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An Exploration of How Health Professionals Create eHealth and mHealth Education Interventions

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AN EXPLORATION OF HOW HEALTH PROFESSIONALS CREATE eHEALTH AND mHEALTH EDUCATION INTERVENTIONS

by

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ABSTRACT

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The purpose of this study was to explore how health education professionals create ehealth and mhealth education interventions. Three research questions led this qualitative study. The first research question focused on the use of learning theories, instructional models, and instructional design models. The second research question focused on the use of elearning and mlearning design principles. The third research question focused on the use of health behavior theories and models. Twelve health professionals selected for their involvement in the creation of ehealth and mhealth education interventions participated in this study.

The themes emerging from the research questions showed a variability in how the participants used education theories and models, principles of elearning and mlearning design, and health behavior and health education theories and models to create ehealth and mhealth interventions. On education theories and models, the participants used elements of instructional design (i.e., analysis, design, evaluation) but did not use any specific instructional design model. Moreover, they invested efforts in creating instructional strategies that reflected instructional models of different learning theories but did not specify particular models or theories. Four themes emerged on the instructional strategies they used in the interventions: (1) connections to behaviorist approaches to learning, (2) connections to cognitivist approaches to learning, (3) connections to constructivist approaches to learning, and (4) unspecified learning theories. On the use of elearning design principles, seven patterns emerged: (1)

interaction, (2) learner control, (3) provision of help, (4) use of multimedia, (5) engagement, (6) user friendliness, and (7) visual appeal. On the use of health behavior theories and models, three themes emerged (1) no use of health behavior theory or model, (2), use of a mix of health behavior theories or models, and (3) use of a particular health behavior theory or model.

The variability of the findings and the resulting themes suggested implications for practice and further research. These implications concern all health professionals creating ehealth and mhealth interventions as well as scholars in the field of instructional design and health education and health behavior. The implications and limitations of the study were also discussed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

In its constitution, the World Health Organization (WHO) defines health as "a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity"(WHO, 2011, para 1). This definition has not been amended since its formulation in 1946 (WHO, 2011). Moreover, and despite some criticism, this definition is still the one most commonly referred to in the literature (Sharma & Romas, 2011; Simons-Morton, Greene, & Gottlieb, 1995; Smith, 2010). The reason for its popularity stems from its emphasis on the positive aspect of well-being and the inclusion of health dimensions beyond the physical ones (Simons-Morton et al., 1995; Stroebe, 2000). This positive view on health shifted a previous focus on treatment of disease to a focus on the prevention of disease or complications of disease (Stroebe, 2000). Furthermore, the need for prevention became exacerbated by the increase in health costs, the prevalence of chronic diseases, the effectiveness of early disease detection, and the research evidence on the effect of health behavior on health status (Glanz, Rimer, & Viswanath, 2008; Stroebe, 2000; Willgoose, 2010). Therefore, a major emphasis of health initiatives is now on preventive health behavior.

The characteristics of health behavior and its influence on health have been widely researched in the literature. Consequently, efforts continue to be made to improve the health behavior of individuals in order to attain optimal health (Centers for Disease Control and Prevention, 2011; HealthyPeople, 2011; WHO, 2011). The discipline that is mostly concerned with the interplay of health behavior and health is the discipline of health education (Glanz et al., 2008). However, health education is a multifaceted

discipline (Timmreck, Cole, James, & Butterworth, 2010). For this reason, it becomes important to understand its different components in order to achieve successful outcomes.

Definition of Health Behavior and Health Education

The World Health Organization (1998) defines health behavior as "any activity undertaken by an individual, regardless of actual or perceived health status, for the purpose of promoting, protecting or maintaining health, whether or not such behaviour is objectively effective towards that end" (p.8). Additionally, the Joint Commission on Health Education Terminology (2000) defines health education as "any combination of planned learning experiences based on sound theories that provide individuals, groups, and communities the opportunity to acquire information and the skills needed to make quality health decisions" (p. 6). Health professionals design and implement health education interventions for the purpose of changing health behavior and for health improvement (Glanz et al., 2008).

Health Education Delivery

The context of delivery of the health education interventions varies from formal settings, such as schools and hospitals, to informal settings, such as recreation settings and grocery stores (Glanz et al., 2008). Additionally, the channels of the delivery of these interventions varies to include several forms of communications from face-to-face, to print materials, to mass media, and to technology-based channels (Glanz et al., 2008).

Health communication and information delivered through the use of technology is part of a growing trend in health known as *ehealth* (Pagliari et al., 2005). Moreover, the popularity and the ubiquitous nature of mobile devices (Attewell, Savill-Smith, & Douch, 2009; Chen, Chang, & Wang, 2008) have opened the way to the delivery of health

information through mobile devices known as *mhealth.* The use of both ehealth and mhealth is on the increase, as reported by the WHO (2006, 2011). Fox (2011) stated that seeking health information online is the third most popular use of the Internet among adult Americans, amounting to 80% of Internet users. On a global level, the WHO (2011) reported the presence of 2 billion people connected to the Internet worldwide and more than 100 000 health related websites among its Member States. Moreover, the WHO (2011) found that 83% of Member States reported using at least one mhealth initiative in their countries. This increase in use of ehealth and mhealth is worth investigating because the use of technology adds to the complexity and the multifaceted nature of health education. Moreover, the use of technology in health education interventions facilitates their dissemination on a wide scale and yet enables them to be tailored to the specific needs of the learners, with methods as complex as websites or as simple as emails.

The Foundations of Health Education

Health education draws from a variety of disciplines such as medicine, behavioral sciences, education, and psychology, "resulting in a jungle of theories" (Timmreck et al., 2010, p. 68). Timmreck et al. (2010) state that "the dilemma faced by health education is to discern which and how much of the theory of related or supportive fields to accept and apply while avoiding becoming or duplicating that discipline" (p. 68). As result of the various disciplines from which health education draws, health educators tend to focus on the process more than theory and "research and process methods become isolated and fragmented" (p. 75). In the field of ehealth specifically, most of the reported studies are not tied to any theoretical foundations (Ahern, 2007; Baker et al., 2010; Kreps & Neuhauser, 2010). Therefore, a focus on process in health education, the lack of

reporting on the theoretical perspectives for most health education interventions, and the multiplicity of disciplines behind health education, threatens the discipline to produce interconnected knowledge without much credibility (Timmreck et al., 2010).

The roles of behavioral sciences and education in health education. The two disciplines most aligned with health education are the discipline of behavioral sciences and the discipline of education. The discipline of behavioral sciences informs health professionals about why people behave the way they do in health and offers guidance for behavioral change (Bandura, 1978, 1998, 2004; Glanz et al., 2008; Prochaska & DiClemente, 1986; Rosenstock, 1974; Rosenstock, Strecher, & Becker, 1988). On other hand, the discipline of education informs health professionals about how people learn (Driscoll, 2005; Gredler, 2001; Reigeluth, 1999). The end goal of both of the behavioral sciences and education disciplines is a change of behavior; however, the corresponding theories and models describing the approaches on how to produce change are divergent (Driscoll, 2005; Glanz et al., 2008; Reigeluth, 1999; Sharma & Romas, 2011; Timmreck et al., 2010). People charged with creating learning experiences that leads to behavioral change are the health professionals but their reliance on the theories and models offered from the field of education is minimal (Begoray & Banister, 2005; Timmreck et al., 2010).

Designing eHealth and mHealth Education Interventions

The literature on health education portrays concepts drawn from the field of education. For example, Keyser and Broadbear (2010) discuss the need to teach for critical thinking in health education. Also, Greenberg (2010) calls for the importance of deemphasizing the "1984 syndrome of operant conditioning" (p. 202) and moving

towards guiding the learner in making decisions through a collaborative approach. However, the literature is not explicit on how learning principles fit in the picture of the creation of health education interventions. More so, the health behavior theories or models describe behavioral change without much emphasis on the learning process that result in the behavioral change (Begoray & Banister, 2005; Timmreck et al., 2010; Welle, Russel, & Kittleson, 2010). Kinzie (2005) argues that this lack of explicitness may be due to the "separate nature of the different theories" (p. 14) in health behavior and education.

The discipline of education has a lot to offer to the discipline of health education. It provides the knowledge on how people learn through learning theories (Driscoll, 2005; Gredler, 2001; Reigeluth, 1999). It also provides guidance on how to facilitate the process of learning through instructional models (Reigeluth, 1999; Reigeluth & Carr-Chellman, 2009; Reigeluth & Keller, 2009). Moreover, it provides pathways to the rigor needed to reveal the effectiveness, efficiency, and relevancy of the instruction through instructional design models (Gustafson & Branch, 2007). Several theories and models have been developed to inform health professionals about health behavior. In addition, a variety of learning theories, instructional models, and instructional design models are available in the literature for health professionals to choose from. Therefore, health professionals have at their hands theories and models of health behavior and theories and models of learning and instruction to direct their creation of health education interventions.

In addition to the theories and models of health behavior and the theories and models of learning and instruction, health professionals involved in the creation of

ehealth and mhealth education interventions need to adhere to certain design principles that reinforce the achievement of the desired outcomes of the interventions. Technology offers several advantages to the design of instruction in general. It is cost effective, it is accessible any time and from different sources, it is interactive, it provides the learner with control over the learning process, and provides the learner with a sense of community through collaboration (Fee, 2009; Inan, Flores, & Grant, 2010; Rosenberg, 2001). More specifically to health education, ehealth and mhealth can help learners overcome the barriers of access to health care such as time and distance and it can expand the influence of the health message by addressing the special characteristics and interests of diverse populations (Hesse & Schneiderman, 2007; Kreps & Neuhauser, 2010). However, designing for elearning and mlearning goes beyond the mere transfer of content through a technology platform (Fee, 2009). Some characteristics specific to elearning and mlearning design are collaboration, learner control, navigation, interaction, and the incorporation of media (Alessi & Trollip, 2001; Clark & Mayer, 2003; Moore, 1989).

Therefore, health professionals involved in the creation of ehealth and mhealth education interventions need to pay proper attention to the design process in order to maximize the reach of the goals of their interventions.

Purpose of Study

Health professionals involved in the creation of ehealth and mhealth education interventions can draw from theories and models of health behavior and theories and models of learning and instruction in addition to design principles of elearning and mlearning. The exploration of how health professionals create these interventions can

shed the light on how they navigate through the theories and models of health behavior, the theories and models of learning and instruction and the design principles of elearning and mlearning. Therefore, the purpose of this study is to explore how health professionals create ehealth and mhealth education interventions.

Research Questions

The primary research questions for this study are:

1. How do health professionals use theories and models from the field of education to create ehealth and mhealth education interventions?
2. How do health professionals use principles of elearning and mlearning design to create ehealth and mhealth education interventions?
3. How do health professionals use theories and models from the field of health behavior and health education to create ehealth and mhealth education interventions?

Significance of the Study

The exploration of how health professionals create ehealth and mhealth education interventions will lead to an understanding of the framework through which health professionals analyze, design, develop, implement, and assess the interventions. Additionally, this study will shed the light on how theories, models, and design principles are used by health professionals from several perspectives through the variety of the settings through which these professionals work. Consequently, the findings will draw the landscape of the work behind the scenes of ehealth and mhealth education interventions, leading to a deep understanding of the foundations on which health professionals base their work.

CHAPTER 2

LITERATURE REVIEW

Health professionals create health education interventions to provide learners with the knowledge and skills that enable them to make decisions conducive to reaching and maintaining optimal health (Bensley, 2010; Glanz et al., 2008; Simons-Morton et al., 1995). For that purpose, health professionals draw from several disciplines that explain health behavior and guide the process through which change can occur (Timmreck et al., 2010). Two of these main disciplines from which health professionals use are the discipline of education and the discipline of behavioral sciences. The discipline of education offers theories and models that provide guidance on how people learn through the understanding of learning and instruction (Driscoll, 2005; Gredler, 2001; Reigeluth, 1999). On the other hand, the discipline of behavioral sciences offers theories and models that provide guidance on health behavior change (Bandura, 1978, 1998, 2004; Glanz et al., 2008; Prochaska & DiClemente, 1986; Rosenstock, 1974; Rosenstock et al., 1988). Moreover, when health professionals deliver the health education interventions through technology, either through an online format (ehealth) or a mobile format (mhealth), they have to consider certain design principles that ensure the success of their interventions (Alessi & Trollip, 2001; Clark & Mayer, 2003; Fee, 2009; Moore, 1989; Rosenberg, 2001).

Methodology

The review of literature focused on three main areas of inquiry. One area covered the discipline of education. The second area covered the design principles of elearning. The third area covered the discipline of health behavior and health education. The

resources used were books, research articles published in scholarly journals, and professional websites. The health behavior and health education book resources were located through a review of textbooks used in higher education institutions, books used for continuing education purposes, books available online through Google Books, or books recommended on commercial online bookstores, such as Amazon.com. The design principles of elearning and the education book resources were selected through recommendations from professors, textbooks used in the Instructional Design and Technology program at the University of Memphis, or books available online through Google Books. As the for the research articles, these were located through the databases ERIC, EBSCOhost, JSTOR, ScienceDirect, Wilson Web Omnifile, Academic OneFile, Google Scholar, and the online Journal of Medical Internet Research. Professional websites such as the Centers for Disease Control and Prevention, HealthyPeople, and the World Health Organization were also consulted.

Learning and Instruction

Learning and instruction draw from a variety of theories and models. In the section below, the theories of learning are presented, followed by common instructional models and then by instructional design models. Finally, a definition of elearning and its characteristics is presented.

Learning theories. Learning is a process of change (Alexander, Schallert, & Reynolds, 2009). This change manifests itself in "performance or performance potential…as a result of the learner's experience and interaction with the world" (Driscoll, 2005, p.9). Alexander et al. (2009) describe learning as inevitable, essential, and ubiquitous, because it can happen naturally and without much control from the

learner. As a result, learning can be tacit and incidental. However, learning can also be conscious and intentional. Alexander et al. (2009) add that learning can be resisted by the learner when the required change is difficult to achieve. But, learning is always interactional between the learner and the environment where the resulting change is not only in the learner but also in the surrounding environment (Alexander et al., 2009).

There is agreement in the literature on the nature of learning; however, there are different views on how the learning process occurs and how the underlying psychological variables affect it (Driscoll, 2005; Gredler, 2001; Reigeluth, 1999). Three main learning theories derived from different epistemological perspectives map the terrain of learning and instruction. These three learning theories are behaviorism, cognitivism, and constructivist learning theory (Driscoll, 2005).

Behaviorism. Behaviorism, a learning theory popular between 1960 to 1975 (Wilson & Cole, 1996), emphasizes the overt behavioral aspect of learning (Alonso, Lopez, Manrique, & Vines, 2005; Driscoll, 2005). Its key tenet is that the learned behavior results from the interaction between a stimulus and a response (Deubel, 2003). A stimulus causes a response from the learner. If the events that follow the response reinforce it, then the behavior is more likely to be maintained. Moreover, the behavior is maintained when the events that reinforce the response are consistent and reliable in a programmed manner (Driscoll, 2005; Mishra, 2002; Skinner, 1966). In this respect, the nature of the stimuli and reinforcements directs the change in behavior (Skinner, 1985). So under behaviorism, learning is an observable behavioral change resulting from the effects of the interplay of stimuli, responses, and reinforcements (Gredler, 2001; Skinner 1985).

Cognitivism. Cogntivism, a learning theory popular between 1976 to 1988 (Wilson & Cole, 1996), emphasizes the mental processing and information storing aspect of learning (Alonso et al., 2005; Driscoll, 2005). Its key tenet is that learning is dependent on the organization and acquisition of cognitive structures. Consequently, learning becomes a function of how information is stored in and retrieved from memory (Sweller, 1994). In sensory memory the brain attends to selected information; in working memory the information is processed, and in long-term memory it is stored permanently (Sweller, 2007). However, because memory has limitations, its capacity to retain and process information had to be taken into account in what is known as the cognitive load theory (Sweller & Chandler, 1991; Sweller, van Merrienboer, & Pass, 1998). Cognitive load theory states that processing and storing new information is affected by certain design elements of instruction that overload the short-term memory in the brain. (Paas, Renkl, Sweller, 2004, Sweller, 2007). So under cognitivism, learning is a mental process dependent on information processing and cognitive load.

Constructivist learning theory. The constructivist learning theory stems from the epistemology of constructivism that states that knowledge is constructed by individuals based on their interactions with their environment (Crotty, 2009). However, Harasim (2012) explains that constructivism "refers both to a learning theory (how people learn) and to an epistemology of learning (what the nature of knowledge is)" (p. 60). As a result, the terms describing the constructivist learning theory vary in the literature. Nevertheless, approaches to learning rooted in constructivism, whether as an epistemology or a theory, are known as constructivist approaches to learning (Beilaczyc & Collins, 2009). These approaches, popular since 1989 (Wilson & Cole, 1996) but

explicated as early as 1970 (Vrasidas, 2000), emphasize the construction of knowledge rather than the acquisition of knowledge on the part of the learner (Duffy & Cunnigham, 2005). The key tenet is that learning is constructed through the immersion in real-life contexts where content is applied (Jonassen, Cernusca, & Ionas, 2007). Additionally, constructivist approaches entail the construction of knowledge with multiple perspectives and with multiple representations, within a social activity. They are context dependent, and they allow for self-awareness of learning and knowing (Duffy & Cunningham, 2005). Important facets of constructivist approaches to learning are discovery learning, scaffolding, coaching, collaborative learning, and authentic assessment (Driscoll, 2005; Duffy & Cunningham, 2005). So under constructivist learning theory, the learning is social, authentic, and centered around the learner.

Although behaviorism, cognitivism, and constructivist learning theory describe learning differently, they are not necessarily exclusive of one another. Events belonging to more than one theoretical approach become integrated in the design of the same instruction (Cronjé, 2006).

Summary

The three main learning theories that map the terrain of learning and instruction are behaviorism, cognitivism, and constructivist learning theory. Under behaviorism, learning is an observable behavioral change resulting from the effects of the interplay of stimuli, responses, and reinforcements. Under cognitivism, learning is a mental process dependent on information processing and cognitive load. Under constructivist learning theory, learning is social, authentic, and is constructed by the learner through discovery.

Although these learning theories differ in focus, they are not exclusive of one another and can overlap in the design of the same instruction.

Instructional Models

Learning theories describe the process of learning but they do not provide guidance on designing events that facilitate learning. The design of events that facilitate learning is called instruction (Reigeluth, 1999; Reigeluth & Carr-Chellman, 2009). In order for the instruction to be successful, it must follow instructional models. These models describe the methods through which instruction is designed and implemented (Reigeluth & Keller, 2009).

A variety of instructional models are reported in the literature. These models are typically grounded in one learning theory. Following are selected examples of instructional models that typify the previous categories of learning theories.

Behavioral instructional models. Several instructional models fall under a behaviorist approach to learning. Among these models are personalized system of instruction (PSI), precision teaching, and direct instruction (Burton, Moore, & Magliaro, 1996). Some of the components of PSI are mastery learning, self-pacing, and teacher as motivator. As for precision teaching, its key tenet is measuring success through charting the rate of the occurrence of behaviors (Binder & Watkins, 1990; Burton et al., 1996).

Direct instruction has four main components. First is the presentation component that begins with a review of previously learned material and an introduction to what is to be learned followed by an explanation of the content material and probes form the teacher. Second is the practice phase where students are given the opportunity to practice what they have learned under the supervision of the teacher. Third is the assessment

phase that includes formative and summative assessment. Fourth is the monitoring and feedback phase (Huitt, Monetti, & Hummel, 2009).

Direct instruction has been widely used in a number of teaching programs, and its components have been shared by other instructional models (Binder & Watkins, 1990; Magliaro, Lockee, & Burton, 2005). Moreover, direct instruction has been researched extensively and has proven to be effective (Binder & Watkins, 1990; Magliaro et al., 2005). It must be noted that, although direct instruction is rooted in behaviorism, it has evolved and incorporated cognitivist principles of learning (Huitt et al., 2009; Magliaro, 2005).

Therefore, common to the behavioral instructional models is the central role of the teacher in the learning process, the stimulus-response interplay through practice and assessment, and the generality and universality of the learning process among all learners (Burton et al., 1996).

Cognitivist instructional models. The literature varies on the description of cognitive models. Models that are labeled cognitive are also described as constructivist (Reigeluth & Moore, 1999; Wilson & Cole, 1991; Yilmaz, 2011). In fact, Reigeluth and Moore (1999) posit that the cognitive models have "differences and commonalities" (p.51) and some are compatible while others are complementary to one another (Reiguleth, 1999).

Unlike behaviorism that places the teacher in the center of the learning process, cognitivism and constructivist learning theory place the learner in the center of the learning process and this is why they share similarities in models of instruction (Reigeluth & Moore, 1999; Wilson & Cole, 1991; Yilmaz, 2011). Moreover, these

similarities are also due to the embracement of some cognitive theorists to a constructivist perspective to learning (Ertmer & Newby, 1993).

Reigeluth and Moore (1999) describe cognitive education as " composed of the set of instructional methods that assist students in learning knowledge to be recalled or recognized, as well as developing students' understandings and intellectual abilities and skills" (p. 52). Furthermore, Ertmer and Newby (1993) list five basic characteristics of cognitively based instruction. First, the learner must be actively involved. Second, the learner should be trained to build metacognitive skills. Third, there should be a cognitive task analysis. Fourth, the learning material has to be structured, organized, and sequenced to facilitate learning. Fifth, the learning environment should encourage connections with previously learned material.

Different theorists have proposed different taxonomies for cognitive learning (Reigeluth & Moore, 1999). Bloom identifies six levels of cognitive learning: knowledge, comprehension, application, analysis, synthesis, and evaluation (Krathwohl, 2002; Reigeluth & Moore, 1999). Gagné describes five types of learning outcomes: verbal information, intellectual skills, cognitive strategies, attitudes, and motor skills (Gagné, 1980; Smith & Ragan, 1996). Other taxonomies referenced by Reigeluth and Moore (1999) are rote learning and meaningful learning by Ausubel (1968), declarative knowledge and procedural knowledge by Anderson (1983), and remembering verbatim, remembering paraphrasing, using generality and finding generality by Merrill (1983). These different taxonomies classify the components of cognitive learning in order to guide the design of instruction (Smith & Ragan, 2005).

However, Gagné's work in instructional design remains the most influential (Smith & Ragan, 1996). Described as a behaviorist at times, his work has evolved over the years to incorporate cognitive information processing principles (Driscoll, 2005; Smith & Ragan, 1996). Besides the taxonomy of learning outcomes presented earlier, Gagné developed a sequence of nine learning events to facilitate the processing of the information on the part of the learner. These events are gaining attention, informing learners of the objectives, stimulating recall of prior learning, presenting the content, providing learning guidance, eliciting performance, providing feedback, assisting performance, and enhancing retention and transfer (Driscoll, 2005; Gagne, 1980; Smith & Ragan, 1996).

Other instructional models described in the literature as cognitive are cognitive flexibility hypertext, cognitive apprenticeship, and anchored instruction (Wilson & Cole, 1991). These models are also described in the literature as constructivist models (Driscoll, 2005; Duffy & Jonassen, 1992; Spiro, Feltovich, Jacobson, Coulson, 1991; Vrasidas, 2000). Since components of these models align with the constructivist approach to learning such as problem-solving, situated learning, and social learning (Collins, Brown, Holum, 1991; Driscoll, 2005; Spiro et al., 1991) these models will be discussed under constructivist instructional models.

