<p>Emotions are an i...		
8	Control	control	<p>Control is indivisi...		
9	Work	work	<p>When we think of ...		
10	Positive Humor	positive-humor	<p>Positive Humor ha...		
11	Leisure	leisure	<p>Leisure may be a ...		
12	Stress Management	stress-management	<p>Stress Manageme...		
13	Self Worth	self-worth	<p>What is self-worth...		
14	Realistic Beliefs	realistic-beliefs	<p>Realistic Beliefs a...		
15	Friendship	friendship	<p>What is friendship...		
16	Love	love	<p>Definitions for <e...		24
17	Spiritual	spiritual	<p>Spirituality was id...		
18	Gender Identity	gender-identity	<p>Gender identity is ...		
19	Cultural Identity	cultural-identity	<p>Cultural identity is...		
20	Self Care	self-care	<p>Self-care compris...		
21	Exercise	exercise	<div class="image">...		
22	Nutrition	nutrition	<p>Good nutrition is a...		34
23	Workaholism	workaholism	<p>The following was...	9	
24	The Power of Love	power-love-1	<h1>Hugs and Cuddle...	16	25
25	The Power of Love	power-love-2	<p>Dr. Kathleen C. Li...	24	26
26	The Power of Love	power-love-3	<p>Much of what we ...	25	36
27	What You Can Do For Y...	do-for-yourself	<p>Exercise, nutrition...	20	
28	What Your Doctor Can ...	doctor-do-for-you	<p>The AMA consider...	20	
29	About	about	<p>The AVATAR proje...		
30	Wellness Resources	resources	Wellness Assess...	29	
31	AVATAR References	references	<dl><dt>article<a na...	29	
32	Research Project Infor...	research-project	<p>Informed Con...	29	
33					
34	Age-related Weight Gain	age-related-weight-gai...	<h2>Certain Foods Lin...	22	37
35					
36	The Power of Love	power-love-4	<p>"Most of us are ge...	26	

SQLite 3.7.13 Gecko 17.0 0.7.7 Exclusive Number of files in selected directory: 3 ET: 3 ms

```

/*
AVATAR style sheet
USF colors:
  Green - 00573c (R:000 G:087 B:060)
  Gold - dfd0a5 (R:223 G:208 B:165)
  Tan - f8f3e7 (R:248 G:243 B:231)

Dimensions:
  header - (82) 70 px high + 12px padding, full width
  container - 698 px high, 1024 px wide
  footer - 5% high, 83% width (of container)
  main -
  margins, padding and border add to height
  font assumes 16px default value = 1em

  use the following if you need to see boundaries
  outline: 1px solid yellow;

Not all elements listed are currently used. Unused elements
can be considered as placeholders for future revisions.

*/

/*****
  CSS Reset helps with browser compatibility issues
  *****/

html, body, div, span, applet, object, iframe,
h1, h2, h3, h4, h5, h6, p, blockquote, pre,
a, abbr, acronym, address, big, cite, code,
del, dfn, em, font, img, ins, kbd, q, s, samp,
small, strike, strong, sub, sup, tt, var,
dl, dt, dd, ol, ul, li,
fieldset, form, label, legend,
table, caption, tbody, tfoot, thead, tr, th, td {
  margin: 0;
  padding: 0;
  border: 0;
}

/*****
  Basic HTML that should be common to the entire app
  *****/
html {
  height: 100%;
}
body {
  height: 100%;
  background-image: url(/static/images/background-blend2.png);
  background-repeat: repeat-x;
  background-color: #f8f3e7;
  line-height: 140%;
  color: #000000;
  margin: 0;
}
p {
  font: normal 100% Verdana, Arial, Helvetica, sans-serif;
  margin: 0.5em 0 0 0;
}
p.big {
  font-size: 1.8em;
  line-height: 145%;
  margin-bottom: 18px;
}
p.smaller {
  font-size: 1.3em;
}

h1, h2, h3, h4, h5, h6 {
  font-weight: bold;
  font-family: Verdana, Arial, Helvetica, sans-serif;
  line-height: 1.1em;
  padding: 5px 0 20px 0;
  margin-top: 0px;
  margin-bottom: 3px;
}
h1 {

```

```

    font-size: 2.0em;
}
h2 {
    font-size: 1.5em;
}
h3 {
    font-size: 1.17em;
}
h4 {
    font-size: 1.0em;
    font-family: Garamond, Georgia, Times, "Times New Roman", serif;
    color: #dfd0a5;
}
h5 {
    font-size: 0.83em;
    color: #00573c;
}
h6 {
    font-size: 0.67em;
}
ul, ol, dl {
    font-size:1.4em;
    line-height:155%;
    padding:5px 0 0 40px;
    margin:0 0 15px 0;
}
ol li {
    list-style:decimal inside;
}
ul li {
    list-style:disc inside;
}
table {
    margin:0 0 15px 0;
}
table p {
    font: 1.4em/175% Verdana,Geneva,sans-serif;
    margin:0 0 5px 0;
}
a:link, a:visited, a:active {
    color:#00573c;
    text-decoration:none;
}
a:hover {
    color:#048960;
    text-decoration:underline;
}
a {
    outline: none;
}
img {
    padding-top: 0px;
    padding-bottom: 0px;
    padding-left: 0px;
    padding-right: 12px;
}
/*****
    header and title will be allowed to span browser width
    *****/
#header {
    height: 70px;
    padding-top: 0px;
    padding-bottom: 12px;
}
#title {
    width: 100%;
    height: 100%;
    padding-top: 0px;
    padding-bottom: 0px;
}
#title h1 {
    text-indent: 0.5em;
    font-size: 3em;
    line-height: 120%;
}
#title h1 a {
    color: #dfd0a5;
}

```

```

}
#title h2 {
    text-indent: 1em;
    font-size: 1.2em;
    line-height: 120%;
}
/*****
    container with fixed dimensions for readability, centered in screen use
    1024x768 as baseline, and have users with that resolution use F11 for
    fullscreen. higher resolutions monitors should just show it centered
    *****/
#container {
/*    position: relative; */
    height: 686px;
    width: 1024px;
    margin-left: auto;
    margin-right: auto;
}
/*****
    The vignettes use a central block and footer navigation. The CSS is limited to
    centering the video playback
    *****/
#video_content {
    margin: 0 auto;
    height: 570px;
    width: 80%;
}
/*****
    Scenarios are a little more complex, and this may change in concept as the
    study progresses. To begin with, an image block to the left of the scenario
    setup and question, with two choices below. Feedback response is on a new
    page, and includes embedded images within the same div.
    *****/
#scene_image {
    float: left;
    width: 205px;
    height: 246px;
    padding-top: 32px;
    padding-bottom: 32px;
    padding-left: 48px;
    padding-right: 48px;
}
#scene_question {
    float: right;
    width: 627px;
    height: 246px;
}
#choice1 {
    float: left;
    width: 416px;
    height: 260px;
}
#choice2 {
    float: right;
    width: 416px;
    height: 260px;
}
#response {
    position: relative;
    height: 622px;
}
/*****
    the wellness knowledge section main content area
    *****/
#main {
    float: right;
    width: 83%;
    height: 618px;
    overflow: auto;
}

/* group some common features as generic classes */
.largeTextbox {
    font-size: 1.5em;
    line-height: 140%;
    text-align: justify;
    padding-top: 32px;
}