Constructivist instructional models. Jonassen (1999) explains that constructivist learning must first focus on "a problem, a project, or a question" (p. 217) that drives the learning. Second, this problem, project, or question must be contextualized, engaging, and motivating. Third, it must be supported by related cases to scaffold the learner's memory and enhance cognitive flexibility. Fourth, resources need

to be provided to the learner to help with the understanding of the problem. Fifth, cognitive tools, such as visual organizers or computer tools, also need to be provided to help the thinking process of the learner. Sixth, learning should occur through collaboration among the learners.

Additionally, Jonassen (1999) discusses the importance of the instructional activities of modeling, coaching, and scaffolding in constructivist learning environments. Modeling supports the learning activity of exploration, coaching supports articulation, and scaffolding supports reflection. Therefore, any instructional model that incorporates the components discussed by Jonassen (1999) aligns with a constructivist approach to learning.

Examples of constructivist instructional models are cognitive flexibility hypertext, cognitive apprenticeship, anchored instruction, project and problem-based learning (Driscoll, 2005; Duffy & Jonassen, 1992; Spiro et al., 1991; Vrasidas, 2000).

The basic tenet of cognitive flexibility theory is the "multiple juxtapositions of instructional content" (Spiro et al., 1991, p. 5). In cognitive flexibility theory, instruction is build in a nonlinear manner to present ill-structured problems, with multiple representations of the content to enhance deeper levels of knowledge attainment. The multiple representations and interconnectedness of the content is built with the use of hypertext whose characteristics allow the complexity of structuring (Spiro et al., 1991). Additionally, the instruction is contextualized in mini-cases (Wilson & Cole, 1991).

The basic tenet of cognitive apprenticeship is helping the learner learn from the experts by situating learning in real-life contexts. Through cognitive apprenticeship, the expert makes the learning visible, transforming it from an abstract to embedded in

multiple contexts and in authentic tasks. The purpose of cognitive apprenticeship is to share with the learner the domain and tacit knowledge of the expert and his heuristic, metacognitive, and learning strategies. As for the method used in cognitive apprenticeship model, it includes modeling, coaching, scaffolding, articulation, reflection, and exploration. Through modeling, the learner observes the expert performs a task. Through coaching, the expert observes and facilitates the learner's performance of the task. Through scaffolding, the expert supports the learner's performance of the task. Additionally, the learner is encouraged to verbalize his knowledge and thinking through articulation, compare his performance with others through reflection, and pose and solve new problems on his own through exploration (Collins, 1988; Collins, Brown, & Holum, 1991).

The basic tenet of anchored instruction is "situating instruction in videodisc-based, problem-solving environments" thus the name *anchored* (The Cognition and Technology Group at Vanderbilt, 1990, p.2). The main goal of anchored instruction is to enable the learner to explore a topic from multiple perspectives and face problems as experts do in real-life. Anchored instruction is similar to cognitive apprenticeship in embedding learning in authentic tasks and in providing opportunities for apprenticeship. However, what sets it apart are its visual and technology components (The Cognition and Technology Group at Vanderbilt, 1990).

Problem-based learning is an instructional model where learners conduct research, formulate hypotheses, reflect, and apply their learning to find solutions to ill-structured problems (Hmelo-Silver & Barrows, 2000; Savery, 2006). The process of designing instruction based on problem-based learning requires learners to work in groups of five to

eight. Once presented with the problem, they must generate a hypothesis to solve the problem. Then they must identify what they know and what they need to know in order to solve the problem. Through self-directed study, the learners search for the information needed, share it with the group, assess their progress until they resolve the problem, and summarize their findings. This learning exercise is lead by the teacher who plays the role of a tutor or facilitator (Hung, Jonassen, & Liu, 2007).

In project-based learning, learners pursue a driving question that leads to the investigation of a certain topic, in-depth and in an authentic context and through collaboration with peers (Barron et al., 1998; Grant, 2002; Mergendoller et al., 2006; Thomas, 2000). The end product of project-based learning is the production of artifacts that represent the multiple perspectives of the topic and of the learners (Jonassen, 1999). Inherent to project-based learning is the scaffolding on the part of the teacher that provides the learners with resources on the subject-matter they are working with as well as on the manner in which to conduct inquiry activities and management of tasks (Grant & Branch, 2005; Thomas, 2000). Another aspect of project-based learning is reflection. Through reflection, learners verbalize and articulate their thinking, identifying problems in their learning process, and evaluate the outcome of their work (Kim & Lee, 2002).

Summary

Instructional models are typically grounded in one learning theory. Common to the behavioral instructional models is the central role of the teacher in the learning process, the stimulus-response interplay through practice and assessment, and the generality and universality of the learning process among all learners (Burton et al., 1996). On the other hand, common to cognitivist instructional models is the focus on the

methods and structure that facilitate the mental processing of the learned material. Moreover, common to constructivist models is an authentic problem or project that learners investigate through collaboration among peers and the coaching and scaffolding of the teacher.

Instructional Design Models

The instructional models whether they follow a behaviorist, cognitive, or constructivist approach direct and facilitate the planning of instruction (Reigeluth, 1999; Reigeluth & Carr-Chellman, 2009; Reigeluth & Keller, 2009). However, they are not rigorous enough to reveal the effectiveness, efficiency, and relevancy of the instruction. The solution to this shortage is the development of a systematic approach to planning instruction (Gustafson & Branch, 2007). Models that present a systematic approach to instructional design are known as instructional design models. These instructional design models serve as "conceptual and communication tools to visualize, direct, and manage processes for creating high quality instruction" (Gustafson & Branch, 2002, p.1).

The common components to all instructional design models are analysis, design, development, and evaluation (Reiser, 2007). The difference between these models lies in the structuring of the components and sub-components, as well as the used terminology (Gustafson & Branch, 2007). One model that serves as the blueprint from which all the other models have spun is the ADDIE model. Other common models of instructional design are the Dick, Carey, and Carey model, the Smith & Ragan model, and the Morrison, Ross, and Kemp model (Gustafson & Branch, 2007). Following is an overview of each of these models.

ADDIE. ADDIE stands for analysis, design, development, implementation and evaluation. It is a generic model whose origins are difficult to trace (Bichelmeyer, 2004; Molenda, 2003). In fact, Molenda (2003) wrote an article entitled *In search of the elusive ADDIE model* for the purpose of identifying the origin of ADDIE.

The components of ADDIE are what make its acronym: analysis, design, development, implementation, and evaluation. The analysis phase includes a needs assessment of the performance problem and goal identification. The design phase includes defining the objectives, the learning activities, and the media to be used for the instruction. The development phase includes the preparation of the learning and teaching materials. The implementation phase includes the delivery of the instruction. The evaluation phase includes summative and formative evaluation. It is important to note that the design process in ADDIE is iterative and not linear (Gustafson & Branch, 2007).

Molenda (2003) and Bichelmeyer (2004) argue that ADDIE is not even a model. They posit that ADDIE is a conceptual framework or an umbrella term from which other more elaborate instructional models are developed. Nevertheless, ADDIE includes essential components inherent to all other instructional models. Moreover, ADDIE has been criticized for lack of effectiveness and efficiency (Bichelmeyer, 2004). It has also been criticized as a model that does not resemble the actual application of instructional design in real-life (Gordon & Zemke, 2000).

Dick, Carey, and Carey (2009). The Dick, Carey, and Carey model (2009) is one of the most widely used instructional design models (Gustafson & Branch, 2002). First developed in 1968 to address the needs of teachers, it then evolved to address the

needs of instructional designers designing instruction for business, industry and military (Dick, 1996). Each of the components is discussed below.

Identification of instructional goals. In this phase, an analysis is performed to determine the cause of the performance problem, the gap between actual and desired performance, and the instructional need.

Instructional analysis. In this phase, a goal analysis is performed to classify the goals according to the kind of learning that will occur, based on Gagné's domains of learning. This step is followed by the identification and sequencing of the major steps required to perform the goal as well as the identification of subordinate and entry skills. The goal analysis is portrayed in a visual display that either hierarchal, procedural, or cluster approach.

Learner and context analysis. In this phase, first, the characteristics of the learner are analyzed. Examples of these characteristics are entry skills, prior knowledge of topic area, attitudes towards content and potential delivery system, academic motivation, educational and ability level, general learning preferences, attitudes toward training organization. Second, the context in which the performance occurs is analyzed. Examples of data collected in context analysis are managerial support, physical aspects of the site, social aspects of the site, relevance of skills to workplace. Third, the context in which learning is to take place is analyzed. Examples of data collected in learning context analysis is the compatibility of the site with the instructional requirements, the adaptability of the site to simulate workplace, the adaptability of the site for delivery approaches and learning site constraints that affect design and delivery.

Writing the performance objectives. This phase consists of a detailed description of what the students will be able to do with specification of the condition, behavior, and criteria for performance. The objectives are derived from the instructional analysis and serve as an input for test construction.

Developing assessment instruments. In this phase test-items are developed. They include entry-skills tests to assess learners' mastery of prerequisite skills, pretests to profile the learners with regard to instructional analysis, practice tests to provide active learner's participation during instruction, and posttest to measure the achievement of the objectives.

Developing an instructional strategy. This phase consists of sequencing and clustering of the content according to Gagné's nine events of instruction. So, the instructional strategy is divided into five learning components. Preinstructional activities include gaining attention of the learner, informing him about the objectives and stimulating recall of prerequisite learning. Content presentation includes content and learning guidance. Learner participation includes practice and feedback. Assessment includes entry skills test, pretest, posttest. Follow up through activities: memory aids for retention and transfer considerations.

Developing and selecting instructional materials. In this phase, the delivery system and media selection are considered. Also, the components of the instructional package are determined. Finally the instructional materials are developed taking into consideration existing instructional materials.

Designing and conducting formative evaluation. The formative assessment is carried out in three phases. The first part is the one-to-one evaluation with three or more

learners to address the clarity of the instruction, the impact on the learner, and the feasibility with respect to resources. The second part is the small-group evaluation with eight to twenty learners to determine if the changes made in the one-to-one evaluation were effective and whether the learners can use the instruction without interacting with the instructor for self- instructional materials. The third part is the field trial with about a group of thirty to determine if the changes made in the small-group evaluation were effective and whether the instruction can be used in the context for which it was intended.

Revising the materials. Revisions are made based on the results of the formative evaluation.

Designing and conducting summative evaluation. This summative evaluation is carried out in two parts. The first part is the outcome analysis to measure the impact of the instruction on the performance and the impact on the organization. The second part is the expert judgment analysis to determine the congruence of the instruction with the organization need, the content analysis, the design analysis, and the feasibility analysis.

Dick (1996) posits that the Dick, Carey, and Carey model addresses novice instructional designers. Also, it is not meant to be followed in a linear manner, especially by more seasoned instructional designers. The model is labeled as a behaviorist model (Dick, 1996; Deubel, 2003). However, Dick (1996) states the new editions of the model do contain constructivist aspects such as motivation, the importance of context, and prior experience.

Smith and Ragan (2005). The Smith and Ragan model was first published in 1993. The model "exemplifies and elaborates" (Smith & Ragan, 2000, p.163) on Gagné's types of learning theory. Smith and Ragan (1994, 2000, 2005) argue that Gagné's model

tends to put the focus on how the instruction is done to the learner rather than what the cognitive processing of the learner is. In their model, they expand on Gagné's nine events of instruction and differentiate between supplantive strategies initiated by the instructor and generative strategies produced by the learner (Smith & Ragan, 2000). Moreover, they posit that their model adds to Gagné's theory a focus on learner's characteristics and strategies for the different types of learning. The Smith and Ragan model provides "practical and theoretical information on instructional design" (Tripp, 1995, p. 74) as well as extensive advice on learner's analysis, test construction, teaching strategies (Tripp, 1995). The model consists of the following components:

Instructional analysis. The phase includes analyzing the learning context, analyzing the learners, and analyzing the learning task. The learning context analysis determines the instructional need, the description of the learning environment, and working with the expert on the content. The learner analysis determines the characteristics of the learner such as prior knowledge, cognitive, psychological, and affective characteristics. The learner analysis guides the design of the instruction in areas such as pace, practice, structure, chunking, learner control, and learner guidance. The learning task analysis identifies the learning goals, decomposes the goal into its components in order to identify what the students need to learn, determines the steps through which a task is to be completed and includes writing of the learning objectives.

Assessing learning from instruction. The Smith and Ragan model recommends writing the assessment items immediately after writing objectives. It specifies the characteristics of good assessment such as validity, reliability, and practicality. The

formats of assessment can be done through observation, simulations, essays, portfolios, or pencil-and-paper (i.e., a test).

Develop instructional strategies. The Smith and Ragan model offers strategies based on the types of learning such as for declarative knowledge, concepts, procedures, principles, problem-solving, cognitive strategies, attitude, psychomotor skills. Through the expanded instructional events, the model recommends an introduction, establishing purpose of the instruction, arousing interest and motivation, previewing learning activity, a body, a conclusion, and an assessment.

Produce instruction. The Smith and Ragan model draw attention to key concepts in implementation. These concepts are diffusion, dissemination, adoption, and stakeholders. Another consideration is to be given to the timing of the implementation. Additionally, the model focuses on the importance of project management.

Conduct evaluation. Evaluation in the Smith and Ragan model is similar to the Dick, Carey, and Carey model. Formative evaluation includes design reviews, expert reviews, one-to-one evaluation, small-group evaluation, and field trials. The results of the formative evaluation will guide the revisions needed to improve the instruction. Summative evaluation includes determining the goals for evaluation, selecting the orientation of the evaluation design, designing the evaluation, determining the indicators of success, collecting data, analyzing data, and reporting data.

Morrison, Ross, and Kemp (2007). The Morrison, Ross, and Kemp (MRK) model originated in 1994 and was later revised in several versions (Kowch, 2004). MRK provides instructional designers with a model represented in a diagram and not in a linear array of boxes and arrows (Belland, 1998). The MRK model is described as being useful

for inexperienced instructional designers who are being introduced to the field of instructional design (Nichols, 1995). The theoretical approach of the MRK is both behaviorist and cognitivist (Morrison, Ross, & Kemp, 2007). However, a constructivist approach is also an available option in MRK (Kowch, 2004).

The MRK model consists of the following components:

Instructional problems. MRK presents two steps for defining the instructional problem. First, through needs assessment, the gaps in performance are identified and recommendations for interventions are presented. Second, through goal analysis, the aim and the goals of the intervention are specified followed by a ranking and prioritizing of the goals. Additionally, through performance assessment, the real source of the problem is unveiled in order to design the most appropriate intervention.

Learner characteristics. Three types of learner's characteristics are identified under MRK. First, through learner analysis, the general characteristics of the learner are determined. Examples of these characteristics are entry competencies, learning styles, academic information, personal and social characteristics, and disabilities. Second, through contextual analysis, the orienting context, the instructional context, and the transfer context are identified. The orienting context addresses the motives of the learners for participating in the intervention, its utility to them and their accountability for participation. The instructional context addresses the characteristics of the environment where the instruction will take place. The transfer context addresses how the learning resulting from the intervention will be transferred to the job.

Task analysis. Three types of task analysis are listed in MRK. First, topic analysis identifies concepts, principles, rules, procedures, interpersonal skills, and

attitudes. Second, procedural analysis and through working with the subject-matter expert, accurately identifies the steps needed to complete the task. Third, the critical incident method identifies the conditions that lead to a successful completion of task.

Instructional objectives. The instructional objectives are derived from the task analysis. They address the cognitive, psychomotor, and the affective domain. They can be classified objectives into categories of performance and level of difficulty according to the Mager and Beach's Model (1967) or they can be classified by content type and performance according to the Expanded Performance-Content Matrix Model (Merrill, 1983).

Content sequencing. The MRK model recommends two strategies for sequencing the instruction. The first sequencing strategy is The Posner and Strike Sequence Scheme (1976) where the content is sequenced through learning-related sequencing depending in the learner, world- related sequencing depending reflecting how the content is sequenced in the real world, or concept-related sequencing related to how concepts are organized. The second sequencing strategy is the Elaborating Theory Sequencing (English & Reigeluth, 1996) where the content is sequenced according to mastery of knowledge through concept expertise sequencing, or expertise in task through task expertise sequencing.

Instructional strategies. The instructional strategies help the learner in making connections between the new knowledge and the prior knowledge. MRK describes two types of instructional strategies. One is the generative learning strategy that supports the learning process through recall, integration, organization, and elaboration on the

information. Two is the presentation strategy that represents the manner through which the instruction will be presented.

Designing the message. The MRK focuses in three aspects of the design of the instructional materials. First, the preinstructional strategy that constitutes an introduction to the learner. This can be done through pretests, objectives, overviews, or advance organizers. Second, the message design for text must include signals to facilitate the learning of the instruction. These signals can be signaling the text schema, explicit signals and typographical signals. Third, the pictures and graphics used in the instruction must have a function and must be effective.

Developing instructional materials. The MRK present recommendations when developing the instructional materials. The recommendations include staying focused on solving the performance problem, making the instruction concrete to the learner, controlling the step size, using appropriate pacing, maintain consistency, using cues, using transitions and considering the cognitive load. Also the MRK model points to considering whether the instruction is a group presentation, self-paced instruction, or small-group activities.

Evaluation instruments. Evaluation instruments have to be developed to measure the level of learning achieved after the instruction. Knowledge can be tested through multiple choice questions, constructed response tests, short answers, essay questions, or problem solving questions. Skills and behavior can be tested through direct testing, procedure, analysis of naturally occurring results, ratings of performance, checklists, rating scales, rubrics, anecdotal records, indirect checklist/ rating measure,

portfolio assessment, or exhibition. Attitudes can be tested through observation and anecdotal records. Behaviors can be tested through questionnaires, surveys, or interview.

The MRK also suggests formative and summative evaluation of the instruction. Formative evaluation aims at providing feedback to the designers on the content, achievement of objectives, and the overall design. This type of information is used to improve the instruction. As with the Dick, Carey, and Carey model, formative evaluation is done in three phases: one-to-one, small group trials, and field trials. The summative evaluation aims at measuring the effectiveness of the instruction, the efficiency of learning, the cost and expenses incurred in the program, reactions towards the program, and the long-term benefits to the program.

The MRK model is presented in a parsimonious fashion, making it easy to understand and apply. Moreover, the model offers instructional designers a flexible approach to its implementation and is not as prescriptive as other instructional models (Kowch, 2004).

The three instructional design models presented are examples of hundreds of models (Gustafson & Branch, 2002). Common to all the models are the components of ADDIE: analysis, design, development, implementation, and evaluation (Gustafson & Branch, 2007). However, the literature is scarce in empirical evaluative studies on the successful application of any of the models (Edmonds, Branch, & Mukherjee, 1994; Gustafson & Branch, 2002). Moreover, the instructional design models themselves are not clear on the contexts that fit their application best (Edmonds, et al., 1994). Several attempts have been made to classify these models based on the intended purpose of use, the type of task to be learned, the level of expertise of the designer, the theoretical origin

of the model, or the environments in which the model is to be used (Edmonds et al., 1994; Gustafson & Branch, 2002). Nevertheless, designers vary in their use of the models, even when it comes to the simplest ADDIE form (Visscher-Voerman & Gustafson, 2004).

Summary

Instructional design models provide a systematic approach to planning instruction. This systematic approach ensures a rigor that supports the effectiveness, efficiency, and relevancy of the instruction. Three commonly used instructional models are the Dick et al. model (2009), the Smith and Ragan model (2005), and the Morrison et al. model (2007). Like all other instructional design models, these models incorporate the components of ADDIE (analysis, design, development, implementation, and evaluation) but with more structure and guidance on each of the components.

The Interplay Between Learning Theories and Instruction, and Health Education

The learning theories and the instructional models presented can be applied in any context where learning occurs, including the field of health behavior and health education. However, historically, health education focused on the transmission of knowledge through a teacher-centered approach, aligning with behaviorism and behavioral instructional models (Keyser & Broadbear, 2010). Recently, concerns over the need to teach thinking skills and to support the learner in the decision-making process of behavioral change led to a shift in the learning paradigm of health education towards a more cognitive-based and collaborative approach to teaching, aligning with cognitivism and constructivist learning theory. (Greenberg, 2010; Keyser & Broadbear, 2010; Welle et al., 2010). In this respect, Clark, (2010) posits that the role of the health educator must

shift from teaching facts to teaching people how to learn, especially when technology becomes a channel for the dissemination of information in a fast pace and from different sources. Additionally, Ubbes, Black, and Ausherman, (2010) state that health educators need to teach towards understanding by the use of collaborative learning, focus on the learner, and the thinking through multiple perspectives. However, few of the studies reported in the literature on health education emphasize the instructional strategies used (Kinzie, 2005) and none report on the use of instructional design models. But, in accordance with the expressed need for a shift in paradigm in health education, instructional models such as Gagné's nine events of instruction, cognitive flexibility hypertext, cognitive apprenticeship, anchored instruction, and project and problem-based learning can guide heath professionals in their design of health education interventions. Similarly, instructional design models can support health professionals in creating more robust health education interventions.

eLearning

Instruction can be delivered through many platforms. It varies from face-to face, to print, to technology-based platforms. Instruction delivered through technology-based platforms is known as elearning. The definition of elearning and a discussion on its characteristics will be presented.

Definition of elearning. Many definitions of elearning are available in the literature. Some definitions are technology-specific while others are context-specific. Some definitions are provided from an academic standpoint while others from a vendor standpoint (Fee, 2009). Clark and Mayer (2003) offer one of these elearning definitions as:

Instruction delivered on a computer by way of CD-ROM, Internet, or intranet with the following features:

- Includes content relevant to the learning objectives
- Uses instructional methods such as examples and practice to help learning
- Uses media elements such as words and pictures to deliver the content and methods
- Builds new knowledge and skills linked to individual learning goals or to improved organizational performance (p. 13).

More comprehensively, Fee (2009) defines elearning as, "an approach to learning and development: a collection of learning methods using digital technologies, which enable, distribute and enhance learning" (p.16). The definition provided by Fee is more general in terms of the technology used, encompassing the use of mobile devices or any other form of digital technology that can be developed in the future. For this reason, Fee's definition will be adopted for this study.

Benefits of eLearning

eLearning brings several benefits to learning and instruction. First, it is cost-effective as an instructional delivery method. Second, content can be easily be updated. Third, there is a continuous access to learning. Fourth, it builds a sense of community. Fifth, it is student-centered and can address different learning preferences (Fee, 2009; Rosenberg, 2001). Additionally, elearning allows for providing practice and feedback for the learner, collaboration with other learners, and interactivity and simulations to accelerate expertise (Clark & Mayer, 2003). Therefore, elearning has the potential of enhancing the learning process through the provision of several benefits.

Characteristics of eLearning Design

Fee (2009) identifies three components of elearning: content, technology, and learning design. However, Fee (2009) emphasizes that elearning is not merely transferring content through a technology platform. He posits that learning design must be of prime importance in appropriating the content to the needs of the learner. In fact, Phillips, McNaught, and Kennedy (2012), describe elearning as "primarily a branch of the discipline of education" (p. 5) and add that good design is what is important to produce effective learning. Additionally, Lynch and Roecker (2007) state that, although technology is used in elearning, learning is the essential element.

Therefore, successful elearning is not only limited to the incorporation of technology in the learning materials. It must essentially incorporate sound learning design that is based on a good understanding of how people learn and on creating learning instances that maximize learning, using the advantages provided by technology (Clark & Mayer, 2003; Fee, 2009, Lynch & Roecker; Philllips et al., 2012). Some of the learning design characteristics specific to elearning are collaboration, learner control, navigation, interaction, plus others.

Collaboration. The advantages to collaboration are creating a sense of community, exchanging experiences and knowledge, and enhancing the social learning experience (Clark & Mayer, 2003; Hill, Wiley, Nelson, & Han, 2004). Examples of tools that can be used for collaboration are chats, message boards, and email. Clark and Mayer (2003) recommend including project-based learning, problem-based learning, and peer tutoring as good practices for collaborative elearning, although Hung et al. (2007) raise concerns about related implementation issues.

Learner control. eLearning offers the learner control over the process of learning resulting in a shift from external locus of control to an internal locus of control (Hill et al., 2004; Shapiro & Niederhauser, 2004). Learners prefer to have more control in elearning environments because it allows them to choose the strategies through which they progress in the learning environment (Inan, Flores, Grant, 2010); however, their decision making process about navigation is not always conducive to their learning (Alessi & Trollip, 2001; Clark & Mayer, 2003). The more the prior knowledge and the lower the complexity of the content, the more control can be given to the learner (Clark & Mayer, 2003). Learners can be provided control over the sequence of the content and the pace of movement (Alessi & Trollip, 2001). It is recommended to allow learners to move freely back and forth in the elearning environment and to control the pace through which they proceed through it (Alessi & Trollip, 2001; Clark & Mayer, 2003). The tools that allow learner control are buttons and menus (Alessi & Trollip, 2001).

Navigation. Navigation is an essential feature of elearning because it helps orient the learner who can very easily get lost in hyperspace (Alessi & Trollip, 2001; Hill et al., 2004). The tools that support navigation are menus, hyperlinks, and buttons. These navigation tools must serve a clear purpose, be visible, and located consistently on the screen (Alessi & Trollip, 2001).

Interaction. Three types of interactions are identified in the literature: learner-content, learner-expert, and learner-learner (Alessi & Trollip, 2001; Hill et al., 2004; Moore, 1989). The learner-content interaction is the learner's interaction with the materials provided in the elearning environment. The learner-expert interaction is the interaction between the learner and the teacher or instructor who provides feedback,

support, and motivation. The learner-learner interaction is the collaborative work between learners to exchange information, construct knowledge, or support each other (Hill et al., 2004; Moore, 1989). Using interaction in elearning allows for the active engagement of the learner through knowledge construction and representation (Hill et al., 2004).

Other considerations. One consideration in the design of elearning is the provision of help. Alessi and Trollip (2001) name two types of help: procedural and informational. Procedural help guides the learner in operating the elearning environment while the informational help supports the learner with the content material such as providing resources. Another consideration is the provision of practice opportunities to support the effective learning of the content (Clark & Mayer, 2003).

Therefore, the design of elearning must focus on the needs of the learner with a focus on collaboration, learner control, navigation, interaction, and provision of help and practice.

The Use of Media in eLearning

eLearning allows for the inclusion of several media formats. Examples of these media are text, hypertext, sound, graphics, video, and animation (Alessi & Trollip, 2001; Clark & Mayer, 2003). However, elearning design must follow certain rules on how the media is used in order to support the learning process (Alessi & Trollip, 2001; Clark & Mayer, 2003). For example, the text should be well spaced to increase readability, blinking and moving text should be avoided, and the use of graphics and animations must serve an educational purpose. Clark and Mayer (2003) list five principles for successful use of media. These principles are: multimedia principle, contiguity principle, modality principle, redundancy principle, and coherence principle.

Multimedia principle. This principle addresses the use of words and graphics to facilitate the learning process. Clark and Mayer (2003) recommend the use of graphics not as decorative tools to words but as explanatory tools for better understanding of the content.

Contiguity principle. This principle addresses the positioning of graphics near words. Clark and Mayer (2003) recommend that words be placed next to the graphics that represent them in order to facilitate the process of making connections between graphic and words for the learner.

Modality principle. This principle addresses the use of the audio channel in support of the visual channel through which the learner receives information. Clark and Mayer (2003) recommend using narration instead of onscreen text to decrease the cognitive load of the visual representations by allowing processing through audio representations.

Redundancy principle. The principle addresses the duplication of narration on and text. Clark and Mayer (2003) recommend avoiding using both explanatory text and narration of the same text for graphics. This practice distracts the learner and overloads the visual channel.

Coherence principle. This principle addresses the use of entertaining and motivational materials that do not support the learning process. Examples of these materials are background music, entertaining stories, and detailed descriptions. Extraneous sound such as background music, extraneous pictures, and extraneous words related but not necessary to the content are all elements that increase the cognitive load

for no reason. These extraneous elements distract and disrupt the learning process and should be avoided.

So, the use of media in elearning can enrich the learning experience. However, if not properly incorporated, this use might hinder the learning process instead of enhancing it.

Summary

eLearning is learning delivered through digital technologies. Its design features and delivery methods offer several benefits to the learning process. eLearning focuses on the needs of the learner and is characterized by the features of collaboration, learner control, navigation, interaction, and provision of help and practice. Additionally, the incorporation of media in elearning necessitates the careful consideration of the principles of multimedia, contiguity, modality, redundancy, and coherence principles.

Health Behavior and Health Education

The definition of health education has evolved over the years as the understanding of the nature of health and the factors affecting it deepened (Glanz et al., 2008; Simons-Morton et al., 1995). Terms common to these definitions that date back to 1943 are *learning experiences, behavior, knowledge, attitudes, skills, motivation, informed decisions,* and *health* (Simons-Morton et al., 1995). The Joint Committee on Health Education Terminology (2000) defines health education as "any combination of planned learning experiences based on sound theories that provide individuals, groups, and communities the opportunity to acquire information and the skills needed to make quality health decisions" (p. 6). Recently, Bensley (2010) states that the goal of health education is to " provide learning experiences from which people develop knowledge and skills to

make informed decisions which will maintain their health and the health of others" (p.5). Glanz et al. (2008) clarifies that the quality of informed health decisions made pertain to health behavior. In this regard, Nutbeam (1998) defines health behavior as "any activity undertaken by an individual, regardless of actual or perceived health status, for the purpose of promoting, protecting or maintaining health, whether or not such behaviour is objectively effective towards that end" (p. 355). This brief overview of health education and health behavior definitions points to the action state in health behavior and the learned experiences that guide it.

However, factors that affect the health status of people are multiple. Some are modifiable while others are not. An example of modifiable factors would be the health knowledge of people while an example of nonmodifiable factors would be gender. Both of these factors are called the determinants of health (Nutbeam, 1998). The complexity of the interplay between the health determinants and health behavior leads to the emergence of several theories and models that explain why people behave the way they do in health-related matters (Glanz et al., 2008). Although over 60 theories and models of health behavior and health education were reported in the literature, only few have been used on a wide scale. The three most popular theories and models reported by Glanz et al. (2008) are the health belief model, the social cognitive theory, and the transtheoretical model.

The characteristics of each of these theories/models will be discussed below. These characteristics are: origins, constructs, applications, limitations, and link to learning theories.

Health Belief Model

Origins. The origins of the health belief model (HBM) date back to the 1950s when scholars were trying to explain the health behavior of people in order to plan effective health behavior interventions (Champion & Skinner, 2008). Because people at that time were unreceptive to health preventive measures and screening tests, a theory was needed to "explain health preventive behavior" (Rosenstock, 1974, p. 1). The early work on the HBM was concerned with the motivation and the perceptions of people in the domain of health prevention (Rosenstock, 1974). Preventive health behavior was explained by the interplay between the motivation of an individual to take a certain health action and his or her expectancy of goal attainment (Maiman & Becker, 1974; Simons-Morton et al., 1995). The expectancy of goal attainment is brought about by the values placed on the benefits and the threats resulting from a health behavior will determine how the behavior will be carried out to achieve goals (Kirscht, 1974; Maiman & Becker, 1974).

The health belief model has expanded since the early work of Rosenstock and others from focusing on preventive health behavior to including the more complex health behaviors of illness and compliance (Champion & Skinner, 2008; Maiman & Becker, 1974). As a result, self-efficacy was introduced to HBM to encompass the importance of one's belief in his or her competence in implementing a change in the health behavior (Rosenstock et al.,1988).

Constructs. Rosenstock et al. (1988) explain that HBM focuses on three classes of factors of health-related actions:

- Motivation influenced by a health concern.

- Belief in susceptibility to a certain health condition (perceived threat).
- Belief in the benefits of taking a health action.

These three factors are broken down into six constructs (Champion & Skinner, 2005; Rosenstock, 1974; Sharma & Romas, 2012). These constructs are:

1. *Perceived susceptibility.* It is one's belief in acquiring a disease.
2. *Perceived severity*: It is one' belief in the severity of the consequences of a disease if acquired.

Theses two factors are referred to as perceived threat (Champion & Skinner, 2005).

3. *Perceived benefits*: It is one's belief in the beneficial return of a health action, including reducing the perceived threats.
4. *Perceived barriers*: It is one's beliefs in the negative aspects and costs incurred in taking a health action.
5. *Cues to action*: These are the external or internal triggers to taking action in a health-related matter.
6. *Self-efficacy*. It is one's belief in competence in achieving a change.

Other variables playing a role in health behavior under HBM are the socio-demographic variables and the prior knowledge and experience with the disease. These are known as the modifying variables. Additionally, although motivation is an underlying element in HBM, it is not explicitly labeled as a separate construct. This is due to failure in operationalizing its measure (Rosenstock, 1974). However, Maiman and Becker (1974) posit that the perceived threat and the perceived benefits are truly the motivational incentives that drive health behavior.

Applications. HBM is one of the theoretical approaches that is most researched (Abraham & Sheeran, 2005; Rosenstock et al., 1988). Sharma and Romas (2011) report that it has been used in studies aiming at developing health belief instruments, primary prevention, and secondary prevention initiatives. Studies on health interventions using HBM have shown success (Abraham & Sheeran, 2005). Moreover, HBM has provided professionals with easy-to-understand constructs that explain health behavior in a simple manner.

Limitations. Limitations of HBM have been reported in the literature. For example, HBM does not provide a description of the behavioral change process, but relies on targeting cognitive change. In addition, the relationship between the constructs is not clear resulting in variations in evaluation and intervention studies (Abraham & Sheeran, 2005).

Link to learning theories. HBM focuses on the perceptions and beliefs held by an individual regarding health behavior. Making decisions on how to act on health-related matter is driven by the cognitive process of rationalization of how one's action will affect the outcomes (Simons-Morton et al., 1995). More specifically, it is the rationalization of the threats, benefits, costs, and self-efficacy that will determine the health behavior taken. Consequently, HBM aligns with the cognitive theories (Champion & Skinner, 2005; European Monitoring Center for Drugs and Drugs Addiction, 2010; Rosenstock et al., 1988). However, a link can also be made to behaviorist theories developed by scholars such as Skinner and Pavlov (Maiman & Becker, 1974; Rosenstock et al., 1988). Under HBM, the outcome of the health behavior can act as a reinforcer or suppressor to it. However, Rosenstock et al. (1988) and Simons-Morton et al. (1995)

posit acting on a behavior cannot be exclusive of even the slightest cognitive variables. Therefore, from the rationalization process undertaken in all the HBM constructs, HBM can best be described as aligning with cognitive theories.

Social Cognitive Theory

Origins. The leading theorist of the social cognitive theory (SCT) is Alfred Bandura (Simons-Morton et al., 1995). His work goes back to 1977 when the theory was then called the Social Learning Theory. Bandura continued to refine this theory to rename it the Social Cognitive Theory in 1986 when research started to show the influence of cognition on the learning process (McAlister, Perry, & Parcel, 2008; Sharma & Romas, 2012). In his research, Bandura tried to explain behavioral change and the process of learning. Although SCT explains the cognitive aspect of learning but it does so in a context that considers the effects of the external environments on cognition as well as the self-regulatory behaviors of the individual (Sharma & Romas, 2012; Simons-Morton et al., 1995). Additionally, for Bandura, self-efficacy is a pivotal element in behavioral change (Bandura, 1977).

Health professionals found useful applications for SCT in the health prevention arena (Sharma & Roams, 2012). Bandura later dedicated a considerable amount of his writings to the application of SCT in health promotion (Bandura, 1998, 2004, 2005).

Constructs. The constructs of the social cognitive theory tend not to be displayed in a similar fashion in the literature (Sharma & Romas, 2012). This is may be due to the complexity of SCT (Glanz & Maddock, 2002). In this review, the display by Simons-Morton et al. (1995) will be referred to as well as Bandura's (1977, 1998, 1999, 2004, 2005) explanations for each construct as it appears in the literature.

Bandura (1978, 1998, 2004) explains that the occurrence of a behavior is the result of interplay of behavior, environmental factors, and personal characteristics.

- Behavior and environment shape each other. According to Benight and Bandura (2004), people create and select their environments and are therefore producers as well as products of the environments.
- Environment influences and personal characteristics interact with each other. Personal factors are physical characteristics, beliefs, emotions, and cognitions. Environmental influences are the social influences displayed through modeling, instruction, and social persuasion. People's personal characteristics affect the reactions they receive from their social surroundings and the environmental factors affect and shape their reaction to the environment either by reinforcing or hindering their behaviors (Bandura, 1998).
- Personal characteristics and behavior also interact with each other. Thoughts, beliefs, and feelings affect how people act and behave. Their behavior affect what they think and how they feel about it. In this regard, the behavior becomes self-regulated (Bandura, 2005).

Bandura calls this interplay between behavior, environment and personal factors reciprocal determinism (Bandura, 1978; Benight & Bandura, 2004).

Furthermore, Bandura (1998) posits that the premise for any learning and subsequent behavioral change is knowledge. However, knowledge alone is not enough to elicit actions for behavioral change. Other influences that affect behavior are beliefs in self-efficacy, outcome expectations, cognized goals, and barriers preventing behavioral

expression. He states that self-efficacy is the pivotal factor for behavioral change. Self-efficacy enhances the learning process and regulates motivation. In addition, self-efficacy affects one's outcome expectations of a certain behavior, one's goal settings, and one's perceptions of the barriers to behavior adoption.

However, these beliefs of self-efficacy can be determined by mastery experience (what is the experience like when mastering a behavior), vicarious experiences (modeling provided from the social environment), social persuasion (such as verbal persuasion), and emotional states that result from all of the above experiences (Bandura, 1998).

In summary, the constructs of SCT can be described as follows. The main focus is the interplay of behavior- environmental influences –personal characteristics. The behavior is characterized by self-regulation. The environmental influences include modeling, instruction, and social persuasion. The personal characteristics include physical characteristics, beliefs, emotions, and cognitions. In addition, self-efficacy determines outcome expectations, goal setting, and perception of barriers. Also, self-efficacy is determined by mastery experiences, vicarious experiences, social persuasion, and emotional states.

Applications. SCT has been used in behavioral research, primary, secondary, and tertiary health prevention research (Sharma & Romas, 2012). It has provided guidance to public health professionals in developing health interventions (McAlister et al., 2008). Moreover, SCT oriented health educators to play the role of facilitators and reminded them that learning is the result of interplay between person, environment, and behavior (Simons-Morton et al., 1995). Studies have shown that self-efficacy and outcome expectancies are strong predictors of health behavioral change (Bandura, 1998,

2005; Luszczynska & Schwarzer, 2005). However, these two constructs (self-efficacy and outcome expectancies) are the ones mostly tested in studies reporting the use of SCT in health related studies (Luszczynska & Schwarzer, 2005).

Limitations. Major limitations to the application of SCT are its complexity and its many constructs that are not well arranged (Glanz & Maddock, 2002; Sharma & Romas, 2012). Therefore, in application, not all the constructs are used equally across the board of the health interventions, which add bias and incomparable results among the health interventions that rely on SCT (Sharma & Romas, 2012).

Link to learning theories. SCT is a learning theory that has found useful applications in the health field due to the many constructs built in it that explains behavioral change. Bandura (1998, 2004, 2005) himself talks about the application of STC in interventions aiming at health behavior change. In placing emphasis on the cognitive aspect of behavioral change, SCT can fit under a cognitivist approach to learning (Bandura, 1977, 1998, 2001, 2004; Simons-Morton et al., 1995). However, SCT is not limited to the explanation of learning and behavioral change through cognition alone. In fact, the most important element of SCT is the incorporation of the interplay between the social influences and the cognitive factors in shaping behaviors (Bandura, 1977, 1998, 2001, 2004; Simons-Morton et al., 1995). Therefore, one can also say that SCT might also fit under constructivist learning theory because it emphasizes the social context of learning.

Transtheoretical Model

Origins. Working on a comprehensive approach to explain changes in addictive behaviors, Prochaska and DiClemente (1986) developed the transtheoretical model

(TTM) which they described as "a three dimensional model that integrates stages, processes, and levels of change" (p.4). These three dimensions of change were identified through several studies in addiction therapy settings (Prochaska & DiClemente, 1986). The main purpose of creating a comprehensive approach to change was to shed the light on how people change from the moment they become aware of their problem to the moment they take action and change their behavior (Grimley, Prochaska, Velicer, Blais, & DiClemente, 1994). Early work on TTM began in the late 1970s and early 1980s but several modifications were later introduced (Sharma & Romas, 2012; Sutton, 2001). Additionally, different scales measuring the stages of change were created and tested (McConnaughy, DiClemente, Prochaska, & Velicer, 1989; Miller & Tonigan, 1996, Sharma & Romas, 2012). TTM is currently a very popular model in the field of behavior change, especially in the field of addictions (Sharma & Romas, 2012; Sutton, 2001). However, TTM has also been applied in a variety of other health related fields as well (Prochaska et al., 2008).

Constructs. TTM consists of four main constructs: stages of change, processes of change, decisional balance, and self-efficacy.

First, the construct of stages of change represents how people's behavior changes over time and thus has a temporal dimension (Prochaska & DiClemente, 1986; Prochaska et al., 2008; Sharma & Romas, 2012; Sutton, 2005).

Second, the construct of processes of change describes how people's behavior change and what they do as they change and thus describes their covert and overt activities (Prochaska & DiClemente, 1986; Prochaska et al., 2008; Sharma & Romas, 2012; Sutton, 2005).

Third, the construct of decisional balance is the balance of the pros and cons, the advantages and disadvantages of behavioral change (Prochaska & DiClemente, 1986; Prochaska et al., 2008; Sharma & Romas, 2012; Sutton, 2005).

Fourth, the construct of self-efficacy, taken from the social cognitive theory, represents one's confidence in undertaking a change in behavior (Prochaska & DiClemente, 1986; Prochaska et al., 2008; Sharma & Romas, 2012; Sutton, 2005).

Levels of change is an important dimension in TTM (Petrocelli, 2002; Prochaska & DiClemente, 1986; Sharma & Romas, 2012). However, it has limited use in the field of designing health behavior interventions (Sharma & Romas, 2012) and therefore it is not always reported in the health literature as one of TTM's constructs (Prochaska et al., 2008; Sutton, 2005).

Each constructs in TTM includes additional subconstructs. These are represented as follows (Prochaska & DiClemente, 1986; Prochaska et al., 2008; Sharma & Romas, 2012; Sutton, 2005):

Stages of change. Although the stages are presented in a temporal sequence, however, when undergoing a change in behavior, people do not usually go in a linear progression from one stage to another. Most often, they go in a cyclical or spiral pattern, relapsing and progressing again (Prochaska & DiClemente, 1986; Sutton, 2001). The temporal sequence of the stages of change consists of six stages. These stages are:

Precontemplation. There is no intention to take action within the next six months. People belonging to this category are usually unaware of their problems or they have failed at previous attempts of change (Prochaska & Norcross, 2001; Prochaska, Redding, & Evers, 2008; Sharma & Romas, 2012).

Contemplation. There is an intention to take action within the next six months but not immediately. People belonging to this category are aware of their problems and they are convinced of the need to change but are ambivalent about it (Prochaska & Norcross, 2001; Prochaska et al., 2008; Sharma & Romas, 2012).

Preparation. There is an intention to take action within the next month some early steps and some behavioral changes are starting to take place (Prochaska & Norcross, 2001; Prochaska et al., 2008; Sharma & Romas, 2012).

Action. There are overt behaviors and significant commitment towards change. In addition, alteration in the behavior is apparent for at least six months (Prochaska & Norcross, 2001; Prochaska et al., 2008; Sharma & Romas, 2012).

Maintenance. The change in behavior has lasted for more than six months. People in this stage are working on maintaining the achieved behavior as well as on preventing relapse (Prochaska & Norcross, 2001; Prochaska et al., 2008; Sharma & Romas, 2012).

Termination. The change has been completed with no threat of relapse. People in this stage have complete confidence and self-efficacy and zero temptation to relapse into the undesired behavior (Prochaska & Norcross, 2001; Prochaska et al., 2008).

Processes of change. Grimley et al. (1994) define processes of change as, "covert or overt activities individuals use to alter their experiences and/or environments in order to modify affect, behavior, cognitions, or relationships" (p.208). Additionally, Grimley et al. (1994), Sutton (2005), and Prochaska et al. (2008) label the processes of change as the independent variables that affect the dependent variable *process of change.* Understanding these processes provide guidance to intervention planning (Prochaska et

al., 2008). Ten processes have been identified through research studies. Some are cognitive affective and others are behavioral (Sutton, 2005).

Consciousness raising (cognitive). Collecting facts and learning about the desired behavioral change (Prochaska et al., 2008; Sharma & Romas, 2012).

Dramatic relief (affective). Emotional arousal about the undesired and the desired health behaviors (Prochaska et al., 2008; Sharma & Romas, 2012).

Self-reevaluation (cognitive-affective). Assessment of one's image with the new change in behavior (Prochaska et al., 2008; Sharma & Romas, 2012).

Environmental reevaluation (cognitive-affective). Assessment of how changes in one's behavior will affect his or her environment (Prochaska et al., 2008; Sharma & Romas, 2012).

Social liberation (cognitive). Realization of the presence of social opportunities or alternatives to support the behavioral change (Prochaska et al., 2008; Sharma & Romas, 2012).

Self-liberation (behavior). A behavioral commitment and recommitment to change added to the belief in the capability to change (Prochaska et al., 2008; Sharma & Romas, 2012).

Counterconditioning (behavior). Learning the new behavior (Prochaska et al., 2008; Sharma & Romas, 2012).

Reinforcement management (behavior). A process of reward and punishment for actions taken towards the desired behavior (Prochaska et al., 2008; Sharma & Romas, 2012).

Stimulus control (behavior). Changing the environment to support the behavioral change (Prochaska et al., 2008; Sharma & Romas, 2012).

Helping relationships (behavior). Development of interpersonal relationships that help support the behavioral change (Prochaska et al., 2008; Sharma & Romas, 2012).

Decisional balance. During the process of deciding to change towards the desired behavior, one usually considers the advantages and the disadvantages of this change. When the advantages outweigh the disadvantages, the individual will move forward in the behavior. Decisional balance is two-faceted: pros and cons (Prochaska et al., 2008; Sharma & Romas, 2012). Pros are the advantages of adopting the desired behavior such as gains and approval of others (Prochaska et al., 2008). Cons are the disadvantages such as costs and disapproval of others (Prochaska et al., 2008).

Self-efficacy. Taken from the social cognitive theory, self-efficacy is also two-faceted. The two facets are in fact the opposites of each other (Prochaska et al., 2008; Sharma & Romas, 2012). Confidence is the belief in one's competence in undertaking and maintaining the behavioral change (Prochaska et al., 2008; Sharma & Romas, 2012). Temptation is the inclination to relapse into the undesired behavior (Prochaska et al., 2008; Sharma & Romas, 2012).