```

```

padding-bottom: 32px;
padding-left: 48px;
padding-right: 48px;
}

.smallTextbox {
font-size: 1.0em;
line-height: 140%;
text-align: justify;
padding-top: 8px;
padding-bottom: 8px;
padding-left: 16px;
padding-right: 16px;
}

.image {
float: right;
padding: 6px;
}

.image-caption {
font-size: 0.5em;
}

.image-caption a:link {color: #000;}
.image-caption a:visited {color: #000;}

.section_title {
font-family: Garamond, Georgia, Times, "Times New Roman", serif;
font-size: 1.5em;
line-height: 140%;
color: #00573c;
font-weight: bold;
text-align: center;
padding-top: 0px;
padding-bottom: 0px;
}

#inlinemenu {
width: 40%;
margin: 0 auto;
}

#nomarkerlist {
list-style: none;
}

ul.multi {
float: left;
width: 100%;
margin: 0;
padding: 0;
list-style: none;
}

ul.multi li {
float: left;
width: 8em;
margin: 0;
padding: 0;
list-style: none;
}

blockquote {
padding: 2px;
border: 2px solid #00573c;
width: 50%;
margin: 0 auto;
quotes: "\201C" "\201D";
}

blockquote:before { content: open-quote; font-weight: bold; }
blockquote:after { content: close-quote; font-weight: bold; }

/*****
Footer for navigation and demarkation of screen used for application
*****/

#footer {
position: relative;
clear: both;
bottom: 0;
width: 100%;
height: 36px;
padding-top: 0px;
text-align: center;

```

```

        background-image: url(/static/images/footer-blend.png);
        background-repeat: repeat-x;
    }
    /* Set up a thin slice for a progress bar where called for */
    #progress {
        position: relative;
        width: 100%;
        min-height: 16px;
    }

    /* div setup to use the bulk of the available space */
    #full {
        position: relative;
        width: 928px;
        height: 570px;
        overflow: auto;
    }
    /*****
    Navigation div applicable to all classes. This creates horizontal tabs
    *****/
    #navigation {
        font-size:0.75em;
        width:10em;
        margin-top: 4em;
    }
    #navigation ul {
        list-style: none;
        padding: 0;
        margin: 0;
    }
    #navigation li {
        display: inline;
        float: left;
        border: 1px solid;
        border-bottom-width: 0;
        margin: 0 0.5em 0 0;
    }
    #navigation a {
        color: #fff;
        cursor: pointer;
        display:block;
        height:25px;
        line-height: 25px;
        text-indent: 10px;
        text-decoration:none;
        width:100%;
    }
    #navigation a:hover{
        text-decoration:underline;
    }
    #navigation li:hover {
        background: #00573c;
        position: relative;
    }
    /*****
    Navigation classes
    *****/

    /* separate right and left side nav is easier than combined, unless using
    lists, which is not the case here... just 'back' and 'next' buttons */
    #nav1 {
        float: left;
        height: 100%;
        width: 120px;
    }
    #nav2 {
        float: right;
        height: 100%;
        width: 120px;
    }
    .footnav {
        height: 100%;
    }
    .footnav a {
        float: left;
        width: 120px;
    }

```



```
    height: 100%;
    color: #00573c;
    text-decoration: none;
    text-transform: capitalize;
    font-size: 1.5em;
    text-align: center;
}
.footnav a:hover {
    color: #00573c;
}
/* for the 'off' state, leave the 'buttons', but do not show as active
when hovering */
.footoff {
    height: 100%;
}
.footoff a {
    float: left;
    width: 120px;
    height: 100%;
    color: #dfd0a5;
    text-decoration: none;
    text-transform: capitalize;
    font-size: 1.5em;
    text-align: center;
}
.footoff a:hover {
    color: #dfd0a5;
}
}
```

Appendix J: Phase 2 Prototype Assessment Protocol

The following format is used to guide observation and discussion of the instructional treatment in relation to the proposed local theory framework and related design practices.

1. Assess the use of strategies for motivating learning within the treatment (attention, relevance, confidence, satisfaction) using the following questions:
 - a) attention: Does the treatment gain and keep user/learner attention through perceptual arousal (novelty, surprise, etc.), inquiry arousal (stimulate curiosity with problems or questions), and variability (use a variety of methods)?
 - b) relevance: Does the treatment answer the question “What's in it for me?” by introducing familiarity (content presented in understandable ways), goal orientation (objectives and purpose presented), and motive matching (objectives matched to needs)?
 - c) confidence: Does the treatment establish expectancy for success in completing the instruction, learning, and applying? (relates to self-efficacy below)
 - d) satisfaction: Does the treatment provide opportunities for use (natural consequences), positive feedback (positive consequences), and equity (consistent standards and consequences)?
2. Assess the use of high-efficacy messages within the treatment using the following questions:
 - a) Does the treatment make effective use of cues to action with respect to self-care?
 - b) Does the treatment make effective use of persuasive communication?
3. Assess the threat appraisal implementation for self-care and the use of a personal physician (regular source of care or RSOC) using the following questions:
 - a) Does the treatment enhance the perceived threat of not using a RSOC?
 - b) Does the treatment address unrealistic self-assessment?
 - c) Does the treatment address a sense of social obligation?
 - d) Does the treatment address physician responsibility to patients?
 - e) Does the treatment use statements from respected leaders for positive impact?
4. Assess the coping appraisal implementation for self-care and RSOC using the following questions:
 - a) Does the treatment express positive outcomes obtained through self-care activities?

- b) Does the treatment express positive use of RSOC by peers?
5. Assess the implementation for perceived organizational support using the following questions:
- a) Does the treatment identify what the individual can do using organizational resources?
 - b) Does the treatment provide knowledge of available systems of support?
 - c) Does the treatment address and enhance trust of/for the organization?
 - d) Does the treatment address the common excuse of time constraints?
 - e) Does the treatment address the impact on making the tradeoff among trust, time, and personal self-care?
6. Assess concepts implemented to support self-efficacy (linking success to personal ability rather than external sources) using the following questions:
- a) Does the treatment support user autonomy?
 - b) Does the treatment provide sufficient information without overloading the user?
 - c) Does the treatment use a delivery method already used by the target audience? (reduces extraneous cognitive load)

Assess design approach against a subset of 'best practices' as deemed appropriate for this study.

Subject matter:

1. Is the information presented accurate?
2. Is the information presented current?
3. Is the information presented stable or subject to change?
4. Does the information have adequate scope (depth and breadth)?
5. Is the information presented clearly?