Further work has been undertaken on TTM to shed the light on how the stages of change integrate with the rest of the constructs of the model in order to facilitate the planning of interventions (Norcross & Prochaska, 2001; Prochaska & DiClemente, 1986; Sharma & Romas, 2012).

Applications. TTM has been used in a wide variety of health interventions, including primary, secondary, and tertiary prevention although most of the interventions

studies have focused on smoking cessation (Prochaska et al., 2008). In addition, TTM has provided guidance in tailoring the interventions to the appropriate stage of change and the other constructs of the model (Prochaska et al., 2008; Sharma & Romas, 2012; Sutton, 2005). Studies that followed TTM strictly by the inclusion of all the constructs showed positive intervention results. However, not all the work reported on TTM addresses all these constructs (Sutton, 2005).

Limitations. Some of the limitations reported in the literature on TTM are the questions of validity of the self-reported stages of change, the categorization of the change in stages, and inconsistency of the predictive nature of the TTM constructs (Sharma & Roams, 2012; Sutton, 2005). Additionally, TTM has shown promising results in the area of smoking cessation but have shown mixed results on other health behaviors and different populations (Prochaska et al., 2008; Sutton, 2005). Finally, as with the social cognitive theory, the many constructs of TTM limits the practicality of its use in interventions (Sharma & Romas, 2012).

Link to learning theories. TTM can be described as mostly aligned with the cognitive approach to learning. The processes of change, the decisional balance, and the self-efficacy are based on a mental process of one's own perceptions and mental processes. Additionally, the subconstruct of reinforcement management adds a bent towards behaviorism. However, the subconstruct of helping relationships refers to the importance of the social context for the behavior to be initiated and maintained. Similarly, the construct of self-efficacy, which belongs to one's own belief system, is also a result of a dynamic interaction with one's environment (Bandura, 1998). Therefore, one might allude that TTM slightly leans towards a constructivist approach to learning.

Consequently, TTM can be considered mostly a cognitivist approach to behavioral change, with marginal links to behaviorism and constructivist learning theory.

Difficulties Associated with Health Behavior Theories and Models

The health belief model, the social cognitive theory, and the transtheoretical model presented are examples of many more health behavior theories and models available in the literature. The presence of numerous health behavior theories and models is problematic for the health education scholars and practitioners. One problem is the number of variables used in the different models and theories. Cummings, Becker, and Maile (1980) identified 109 variables from fourteen different models and regrouped them according to their similarities and differences. As a result, they were able to categorize them under six major categories. They concluded that the different models and theories overlap in their constructs and categorizing them as such can help reduce the confusion around them.

Likewise, Noar and Zimmerman (2005) report similarities in the constructs of the theories but difference in terminology that leads to what they call "a fragmentation rather than cumulative knowledge" (p. 276). By comparing different theories, they display the similarities of their constructs. For the health belief model, the social cognitive theory, and the transtheoretical model they categorize similarities in the constructs as follows:

1. Benefits and barriers (HBM); outcome expectation (SCT); decisional balance (TTM).
2. Self-efficacy (HBM); self-efficacy (SCT); self-efficacy (TTM).
3. Cues to action (HBM); social support and reinforcement (SCT); helping relationships (TTM).

4. Perceived susceptibility-perceived threats (HBM); emotional coping – environmental cues (SCT); dramatic relief (TTM).
5. Social environment (SCT); social liberation (TTM).
6. Self-regulation (SCT); contemplation-preparation-self-liberation (TTM).

Beside the confusion over and the overlap between the different constructs, the theories of health behavior have not been able to guide health interventions effectively due to lack of empirical testing in complex social settings (Noar & Zimmerman, 2005; Rothman, 2004). Noar and Zimmerman (2005) posit that there are numerous theories in the field of health behavior but little consensus on which theories are superior to others. Moreover, Abraham and Michie (2008) discuss how a lack of a standardized vocabulary makes the comparison between interventions difficult.

Summary

A multitude of theories and models have been developed to explain health behavior. The three most popular theories and models reported by Glanz et al. (2008) are the health belief model, the social cognitive theory, and the transtheoretical model. The health belief model provides professionals with easy-to-understand constructs that explain health behavior in a simple manner. The social cognitive theory provides professionals with an understanding of the result of interplay between person, environment, and behavior in the learning process, in addition to a focus on the importance of self-efficacy in behavioral change. The transtheoretical model provides professionals with guidance on tailoring the interventions to the appropriate stage of change and with an understanding of the processes of change. Unlike the health belief model, the social cognitive theory and the transtheoretical model include a complex

structure of constructs that hinders their application in full. Moreover, although the terminology of the constructs differ in these models and theory, their meaning overlap resulting in a lack of clarity in the literature around them.

The State of Technology in Health Education Interventions

The use of technology in health education interventions is multidimensional. It varies in purpose and platform of delivery. It also varies in design and effectiveness. In order to shed the light on the state of technology in health education interventions, a definition of terms, potentials of technology-based health education interventions, reports on the effectiveness, examples, advantages to the learners, and instructional design features of these interventions will be presented.

Definition of Terms

eHealth is a term used to describe the integration of technology in the health area. A literature search reveals several definitions of ehealth that vary in scope and focus (Pagliari et al., 2005). Lintonen, Konu, and Seedhouse (2008) reported 51 definitions of ehealth. These definitions primarily encompass (a) the dissemination of health information, (b) education, (c) interaction between professionals and interactions between providers and patients, (d) telemedicine, (e) online communities, (f) health services management, and (g) the use of networked information and communication technologies (Pagliari et al., 2005). Likewise, a search on the uses of Web 2.0 in health promotion sheds the light on the terms Health 2.0 and Medicine 2.0. As with ehealth, the definitions are many. Van De Belt et al. (2010) reported forty-six definitions covering themes such as consumers' active participation and empowerment in the health care system, use of Web2.0 technology by stakeholders to share and communicate information, social

networking, the emergence of online communities, and collaboration between professionals and patients. Regardless of their multitude, the common themes depicted in ehealth and Health 2.0/Medicine 2.0 definitions show that new technologies are moving users from passive recipients of information to users who exercise control in the selection of information and in the creation of online connections (Kreps & Neuhauser, 2010). Moreover, the electronic forms of health promotion are moving from the static read-only webpages created by the experts (Web 1.0) to interactive read-and-write sites where users collaborate and engage with the content (Web 2.0) (Hanson et al., 2008). In reality, ehealth and Health 2.0 definitions blend together and the former can be considered to encompass the latter. Therefore, using the term ehealth covers all interactive and collaborative instructional technology in health promotion. Other terms used in the same respect are health communication and health information technology (HealthyPeople, 2011; Lintonen et al., 2008).

In 2006, the World Health Organization (WHO) reported a significant increase in the use of ehealth globally. More recently, WHO (2011) also reported a rise in the use of mobile technology in health, referred to as mhealth.

Potentials of eHealth and mHealth in Health Education Interventions

The rise in the use of ehealth and mhealth offers much potential to health education interventions and health behavior change.

Glanz et al. (2008) posit that health behavior interventions have a much larger outreach with the Internet and the use of computers, representing " an important part of the armamentarium of strategies for health education and health behavior" (p. 8). Additionally, Kreps and Neuhauser (2010) explain that ehealth tools have great potentials

to promote the adoption of healthy behaviors and healthy life-styles. For example, ehealth can increase access to health information, facilitate decision-making, build health skills and knowledge, and provide tailored information (Atkinson & Gold, 2002; HealthyPeople, 2011).

Moreover, Lintonen et al. (2008) investigated the use of information technology in the field of health promotion. They reported that one of the main uses of technology was as an intervention medium. More specifically, technology was used to tailor information to the learner, distribute health information, or change behavior. Also, technology was used to seek health information. Studying online behavior of Internet activities among users of health websites, Atkinson, Saperstein, and Pleis (2009) report that 60% of users visited the Internet to seek health related information making the Internet a valuable portal for the dissemination of health information.

From another perspective, reviewing the literature on promotion efforts addressing physical activity and dietary behavioral changes, Norman et al. (2007) found that websites and email were the methods most commonly used in the interventions.

Therefore, the use of technology in health education interventions facilitates their dissemination on a wide scale and yet enables them to be tailored to the specific needs of the learners, with methods as complex as websites or as simple as emails.

Effectiveness of eHealth and mHealth Education Interventions

Investing in ehealth and mhealth education interventions is worthwhile when these interventions show effectiveness in the desired outcomes. Nevertheless, the literature varies in the description of the effectiveness of ehealth and mhealth education interventions.

Noar, Peirce, and Black (2010) reported that computer-mediated health interventions can be as persuasive as face-to-face communications, in addition to being cost-effective and possessing the flexibility of tailoring information. However, few studies have been able to prove their effectiveness due to poor development and implementation of the ehealth programs (Kreps & Neuhauser, 2010). Moreover, research has not proved yet which, if, and for whom ehealth interventions are effective (Baker et al., 2010).

Additionally, among the interventions reported in the literature, few are tied to sound theoretical foundations and even fewer provide evidence to support how their theory relates to the program components (Ahrem, 2007). In fact, Norman et al. (2007) report that, even when studies related their interventions to a health behavior theory or model, they failed to show testing on how the interventions worked through the adopted theoretical constructs. In this respect, Lau, Lau, Wong, and Randsell (2011) evaluated the efficacy and methodological quality of computer-based interventions promoting physical activity behavior change in children and adolescents. They reported that the interventions varied in their effect on behavior. Nevertheless, the intervention with large effects were those that proved an extensive use of theory, used behavior change techniques, and included interaction with the participants, especially through text-messaging. The theories used were the social cognitive theory, the transtheoretical model, and the relapse prevention model. Similarly, Webb, Joseph, Yardley, and Michie (2010) reported that the use of theory, behavior change techniques, and the use of text-messages were characteristics of Internet-based interventions that showed the most effect size in health behavior change.

A theoretical foundation for ehealth interventions might be a good predictor for their effectiveness; however, not all reported interventions reflect theory; and even when they do, the theoretical application may not consistent (Abraham & Sheeran, 2005; Ahrem, 2007; Noar & Zimmerman, 2005; Sharma & Romas, 2012). With the absence of a clear theoretical picture, the rationale of the intervention is lost and measures of success are difficult to track (Baker et al. 2010).

Examples of eHealth and mHealth Education Interventions

There is no shortage in the literature of examples of ehealth and mhealth education interventions. The reported studies show a range of focus, health topics, strategies, and theoretical perspective. Examples of such studies are presented.

Meyer et al. (2009) investigated the effectiveness of web-based interventions addressing depression among adults in Germany. The interventions were interactive, using simulated dialogues and eliciting the participants' response through a set of exercises. By the end of the treatment, the participants reported a decrease in the level of their depression that was maintained over a period of six months. In addition, the participants showed an improvement in their social functioning. No theoretical framework was mentioned by the authors. Similarly, Paschall, Antin, Ringwalt and Saltz (2011) evaluated the effectiveness of on Internet-based alcohol misuse prevention course among freshmen college students. The authors did not mention a theoretical framework but reported a reduction in the frequency of drinking among students 30 days after course completion. However, this behavior did not persist in the following semester.

On the other hand, Whittaker et al. (2011) studied the effectiveness of a smoking cessation intervention using mobile text and video messages in New Zealand. The video

messages were based on role models in compliance with the social cognitive theory in order to enhance self-efficacy. No results were found between intervention and control groups. The authors explain these findings to the low recruitment and the cost of text messaging. However, they do stress their use of theory on which the intervention was built.

These studies are examples of health education interventions with different technology uses, variant effects on behavior, and inconsistency with the theoretical background. In fact, these studies reflect what is available in the literature on health education interventions at large. This phenomenon might be the consequence of the interdisciplinary nature of health education and the fragmented literature on its theories (Noar & Zimmerman, 2005; Timmreck et al., 2010).

Advantages of eHealth and mHealth Interventions to the learner

eHealth and mHealth interventions offer several advantages to the learner. Its interactive and collaborative nature allows the learner to relate to the content differently than from print or read-only web pages (Hanson et al., 2008; Kamel Boulos & Wheeler, 2007). Examples of these advantages are shown in the studies that follow.

Blanchard, Metcalf, Degney, Herrman, and Burns (2008) described a project aimed at promoting mental health among young Australians at risk of experiencing marginalization. The project used information technology tools to develop and implement workshops to bring about social inclusion and civic empowerment among these young people. Blanchard et al. reported that the use of emails, social networks, and instant messaging in this project provided a safe environment for help seeking for those people who felt marginalized, such as youth with disabilities or youth with specific sexual

orientations.

Similarly, Comer and Grassley (2010) described a website providing childbearing adolescents with smoking cessation strategies. In addition to interactive modules on self-efficacy, the website included a social connectivity page. The choice of social interaction appealed to the adolescent age group and helped them engage in discussions with other adolescents, especially when they might have been reluctant to do so with their health care providers.

Also, Fukuoka, Kamitani, Bonnet, and Lindgren (2011) explored the applicability of a mobile phone healthy lifestyle program to prevent the onset of type 2 diabetes mellitus. Through focus groups discussions in a qualitative study, the participants expressed that an advantage to using mobile phones would be the provision of real-time peer, social, and professional support. In addition, they stated that the messages of the mobile phone healthy lifestyle program needed to be tailored to their individual needs in terms of frequency, timing, and content.

Furthermore, Franklin, A. Greene, Waller, S. A. Greene, and Pagilari (2008) described the delivery of tailored motivational messages to young people with type 1 diabetes through text messaging. Based on the social cognitive theory, the messages were pushed to the participants and covered information and reminders. The messages were tailored based on the participants' profiles. The authors reported that most of the participants became actively involved in submitting questions and that they valued the opportunity of this form of communication.

Therefore, ehealth and mhealth interventions engage learners by encouraging them to be actively involved, especially for those reluctant to do so face-to-face, and by

providing them with information tailored specifically to their needs. These characteristics make the learning meaningful and motivate the learners to initiate health behavior change (Banas, 2009; Kelders, Van Gemert-Pijnen, Brandenburg, & Seydell, 2011).

Instructional Design Features in eHealth and mHealth Education Interventions

Some ehealth and mhealth education interventions reported in the literature elaborate on the instructional design features of the interventions. The following studies describe design features necessary in ehealth and mhealth interventions and the design and development process of the interventions.

Design features necessary in ehealth and mhealth interventions. Certain design characteristics valued by the learners in ehealth and mhealth interventions are reported in the literature. These characteristics are discussed in the examples below.

In an effort to identify the important factors affecting the visit by adults to Internet-delivered behavior change interventions, Brouwer (2008) conducted a three-round Delphi study among national and international experts of Internet interventions and web-based technology. The experts interviewed in the study reported that motivation and perceived personal relevance are important factors, in addition to the provision of tailored feedback, relevant and reliable information, and easy navigation. In this respect, Nijland, van Gemert-Pijnen, Kelders, Brandenburg, and Seydel (2011) stated that online monitoring and personal feedback stimulated participation of older diabetic patients if a Web-based application tool. Likewise, Ferney and Marshall (2006) reported that the design, such as ease of accessibility and time of download, is an important key feature to users of a website tailored for the promotion of physical activity. Additionally,

interactivity and engagement of the users and the inclusion of multimedia were also favored. On the other hand, Zulman, Kirch, Zheng, and An (2011) reported that older adults who are 50 years and older looked favorably at the Internet as a source for health information and communication with health care providers. However, the extent of use was related to the trust and credibility of the site.

Therefore, engagement, interactivity, ease of use, and information relevance, reliability, and credibility seem to be important features of ehealth and mhealth interventions from the point of view of the learners.

Design and development process of health and mhealth interventions. Although rare in the literature, reports on the process of design and development of ehealth and mhealth interventions are available in the literature. Examples of such reports follow.

Stevens et al. (2008) described the design, development, and implementation of a web-based intervention addressing weight loss. A team was created consisting of content and theory experts, an interface designer, application developers, a steering committee, and a project manager. A theoretical framework was selected combining self-directed behavior change theory, social support theory, motivational interviewing, and the transtheoretical stages of change model. The scope and the objectives of the website were determined. The content was translated into interactive modules and the interface was designed. A paper prototype was presented to the team for approval and sign off. After development, the intervention was pilot tested and data on usability was collected. Stevens et al. present a good example of design, although the needs assessment phase, especially on the learners part is not very clear.

In another example, Card et al. (2011) described the design of an HIV prevention website addressing young African American women. Card et al. specify the social learning theory, gender and power theory as the underlying theoretical background for the intervention. They started by translating the face-to-face version of the intervention into multimedia equivalent appropriate for computer-based interventions. Using the software Flash, the multimedia intervention was developed. Later, measuring sexual and contraceptive behavior changes after the implementation of the intervention they showed positive results on knowledge, self-efficacy, and risk reduction behavior. The authors do not report on other design features used in the creation of the intervention, leaving question to be answered on the needs assessment, and formative evaluation of the intervention.

Moreover, Banas (2009) described the design and development of tailored lesson introductions on learning how to evaluate health websites. These introductions addressed college students and aimed at creating situational interest in the topic. For this purpose, the Persuasive Health Message Framework was used as a communication model. In compliance with the model, Banas undertook three steps for the message design. In the first step, she determined the audience, the goals, and the objectives. In the second step, she collected data on the salient beliefs, norm referents, and the message preferences through questionnaires. In the third step, she analyzed the results and accordingly designed the tailored messages that generated situational interest. These tailored lesson introductions were delivered to both the experimental group for whom the introductions were tailored and a control group for whom the introductions were not tailored. The experimental group showed higher levels of motivation than the experimental group,

achieving the goal of situational interest. Moreover, the experimental group showed better cognitive performance through a posttest quiz. Although the platform of delivery of the tailored introductions is not specified, Banas followed a systematic approach in design and development, rooting it in a theoretical framework of communication.

Additionally, Cousineau, Houle, Bromberg, Fernandez, and Kling (2008) explained the process of development of a workplace nutrition web-based program prototype. They began by interviewing the stakeholders who are gaming industry employees and benefits managers. The interviews aimed at collecting data on nutrition concerns and questions, barriers in the workplace, and strategies to overcome the barriers. The next step consisted of prioritizing the content through a rating process of the data collected. Concept mapping was used to sort the data. Based on these results, a prototype interactive website was developed addressing the needs of both of the stakeholders. Formative evaluation done through a pre and posttest on knowledge and a satisfaction survey revealed a statistically significant increase in knowledge and a high overall satisfaction. Cousineau et al. followed a systematic approach to design and development but did not use a theoretical framework for that purpose. Moreover, the formative evaluation covered the prototype that included only 10% of the content and interactivity, which is not sufficient from an instructional design point perspective.

On the use of devices for health education interventions, Chomutare, Fernandez-Luque, Arsand, and Hartvigsen (2011) reviewed mobile applications available in the literature and the commercial markets. They found that the most common feature of the applications was data recording. However, only few applications included an educational feature and even these did not include personalized feedback. Moreover, the social media

feature portrayed in most applications was in the form of links to join a social network group on Facebook and Twitter.

Although some studies on mhealth reveal advantages in tailoring, feedback, and support (Fukuoka et al., 2011; Whittaker et al., 2011), others reveal that the educational emphasis is low in mobile applications. Therefore, the instructional design process in the emerging field of mhealth seem to need further focus.

From another perspective, and in an attempt to offer guidance in the design of health education interventions, Kinzie (2005) presented a set of instructional design strategies based on the literature of health behavior and education. These strategies drew from the health belief model, the social cognitive theory, and the diffusion theory, in addition to Gagné's nine events of instruction. However, conducting a review of literature on adolescent smoking prevention intervention, she reported an inconsistency in the use of the suggested strategies.

Therefore, there are efforts invested by health professionals involved in the creation of ehealth and mhealth interventions to address the instructional design process of the interventions. However, they do not always follow a thorough systematic approach to achieve this purpose.

Summary

The potentials of ehealth and mhealth interventions are significant in the field of health education and health behavior. They allow for a greater reach of populations and they tailor to specific needs within the populations (Glanz et al., 2008; Kreps & Neuhauser, 2010). Additionally, they facilitate the active engagement of the learners through interactivity, collaboration, and the provision of peer and professional support

(Hanson et al., 2008; Kamel Boulos & Wheeler, 2007). However, the reports in the literature on these interventions vary in terms of effectiveness and theoretical background. Consequently, pinning down the rationale and the measures of process is difficult to measure (Baker et al., 2010). Moreover, few of these reports display their learning theoretical foundations and the instructional design process of their development, which in turn create unanswered questions about their rigor, efficacy, effectiveness, and relevancy (Gustafson & Branch, 2007).

Chapter Summary

Begoray and Banister (2005) posit that health professionals overlook educational theories and education professionals limit the discussion on learning to schools. They state that health interventions have a lot to benefit from the field of education. Moreover, Hoyman (2010) posits that " in health education, 'health' is the goal and 'education' is the process" (p. 233). In fact, Timmreck et al. (2010) state that although education is a founding principle of most of the health promotion efforts, it is the behavioral sciences/psychology that enter strongly in the picture to create an "entangled thicket" (p. 71) making the distinction between the contribution of the two difficult to define.

Professionals involved in the creation of eHealth education interventions are faced with a multitude of health behavior theories of models. Additionally, as they design their interventions, they have to give careful consideration to the instructional design principles. From the health behavior field they need guidance on health behavior change; from the education field they need guidance on the learning process. These factors can be challenging to health professionals who seek success in the creation of their interventions.

CHAPTER 3

METHODOLOGY

The purpose of this study was to explore how health professionals create ehealth and mhealth education interventions.

The following research questions guided the study:

1. How do health professionals use theories and models from the field of education to create ehealth and mhealth education interventions?
2. How do health professionals use principles of elearning and mlearning design to create ehealth and mhealth education interventions?
3. How do health professionals use theories and models from the field of health behavior and health education to create ehealth and mhealth education interventions?

Design

This study followed a qualitative approach of inquiry. Creswell (2007) describes qualitative research as one where the researcher explores a problem through the meaning and interpretations given to it by people and individuals. More specifically, Denzin and Lincoln (2000) define qualitative research by saying, " Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible" (p. 3). Regardless of its nature, any research must stem from certain theoretical perspectives, also known as paradigms. These perspectives reflect the philosophical stance of the researcher and his beliefs about the nature of the world and the relationships between the world and the individuals and between the individuals themselves (Creswell, 2007; Crotty, 2009; Denzin & Lincoln, 1998). Behind

the theoretical perspectives lies the epistemology that guides the researcher's beliefs of how knowledge is derived and acquired (Crotty, 2009). Since qualitative research is concerned with observing the world and constructing meaning through the different perspectives given by different people, then qualitative research follows a constructivist epistemology (Crotty, 2009). Additionally, since qualitative research focuses on interpreting the different perspectives of individuals, then qualitative research most generally, but not exclusively, becomes characterized with an interpretivist theoretical perspective (Creswell, 2007).

As with any research initiative, a qualitative researcher needs to also select the methods through which research is conducted. Denzin and Lincoln (2000) describe the qualitative researcher as a *bricoleur* who uses several methodological practices and as a *quilt maker*, who assembles several images, connects them together, and interprets them to display the larger picture in a montage. Thus, as a *bricoleur*, the qualitative researcher uses several data collection methods. Examples of these methods are: observation, interviews, and unobtrusive measures through the analysis of texts and artifacts (Esterberg, 2002). As a *quilt maker*, the qualitative researcher uses an inductive approach while working with the data, immersing himself in it, uncovering meanings, making connections, analyses and interpretations (Denzin & Lincoln, 2000). Therefore, under a constructivist epistemology and an interpretivist theoretical perspective, the qualitative researcher collects data through a variety of methods, and then inductively analyzes the data, putting the pieces together to present new knowledge born from the interactions and interpretations between him and his research participants.