Design:

1. Is the navigation user-friendly, underconstrained, or overconstrained?
2. Does the design effectively integrate media?
3. Is an effective site map implemented; is a site map needed?
4. Is a 'help' function implemented effectively?
5. Would you consider this to be a good web application design?
6. Is the implementation compatible with required equipment (as standardized for USF faculty)?
7. Is the implementation usable across multiple types of platforms?
8. Does the implementation protect the confidentiality of the user?
9. Does the instrument provide for interactive exploration?
10. Does the instrument provide for any user configuration; is user configuration needed?
11. Does the instrument include unimportant information that should be excluded?
12. Is the content well-written to the level of the intended audience?

Appendix K: Phase 3 Implementation Templates and Scripts

```
# Filename: avatar.wsgi
# Author: David Donnelly
# Released: 2012-05-05
# Modified:
#
# bottle microframework implementation of the AVATAR application
# developed using the built-in local server and uses sqlite3 db
# intended for deployment on servers using Apache and mod_wsgi
#####

import os,sys,bottle,sqlite3,time
ver = sys.version

# wsgi hook for deploying with apache
def application(environ, start_response):
    return bottle.default_app().wsgi(environ,start_response)

# add the current directory to the path
cmd_folder = os.path.dirname(os.path.abspath(__file__))
if cmd_folder not in sys.path:
    sys.path.insert(0, cmd_folder)

# Change working directory so relative paths (and template lookup) work again
os.chdir(os.path.dirname(__file__))

from bottle import route, run, install, template, request, validate, error, static_file,
debug, get, post, request

# the following permits catching python errors in apache logs
bottle.app().catchall = False

# route support for error handling
@error(403)
def mistake403(code):
    return 'The parameter you passed has the wrong format!'
@error(404)
def mistake404(code):
    return 'Sorry, the Avatar says this page does not exist!'

# Main method for local development
# do not use bottle.run() with apache!
#if __name__ == "__main__":
#    debug(True)
#    run(reloader=True)

# routing to serve static files (css, js, images) for development server
#@route('/static/css/:filename')
#def server_css(filename):
#    return static_file(filename, root='static/css')
#@route('/static/images/:filename')
#def server_images(filename):
#    return static_file(filename, root='static/images')
#@route('/static/video/:filename')
#def server_video(filename):
#    return static_file(filename, root='static/video')

#####
# static filenames
# video clips
vid_info = (
'/static/video',
'/vignette-1',
'/vignette-2',
'/vignette-3',
'/vignette-4',
'/vignette-5'
)

#####
```

```

# the base address will launch the splash introduction collage
@route('/')
def intro():
    return template('intro.tpl')

#####
# after the introductory scenes, the information page will be presented
@route('/info')
def info():
    return template('info.tpl')

#####
# route to run through the video vignette section
@route('/vignette/:id#[0-5]#')
def vignette(id):
    return template('vignette.tpl', result=id, vid_info=vid_info)

#####
# route to click through the scenario section
# using a database to store all the content
@route('/scenario/:id#[0-5]#')
def scenario(id):
    if request.GET.get('choices','').strip():
        choice = request.GET.get('choices','').strip()

        conn = sqlite3.connect('avatar.db')
        c = conn.cursor()
        if choice == 'Choice1':
            c.execute("SELECT id, feedback, choice1_image FROM scene WHERE id LIKE ?",
(id))
        else:
            c.execute("SELECT id, feedback, choice2_image FROM scene WHERE id LIKE ?",
(id))

        row = c.fetchone()
        c.close()
        return template('scenario_response', result=row)

    else:
        conn = sqlite3.connect('avatar.db')
        c = conn.cursor()
        c.execute("SELECT id, question, response1, response2, scene_image FROM scene
WHERE id LIKE ?", (id))
        row = c.fetchone()
        c.close()
        return template('scenario', result=row)

#####
# routing for wellness knowledgebase
#
# route to manage all the educational content; uses a separate database table
# due to requiring a different structure
# routes on just the number or number + slug, even though slug is not use
# in the actual routing... it's just there for the user experience
# the order is important; if the base route (with id only) is placed first,
# calling id+slug produces an error
@route('/wellness/:id#[0-9]+#/:slug')
@route('/wellness/:id#[0-9]+#')
def wellness(id,slug=""):
    conn = sqlite3.connect('avatar.db')
    c = conn.cursor()
    c.execute("SELECT id, title, slug, content, last, next, pages, page FROM wellness
WHERE id LIKE ?", [id])
# have to use [id] instead of (id) when more than one character, else crashes
    row = c.fetchone()
    c.close()
    return template('wellness', result=row)
#     return str(row)

```

```

<!doctype html>
<!--

```

Filename: intro.tpl
Author: David Donnelly
Released: 2012-xx-xx
Modified:

This is just to launch the introductory video clips.

Note - require doctype before comments, else IE goes into quirksmode
-->

```
%av_css_fname = "/static/css/AVATAR_styles.css"

%fname = "/static/video/avatar_intro"
%vid_fname1=fname+".mp4"
%vid_fname2=fname+".ogv"
%vid_fname3=fname+".webm"
%vid_fname4=fname+".flv"
%swf_fname="/static/video/player.swf"
%next_page="/info"

<head>
  <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
  <title>AVATAR</title>
  <style type="text/css">
    a { text-decoration:none }
  </style>
  <link rel="stylesheet" type="text/css" href={{av_css_fname}} />
</head>

<body style="background-image:none; background-color:black;">
  <div id="wrapper">

    <div id="header">
      <div id="title">
      </div>
      <div id="top-nav">
      </div>
      <div id="mid-nav">
      </div>
      <div id="page-nav">
        <ul>
          <li><a href={{next_page}} style="color:white;font-
size:1.5em">Next ></a></li>
        </ul>
      </div>
    </div>

    <div id="content">
      <div id="video_content">
        <video width="720" height="480" autoplay >
          <source src="{{vid_fname1}}" type="video/mp4" />
          <source src="{{vid_fname3}}" type="video/webm" />
          <source src="{{vid_fname2}}" type="video/ogg" />

          <object width="720" height="480" type="application/x-shockwave-
flash" data="{{swf_fname}}">
            <param name="movie" value="{{swf_fname}}" />
            <param name="flashvars"
value="autostart=true&amp;controlbar=over&amp;file={{vid_fname4}}"> />
          </object>
        </video>
      </div>
    </div>
  </div>
</body>
</html>
```

```
<!doctype html>
<!--
Filename: info.tpl
Author: David Donnelly
Released: 2012-xx-xx
Modified:
```

This is the screen layout for the main/start page for the AVATAR application. It provides basic information and nominal navigation help.

```
-->

%av_css_fname = "/static/css/AVATAR_styles.css"

%backref="/info"
%next_page="/vignette/0"

<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
    <title>AVATAR</title>
    <style type="text/css">
      a { text-decoration:none }
    </style>
    <link rel="stylesheet" type="text/css" href={{av_css_fname}} />
  </head>

  <body>
    <div id="wrapper">

      <div id="header">
        <div id="title">
          <h1><a href="/" title="AVATAR">AVATAR</a></h1>
          <h2>Access Viable Alternatives To Achieve Resilience</h2>
        </div>
        <div id="top-nav">
        </div>
        <div id="mid-nav">
        </div>
        <div id="page-nav">
          <ul>
            <li><a href={{next_page}}>Next >></a></li>
          </ul>
        </div>
      </div>

      <div id="content">
        <p class="section_title">Welcome to AVATAR!</p>
        <p>This program has been designed to provide physicians with tools for improving personal wellness. Developed around the Indivisible Self empirical model of wellness, AVATAR has been specifically created for physicians using the collaborative talents of instructional designers, I/O psychologists, and physicians.</p><br>
        <p>This site provides HTML without the need for Javascript, so feel free to turn it off. Although best viewed with the latest version of browsers, you should have no problem using Internet Explorer 8+, Firefox 5+, or Safari 5.1+ (Mac or PC). The iPad is not supported at this time due to performance restrictions.</p><br>
        <p>The site is built in three sections, and each can be completed in five minutes or less. The first shows a series of five video vignettes. You may have to start each of the video sequences, depending on how your browser is configured. Older browsers require Flash, which takes longer to download, so please be patient. When completed, click on the 'next' button above the video to move on to the next video.</p><br>
        <p>The second section presents a series of five scenarios, giving you a choice of responses. Select your response by clicking on the response button, which will take you to a feedback screen. On the feedback screen, click on the 'next' link like the one above to continue.</p><br>
        <p>The final section provides multi-level navigation with visual feedback to show your position and progress. Menu text will change color to indicate that you have visited that section, while the background for the top level will change so you know which section you are in as you move through the sublevels. It is best to move through the sections in sequence, but you are free to navigate to any section at any time. This help information will also be available under 'Instructions' in the third section.
        <b>NOTE:</b>The user feedback survey link in the invitational email was cut off. The complete link, also found under the menu item 'About' in the final section of this application, is <a href="http://dfourth.limequery.org/41466/lang-en" target="_blank"><em>http://dfourth.limequery.org/41466/lang-en</em></a>
        <p>When you are ready to move on, click on the 'next' link to the right of the page title.</p>
      </div>

      <div id="footer">
      </div>

    </div>
  </body>
</html>
```



```
</body>
</html>
```

```
<!doctype html>
<!--
```

```
Filename: vignette.tpl
Author: David Donnelly
Released: 2012-xx-xx
Modified:
```

```
This is the screen layout for the vignettes shown in the AVATAR application.
It includes all the information from the base page, and sets up a central area
for displaying the vignette videos. As the intent is to just move through them,
there is no need for user navigation expected.
-->
```

```
%av_css_fname = "/static/css/AVATAR_styles.css"
```

```
%doc_home = ""
%img_home = doc_home + "/static/images"
```

```
%id = int(result)
%nextid = id+1
%lastid = id-1
```

```
%fname = vid_info[0] + vid_info[id]
%vid_fname1=fname+".mp4"
%vid_fname2=fname+".ogv"
%vid_fname3=fname+".webm"
%vid_fname4=fname+".flv"
%swf_fname="/static/video/player.swf"
```

```
%previous_page="/vignette/"+ str(lastid)
%next_page="/vignette/"+ str(nextid)
%location = " Page "+str(id)+" of 5 "
```

```
%if id == 0:
%   previous_page="/info"
%   location="Intro"
%elif id == 5:
%   next_page="/scenario/0"
%end
```

```
<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
    <title>AVATAR</title>
    <style type="text/css">
      a { text-decoration:none }
    </style>
    <link rel="stylesheet" type="text/css" href={{av_css_fname}} />
  </head>
  <body>
    <div id="wrapper">
      <div id="header">
        <div id="title">
          <h1><a href="/" title="AVATAR">AVATAR</a></h1>
          <h2>Access Viable Alternatives To Achieve Resilience</h2>
        </div>
        <div id="top-nav">
        </div>
        <div id="mid-nav">
        </div>
        <div id="page-nav">
          <ul>
            %if id > 0:
              <li><a href={{previous_page}}><<Previous</a></li>
              <li><b>{{location}}</b></li>
            %end
          </ul>
        </div>
      </div>
    </div>
  </body>
</html>
```



```

<head>
  <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
  <title>AVATAR</title>
  <style type="text/css">
    a { text-decoration:none }
  </style>
  <link rel="stylesheet" type="text/css" href={{av_css_fname}} />
</head>

<body>
  <div id="wrapper">

    <div id="header">
      <div id="title">
        <h1><a href="/" title="AVATAR">AVATAR</a></h1>
        <h2>Access Viable Alternatives To Achieve Resilience</h2>
      </div>
      <div id="top-nav">
      </div>
      <div id="mid-nav">
      </div>
      <div id="page-nav">
        %if id == 0:
          <ul>
            <li><a href={{next_page}}>Next »</a></li>
          </ul>
        %end
      </div>
    </div>

    <div id="content" style="overflow:hidden;">
      %if id == 0:
        <p class="section_title">Choices</p>
        <p class="big">{!!result[1]}</p>
      %else:
        <div id="scene_image">
          %fname=img_home+result[4]
          <img src={{fname}} alt={{fname}} style="width:100%;" />
        </div>

        <div id="scene_question">
          {!!result[1]}
        </div>

        <div id="choice1">
          <form action="/scenario/{{id}}" method="get">
            <input type="submit" name="choices" value="Choice1">
          </form>
          {!!result[2]}
        </div>

        <div id="choice2">
          <form action="/scenario/{{id}}" method="get">
            <input type="submit" name="choices" value="Choice2">
          </form>
          {!!result[3]}
        </div>
      %end
    </div>

    <div id="footer">
    </div>

  </div>
</body>
</html>

```

```

<!doctype html>
<!--
Filename: response_page.tpl
Author: David Donnelly
Released: 2012-xx-xx

```

Modified:

This is the screen layout for the scenario responses in the AVATAR application. It includes all the information from the base page, and sets up a central area for displaying the responses. The user will land here after choosing a scenario option, and feedback information will be provided. Only 'forward' nav will be provided, to go on to the next scenario or next section. If some bug occurs, it will route back to the beginning of the application
-->

```
%av_css_fname = "/static/css/AVATAR_styles.css"

%doc_home = ""
%img_home = doc_home + "/static/images/"
%fname=img_home+result[2]

%id = int(result[0])
%nextid = id+1
%lastid = id-1
%backref="/response/"+ str(id)
%if id < 5:
%   next_page="/scenario/"+ str(nextid)
%elif id == 5:
%   next_page="/wellness/0/menu"
%else:
%   next_page="/"
%end

<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
    <title>AVATAR</title>
    <style type="text/css">
      a { text-decoration:none }
    </style>
    <link rel="stylesheet" type="text/css" href={{av_css_fname}} />
  </head>
  <body>
    <div id="wrapper">
      <div id="header">
        <div id="title">
          <h1><a href="/" title="AVATAR">AVATAR</a></h1>
          <h2>Access Viable Alternatives To Achieve Resilience</h2>
        </div>
        <div id="top-nav">
        </div>
        <div id="mid-nav">
        </div>
        <div id="page-nav">
          <ul>
            <li><a href={{next_page}}>Next ></a></li>
          </ul>
        </div>
      </div>
      <div id="content">
        <div id="response_image">
          <img src={{fname}} alt={{fname}} />
        </div>
        <div id="response">
          {{!result[1]}}
        </div>
      </div>
      <div id="footer">
      </div>
    </div>
  </body>
</html>
```

```

<!doctype html>
<!--
Filename: wellness.tpl
Author: David Donnelly
Released: 2012-xx-xx
Modified:

This is the screen layout for the knowledge section of the AVATAR application.
Top-level menu always shown. Mid-level menu depends on current top-level location.
Pagination shown on content that requires it.
Note - require doctype before comments, else IE goes into quirksmode
-->

%av_css_fname = "/static/css/AVATAR_styles.css"

<!-- nav_menu contains the full list of top and mid level menu items
    organized as address, title pairs in order-->

%nav_menu = (
%('/wellness/0/home','Home'),
%('/wellness/1/creative-self','Creative'),
%('/wellness/2/coping-self','Coping'),
%('/wellness/3/social-self','Social'),
%('/wellness/4/essential-self','Essential'),
%('/wellness/5/physical-self','Physical'),
%('/wellness/6/thinking','Thinking'),
%('/wellness/7/emotions','Emotions'),
%('/wellness/8/control','Control'),
%('/wellness/9/work','Work'),
%('/wellness/10/positive-humor','Positive Humor'),
%('/wellness/11/leisure','Leisure'),
%('/wellness/12/stress-management','Stress Management'),
%('/wellness/13/self-worth','Self Worth'),
%('/wellness/14/realistic-beliefs','Realistic Beliefs'),
%('/wellness/15/friendship','Friendship'),
%('/wellness/16/love','Love'),
%('/wellness/17/spirituality','Spirituality'),
%('/wellness/18/gender-identity','Gender Identity'),
%('/wellness/19/cultural-identity','Cultural Identity'),
%('/wellness/20/self-care','Self Care'),
%('/wellness/21/exercise','Exercise'),
%('/wellness/22/nutrition','Nutrition'),
%('/wellness/23/work2',''),
%('',''),
%('',''),
%('',''),
%('',''),
%('/wellness/27/do-for-yourself',''),
%('/wellness/28/doctor-do-for-you',''),
%('/wellness/29/about','About'),
%('/wellness/30/resources','Resources'),
%('/wellness/31/references','References'),
%('/wellness/32/acknowledgement','Acknowledgement'),
%('/wellness/33/instructions','Instructions')
%)

<!-- attempting to separate out the different nav levels
    so the right items get shown when needed -->
%level1 = (0,1,2,3,4,5,29)
%level2 = (
%(33,),
%(6, 7, 8, 9, 10),
%(11, 12, 13, 14),
%(15, 16),
%(17, 18, 19, 20),
%(21, 22),
%(30, 31, 32)
%)
%level3 = (
%(),
%(23,),
%(),
%(),
%(27,28),
%(),
%()
%)
<!-- combine all three levels -->

```

```

%nav_org = [""] * 7
%for j in range(0, len(level1)):
%   nav_org[j] = (level1[j],)+level2[j]+level3[j]
%end
<!-- identify which of the seven top-level items is the current page -->
%current_page = [""] * 7
%if result[0] in nav_org[0]:
%   current_page[0]="selected"
%   top_level = 0
%elif result[0] in nav_org[1]:
%   current_page[1]="selected"
%   top_level = 1
%elif result[0] in nav_org[2]:
%   current_page[2]="selected"
%   top_level = 2
%elif result[0] in nav_org[3]:
%   current_page[3]="selected"
%   top_level = 3
%elif result[0] in nav_org[4]:
%   current_page[4]="selected"
%   top_level = 4
%elif result[0] in nav_org[5]:
%   current_page[5]="selected"
%   top_level = 5
%elif result[0] in nav_org[6]:
%   current_page[6]="selected"
%   top_level = 6
%end

<!-- using next/last from database to determine
      if there are more pages to link -->
%if result[4] > 0:
%   previous_page = nav_menu[result[4]][0]
%else:
%   previous_page = nav_menu[result[0]][0]
%end
%if result[5] > 0:
%   next_page = nav_menu[result[5]][0]
%else:
%   next_page = nav_menu[result[0]][0]
%end

<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
    <title>AVATAR</title>
    <style type="text/css">
      a { text-decoration:none }
    </style>
    <link rel="stylesheet" type="text/css" href="{{av_css_fname}}" />
  </head>

  <body>
    <div id="wrapper">

      <div id="header">
        <div id="title">
          <h1><a href="/" title="AVATAR">AVATAR</a></h1>
          <h2>Access Viable Alternatives To Achieve Resilience</h2>
        </div>
        <div id="top-nav">
          <ul>
            <!-- this creates the top-level menu -->
            %for j in range(0, 6):
              <li id={{current_page[j]}}><a href={{nav_menu[j][0]}}
>{{nav_menu[j][1]}}</a></li>
            %end
              <li id={{current_page[6]}}><a href={{nav_menu[29][0]}}
>{{nav_menu[29][1]}}</a></li>
          </ul>
        </div>
        <div id="mid-nav">
          <ul>
            <!-- this creates the mid-level menu according to the current top-
level -->
            %mid_len = len(level2[top_level])

```

```

        %if mid_len > 1:
        %   for j in range(0,mid_len-1):
        [0]}>{{nav_menu[level2[top_level][j]][1]}}</a></li>
        %       end
        [0]}>{{nav_menu[level2[top_level][mid_len-1]][1]}}</a></li>
        %else:
        [0]}>{{nav_menu[level2[top_level][0]][1]}}</a></li>
        %end
        </ul>
    </div>

    %if result[6] > 1:
    <div id="page-nav">
        <ul>
            <li><a href={{previous_page}}><<Previous</a></li>
            % location = " Page "+str(result[7])+" of "+str(result[6])+"
            "
            <li><b>{{location}}</b></li>
            <li><a href={{next_page}}>Next >></a></li>
        </ul>
    </div>
    %end
</div>

<div id="content">
    <p class="section_title">
        {{result[1]}}
    </p>
    <p class="bigger">
        {{!result[3]}}
    </p>
</div>

<div id="footer">
</div>

</div>
</body>
</html>