The purpose of this research was better served with a qualitative approach since it aimed at exploring the process through which health professionals create ehealth or mhealth education interventions. The nature of the knowledge desired in this research was detailed, varied, individualized, and interpretive. Its purpose was to paint the landscape of how health professionals use different theories and models of learning, health behavior, and elearning/mlearning design principles to create health education interventions in their own settings.

Therefore, a constructivist epistemology and an interpretivist theoretical perspective guided this qualitative research. The data collection methods varied and the data analysis was inductive, aiming at showing the different experiences of the participants.

Participants

Unlike quantitative researchers, qualitative researchers are not concerned with generalizability; rather, they are concerned with details. They aim at covering depth more than breadth (Esterberg, 2002). Consequently, the selection of the participants becomes based on the types of individuals who will offer a good understanding and great insights on the issue at hand (Creswell, 2007; Esterberg, 2002). Therefore, the selection of the sample is driven by a purpose, one that informs the research questions the most. This sampling method is known as purposeful or purposive sampling (Creswell, 2007; Esterberg, 2002). In this research, purposeful sampling was used in order to reach an in-depth understanding of the object of the study and to best inform the research questions.

The search for potential participants was done through the following methods:

- A review of published work on the creation of ehealth and mhealth education interventions.
- An online search of ehealth and mhealth education interventions available on the Internet.
- A search for health professionals involved in the creation of ehealth and mhealth education interventions through social networking sites, such as Twitter and LinkedIn.
- Personal contacts with individuals responsible for the creation of ehealth and mhealth education interventions.

Miles and Huberman (1994) suggest sixteen types of sampling strategies for a purposeful sample. The selection of these strategies is guided by the nature of the research questions, the richness of the information desired, and feasibility (Curtis, Gesler, Smith, & Washburnb, 2000). In this research, two sampling strategies were used to select the purposeful sample, based on Miles and Huberman (1994) typology: criterion and snowball.

1. Criteria denote the shared characteristics between all the participants (Creswell, 2007). For this study the following criteria guided the selection of the participants:
    a. Health professionals responsible for the creation of ehealth or mhealth education interventions.

b. These health professionals should be working in health setting environments such as provision of health promotion settings, provision of health education settings, or academic health settings.

Health professionals were not eligible for inclusion if their intervention was less than 6 months in duration.

2. Snowball denotes the referral of a participant to other participants (Esterberg, 2002). In this study, some of the initial participants selected through the purposeful sample made referrals to other participants who met the selection criteria.

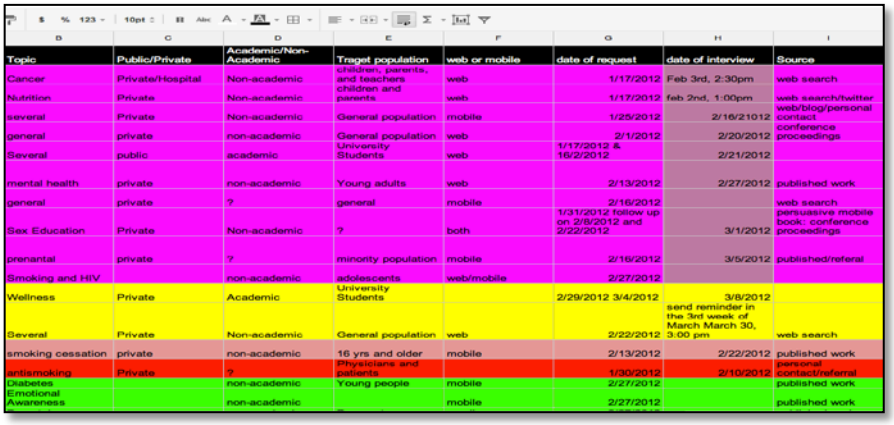
The three selection methods that ultimately led to potential participants were the online search, the review of published work, and personal contacts (see Table 1). These methods generated a list of 34 potential participants that was created in a spreadsheet using Google Documents. The spreadsheet was color-coded and it displayed the names of the participants, their email addresses, the names and links to the ehealth or mhealth intervention when available, type of intervention, dates of contacts, and dates of the interviews. This spreadsheet facilitated the management and the execution of the interviews (see Figure 1). Potential participants were simultaneously contacted as the list was generated. New potential participants were added when first contacts failed to result in an interview. Contacting the participants was done through the following process: An initial email was sent explaining the purpose of the study, the duration desired for the interview, and a note that the interview would be recorded. For the interviews that could not be done face-to-face, a request for a Skype call was noted as well. However, some participants preferred a phone interview instead of a Skype interview. In this case, the

phone call was recorded. A week later, a second email followed to the participants who did not reply to the original email. Out of the 34 potential participants who were contacted, three declined and fifteen never replied or did not follow up on the initial

Table 1

Methods and Criteria of Selection of Participants

Selection method or strategy	Name
Online search	Anna, Camilla, Daniel, Isabella, Sophie, Ryan
Publications	Emily, Lillian, Mia, William
Personal contact	Robert
Snowball	Leah
Social networking sites	None



Topic	Public/Private	Academic/Non-Academic	Traget population	web or mobile	date of request	date of interview	Source
Cancer	Private/Hospital	Non-academic	children, parents, and teachers	web	1/17/2012	Feb 3rd, 2:30pm	web search
Nutrition	Private	Non-academic	children and parents	web	1/17/2012	feb 2nd, 1:00pm	web search/twitter
several	Private	Non-academic	General population	mobile	1/25/2012	2/16/21012	web/blog/personal contact
general	private	non-academic	General population	web	2/1/2012	2/20/2012	conference proceedings
Several	public	academic	University Students	web	1/17/2012 & 16/2/2012	2/21/2012	
mental health	private	non-academic	Young adults	web	2/13/2012	2/27/2012	published work
general	private	?	general	mobile	2/16/2012		web search
Sex Education	Private	Non-academic	?	both	1/31/2012 follow up on 2/8/2012 and 2/22/2012	3/1/2012	persuasive mobile book; conference proceedings
prenantal	private	?	minority population	mobile	2/16/2012	3/5/2012	published/referal
Smoking and HIV		non-academic	adolescents	web/mobile	2/27/2012		
Wellness	Private	Academic	University Students		2/29/2012 3/4/2012	3/8/2012	
Several	Private	Non-academic	General population	web	2/22/2012	send reminder in the 3rd week of March March 30, 3.00 pm	web search
smoking cessation	private	non-academic	16 yrs and older	mobile	2/13/2012	2/22/2012	published work
antismoking	Private	?	Physicians and patients		1/30/2012	2/10/2012	personal contact/referral
Diabetes		non-academic	Young people	mobile	2/27/2012		published work
Emotional Awareness		non-academic		mobile	2/27/2012		published work

Figure 1. Selection of participants

communication to schedule an interview, resulting in sixteen interviews. Once the interview was scheduled, a reminder email was sent a day before the interview with the interview consent form attached. For the face-to-face interviews, a hard copy of the

interview consent form was given in the meeting. Out of the sixteen interviews conducted, one was dropped because it did not fit the selection criteria. A second was also dropped because of failure in the recording and loss of data. Two other interviews recruited through snowballing were neither transcribed nor coded because they related to the same project of one of the participants who had already been interviewed. The final sample size consisted of twelve participants. Once this sample size was reached, the search for additional participants was stopped. The researcher felt that data saturation was achieved. The sample showed a satisfactory level of variability in terms of the type of the health education interventions, the objectives of the interventions, and the target populations of the interventions. Additionally, the target covered a wide geographical area extending to an international level and a variety of expertise in terms of the health professionals responsible for the creation of the intervention. Most importantly, the interviews reflected a range of learning and health behavior theoretical perspectives as well as a range of elearning design principles.

Profiles of Participants

The 12 participants consisted of 8 females and 4 males with a variety of roles and representing a variety of interventions. The average age of the participants was 40, the average number of years of experience in health education interventions was 9, and the average number of years of experience in ehealth and mhealth education interventions was 7.25. The profile of each of the participants is presented below and summarized in Table 2.

Anna. Anna is the founder and president of a web-based company aiming at improving nutritional habits of children. Her company is based in the United States.

Anna is 51 years old and holds a bachelor's degree in Nursing and a master's degree in Business Administration. She has been involved in the creation of different types of health education interventions for a period of 10 years, eight of which addressed ehealth education interventions. Anna is passionate about presenting a website rich in information and resources, but one that is also fun and appealing. She achieves that by creating and working within a team comprised of multiple experts. She is energetic in reaching out and connecting with different target audiences.

Camilla. Camilla is the health educator in the student health services in a big public university in the United States. She is 61 years old. She is a registered nurse and holds a master's degree in Nursing. She has been involved in the creation of different types of health education interventions for a period of 26 years, 12 of which addressed ehealth education interventions. Camilla is responsible for the health education of the entire student population at the university, addressing its health issues. She works nearly single-handedly, assisted by three students. She values the importance of using the web for health education purposes. However, the nature of her work, which prioritizes face-to-face contact with her students, and the shortage in her staff impose limitations on the scope of design and development of the web-based portion of her health education interventions. Nevertheless, she tries to enrich her website with reliable information and resources for students to use.

Daniel. Daniel is the founder and president of a behavior change text-messaging service company that addresses a variety of health topics for adults. He is 40 years old. He holds a doctoral degree in Clinical Psychology and works as an assistant professor in a private university in the United States. He has been involved in the creation of different

Table 2

Profiles of Participants

Name	Age	Role	Type of organization	Academic background	Type of intervention	Years of experience in health education interventions	Years of experience in ehealth and mhealth education interventions
Anna	51	Founder and president	Web-based company	Nursing, Business administration	eHealth	10	8
Camilla	61	Health educator	Students' health services in a big public university	Nursing	eHealth	26	12
Daniel	40	Founder and president	Behavior change text-messaging service company	Clinical psychology	mHealth	15	8
Emily	37	Tele-health and Tele-medicine program specialist	Children's hospital	Psychology, Business administration	mHealth	0	5

(table continues)

Table 2

Profiles of Participants

Name	Age	Role	Type of organization	Academic background	Type of intervention	Years of experience in health education interventions	Years of experience in ehealth and mhealth education interventions
Isabella	44	eLearning coordinator and researcher	Health care institute	Instructional technology, pedagogy, distance education	mHealth	0	6
Leah	35	President and research director	Health improvement organization	Child mental health services research and evaluation	eHealth and mhealth	0	5
Lillian	29	Head of projects and partnerships	Wellness research center	Psychology, political science, adolescent health and welfare, youth mental health	eHealth and mhealth	6	6

(table continues)

Table 2

Profiles of Participants

Name	Age	Role	Type of organization	Academic background	Type of intervention	Years of experience in health education interventions	Years of experience in ehealth and mhealth education interventions
Mia	31	Director of research of program design	Health improvement company	Cognitive psychology	eHealth and mhealth	0	2
Robert	47	Director of education and informatics	Research hospital	Systems design and engineering	eHealth	22	17
Ryan	25	Founder and chief executive officer	Interactive health technology company	Medicine and cognitive systems	eHealth	0	2
Sophie	40	Assistant director	Student wellness at a private university	Recreation education, health promotion	eHealth	14	12
William	40	Deputy director	Health education services organization	Medicine	eHealth and mhealth	15	4

types of health education interventions for a period of 15 years, eight of which addressed ehealth and mhealth education interventions. Because of his expertise in the field of clinical psychology, Daniel brings a deep theoretical understanding of behavioral change and grounds his mhealth interventions in it. In addition, his strong theoretical background enables him to add versatility in the text messaging services he offers through his company. He is passionate about the potentials mobile devices offer to behavioral change interventions in terms of technological options and tailoring of information.

Emily. Emily is a tele-health and tele-medicine program specialist at a children's hospital in the United States. She serves as a program developer and project manager for delivering communication technology for health care enhancement. Emily is 37 year old. She holds an undergraduate degree in Psychology and a master's degree in Business Administration. She has been involved in the creation of ehealth and mhealth education interventions for a period of five years. In this study, she shares her experience managing a prenatal care mhealth project that addressed at- risk pregnant teens. In talking about her role in this project, Emily shows a clear vision of the needs of the different stakeholders. She also shows an expertise in using technology for health improvement, even with no training in the field of health.

Isabella. Isabella is an elearning coordinator and researcher in an internationally renowned health care institute based in Belgium. She is 44 years old and has a background in instructional technology, pedagogy, and distance education. She has been involved in the creation of ehealth and mhealth education interventions for a period of six years. Her role in these interventions is to act as the pedagogy and distance education

expert. She works within a team of experts in the fields of health and technology. In describing the pilot phase of her mhealth intervention that addresses diabetes management for adults in developing countries, Isabella appears to be a careful and meticulous planner and designer. She prefers to limit the scope of her project in its earlier phase and to establish a solid foundation for it before moving on to a wider reach.

Leah. Leah is the president and research director of an organization that aims at using technologies for the improvement of adolescent health. Her organization is based in the United States but includes projects of national and international outreach. Leah is 35 years old. She has been involved in the creation of ehealth and mhealth education interventions for a period of five years. Leah holds a doctoral degree in Child Mental Health Services Research and Evaluation. Leah takes a theoretical perspective and an evidence-based approach in the different projects that she manages, revealing a clear academic influence. She is comfortable in maneuvering her use of theories and intervention strategies because of her academic background and her collaborative team-based approach.

Lillian. Lillian is the head of projects and partnerships of a wellness research center in Australia that addresses mental health issues for young people. She is 29 years old. She holds an undergraduate degree in Psychology and Political Science, a graduate diploma in Adolescent Health and Welfare, and a doctoral degree in Youth Mental Health. She has been involved in the creation of ehealth and mhealth education interventions for a period of six years. She supports research project leaders in developing and implementing their own ehealth and mhealth education interventions. Therefore, she oversees several interventions. Having the advantage of being well

funded, Lillian works on interventions that are versatile in scope. However, in all these interventions, she places a lot of importance on the collaborative approach to design and development between the learners and the design team. In her role, she also plays the academic research partner for all the projects she supervises.

Mia. Mia is the director of research of program design for a company that aims at improving the general health of people. Her company is based in the United States. Mia is 31 years old. She holds a doctoral degree in Cognitive Psychology. She has been involved in the creation of ehealth and mhealth education interventions for a period of two years. Mia is a member of a big team that consists of highly specialized designers, software engineers, and marketing experts. She is passionate about providing the learners ehealth and mhealth interventions that are practical, fun, entertaining, and appealing. In spite of her aim for light interventions, she values the highly sophisticated design that lies behind them and she is a strong believer in the success of this approach that the company takes.

Robert. Robert is the director of education and informatics at a research hospital. The hospital is based in the United States and has an international outreach. He is responsible for initiatives addressing cancer prevention education for children. He is 47 years old and holds a doctoral degree in Systems Design and Engineering. He has been involved in the creation of different types of health education interventions for a period of 22 years, 17 of which addressing ehealth and mhealth education interventions. His approach to the creation of the interventions is multidisciplinary, enabled by the resources available to him in his institution. His calm demeanor projects a deep vision for his interventions with an inclination for research-based approaches and evidence-based

successes. Although not trained in the fields of education or health behavior, he shows expertise in them with an awareness of the theoretical perspectives, practical implementations, challenges and limitations.

Ryan. Ryan is the founder and chief executive officer of an interactive health technology company based in Canada that addresses a variety of health issues for different target groups. He is 25 years old and holds a medical degree in Family Medicine. He also has a background in cognitive systems. He has been involved in the creation of ehealth and mhealth education interventions for a period of two years. Ryan is passionate about visually appealing and highly functional designs that cater to the needs of the learner. He is energetic and enthusiastic about the work of his company. His interest lies in providing a unique experience for his learners by answering to their specific health concerns, revealed to him through his medical practice and close contact with people.

Sophie. Sophie is the assistant director of student wellness at a private university in the United States. She is 40 years old. She holds an undergraduate degree in Recreation Education and a master's degree in Health Promotion. She has been involved in the creation of different types of health education interventions for a period of 14 years, 12 of which addressing ehealth education interventions. Sophie is passionate about providing the student population with health improvement resources that answer to their health concerns. She is equally passionate about providing these resources in a format that appeals to them. Sophie manages her website almost single-handedly, assisted by student helpers. Nevertheless, she works hard at finding ways for collaborating with students on the different aspects needed for the website design and development.

William. William is the deputy director of an organization based in the United States that offers ehealth and mhealth education services addressing sexual health and reproductive health for young people. He is 40 years old. He holds a medical degree, a master's degree in Business Administration, and a master's degree in Health Management and Hospital Administration. He has been involved in the creation of different types of health education interventions for a period of 15 years, four of which addressing ehealth and mhealth education interventions. William is involved in projects that are versatile, covering several uses of the web as well as mobile devices. The nature of the organization he works in allows him to collaborate efficiently with team members of many specialties leading to creative ehealth and mhealth education interventions. His educational background and field experiences gives him a deep understanding of behavioral change and its theoretical underpinnings.

Description of the Participants' eHealth and mHealth Education Interventions

The ehealth and mhealth education interventions created by each of the participants varied in terms of the approach, the target population, the health topic, and the type of the intervention. A description of the intervention(s) created by each of the participants is presented below and summarized in Table 3.

Anna's health education intervention. Anna's health education intervention is web-based. Her website provides resources for parents and teachers to teach children about nutrition. She describes her website as "supplementive" to other nutrition programs and not a comprehensive nutrition intervention.

Camilla's health education intervention. Camilla is responsible for the health education webpage of the student health services university website. This page is

Table 3

Description of the Participants' eHealth and mHealth Interventions

Name	Type of intervention	Health topic	Target population	Base	Outreach
Anna	eHealth	Nutrition	Children	USA	USA
Camilla	eHealth	General	University students	USA	USA
Daniel	mHealth	General	Adults	USA	USA
Emily	mHealth	Prenatal care	High-risk pregnant teens	USA	USA
Isabella	mHealth	Diabetes	Adults	Belgium	Cambodia. Philippines, Democratic Republic of Congo
Leah	eHealth and mhealth	HIV prevention Smoking	Young adults	USA	Uganda, Turkey, USA
Lillian	eHealth and mhealth	Mental health	Young adults	Australia	Australia
Mia	eHealth and mhealth	General	Adults	USA	
Robert	eHealth	Cancer prevention	Children	USA	USA, Spain
Ryan	eHealth	General	Adults	Canada	
Sophie	eHealth	General	University students	USA	USA
William	eHealth and mhealth	Sexual and reproductive health	Young adults	USA	USA

complementary to face-to-face interventions she does on campus and provides links to resource materials to university students that support their well-being and address their health problems.

Daniel's health education intervention. Daniel manages a health education intervention based on the use of mobile phones. He has also created a website through which he offers his services in several ways. He facilitates the creation of a text-messaging intervention for organizations that want to build their own set of messages. He also manages text-messages sent directly to the public, either by creating messages for them or assisting them in creating self-directed messages. The text-messages are a one-way communication. They are not conversational.

Emily's health education intervention. Emily acts as consultant for different tele-health and tele-medicine interventions. For the purpose of this study she talked about the pilot phase of a prenatal care intervention addressing at-risk pregnant teens. This intervention consisted of text-messages sent to the pregnant teens, encouraging them to engage in prenatal care. The text-messages are a one-way communication. They are not conversational.

Isabella's health education intervention. In her capacity as a pedagogy and distance-learning expert, Isabella helped develop a diabetes management intervention for patients in developing countries with little access the health care. The intervention consisted of a one-on-one text-message exchange between the health care workers and the patients that is complimented by intermittent face-to-face interactions.

Leah's health education interventions. Through her organizations, Leah works on several projects that address adolescent health. For this study, she talked about a web-

based intervention targeting HIV prevention in adolescents in Uganda. She also talked about a smoking intervention that uses mobile phones to address young adults in Turkey and the USA. The HIV preventions consisted of self-paced modules whereas the smoking intervention consisted of text-messages that partners learners through a buddy system.

Lillian's health education interventions. Under the general topic of mental health, Lillian manages different ehealth and mhealth education interventions. These interventions are implemented through the web and through mobile devices. The main approach to Lillian's interventions is creating an "online hub" that offers different mental health resources, tools, and applications for young adults in Australia.

Mia's health education intervention. Through her company, Mia works on several interventions that are either web-based or mobile-based. For this study, she talked about a web-based intervention. Her intervention addresses the general adult population and covers general well-being. It is accomplished through daily prompts to take action, sent through emails, and supported by a social network of participants.

Robert's health education intervention. Robert's health education intervention is multifaceted. It addresses cancer prevention in children. It is implemented through face-to-face interactions, print materials, and supported by an online experience, especially when the face-to-face interaction is not feasible. The intervention has been implemented in the USA and Spain. The online experience represented in a website offers interactive experiences for children and resources for parents and teachers.

Ryan's health education intervention. Ryan's health education intervention is web-based. It addresses general health and targets the adult population of Canada. The

intervention includes interactive health assessment tools that focus on different health conditions. The assessment tools are supported by related health advice tailored to the needs of the learner.

Sophie's health education intervention. Sophie is responsible for the wellness webpage of the university's website. Her webpage offers resources and information on health topics of concern to university students. At the time of this study, considerable updates were being done on her website.

William's health education interventions. Due to the nature of his organization, William's health education interventions vary between being web-based, mobile-based, and sometimes face-to-face. They also cover a variety of topics under the general title of adolescent sexual and reproductive health. For this study, he talked about both the web and the mobile-based interventions. The web-based interventions cover a wide spectrum of resources and information. He described it as taking the user "all the way from information to assessment to testing to treatment." The mobile interventions are also versatile, offering the youth with support and multiple resources for sexual and reproductive health.

Data Collection Methods

Two data collection methods were used to achieve the richness in the data and to help answer the research questions (Charmaz, 2006). These methods were interviews and unobtrusive measures (Esterberg, 2002). An interview is a method of data collection that supplies data through a conversation between the researcher and the participants whereas unobtrusive measures are methods of data collection that supply data without relying on interviews or observations (Esterberg, 2002). For this study, one interview was scheduled

with each of the participant selected. In addition, two forms of unobtrusive measures were used. One was the planning material for the ehealth and mhealth education intervention. Two was the actual ehealth and mhealth education intervention that is referred to as artifact (see Table 4). The planning materials received from the participants ranged in quantity and quality depending on availability and possibility of sharing on the part of the participants. They ranged from published and unpublished academic papers, to internal documents, to wireframes, to information posted on their websites. In addition, artifacts were accessed, except for the mhealth interventions that were overseas or based on text-messages targeting specific target populations. It should be noted here that some of the participants worked on more than one intervention, and therefore represented more than one artifact. The confidentiality of the data collected was maintained within the limits of law. In the interpretation of the data, every effort was taken to avoid any linkage of the data to a particular participant. Moreover, all personal information relating to participants was concealed as well. Pseudonyms were assigned to all of the participants.