```

SQLite Manager - /media/EXCHANGE/hgrepos/avatar-wip3/avatar.db

Database Table Index View Trigger Tools Help

Directory (Select Profile Database) Go

Structure Browse & Search Execute SQL DB Settings

Avatar.db

- Master Table (1)
- Tables (3)
 - scene
 - sqlite_sequence
 - wellness**
- Views (0)
- Indexes (0)
- Triggers (0)

TABLE wellness Search Show All Add Duplicate Edit Delete

id	title	slug	content	last	next	pages	page
0	Wellness	wellness	<p>This wel...			1	
1	Creative Self	creative-self	”...	9		2	2
27	What You Ca...	do-for-yourself	<p>Exercis...	20	28	3	2
28	What Your D...	doctor-do-fo...	<p>Physicia...	27		3	3
29	About	about	<p>The AV...			1	
30	Resources	resources	<p>External...			1	
31	References	references	<p>Referen...			1	
32	Acknowledg...	acknowledg...	<p>The dev...			1	
33	Instructions	instructions	<p>This fin...			1	
35						1	
38						1	

<< < 1 to 33 of 33 > >>

SQLite 3.7.13 Gecko 17.0 Exclusive Number of files in selected directory: 3 ET: 2 ms

Appendix L: Phase 3 Treatment Verification Instrument

The TVI used a five point scale from Strongly Disagree to Strongly Agree; Strongly Agree coded as 5. The questions were grouped into three knowledge domains for expert assessment. These were the questions deployed:

Assess Application of Domain Theory

1. The treatment uses appropriate methods to gain and keep the user's attention through one or more of the following approaches:
 - a) perceptual arousal through the use of novel or unique features, or surprising content.
 - b) inquiry arousal through the use of questions or posing of problems to stimulate curiosity.
 - c) variability by using a variety of information delivery methods.
2. The treatment answers the question "What's in it for me?" by introducing content in understandable ways and providing a sufficient number of examples to illustrate why the information is relevant to the user.
3. The information provided by the treatment is easy to understand.
4. The treatment provides appropriate opportunities for user interaction with feedback.
5. The information provided is delivered persuasively through the effective use of language.
6. The treatment provides specific cues to encourage the user to obtain and use a personal physician if he/she has not already done so.
7. The treatment enhances the user's perception of susceptibility to the problems associated with NOT using a personal physician, and enhances the perceived severity of potential consequences.
8. The treatment includes statements from appropriate sources to enhance the threat appraisal.
9. The treatment provides an appropriate degree of focus on inappropriate self-assessment by physicians.
10. The treatment provides prescriptive information for appropriate use of a personal physician in addition to other self-care activities.
11. Methods for addressing some of the concerns of time constraints are provided.
12. Appropriate mention is made of organizational support resources available to users.
13. The treatment provides information on additional support information and tools (with external links).
14. The treatment incorporates design elements that are indicative of organizational support.
15. The design of the treatment supports user autonomy within the application.
16. The treatment is appropriately implemented to limit extraneous cognitive load.
17. The information provided by the treatment is easy to make use of.
18. Imagery is effectively used to enhance the persuasive delivery of information.
19. The treatment provides specific cues to encourage appropriate use of a personal physician.
20. The treatment provides an appropriate level of focus on ways physician self-care relates to responsibility for patients.

Assess Instructional Design Framework

1. The screen layout for this treatment is well-designed for the purpose intended.
2. The colors used are appropriate for this treatment.
3. The introduction is attention-grabbing.
4. Instructions for using the treatment are simple and clear.
5. Navigation throughout the application is simple and clear.
6. All navigation features work as they should.
7. Images and video load in reasonable time.
8. Images and video are appropriate for enhancing content delivery.
9. Where used, menus are clear and easy to understand and use.
10. The user is able to control the pace through the treatment.
11. The user can easily exit the treatment or start over at any time.
12. The user can explore the treatment with an appropriate level of interaction.
13. The (web) delivery method is appropriate for the intended user group.
14. The implementation is compatible with standard computer equipment in use by the user group.

15. The treatment is usable across multiple types of platforms (operating systems and browsers).
16. The treatment protects the privacy of the user by not saving attributable user data.
17. The design of the background is appropriate for this treatment.

Assess Instructional Content

1. The information presented in this treatment is accurate.
2. The information presented in this treatment is current.
3. The information presented in this treatment has adequate depth and breadth for the intended purpose.
4. Sources of information cited are accurate.
5. The information is presented clearly.
6. The information is free from typographical errors.
7. The information appears free from bias.
8. External links provided are current, relevant and appropriate for the intended purpose.
9. The amount of information is appropriate for the intended purpose (i.e. little or no unimportant or redundant information).
10. Graphical elements enhance the content delivery.
11. The information presented in this treatment has adequate breadth for the intended purpose.
12. Sources of information cited are credible.

Appendix M: PDQ Analysis Script

```
# Modified version of Lime Survey R export file
# added barplots as appropriate
#
#$Rev: 12179 $ .
data <- read.table("survey_41466_R_data_file_comp.csv", sep=";", quote = "'",
na.strings=c("","\\\""), stringsAsFactors=FALSE)

data[, 1] <- as.numeric(data[, 1])
attributes(data)$variable.labels[1] <- "id"
names(data)[1] <- "id"

data[, 2] <- as.character(data[, 2])
attributes(data)$variable.labels[2] <- "submitdate"
names(data)[2] <- "submitdate"

#Field hidden

data[, 3] <- as.character(data[, 3])
attributes(data)$variable.labels[3] <- "startlanguage"
names(data)[3] <- "startlanguage"

data[, 4] <- as.character(data[, 4])
attributes(data)$variable.labels[4] <- "datestamp"
names(data)[4] <- "datestamp"

data[, 5] <- as.character(data[, 5])
attributes(data)$variable.labels[5] <- "startdate"
names(data)[5] <- "startdate"

data[, 6] <- as.character(data[, 6])
attributes(data)$variable.labels[6] <- "ipaddr"
names(data)[6] <- "ipaddr"

data[, 7] <- as.numeric(data[, 7])
attributes(data)$variable.labels[7] <- "I have received informed consent and agree to
take this survey."
data[, 7] <- factor(data[, 7], levels=c(1,2),labels=c("Yes","No"))
names(data)[7] <- "ack1"

# collect this into one document for demographics
sink("pdq.demographics.out", append=FALSE, split=TRUE)
data[, 8] <- as.numeric(data[, 8])
attributes(data)$variable.labels[8] <- "Gender"
data[, 8] <- factor(data[, 8], levels=c(1,2),labels=c("Female","Male"))
names(data)[8] <- "dem1"
print(table(data[,8]))

data[, 12] <- as.numeric(data[, 12])
attributes(data)$variable.labels[12] <- "Physician specialization"
data[, 12] <- factor(data[, 12],
levels=c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27), labels=
c("Allergy & Immunology","Anesthesiology","Colon & Rectal
Surgery","Dermatology","Emergency Medicine","Family Medicine","Medical
Genetics","Internal Medicine","Neurological Surgery","Neurology","Nuclear
Medicine","Obstetrics & Gynecology","Ophthalmology","Orthopaedic
Surgery","Otolaryngology","Pathology","Pediatrics","Physical Med & Rehab","Plastic
Surgery","Preventive Medicine","Psychiatry","Diagnostic Radiology","Radiation
Oncology","Surgery","Thoracic Surgery","Urology","Other Specialty"))
names(data)[12] <- "dem5"
print(table(data[,12]))
sink() # close the text portion

pdf("pdq.demographics.pdf")
data[, 9] <- as.numeric(data[, 9])
attributes(data)$variable.labels[9] <- "Age"
data[, 9] <- factor(data[, 9], levels=c(1,2,3,4,5,6),labels=c("< 35","35-44","45-54","55-
64","65-74",> 74"))
names(data)[9] <- "dem2"
barplot(table(data[,9]),main=attributes(data)$variable.labels[9])
```

```

data[, 10] <- as.numeric(data[, 10])
attributes(data)$variable.labels[10] <- "Years as practicing physician"
data[, 10] <- factor(data[, 10], levels=c(1,2,3,4,5,6),labels=c("< 4","5-14","15-24","25-34","35-44",">44"))
names(data)[10] <- "dem3"
barplot(table(data[,10]),main=attributes(data)$variable.labels[10])

data[, 11] <- as.numeric(data[, 11])
attributes(data)$variable.labels[11] <- "Years as faculty physician"
data[, 11] <- factor(data[, 11], levels=c(1,2,3,4,5,6),labels=c("< 4","5-14","15-24","25-34","35-44",">44"))
names(data)[11] <- "dem4"
barplot(table(data[,11]),main=attributes(data)$variable.labels[11])
dev.off() # close demographics file

pdf("pdq.motivation.13.pdf")
data[, 13] <- as.numeric(data[, 13])
attributes(data)$variable.labels[13] <- "I viewed the AVATAR application because I wanted to learn something of value to me."
data[, 13] <- factor(data[, 13], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[13] <- "feed1_1"
barplot(table(data[,13]),main=strwrap(attributes(data)$variable.labels[13],60))
dev.off()

pdf("pdq.motivation.14.pdf")
data[, 14] <- as.numeric(data[, 14])
attributes(data)$variable.labels[14] <- "I felt compelled to view the application for reasons other than my own personal interest."
data[, 14] <- factor(data[, 14], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[14] <- "feed1_2"
barplot(table(data[,14]),main=strwrap(attributes(data)$variable.labels[14],60))
dev.off()

pdf("pdq.motivation.15.pdf")
data[, 15] <- as.numeric(data[, 15])
attributes(data)$variable.labels[15] <- "Before viewing the AVATAR application, I expected to learn something of value."
data[, 15] <- factor(data[, 15], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[15] <- "feed1_3"
barplot(table(data[,15]),main=strwrap(attributes(data)$variable.labels[15],60))
dev.off()

pdf("pdq.motivation.16.pdf")
data[, 16] <- as.numeric(data[, 16])
attributes(data)$variable.labels[16] <- "I found personal relevance in some of the information presented."
data[, 16] <- factor(data[, 16], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[16] <- "feed1_4"
barplot(table(data[,16]),main=strwrap(attributes(data)$variable.labels[16],60))
dev.off()

pdf("pdq.design.17.pdf")
data[, 17] <- as.numeric(data[, 17])
attributes(data)$variable.labels[17] <- "The introduction was attention-grabbing."
data[, 17] <- factor(data[, 17], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[17] <- "feed2_1"
barplot(table(data[,17]),main=strwrap(attributes(data)$variable.labels[17],60))
dev.off()

pdf("pdq.design.18.pdf")
data[, 18] <- as.numeric(data[, 18])
attributes(data)$variable.labels[18] <- "The instructions were clear and easy to follow."
data[, 18] <- factor(data[, 18], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[18] <- "feed2_2"
barplot(table(data[,18]),main=strwrap(attributes(data)$variable.labels[18],60))
dev.off()

pdf("pdq.design.19.pdf")
data[, 19] <- as.numeric(data[, 19])

```

```

attributes(data)$variable.labels[19] <- "The design elements (colors, layout, imagery
etc.) were visually appealing."
data[, 19] <- factor(data[, 19], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend
to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[19] <- "feed2_3"
barplot(table(data[,19]),main=strwrap(attributes(data)$variable.labels[19],60))
dev.off()

pdf("pdg.design.20.pdf")
data[, 20] <- as.numeric(data[, 20])
attributes(data)$variable.labels[20] <- "I feel confident that my privacy and
confidentiality were protected while using the application."
data[, 20] <- factor(data[, 20], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend
to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[20] <- "feed2_4"
barplot(table(data[,20]),main=strwrap(attributes(data)$variable.labels[20],60))
dev.off()

pdf("pdg.design.21.pdf")
data[, 21] <- as.numeric(data[, 21])
attributes(data)$variable.labels[21] <- "The navigation was clear and easy to follow."
data[, 21] <- factor(data[, 21], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend
to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[21] <- "feed2_5"
barplot(table(data[,21]),main=strwrap(attributes(data)$variable.labels[21],60))
dev.off()

pdf("pdg.design.22.pdf")
data[, 22] <- as.numeric(data[, 22])
attributes(data)$variable.labels[22] <- "The level of interactivity was:"
data[, 22] <- factor(data[, 22], levels=c(1,2,3),labels=c("too little","just right","too
much"))
names(data)[22] <- "feed3"
barplot(table(data[,22]),main=strwrap(attributes(data)$variable.labels[22],60))
dev.off()

pdf("pdg.rsoc.24.pdf")
data[, 24] <- as.numeric(data[, 24])
attributes(data)$variable.labels[24] <- "It is important for me to have a regular source
of care (RSOC)."
data[, 24] <- factor(data[, 24], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend
to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[24] <- "feed7_1"
barplot(table(data[,24]),main=strwrap(attributes(data)$variable.labels[24],60))
dev.off()

sink("pdg.rsoc.out")
data[, 23] <- as.numeric(data[, 23])
attributes(data)$variable.labels[23] <- "I did receive the influenza vaccine within the
past year."
data[, 23] <- factor(data[, 23], levels=c(1,2),labels=c("Yes","No"))
names(data)[23] <- "feed4"
print(round(prop.table(table(data[,23]))*100))

data[, 25] <- as.numeric(data[, 25])
attributes(data)$variable.labels[25] <- "I do have a personal physician other than myself
or a colleague (regular source of care)."
data[, 25] <- factor(data[, 25], levels=c(1,2),labels=c("Yes","No"))
names(data)[25] <- "feed5"
print(round(prop.table(table(data[,25]))*100))

data[, 26] <- as.numeric(data[, 26])
attributes(data)$variable.labels[26] <- "I have met with my personal physician within the
past 24 months."
data[, 26] <- factor(data[, 26], levels=c(1,2),labels=c("Yes","No"))
names(data)[26] <- "feed6"
print(round(prop.table(table(data[,26]))*100))

data[, 27] <- as.numeric(data[, 27])
attributes(data)$variable.labels[27] <- "I do not have a RSOC or have not met with my
RSOC in the past 24 months because:"
data[, 27] <- factor(data[, 27], levels=c(1,2,3,4),labels=c("time","money","don't need
one","other (explain in the comment section)"))
names(data)[27] <- "feed8"
print(round(table(data[,27])))

data[, 28] <- as.numeric(data[, 28])