Table 4

Data Collection Methods

Research question	Data collection methods
RQ1: How do health professionals use theories and models from the field of education to create ehealth and mhealth education interventions?	• Interviews • Planning materials • Artifact

(table continues)

Table 4

Data Collection Methods

Research question	Data collection methods
RQ2: How do health professionals use principles of elearning and mlearning to create ehealth and mhealth education interventions?	• Interviews • Planning materials • Artifact
RQ3: How do health professionals use theories and models from the field of health behavior and health education to create ehealth and mhealth education interventions?	• Interviews • Planning materials • Artifact

Interviews

A semi-structured individual interview was carried out with each of the participants. The interviews lasted between 31 minutes and 79 minutes, averaging at 45 minutes each. The duration of the interviews depended on the time availability of the participants and the probing process that guided the interview. The interviews followed the protocol guided by the research questions and provided room for the exploration of the research questions with the participants (see Tables 5, 6, 7, & Appendix A). The interview protocol was pilot tested prior to data collection.

Long distance interviews were conducted and recorded either by using the videoconferencing tool Skype or by using the software GarageBand for recording phone interviews. Local interviews were conducted face-to-face and recorded using

Table 5

Interview Protocol for Research Question 1

Research Question	Interview Questions Aligned with Research Question 1
RQ1: How do health professionals use theories and models from the field of education to create ehealth and mhealth education interventions?	1. When you are in the process of designing your intervention, what is the learning approach that you try follow? 2. Can you elaborate on how you aim for the learner to learn the content of the intervention? 2a. In what format do you present the content to the learner? 2b. How do you envision the interaction between the learner and the content that you present to him/her? 2c. What is the role of the learner in your intervention? 3. Do you rely on a particular learning theory? (Driscoll, 2005) 3a. If yes, what is it? 3b. Why do you choose to use it? 3c. Can you give me examples on how you incorporate the theory in your design? 4. In designing the intervention, what strategies do you use in order to facilitate the learning process? (Reigeluth, 1999; Smith & Ragan, 2005; Wilson & Cole, 1996) 4a. Can you give me examples on how you use the strategy to teach a particular concept or skill? 5. Do you follow a particular model? 5a. If yes, what is it? 5b. Why do you choose to use it? 5c. How do you incorporate it in the intervention? 6. If I were to follow you step-by-step through the process of creating the intervention from start to finish, what would be the phases that I would observe? (Dick et al., 2009; Morrison et al., 2007; Reiser, 2007; Smith & Ragan, 2005). 6a. How do you decide on what the intervention should address? 6b. How do you decide on the structure of the intervention regarding the content and the strategies? 6c. How do you put your plan into action? 6d. How do you evaluate the appropriateness and the effectiveness of the intervention? 7. Do you follow a particular instructional design model? 7a. If yes, what model is it? 7b. Why do you choose it? 8. Can you tell me who is involved in this whole process and what is the role of each one?

Table 6

Interview Protocol for Research Question 2

Research Question	Interview Questions Aligned with Research Question 2
RQ2: How do health professionals use principles of elearning and mlearning design to create ehealth and mhealth education interventions?	(Alessi & Trollip, 2001; Clark & Mayer, 2003) 1. Why do you choose to use the Web or the mobile applications as a platform for your intervention? 2. In terms of the health intervention, how is it different from designing a face-to-face intervention or an intervention through print materials? 3. What types of software or applications do you choose to build your intervention with? 4. How does designing for the Web or mobile devices differ from designing for print? 5. What is your opinion on using multimedia, such as images and videos on the intervention? 5a. For what purpose do you incorporate multimedia in your intervention? (if participant is using a multimedia approach). 5b. Why don't you use multimedia in your interventions? (if participant is not using a multimedia approach). 6. Once you choose the multimedia that you want to incorporate, how do you decide on when and how to use them in the intervention? 6a. Can you elaborate? 7. What features do you include in your design in order to engage the learner? 7a. Is the intervention you create collaborative? Can you explain? 7b. Can you describe how you design the navigation? 7c. Can you elaborate on the level of interactivity on the part of the learner? How do you design it? 7d. How do you help the learner through the navigation process?

Table 7

Interview Protocol for Research Question 3

Research Question	Interview Questions Aligned with Research Question 3
RQ3: How do health professionals use theories and models from the field of health behavior and health education to create ehealth and mhealth	1. What approach do you use to achieve the desired health behavior outcome? 1a. How do you motivate the learner to adopt the desired health behavior? 1b. What aspects of the health behavior or health topic do you incorporate in the intervention to help the leaner adopt the desired health behavior? 1c. What strategies do you use to help the learner adopt the desired health behavior? 2. Do you follow a particular health behavior theory or model? (Glanz, Rimer, & Viswanath, 2008) 2a. If yes, what is it? 2b. Why do you choose to use it? 2c. How do you incorporate it in the intervention?

GarageBand. The audio files were stored digitally and retrieved later for transcription. Each file was transcribed and saved as a Word document.

Interview protocol. The interview protocol aligned with the three research questions.

First, the interview protocol addressed the use of learning theories (Driscoll, 2005), instructional approaches (Reigeluth, 1999; Smith & Ragan, 2005; Wilson & Cole, 1996), and instructional design models (Dick et al., 2009; Morrison et al., 2007; Reiser, 2007; Smith & Ragan, 2005) by the health professionals as they created their elearning and mobile learning interventions. No specific learning theory or instructional approach guided the interview protocol. On the other hand, four instructional design models guided the interview protocol. These models were Dick et al. (2009); Morrison et al. (2007). ADDIE (Reiser, 2007); and Smith and Ragan (2005);

Second, the interview protocol addressed the use of elearning design principles by the health professionals as they created their elearning and mlearning interventions (Alessi & Trollip, 2001; Clark & Mayer, 2003).

Third, the interview protocol addressed the use of theories and models of health behavioral change and/or health education planning models by the health professionals as they created their ehealth and mhealth education interventions (Glanz et al., 2008). Three health behavior theories/models guided the interview protocol for this study. These theories/models were the Health Belief Model (Becker, 1974), the Transtheoretical Model (Prochaska & DiClemente, 1986), and the Social Cognitive Theory (Bandura, 1998, 2005). These models were chosen because the literature reports them as the three most popular theories and models used (Glanz et al., 2008).

Unobtrusive Measures

Two forms of unobtrusive measures were used. One was the planning material for the elearning or mlearning health education intervention. Two was the actual elearning or mobile learning health education intervention that is referred to as artifact. The analyses of the planning materials and of the artifacts followed protocols aligned with the research questions.

These analyses provided room for the exploration of the research questions from other sources, in addition to corroborating the content of the interviews. The protocol used to analyze both the content of the planning materials and the artifacts paralleled the interview protocols and provided a checklist that facilitated a thorough exploration and interpretation of the data.

Planning material protocol. The planning material protocol aligned with each of the research questions can bee seen in Tables 8, 9, and 10 and in Appendix B.

Table 8

Planning Material Protocol for Research Question 1

Planning Material Details Aligned with Research Question 1	
Learning Theory (Driscoll, 2005)	1. Is the learning theory explicitly displayed? 2. If yes, how is it displayed? 3. If not, what learning theory is the planning material mostly aligned with? 4. How is it displayed?
Instructional approach (Reigeluth, 1999; Smith & Ragan, 2005; Wilson & Cole, 1996)	1. Is an instructional approach explicitly displayed? 2. If yes, how is it displayed? 3. If not, what instructional approach is the planning material mostly aligned with? 4. How is it displayed?
Instructional design model (Dick et al., 2009; Morrison et al., 2007; Reiser, 2007; Smith & Ragan, 2005)	1. Is an instructional design model explicitly displayed? 2. If yes, how is it displayed? 3. If not, what instructional approach is the planning material mostly aligned with? 4. How is it displayed?

Table 9

Planning Material Protocol for Research Question 2

Planning Material Details Aligned with Research Question 2	
Rationale for use of the platform chosen (Clark & Mayer, 2003; Fee, 2009)	1. Is a rationale for the use of the platform displayed in the planning material?
Software or mobile applications used?	2. What types of software or applications are chosen to build the intervention with?
Multimedia used (Alessi & Trollip, 2001; Clark & Mayer, 2003)	1. What types of media are incorporated in the intervention? 1. How is the design of the multimedia articulated in the planning material?
Collaboration (Alessi & Trollip, 2001; Clark & Mayer, 2003)	2. How is collaboration displayed? a. learner-expert b. learner-learner
Learner control (Alessi & Trollip, 2001; Clark & Mayer, 2003)	2. How is learner-control displayed? a. The sequence through which to proceed through the intervention? b. The pace
Navigation (Alessi & Trollip, 2001; Clark & Mayer, 2003)	1. How is navigation designed? 1. menu 2. hyperlinks 3. buttons
Interaction (Alessi & Trollip, 2001; Moore, 1989)	1. How is interaction articulated? a. learner-content b. learner-expert c. learner-learner
Mobile design features	1. If using a mobile learning intervention? How are the design features specific to mobile applications displayed?

Table 10

Planning Material Protocol for Research Question 3

Planning Material Details Aligned with Research Question 3	
Health behavior theory or model (Glanz et al., 2008)	1. Is a health behavior model or theory explicitly displayed? 2. If yes, how is it displayed? 3. If not, what health behavior approach is the planning material mostly aligned with? 4. How is it displayed?
Health Belief Model (Becker, 1974)	1. Are any of the constructs of the Health Belief Model apparent in the planning materials? 2. How?
Transtheoretical Model (Prochaska & DiClemente, 1986)	1. Are any of the constructs of the Transtheoretical Model apparent in the planning materials? 2. How?
Social Cognitive Theory (Bandura, 1998, 2005; Rosenstock et al., 1988)	1. Are any of the constructs of the Social Cognitive Theory apparent in the planning materials? 2. How?

Artifact protocols. The artifact protocol aligned with each of the research questions can bee seen in Tables 11, 12, & 13 and in Appendix C.

Table 11

Artifact Protocol for Research Question 1

Artifact Details Aligned with Research Question 1	
Learning Theory (Driscoll, 2005)	1. If a learning theory or model was mentioned in the interview or the planning material, how is displayed in the intervention? 2. If not, what learning approach is the artifact mostly aligned with? 3. How is it displayed?
Instructional approach (Reigeluth, 1999; Smith & Ragan, 2005; Wilson & Cole, 1996)	1. If an instructional approach was mentioned in the interview or the planning material, how is displayed in the intervention? 2. If not, what instructional approach is the artifact mostly aligned with? 3. How is it displayed?
Instructional design model (Dick et al., 2009; Morrison et al., 2007; Reiser, 2007; Smith & Ragan, 2005)	1. Are the elements of instructional design displayed in the artifact? 2. If yes, how are they displayed?

Table 12

Artifact Protocol for Research Question 2

Artifact details Aligned with Research Question 2	
Multimedia used (Alessi & Trollip, 2001; Clark & Mayer, 2003)	1. What types of media are incorporated in the intervention? 2. How are they used? 3. How is the text displayed? 4. How is the contiguity principle displayed? 5. How is the modality principle displayed? 6. How is the redundancy principle displayed? 7. How is the coherence principle displayed?
Collaboration (Alessi & Trollip, 2001; Clark & Mayer, 2003)	1. How is collaboration displayed? a. Learner-content a. learner-expert b. learner-learner
Learner control (Alessi & Trollip, 2001; Clark & Mayer, 2003)	1. How is learner-control displayed? a. The sequence through which to proceed through the intervention? b. The pace.
Navigation (Alessi & Trollip, 2001; Clark & Mayer, 2003)	1. How is navigation designed? a. menu b. hyperlinks c. buttons
Interaction (Alessi & Trollip, 2001; Moore, 1989)	1. How is interaction displayed?
Practice (Alessi & Trollip, 2001; Clark & Mayer, 2003)	1. Are opportunities for practice given to the learner?
Provision of help and resources (Alessi & Trollip, 2001)	1. How are the "help" and "resources" features displayed?
Mobile design features	1. If using a mobile learning intervention? How are the design features specific to mobile applications displayed?

Table 13

Artifact Protocol for Research Question 3

Artifact Details Aligned with Research Question 3	
Health behavior theory or model (Glanz, Rimer, & Viswanath, 2008)	1. If a health behavior theory or model was mentioned in the interview or the planning material, how is displayed in the intervention? . (Glanz, Rimer, & Viswanath, 2008). 2. If not, what health behavior approach is the artifact mostly aligned with? 3. How is it displayed?
Health Belief Model (Becker, 1974)	1. Are any of the constructs of the Health Belief Model apparent in the artifact? (Becker, 1974). 2. How?
Transtheoretical Model (Prochaska & DiClemente, 1986)	1. Are any of the constructs of the Transtheoretical Model apparent in the artifact? 2. How?
Social Cognitive Theory (Bandura, 1998, 2005; Rosenstock, Strecher, & Becker, 1988)	1. Are any of the constructs of the Social Cognitive Theory apparent in the artifact 2. How?

Pilot Study

A pilot study was conducted in December of 2011 in order to test the interview instrument and method. Two participants were selected through personal contacts. These participants were representative of the sample consisting of health professionals responsible for the design and development of elearning and mlearning health education materials who work in health setting environments. The first participant was an instructional designer who developed a unit on the H1N1 virus for a university health

center. The second participant was a pediatrician who is in the process of developing an elearning unit on proper hand washing for health personnel.

Initially, the interviews were to be done face-to-face. However, due to a conflict in schedules, the participants preferred the videoconferencing method through Skype because it gave them more flexibility with time. One of the interviews was completed and recorded through Skype. The other interview had to be completed through a phone call because of problems with the Internet connection on the participant's side, and therefore was not recorded. The duration of each interview lasted around one hour, which fit the estimated time of the interview.

Changes Made

Some of the questions in the interview protocol were abstract and confusing to the participants. Therefore, they had to be reworded or supplemented with subquestions. Moreover, an introductory question asking the participant to describe his/her intervention was added to provide a better transition between the questions on demographics and the questions on the theories and models.

Introductory question. The introductory question consisted of the following subquestions.

1. Can you describe to me your health intervention?
2. What is the health topic that you are trying to address?
3. Who is your target audience?
4. What are your objectives?

Changes to research question 1. For research question 1, changes needed to be made on questions 1, 2, and 4.

Question 1 and 2. These questions aimed at clarifying the learning theory used in the intervention. The questions as written in the interview protocol seemed to be a little abstract for the participants requiring more probing with more specific questions. For this purpose, subquestions were added to question 2 as follows:

2. Can you elaborate on how you aim for the learner to learn the content of the intervention?

    2a. In what format do you present the content to the learner?

    2b. How do you envision the interaction between the learner and the content that you present to him/her?

    2c. What is the role of the learner in your intervention?

Question 4. "In designing the intervention," was added to the sentence to provide a better focus.

Changes to research question 2. For research question 2, changes needed to be made on questions 2, 4, 5, 6, and 7.

Question 2. This question aimed at exploring the difference between designing for the Web or mobile devices and designing for print. Since one of the participants was also involved in face-to-face interventions, the question was changed to the difference between designing for the Web or mobile devices and print or face-to-face interventions. The change was as follows:

3. In terms of the health intervention, how is it different from designing a face-to-face intervention or an intervention through print materials?

Question 4. This question was repetitive to question 2 and was deleted.

Question 5. This question was clarified. It was changed from "How do you use the multimedia in your interventions" to "For what purpose do you use the multimedia in your intervention?"

Question 6. This question aims at investigating the incorporation of multimedia principles in the interventions. The question was confusing to the participants and needed to be reworded. It was changed from "What features do you include in your design in order to facilitate the learning process?" to "Once you choose the multimedia that you want to incorporate, how do you decide on when and how to use them in the intervention?

Question 7. This question needed more probes. The following subquestions were added:

7. What features do you include in your design in order to engage the learner?

    7a. Is the intervention you create collaborative? Can you explain?

    7c. Can you describe the level of interactivity on the part of the learner? How do you design it?

    7d. How do you help the learner navigate through the content?

Changes to research question 3. For research question 3, changes needed to be made on questions 1 and 5.

Question 1. This question needed more probes. Therefore, subquestions were added and consequently question 3 and 4 were deleted. Question 1 was changed as follows:

1. What approach do you use to achieve the desired health behavior outcome?

    1a. How do you motivate the learner to adopt the desired health behavior?

1b. What aspects of the health behavior or health topic do you incorporate in the intervention to help the leaner adopt the desired health behavior?

1c. What strategies do you use to help the learner adopt the desired health behavior?

Question 5. This question on how the intervention is planned seemed repetitive to earlier questions. Therefore, it was deleted.

Procedures

The procedures of this study followed a timeline that was divided into three phases. Phase 1 included establishing contact with the participants and gaining access. This phase consisted of email or phone correspondence with the selected participants. Phase 2 included data collection through in-depth interviews and unobtrusive measures. In addition to the in-depth interviews and the collection of planning materials and artifacts, this phase included concurrent transcriptions, coding, and analysis of the interviews., the planning materials, and the artifacts collected. Phase 3 included the writing of the results and the discussion. Table 14 illustrates the duration of and the overlap between each phase. The implementation of the three phases followed the Institutional Approval on December 8, 2011 (Appendix D).

Table 14

Procedures

	Month				
Procedures	1	2	3	4	5
Establishing contact and gaining access					
In-depth interviews					
Documents and artifacts collection					
Transcription of data					
Coding of data					
Analysis of data					
Writing the results and discussion					

Data Analysis

The methodology followed in the analysis of the interviews was the constant comparison method (Glaser & Strauss, 1967). Charmaz (2006) explains constant comparison as " comparing data with data to find similarities and differences" (p.54). More specifically, she defines it as:

> A method of analysis that generates successively more abstract concepts and theories through inductive processes of comparing data with data, data with category, category with category, and category with concept. Comparisons then constitute each stage of analytic development. (p.187)

The constant comparison began with the creation of open codes known as open coding. Through open coding, the transcriptions of the interviews were analyzed line by line as a first attempt at exploring the data (Esterberg, 2002; Ezzy, 2002). The coding of the interviews was accomplished using the qualitative data analysis software NVivo 9. Segments of the transcribed text were highlighted and coded. The codes were mostly *in vivo,* where the participants' words were kept as is, in order to preserve their meanings

and contexts (see Figure 2). In vivo codes refer to the "participants' special terms" (Charmaz, 2006, p. 55).

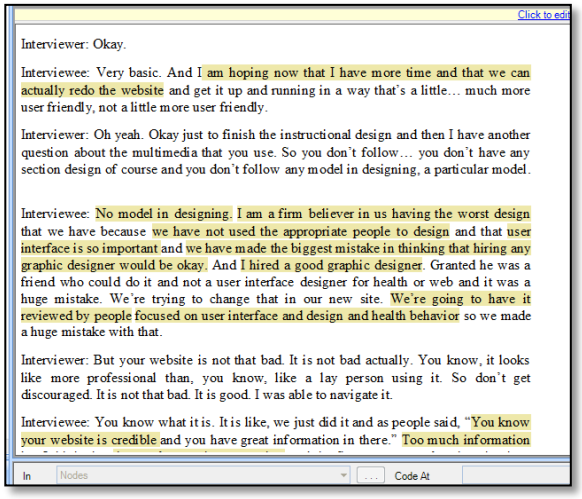


Figure 2. Open coding in NVivo 9.

The open coding resulted in 5,324 codes. This large number of open codes was organized in folders for easier management and exploration. The folders mirrored the phases of the instructional design framework ADDIE: analysis, design, development, implementation, and evaluation. Additional folders were created for the codes that did not fit under any of the phases of ADDIE (see Figure 3). For example, when participants described the objectives of their intervention and the reasons for selecting these objectives, the open codes where moved to the analysis folder. When participants talked about the challenges they faced, the corresponding codes were put under a new folder named challenges and limitations.

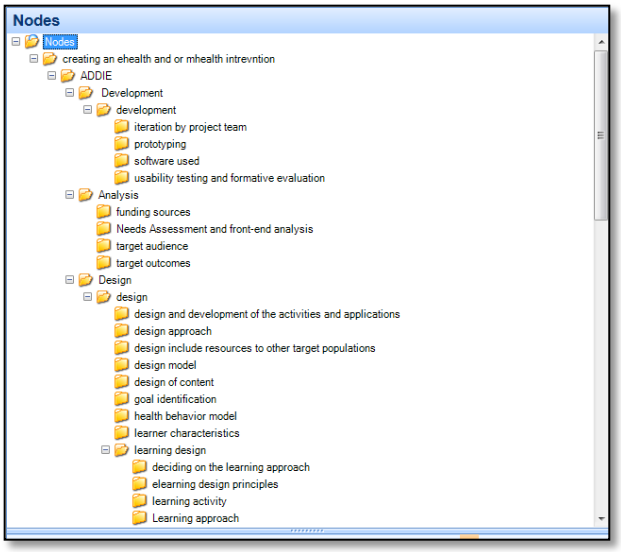


Figure 3. The folders organizing the open codes according to ADDIE

Once codes were identified and categorized into folders, a second round of analysis followed, aiming at identifying the different categories that emerged from the open coding (Esterberg, 2002). During this phase, similarities and differences in the open codes were identified and helped create the categories (Esterberg, 2002; Ezzy, 2002). The categories were created by a single selection of codes into one category or by duplication of codes into several categories (see Figure 4). This step enabled looking at the codes from different angles and facilitated the creation of categories and later, patterns and themes. The following is an example of how categories and codes were created. For example, in the evaluation folder, when participants described how they tested the likability of their intervention by their learners before finalization, the codes where gathered under the category of assessment of attitudes. Likewise, when participants talked about testing how their learners moved around the interventions, the corresponding codes were put under the category of usability.

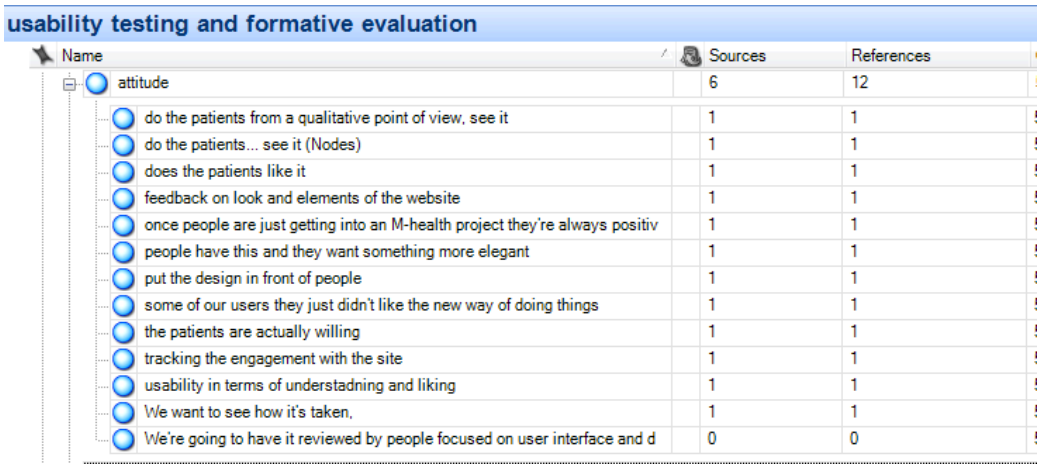


Figure 4. Creation of categories.

The third round of analysis aimed at identifying the patterns that emerged from comparing the different categories. For the same example of formative evaluation, the two categories of attitudes and usability were then put under the pattern of focus of formative evaluation, containing all the elements that the participants tested in their formative evaluation. Using the same process, another pattern was created under formative evaluation to contain all the categories of the methods used for conducting formative evaluation and it was named process of formative evaluation (see figure 5). The same steps were repeated for all folders. These patterns were sorted in hierarchal fashion in order to subsume child patterns under parent patterns.

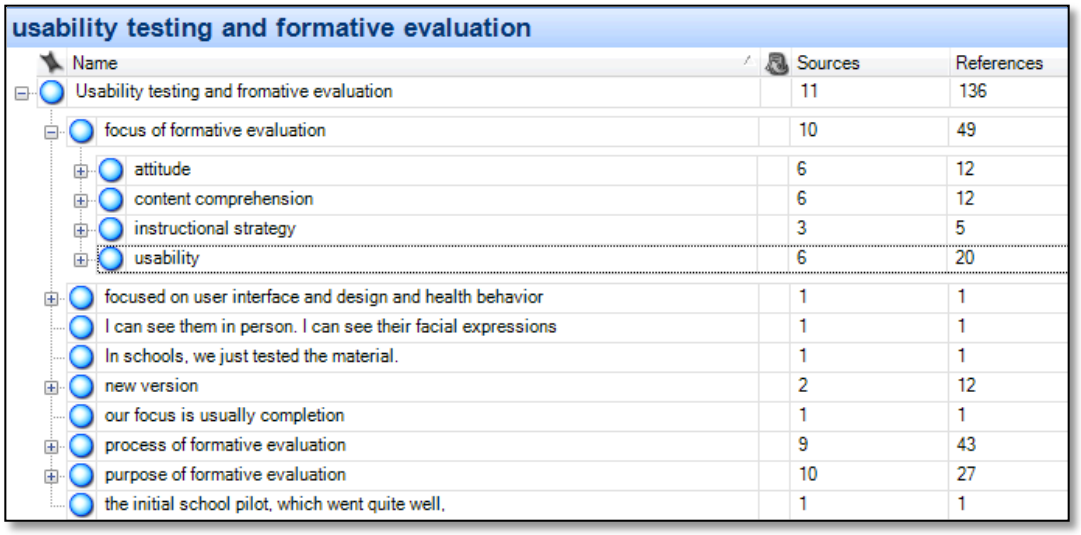


Figure 5. Creation of patterns.

The final round of analysis consisted of identifying the themes that emerged from the patterns, mapping them and identifying the relations between them (Esterberg, 2002). These iterative rounds of data reduction helped explore the depth and the richness of the data. Data reduction was completed in NVivo 9. Additionally, several peer debriefing sessions were held with the dissertation committee chair where codes, categories, and themes were discussed. These discussions were based on concept maps and outlines displayed on a white board and a notebook. Discussions also covered how rigor was achieved (see Figure 6).

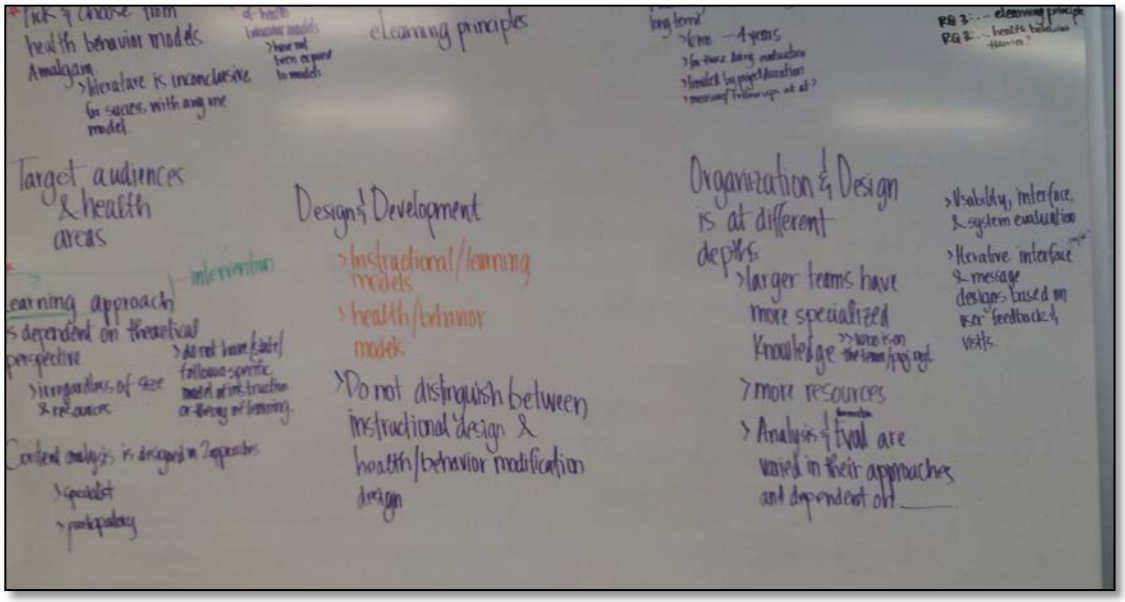


Figure 6. Peer debriefing

Following the analysis of the interviews, the planning materials and artifacts were analyzed using the protocols available in Appendices B and C. The checklists available in these protocols facilitated the coding of the data according to pre-established codes identified from the literature. The data obtained from the planning materials and the artifacts were used to corroborate the findings from the interviews. Due to the different types of planning material collected, the data analysis was inconsistent among the documents. Four of the participants sent their planning materials to the researcher, which ranged from storyboard to mockups to complete documentation of the creation of the intervention. Four of the participants' planning materials were analyzed by the researcher through published papers they had written about their interventions or through documents available on their intervention's website. No documents were collected from the remaining four participants. As for the artifacts, all of the eight ehealth education interventions were analyzed and these were easily accessible. However, the mhealth

education interventions were harder to analyze. Three of them required registration of specific target populations with specific health behavior concerns, such as smoking teens at risk pregnant teens, or diabetic patients. Here, the researcher found it unethical to register under a fake identity and therefore was unable to analyze the artifact. Additionally, one of the artifacts was deployed in other continents and was logistically inaccessible. Nevertheless, the researcher did register to receive text-messages for two of the mhealth interventions and was able to access them this way. Additionally, when screen shots or sample text-messages were available these were analyzed as well. However, the text messages and the screen shots provided a limited amount of data for the protocol. Still, the protocols for both the planning materials and the artifacts were used when possible. Figure 7 and 8 show the coding process of both.

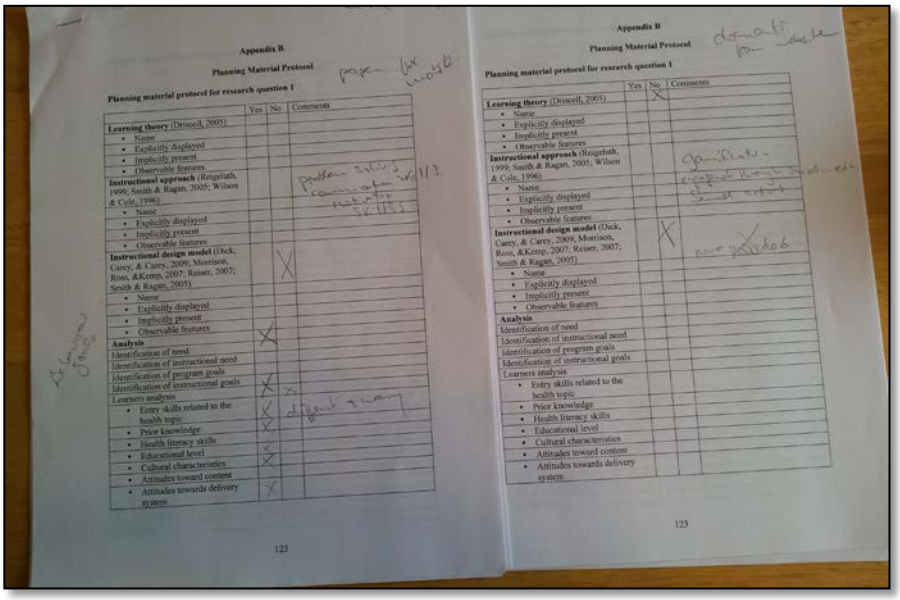
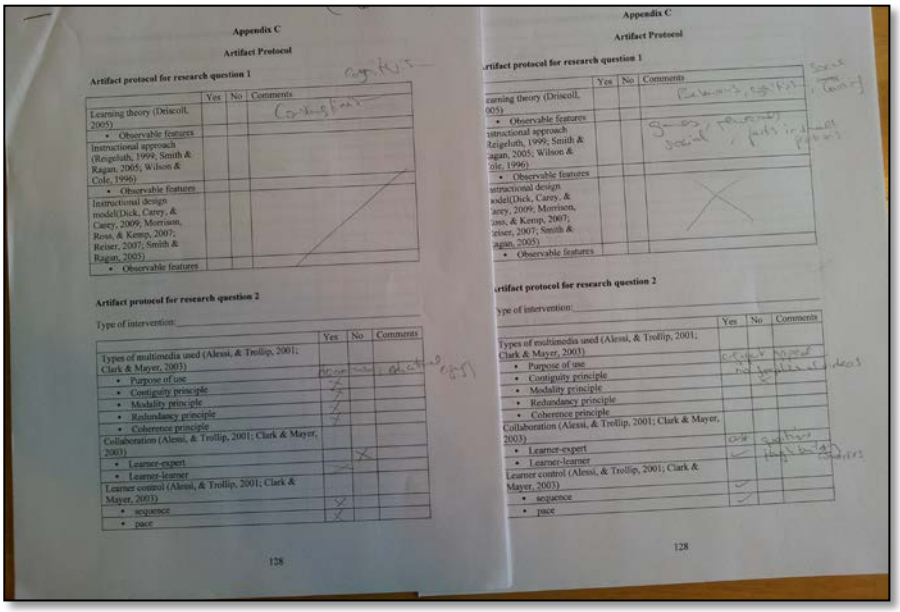


Figure 7. Coding of the planning materials.



Appendix C

Artifact Protocol

Artifact protocol for research question 1

	Yes	No	Comments
Learning theory (Driscoll, 2005)			
• Observable features			
Instructional approach (Reigeluth, 1999; Smith & Ragan, 2005; Wilson & Cole, 1996)			
• Observable features			
Instructional design model(Dick, Carey, & Carey, 2009; Morrison, Ross, & Kemp, 2007; Reiser, 2007; Smith & Ragan, 2005)			
• Observable features			

Artifact protocol for research question 2

Type of intervention:

	Yes	No	Comments
Types of multimedia used (Alessi, & Trollip, 2001; Clark & Mayer, 2003)			
• Purpose of use			
• Contiguity principle			
• Modality principle			
• Redundancy principle			
• Coherence principle			
Collaboration (Alessi, & Trollip, 2001; Clark & Mayer, 2003)			
• Learner-expert			
• Learner-learner			
Learner control (Alessi, & Trollip, 2001; Clark & Mayer, 2003)			
• sequence			
• pace			

128

Appendix C

Artifact Protocol

Artifact protocol for research question 1

	Yes	No	Comments
arning theory (Driscoll, 005)			
• Observable features			
nstructional approach Reigeluth, 1999; Smith & agan, 2005; Wilson & ole, 1996)			
• Observable features			
nstructional design odel(Dick, Carey, & arey, 2009; Morrison, oss, & Kemp, 2007; eiser, 2007; Smith & agan, 2005)			
• Observable features			

Artifact protocol for research question 2

Type of intervention:

	Yes	No	Comments
Types of multimedia used (Alessi, & Trollip, 2001; Clark & Mayer, 2003)			
• Purpose of use			
• Contiguity principle			
• Modality principle			
• Redundancy principle			
• Coherence principle			
Collaboration (Alessi, & Trollip, 2001; Clark & Mayer, 2003)			
• Learner-expert			
• Learner-learner			
Learner control (Alessi, & Trollip, 2001; Clark & Mayer, 2003)			
• sequence			
• pace			

128

Figure 8. Coding of the artifacts.

Rigor and Trustworthiness

Four strategies were used to ensure the rigor and trustworthiness of this research.

Triangulation

Esterberg (2002) states that each data collection method has its strengths and its weaknesses and using more than one source of data, also called triangulation, gives strength to the findings. In addition, Creswell (2008) defines triangulation as "the process of corroborating evidence from different individuals, (e.g., principal and a student), types of data (e.g., personal field notes and interviews), or methods of data collection (e.g., documents and interviews) in description of themes in qualitative research" (p. 266).

In this study, three sources of data were used in order to ensure triangulation: semi-structured interviews, planning materials, and artifacts. The semi-structured interviews were based in the interview protocol and consisted of open-ended questions.

This way, the participants were able to elaborate on their responses by giving their own perceptions and interpretations without much interference from the researcher. As for the planning materials and the artifacts, they were studied according to their protocols to look for corroboration on the content of the interviews. The artifacts representing the ehealth interventions were accessed whereas the artifacts representing the mhealth interventions were not accessed except for one, as they required enrollment in a program.

Member Checks

This technique allows the participants to "check the accuracy of the account" (Creswell, 2008, p. 267) and to make the changes they deem necessary to represent their thoughts fairly. Here, the transcript of the interview and an overview of the participant's response as interpreted by the researcher were sent to each participant for his or her review, in order to satisfy the member checks.

Peer Debriefing

Peer debriefing is a form of an "external check" (Creswell, 2007, p. 208) on the rigor used by the researcher in the methods and interpretations of the findings. Several peer debriefing sessions were held with the dissertation committee chair and committee members where codes, categories, and themes were discussed. These discussions were based on concept maps and outlines displayed on a white board. Additionally, discussions covered how rigor can be achieved.

Audit Trail

Audit trail consists of notes taken through the research to document the researcher's train of thinking and decision-making process. For this purpose, the

researcher created memos in NVivo 9 and handwritten memos that represented reflections on the participants, on the coding process and on the creation of categories and themes. As Charmaz (2006) posits, " Memo-writing is the pivotal step between data collection and writing drafts of papers" (p. 72). Additionally, the researcher used journaling for the same purpose. These memos helped document the researcher's initial interpretations of the interview process, the document and the artifact analysis (see Figures 9 and 10).

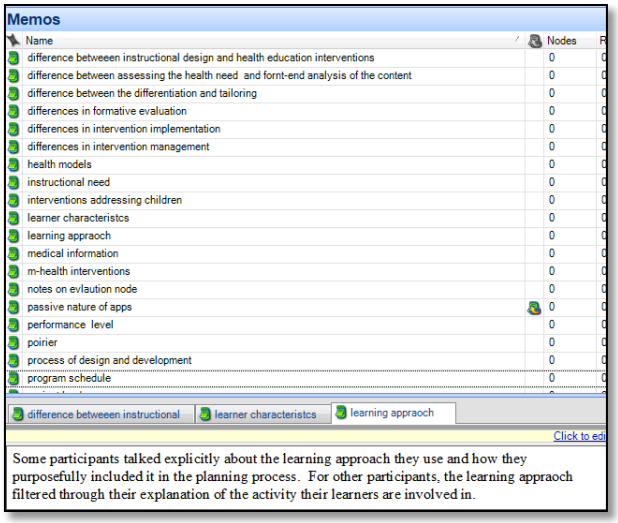


Figure 9. Memos created in NVivo 9.

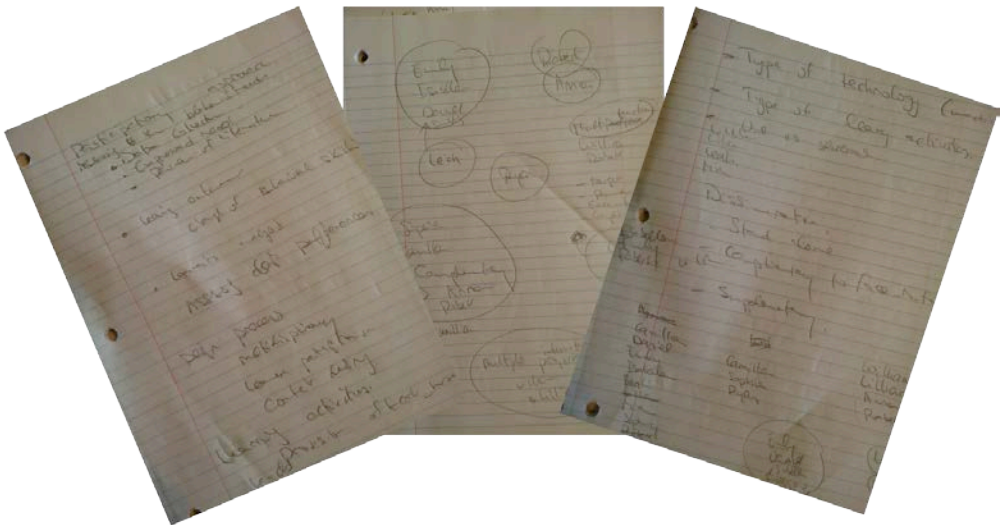


Figure 10. Handwritten memos.

Researcher's Subjectivities

Qualitative researchers often use bracketing as a means of laying out their preconceptions, assumptions, perspectives, and background before and during their interaction with the topic they are exploring (Gearing, 2004; Fischer, 2009). By doing so, qualitative researchers can continuously check if they are imposing their own meaning on the data at the expense of missing new meanings that may emerge. In addition, through bracketing, qualitative researchers open themselves up to re-examine their interpretations and uncover new insights (Fischer, 2009). Therefore, I will present my subjectivities in an attempt to bracket them out as I proceed in this study. My educational background is one factor that I need to consider. My schooling in health behavior and health education equips me with a sound theoretical background on health behavior theories and models of health behavior change, with particular focus on health education. Moreover, my current training as a doctoral student in instructional design and technology equips me with a strong understanding of the learning theories, the

instructional approaches, and the principles of elearning design. These two subjectivities will have an impact on the protocols that I have designed and the probing process in my interviews. These subjectivities might also create biases in my interpretations of the data. My working experience is a second factor of which I need to be mindful. Having previously taught a course on the design and development of health education materials (although not elearning or mobile learning), I may tend to be judgmental and have some prejudice in my analysis and my interpretation of the data. A third factor on which I may need to reflect is my passion for creating learning that is motivating and engaging. Over the years, I have come across several health education materials that, in my opinion, were not well-designed and I feel the need to be a campaigner for proper design. Finally, my backgrounds are mostly theoretical, with little fieldwork. This is another factor that might overshadow my interpretations of the data.

Limitations

Certain characteristics of this study might limit its findings. The limitations are:

1. The qualitative nature of the study limits the generalization of its findings.
2. The number of participants is dependent on their willingness to be interviewed for approximately an hour and their willingness to be recorded.
3. The materials collected to corroborate the data from the interviews may differ in nature and quantity between participants, depending on their willingness to share.
4. Interviews of participants who are not accessible locally will be done online and not face-to-face. This might affect the nature of the field notes taken by the researcher.

Delimitations

This study has delimitations that set its boundaries. These delimitations are:

1. Health education interventions must be accessible to the researcher.
2. Health education interventions developed for school health will be excluded from the study.
3. Health education interventions developed for commercial profit will be excluded from the study.
4. Health education interventions solely based on behavioral modification techniques will be excluded from the study.

CHAPTER 4

FINDINGS

The findings of this study revealed a wide variability in the way the health education professionals create their ehealth or mhealth education interventions. The different backgrounds of the participants, the type of organization they work for, the resources available to them, their perceptions of what makes effective health education interventions, in addition to the type of the intervention they created, are all possible reasons for this variability. The profiles of the participants and their interventions described in Chapter 3 are indicative of the differences among them.

On the other hand, the health education field itself is multifaceted, drawing from many disciplines, namely, health, behavioral psychology, and education (Timmreck et al., 2010). As a result, the participants of this study described their intervention from the perspective of the discipline that influenced their work.

However, all the participants followed certain processes to create their health education interventions showing similarities in the general approach but differences in the details.

Due to the wide variability in the findings and in order to facilitate their understanding, a descriptive approach is followed in presenting them, mirroring the phases of the instructional design process. In chapter 5, the themes emerging from the findings will be discussed to reflect the research questions. For this descriptive approach on the findings, three phases of instructional design are highlighted: analysis, design, and evaluation. This organization complies with the Smith and Ragan model (2005) and is a better fit with the nature of the findings collected. In the presentation of the findings,

pseudonyms are used to refer to the participants in order to ensure confidentiality. In addition, verbatim quotes denote to the actual words said by the participants during the interviews.

From an instructional design perspective, none of the participants used the systematic approach described in the instructional design models available in the literature, such as Dick et al. (2009), Morrison et al. (2007), and Smith and Ragan (2005). Only one of the participants explicitly named a specific design model, the logic model, which is a planning model originating in the 1970s (Taylor-Powell & Henert, 2008).

In their description of the processes of creating their ehealth or mhealth education interventions, the participants elaborated on the analysis, design, and evaluation phases.

Analysis

This phase of instructional design includes a needs assessment to explore the nature of the performance problem. In health education interventions, the performance problem is the health behavior. Therefore, this section of the findings reflects how the participants assess the health behavior problem and how they identify their goals for designing a health education intervention that will help solve the problem. In the analysis phase, the findings revealed five types of assessment: (1) choice of health behavior problem and related target audience, (2) assessment of health behavior needs, (3) determination of learning outcomes, (4) goal analysis, and (5) learner's analysis.

Choice of the health behavior problem and the related target audience. The manner through which the participants selected the health behavior problem and the related target populations of the interventions can be classified under four patterns: (1) choice reflected the mission of the organization, (2) choice reflected the area of expertise

or interest of the participants, (3) choice reflected the need of a stakeholder, and (4) choice was dictated by a grant.

William represented the choice of health behavior problem reflecting the mission of the organization:

> The founding director … her background is in social work and sexual health and so when she started working, she started this intervention … because she realized a lot of young people have questions but have no where to go to ask those questions so she started this … She connected with people and that is sort of what the thought of [our company], where she was to develop an intervention providing information and services to young gay men online. And since then it has just expanded and that's how we continue to work in sexual and reproductive health.

Daniel represented the choice of health behavior problem reflecting the area of expertise or interest of the participants. He explained:

> The topics were based on three things. One was the addiction one where we just kept it, you know, it just… that was what I knew so that's why there was this heavily focused on smoking, gambling, drinking, substance use.

Emily described the choice of health behavior problem based on the need of a stakeholder. She said, "People at [the clinic] wanted to make sure that, that [the patients] knew how to reach them and you know basic stuff about drinking water and prenatal vitamins." Leah talked about her interventions being funded by a grant. She said, "The Internet-based HIV prevention program was funded in 2007…. The smoking one also was funded in 2007." The participants therefore, showed variability in the choice of the targeted health behavior problem and related populations based on to the nature of their organization and the different stakeholders.

Assessment of health behavior needs. The selection of the health behavior problem was followed by a more elaborate needs assessment in order to address the health behavior needs of the target population. All the participants conducted this phase

of the analysis but using different methods. They identified the health behavior needs through four main methods. These methods were data collection, expressed need, felt need, and review of literature.

Data collection. Ten of the participants measured the need through the collection of data directly from the target population. Depending on the resources available to the participant, the data collection was conducted through surveys or health assessment tools embedded in the interventions. Camilla explained how she addressed the needs of her university students based on social norm marketing:

> I guess because through assessments and I like to assess and see where the students are but through assessments, those are some of the things that… have biggest priority from what I've seen…. I do social norms marketing… So social norms takes the student's perception that in college, everyone drinks a lot of alcohol. It takes that perception and then it assesses what the true facts are and then, presents the true facts.

Leah explained how she assessed the health behavior needs for HIV prevention in Uganda by saying:

> We already had done a … fuller scale survey … understanding their sexual behaviors and maybe some reasons why they were choosing to have sex versus not have sex and their experiences with other sort of romantic relationship domains.