```

```

attributes(data)$variable.labels[28] <- "[Comment] I do not have a RSOC or have not met
with my RSOC in the past 24 months because:"
names(data)[28] <- "feed8_comment"
#data[,28]
# there were no comments, so nothing of value added
sink()

# Organizational involvement feedback
pdf("pdq.org.29.pdf")
data[, 29] <- as.numeric(data[, 29])
attributes(data)$variable.labels[29] <- "It is clear that USF Health was involved in this
study and application."
data[, 29] <- factor(data[, 29], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend
to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[29] <- "feed9_1"
barplot(table(data[,29]),main=strwrap(attributes(data)$variable.labels[29],60))
dev.off()

pdf("pdq.org.30.pdf")
data[, 30] <- as.numeric(data[, 30])
attributes(data)$variable.labels[30] <- "My belief that USF Health considers my personal
wellness to be very important is stronger after viewing the AVATAR application."
data[, 30] <- factor(data[, 30], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend
to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[30] <- "feed9_2"
barplot(table(data[,30]),main=strwrap(attributes(data)$variable.labels[30],60))
dev.off()

pdf("pdq.org.31.pdf")
data[, 31] <- as.numeric(data[, 31])
attributes(data)$variable.labels[31] <- "My belief that USF Health considers the use of a
RSOC to be very important is stronger after viewing the AVATAR application."
data[, 31] <- factor(data[, 31], levels=c(1,2,3,4,5),labels=c("Strongly disagree","Tend
to disagree","Neither agree nor disagree","Tend to agree","Strongly agree"))
names(data)[31] <- "feed9_3"
barplot(table(data[,31]),main=strwrap(attributes(data)$variable.labels[31],60))
dev.off()

# General open-ended qualitative feedback
sink("pdq.qual.like.txt")
data[, 32] <- as.character(data[, 32])
attributes(data)$variable.labels[32] <- "Please list three aspects of this application
that you particularly liked. Write as much as you would like; the text box will expand as
needed."
names(data)[32] <- "feed10"
print(data[,32])
sink()

sink("pdq.qual.dislike.txt")
data[, 33] <- as.character(data[, 33])
attributes(data)$variable.labels[33] <- "Please list three aspects of this application
that you did not like. Write as much as you would like; the text box will expand as
needed."
names(data)[33] <- "feed11"
print(data[,33])
sink()

```

Appendix N: List of Acronyms and Initializations

Term	Meaning
AAMC	Association of American Medical Colleges
ADDIE	analysis, design, development, implementation, evaluation
AMA	American Medical Association
ANOVA	analysis of variance
ARCS	attention, relevance, confidence, satisfaction
COD	Council of Deans
COTH	Council of Teaching Hospitals
CPE	continuing professional education
FP	faculty physicians
HBC	health behavior change
HBM	health belief model
HPT	human performance technology
ID	instructional design
IM	intervention mapping; development framework
IMMS	Instructional Materials Motivation Survey
IS	Indivisible Self
ISD	instructional system design
MANOVA	multivariate analysis of variance
PAPM	precaution adoption process model
POS	perceived organizational support
QOL	quality of life
RP	rapid prototyping
PMT	protection motivation theory
RSOC	regular source of care
SCT	social cognitive theory
SLT	social learning theory
TPB	theory of planned behavior
TRA	theory of reasoned action
TTM	transtheoretical model

Term	Meaning
TIB	theory of interpersonal behavior
VIE	valence-instrumentality-expectancy
WHO	World Health Organization
WOW	Wheel of Wellness

Appendix O: List of Free and Open-source Programs

The following table lists the free programs the PI located and found most useful during the course of this study. Where possible, the PI sought out applications that could be used across a wide variety of platforms. In the table, L = GNU/Linux and/or Unix-like systems, W = Microsoft Windows systems, and M = Apple Mac OS systems. The PI made use of these applications using Debian-base GNU/Linux systems and Windows 7.

Name	URL	L	M	W	Comments
Image editing					
The GIMP	http://www.gimp.org/	√			GNU Image Manipulation Program
IrfanView	http://www.irfanview.com/			√	Works under Linux with WINE
Inkscape	http://inkscape.org/	√	√	√	Especially for SVG
Video editing					
PhotoFilmStrip	http://www.photofilmstrip.org/	√		√	Used for the Ken Burns effect
OpenShot Video Editor	http://www.openshot.org/	√			Used to combine video clips
Drawing tools					
Xmind	http://www.xmind.net/	√	√	√	Block diagrams/mind-mapping
Freemind	http://freemind.sourceforge.net/	√	√	√	Mind-mapping
Vue	http://vue.tufts.edu/index.cfm	√	√	√	Mind-mapping
Yed	http://www.yworks.com/en/products_yed_about.htm	√	√	√	Diagrams and flowcharts
LibreOffice Draw	https://www.libreoffice.org/	√	√	√	Block diagrams
Database and networking tools					
SQLite Manager	https://addons.mozilla.org/en-us/firefox/addon/sqlite-manager/	√	√	√	Firefox extension
FileZilla	http://filezilla-project.org/	√	√	√	SFTP manager
PuTTY	http://www.chiark.greenend.org.uk/~sgtatham/putty/	√		√	Telnet and SSH tool
Website test and validation					
W3 CSS validator	http://jigsaw.w3.org/css-validator/	√	√	√	Upload file or point to website
W3 HTML validator	http://validator.w3.org/	√	√	√	Upload file or point to website
Dust-Me Selectors	https://addons.mozilla.org/en-us/firefox/addon/dust-me-selectors/	√	√	√	Firefox add-on to locate unused CSS selectors

Name	URL	L	M	W	Comments
Reference management					
JabRef	http://jabref.sourceforge.net/	√	√	√	Java-based; works with LaTeX
RefWorks	http://www.refworks.com/	√	√	√	Web-based
Document creation					
LibreOffice	https://www.libreoffice.org/	√	√	√	MS Word alternative
TexMaker	http://www.xmlmath.net/texmaker/	√	√	√	For use with LaTeX typesetting system
TeXWorks	https://code.google.com/p/texworks/	√	√	√	Alternative to TexMaker (simpler)
LaTeX	http://www.latex-project.org/	√	√	√	Typesetting system
Scribus	http://www.scribus.net/canvas/Scribus	√	√	√	Document layout and publishing system