On the other hand, Daniel talked about the brief assessment embedded in his intervention that helped him get a better understanding of the health behavior needs of his learners:

> Our old program even has the questions or just getting the answer so we can figure out where people are, end up where we have a brief assessment. But our new program will have six key questions as well as gender and age.

In addition, Ryan described how he used health assessment applications embedded in his website to collect data on the health behavior needs of his target population:

> Like our trademark application focus is on being able to ask or listen to questions from our users and then actually learn from them and then provide personalized information as opposed to generic information, which is the standard across most

> health websites. So I'll just give you a little bit of an understanding of what's going on in the backend. Let's say you take a checkup on your risk factors from heart disease and you tell me that you have a history of high blood pressure. You have a history of high cholesterol and you don't exercise much.

These participants aimed at collecting data through several sources in order assess the needs of the learners and design their intervention accordingly.

Expressed need. Expressed needs are needs voiced by the target population (Morrison et al., 2007). In this study, the participant listened to the expressed needs of the target population through focus group discussions and informal conversations. Explaining the needs assessment for the mhealth smoking campaign Leah said:

> In our focus groups and our development, we found that young adults were particularly skeptical about pharmacotherapy that they sort of felt like they shouldn't need it… that they sort of be able to will it through these types of things.

Lillian also mentioned the expressed need of her population as one way of assessing it. She said, "The way we choose the population really depends on, I guess, an identified need at that time either directly by young people or by the research evidence." These participants discussed with their learners their needs in order to get a better understanding of them.

Felt need. Felt needs are desires for improvement felt by the learner or the expert (Morrison et al., 2007). Here, the participants identified a felt need from the subject-matter expert, or in this study the health practitioner, whose input stemmed from experiences with the target population. Emily talked about how the managers of the clinic defined the need: "We were targeting at risk pregnant teens. So, realizing the hypothesis was that these teens typically don't engage as much as they should in prenatal care." Isabella also described how the need was assessed based on the felt need of the health workers. She said, "In all regions there was a demand from the healthcare workers

to set up a mobile project aiming at enhancing the diabetes awareness in the diabetes patients and from there onwards." Through felt needs, the participants obtained a better perspective on the aspects health problems that needed to be addressed.

Review of literature. All the participants conducted extensive reviews of literature. These reviews looked at research that reported trends and issues related to the health behavior problem and its corresponding health behaviors, and the successes and failures of the approaches taken in addressing them. The reviews were done regardless of whether the participants collected their own data or not.

Anna: We certainly don't do the studies. We look at the literature. We look at the research that's already done and then we make decisions. We try to make intelligent decisions based on, you know, the research that's already been done.

Camilla: I do a lot of reading and I belong to a national listserv for health educators. I guess, just through reading and reading other research, reading what other colleges are doing.

Leah: I did a literature review… I looked to see what sort of prevention content was already available in text and whether or not we could use that to create a framework.

Robert: We're looking at cancer and for health prevention areas that are related to cancer. So for example, avoiding smoking, better exercise, better nutrition, and avoiding sunscreening. So we're looking at those four topics. So we're kind of laying the groundwork to sort of see what prevention has worked.

William: Pretty much every time we have a new project we go out and we do formative research. We look at existing literature. We do a lot of reading … internally.

However, in identifying the health behavior needs of their populations, most of the participants did not exclusively use one single method of data collection, but they used a mixed method approach. William summarized it in one statement:

> Like I said the first step of the course is understanding what we want to do and doing formative research understand what the communities needs are and so we do some literature review and then we do some focus groups, survey interviews, whatever is required for that specific project.

The emerging patterns of the health behavior needs assessment are congruent with the categories of needs described by Morrison et al., (2007) who identify normative and comparative needs from data collection and review of literature, expressed needs from the target population, and felt needs from the professionals. Additionally, the fact that most of the participants used more than one method to assess the health behavior needs reflect an investment in efforts to understand the factors surrounding the health behavior problem in order to address it appropriately.

Determination of learning outcomes. All the participants created interventions that aimed at the improvement of health. However, these interventions varied in the targeted learning outcomes. Three learning outcomes emerged from the data and these will be presented in descending order that represents the number of participants reporting on them. The first was solely based on a change in knowledge. The second targeted behavioral skills to empower the learner to change the risky behavior. The third was a change in attitude. The emerging patterns on the learning outcomes were sometimes explicitly stated by the participants and other times deduced from their accounts on what they would like to achieve from their interventions.

Change in knowledge. All of the participants talked about targeting the knowledge level of the population. Only Robert stated explicitly that his intervention remained at the knowledge level. The other participants showed a reach for other domains of learning either through their descriptions or through evidence in their interventions.

Robert said:

> The program, the way it's currently structured, is mainly a knowledge improvement program; its objective is to raise your knowledge. We have not included not at this point a lot of behavior change, although it's a long-term goal to include that.

Sophie, whose website included videos that teach nutrition skills, also talked about the provision of information on her website. She said, "What we're really trying to push is that if you're not sure where to go for information, you're not sure like where can I find this or how about this topic, call us or go to our website." Therefore, these participants targeted the knowledge domain as an essential asset for behavioral change.

Behavioral skills. Eight of the participants discussed their aim of having their target population acquire behavioral skills as a learning outcome.

Anna: [The children will] take a little more responsibility of the choices that they make.

Emily: Making a difference to attending their prenatal appointments, which is really what they are trying to do was, increase prenatal attendance at their appointments and to prevent unnecessary emergency room visits.

Isabella: We hope to achieve that they will be better able to control their diabetes.

Leah: The objective is two-folds so to increase the rate of condom use among those who are sexually active and to promote ongoing abstinence among those who were not having sex.

Lillian: We focus on things like the development of life skills, but we also focus on promoting protective factors and reducing risk factors.

Mia: We are setting small goals and we know people can reach everyday and feel good about themselves and then build on from one day to another to eventually have a routine of taking care of themselves and taking a proactive approach to protecting and improving their health and well being.

William: Provide young people with the information and services that they need to make choices about their health and to be able to not be ashamed around sexual and reproductive health and be able to access those services.

These participants showed variety in how behavioral skills are targeted. It was achieved either through providing options to facilitate the acquisition of behavior, such as William or through direct work with the learners to instill skills, such as Leah and Lillian.

Change in attitude. Two of the participants, Camilla and Anna, explicitly described how they targeted attitudes.

Anna: To help children set a mindset that learning about nutrition and eating healthy is fun… So trying to make again a positive mindset association with healthy food with children.

Camilla: I think mainly it's the -- I think it's attitude more and just behavioral things so that -- I want students to be aware of how they can become healthier and then give them resources so they can do it when they are ready. I think that's my approach. I'm not going to -- I don't try to do scare tactics. I don't try to force people you know, but I like to put the options in front of them.

These two participants showed their views on the importance of attitude change as part of behavioral change.

Overall, the choice of these learning outcomes was influenced by challenges and limitations perceived by the participants in achieving them. Anna and Robert explained:

Anna: But, you know, that's a much harder, you know, objective to reach meaning that there is so much studies and achieving human behavior is very difficult and there is a lot of stuff that influences the child, it influences the family. It is a very difficult challenge that we are facing so we are just trying to be one little slice of the big picture puzzle.

Robert: But in all likelihood, it really requires a longer engagement, more content over a longer period of time. And how do we do that in way that is still sufficiently lean in terms of resources and time so teachers can integrate it in their school curriculum. It's going to be a challenge.

Anna and Robert revealed awareness in the participants of certain limitations to achieving desired learning outcomes. This in turn determined the actual specification of the learning outcomes of their interventions.

However, the learning outcome patterns reflected to a certain degree the domains of learning used in instructional design and described in the literature. Morrison et al. (2007) discuss the cognitive domain (knowledge), the affective domain (attitudes) and the psychomotor domain (more or less behavioral skills). Dick et al. (2009) and Smith and Ragan (2005) refer to Gagné's types of learning outcomes (i.e., declarative knowledge, intellectual knowledge, cognitive strategies, attitudes, and psychomotor skills). The participants in this study did not reveal a systematic approach of determination of learning outcomes described in instructional design literature. Nevertheless, they were cognizant of the different domains, and they attempted to cover them to the extent that it was possible for them. Moreover, the determination of the learning outcomes most likely reflected the training of the participants.

Goal analysis. Goal analysis determines the steps that need to be taken in order to achieve the objectives of the intervention (Dick et al., 2009). In this study, whether it is the initiation of a new health intervention or follow-up and design of new additions to an existing health intervention, the participants engaged in brainstorming sessions with their teams in order to set a vision, overall goals, and objectives. Additionally, the participants discussed approaches to be taken in order to achieve their objectives. The goal analysis phase described as such was more apparent in the participants working within a team. Eight of these participants displayed a form of goal analysis. For example:

Anna: What are the initial, you know, key objectives that we're going to target this child with this game and so we focus on one to two key objectives throughout this.

Emily: Who do we need in the room, what should we talk about in terms of what the operations need to be considered and also what the content should be considered.

Isabella: So all the partner institutes including our equal partners and everybody is involved in equal way and also, the subject matter experts are equally discussing things or proposing things. Of course, it's only one lead just to make it a little bit easier…. it's preferably someone who is already familiar with the specific health topic and determined on which type health topic it will [be]…. But then that person will look for technical people as well as subject matter experts to give extra inputs. So it's always a collaborative interdisciplinary planning phase.

Mia: The advantage that we have is as a team we can meet and we do on a weekly basis where we identify the goals that we have for the week in terms of what the products needs to improve…. Then we lift what we think our users have in terms of goals and expectations for the product, what they would like to see, what we think they would like but they might not know about. And we list our goals.

Robert: First thing we did is to define the mission and the objectives.

William: Whenever a new idea or a project comes in then one person will become the project lead and that person then gets together a team for implementing the design and implementing the project and then there is a kick off meeting that happens picking the project team and the funders and other key stakeholders that are important. Once that kick off meeting happen that gives direction to the whole team on how to move forward… the first step of the course is understanding what we want to do… what the objectives are going to be… a problem statement.

The participants working within teams showed a clearer picture of goal analysis. This may be due to the resources that a large team provided and the possibility of interactions with team members of different backgrounds. However, none of the participants reflected the structured goal analysis described in the instructional design literature such as the models of Dick et al. (2009), Smith and Ragan (2005), and Morrison et al. (2007).

Learner's analysis. Learner's analysis identifies the characteristics of the learners that need to be considered in order to maximize the impact of the intervention (Dick et al., 2009; Morrison et al., 2007). The participants seemed to give great importance to learner's analysis. Four patterns of learner's analysis emerged: (1) assessing the technology needs and preferences of the learners, (2) assessing the learner's

learning preferences, (3) assessing the health behavior characteristics of the learner, and (4) assessing the design preferences.

Assessing the technology need of the target population. Three participants discussed the assessment of technology needs of their target population revealing a variation in how they did it. Emily discussed with her team members how a mobile intervention would be received best by at-risk pregnant teens:

> There is a tendency to think that maybe, the population… might not be as receptive as to technology… Texts might be something that these lower, socio-economic status that patients would have…. and that they would respond to it because they would be adolescent so according to some of the research, adolescents are more likely to accept texts versus other demographics.

Leah conducted a technology assessment with her target population to determine their computer and Internet use skills. She explained:

> One of the things we did was a technology assessment so young people who have used the Internet one of their basic skills. If we give them four different tasks like opening a browser, creating an email address, can they do it? How much help do they need?... the technology assessment we did with 20 kids.

William conducted focus group discussions on the media preferences of the target population. He said:

> All the way from understanding what young people want and how they want it and then using that as oppose to asking and telling young people what to do and telling them in a manner that we feel comfortable with. They actually go to their clinic and ask them, what is the way that you want the messages to be. What you are most comfortable using? What media or what technology are you most comfortable with using.

Emily, Leah, and William used focus group discussions, demonstrations, and conversations with team members to assess the technology needs. Other participants, who did not conduct an actual assessment, did express their perceptions of the technology preferences of their learners as discussed under learner's learning preferences.

Assessing the learners' learning preferences. Six of the participants depicted learning preferences among their learners depending on age, type of technology, or learning modalities.

Age. Robert talked about his perceptions of children's learning preferences. He explained, "Especially for young kids, exploration is a more fun and engaging area." Ryan and Mia talked about their perceptions of the learning preferences of adults. Ryan said, "People really love videos … in terms of articles they skim articles." Mia said:

Mia: We have individuals who are really looking for a way to learn more about health, others are looking for light-weight intervention to help them change their behavior. Others are overwhelmed in time so they are already actively trying to change their behavior but have found other programs too heavy and demanding and therefore have quit those programs and they turn to us….

Sophie talked about her perceptions of the learning preferences of university students.

Sophie: I'm finding the student population would much rather do this at 2:00 or 3:00 in the morning on their computer and surfing around and figure out where they want to look and get that information than trying to wait until we're open at a certain time and then come in and ask for the information, get a brochure, or check out a book or something like that.

These participants showed awareness to how age influenced the learning preferences of their learners.

Type of technology. Anna, Camilla, Daniel, and Sophie described their observations on the type of technology their learners preferred. Anna said, "We knew that they were using computers…we knew that they were playing video games." On the other hand, Camilla said:

> I think that other types of electronic information probably are better at this point because students are more likely to look at their Twitters or that type of thing…. Students are more likely to look at their Twitters or that type of thing.

On text-messages Daniel remarked, “Everybody has text messaging…[Patients] are fine with the mobile piece…. People do not like to end the messages, people said, “If I stop the messages that means that I am giving up on a goal”.

Sophie also said:

> Students are never likely to come in and borrow something out of our library than they are to just want to find the information online…. they’re still used to having instantaneous media happening at all times with their cell phones and their smart phones, with their emails and everything.

These participants revealed how they catered to the technology preferences of their learners in order to motivate them.

Learning modalities. Robert and William expressed their belief in learning differences among learners. William said, “Everybody… is a different learner.” Robert explained, “Different children learn differently, so some of them are more visual learners, some are more audio-based, some prefer manipulatives…. So we wanted to give a range of activities that in different modalities, so… different learning styles would be accommodated.” Robert and William revealed their understanding of how people learn differently and considered this characteristic in planning their interventions.

Learning approach. Mia and Robert explained how learners engage in different learning approaches. Mia said, **“**Those [game] mechanics are really a hook to keep their attention and their motivation going” and Robert said, “It was found that active learning, hands-on learning and self-directed tended to show higher level of engagement.” So, Mia and Robert placed value on the importance of engagement in learning and aimed at using the learning approaches that achieve it.

Assessing the health behavior characteristics of the learner. Seven participants discussed the health behavior characteristics of their target audience. Their assessment was mostly based on perceptions and experiences with the target audience.

Anna talked about the difficulty of changing the health behavior of people, "We know that changing people's habits are very difficult and obviously we have a large growing population of individuals who are struggling eater." Daniel described how people lack the skill of self-motivation, "I am thinking they don't know what to say to themselves. They don't know what will be motivating." Isabella explained the reasons why her target population does not access health care services, "Some of the patients never go to their educator because it takes some time to travel, which means that they are away from their professional activities or personal activities and so they weren't always eager to do so." Ryan talked about the health behavior needs of his learners and their lack of analytical skills in reading health information, "People are not looking necessarily for lifestyle modification or prevention…. the average person doesn't have the analytical skills to be able to differentiate between that valuable information and that unvalidated information." William clarified how the health behavior need vary among the same target population:

> [The young people] could be at various different levels of behavioral change. So applying the same strategy to everybody across the field doesn't seem to make sense because we need to pick out where the predominant majority for young population is and then take them from that step to cross the…what is next in the right direction.

Again, the participants showed efforts in gaining an understanding of the health behavior characteristics of the learners in order to answer to their needs in the interventions.

Assessing the design preferences. Five participants explained how their approach to the design of the intervention is based upon discussions and feedback from

the target audience. They felt that the more the intervention suited the preferences of the target population, the more it engaged them.

Daniel explained how he goes about the text-message design in his intervention:

> We surveyed people and asked them what they wanted and overwhelmingly people said they wanted a combination…. The organizations said they wanted a combination where they can create their own messages as well as where they could borrow messages from us.

Leah talked about the opinion leaders that she consulted:

> We conducted a massive quantitative survey primarily to identify what we called youth opinion leaders. Popular opinion leaders in their schools so these are kids that were sort of the most popular kids in each class and we wanted that kid from each class to come together into a youth advisory board essentially so that they can help us develop this thing so that when it was done it would be interesting to the popular kids and hopefully then they could sort of lead the opinions of others. We had to do a survey to better understand that.

Lillian described the user-led design approach that she used:

> So, we use what's called user-led design or participatory design framework to create an environment where young people are actually working with healthcare professionals to design and deliver what the materials need to look like…. So, if it was a mobile app for example, you might run a workshop with young people at the beginning, just think about what the app might look like, what components it needs to have, all those sorts of things…young people and the organization have an enormous say in what the website looks like, so as part of the participatory design process, you work with young people to capture the elements that they think should be on the website…. They might go well I really like the font on the Facebook site, but I really like the images on YouTube or I really like the MTV website, [it] has excellent edge, elements on their homepage.

Sophie explained the kind of feedback she collects from students:

> I'm actually getting feedback and assessment from the students, the student population and finding out -- especially my first year students, finding out what is it they want to see so we can tailor the website and make certain that that's exactly what they want.

William summarized it all by saying: "So the principle that we work on is, is that, you know, we don't know best." Here also, the participants revealed awareness towards the

need to respond to their learner's design preferences.

Overall, the participants depicted a wide range of elements in their learner's analysis. They touched on technology, learning, health behavior, and design preferences, which are all essential in the analysis phase of instructional design. The instructional design literature varies in process and elements assessed in the analysis phase. However, any information that adds to the understanding of the learner will help in the success of the instruction (Dick et al., 2009; Morrison et al., 2007; Smith & Ragan, 2005), in this case the health education intervention.

In summary, all the participants conducted the analysis phase of ADDIE, though to varying degrees. They defined a target health behavior problem and the related populations based on to the nature of their organization and the different stakeholders. They clearly identified the health behavior needs of their populations and analyzed their learners, though with different methods. As a result, they defined appropriate learning outcomes that they perceived attainable and carried out a goal analysis to achieve the learning outcomes.

Design

This phase of instructional design includes defining the objectives, the learning activities, and the media to be used for the instruction. In this study, the design phase revealed three emerging patterns: (1) design process, (2) content design, (3) learning activities design.

Design process. All of the participants discussed the design process they went through. As a result, three approaches emerged: These approaches are: (1) multidisciplinary approach, (2) expert approach, and (3) learner participation approach.

Multidisciplinary approach. A multidisciplinary approach to design involves the collaboration of several team members who are skilled in different disciplines. The team members can be content specialists, education specialists, instructional designers, and specialists in production. This approach has the potential of maximizing the use of the resources needed in creating a learning intervention (Brooke, Bell, & Oppenheimer, 1976; Care & Scanlan, 2001). In this study, the participants working within large teams showed a multidisciplinary approach in the way they approached the design of their intervention. Anna, Mia, Robert, and William explained:

Anna: People have different ideas. We brainstorm on them together and figure out what exactly is going to be the game that has got that pulse.

Mia: The design and engineering team … actually brainstorm some ideas on how to best implement those features or goals that we have expressed earlier in the first design meeting. So they will talk about ideas, colors, all the visual side of things.

Robert: So we had several brainstorming meeting were people present their favorite game, what they like. So, apart from reading the literature, we also spent time exploring websites and apps.

William: Whenever a new idea or a project comes in, then one person will become the project lead and that person then gets together a team for implementing the design and implementing the project… if it is a website project then that is the kind I can bring in or market and communication team and our graphic designers and our engineers and we pass all these information to the graphic designer and the engineers. We pass on the content and we also pass on the design agreed to them and subsequently depending on what the content is, what the design is we use different sources to get designs.

The description of the participants of their multidisciplinary approach to design revealed how they benefited from the expertise and opinions of the different team members to facilitate the design of their interventions.

Expert approach. An expert approach to design indicates the subject-matter expert taking on the tasks of the instructional design process. Although subject-matter experts are highly knowledgeable on the content, they are not as skilled in how to transform the content into learning materials that address its objectives (Dick et al., 2009; McVay & Roecker, 2007) In this study, participants working in smaller teams approached their design from the perspective of their area of expertise. Daniel, Ryan, Camilla, and Sophie are examples. For Daniel, who is a clinical psychologist and expert on behavioral change, the design was heavily based on strategies of behavioral change. He said:

> I think the interventions have to be adaptive and I think they have to be just time interventions. So they have to be adapted to the current state and this is where the users are required to do something where they answer a question and then you adapt based on where they are in the moment… Based on the behavioral change literature this is why you want to change, what would you say to yourself if you were considering not changing, what are your new behaviors?

Similarly, for Ryan, who is an expert in medical and health issues, the design leaned towards providing assessment and informative advice on health problems.

Ryan: But at the same time a lot of what we do is based on almost like a family medicine approach…. Let's say you take a checkup on your risk factors from heart disease and you tell me that you have a history of high blood pressure. You have a history of high cholesterol and you don't exercise much. What our system actually does is it actually starts developing, it starts feeding the database with that information which will then allow us to target you with personalized information.

For Camilla and Sophie, who are experts in health promotion, but work without a team, the design was based on provision of information and resources and decisions were taken single-handedly.

Camilla: "I will collect websites that I find that are good and then I'll send them over to the IT department and I ask our IT person to put them on the website and so, that's how they get put up there."

Sophie: The content I can do whatever I want with, you know, obviously within professional realms. But the content, I have the freedom to do whatever information I'd like to put on there for the site…. I'm going to put this site up and I'm going to make some executive decisions on which submenus and tabs to have and all that.

So, these participants played the double role of the subject-matter expert and the instructional designer. This role was influenced by the expertise they had in the health and behavioral change domains and their intuitive approach to design.

Learner participation approach. Learner participation approach, also referred to in the literature as learner-centered or user-centered approach, aims at involving the learner in the early stages of design in order to enhance the achievement of the objectives of the learning material (Corry, Frick, & Hansen, 1997; Vincini, 2001; Zaharias & Poulymenakou, 2006). In this study, a learner participation approach was used where members of the target population were involved in the design process from the beginning. Lillian and William exemplified this approach the most. They explained:

Lillian: So, we use what's called user-led design…. Young people… have an enormous say in what the website looks like. So as part of the participatory design process, you work with young people to capture the elements that they think should be on the website….[They] bring in a list of websites that they really like, that they find engaging and they might go well I really like the font on the Facebook site, but I really the images on YouTube or I really like the MTV website, has excellent edge, elements on their homepage, and then their design is actually… so they're never starting from the blank slide.

William: Whenever we are designing or developing concept framework…we do some focus with the target population, get information from them…. So for example, we have conducted a lot of focus group discussions with young women… and then based on that information we developed a website. They all wanted a website with a specific look and feel. They wanted real people, pictures as opposed to abstract the designing. They wanted linkage and resources and those are the kind of information that we put up there. They also wanted an ability to interact with other people who might be in a similar situation so we've actually linked or provided linkages on some of those websites to parallel social media pages for example Facebook.. So wherever we can link we create linkages across

> multiple platforms and we always, always take information from the community, from the target population before we develop the concept.

William and Lillian revealed how they reach out to their target population to collaborate with them on decisions regarding content and activities, in order to create an intervention that fits their needs. In collaborating with their learners as such, they ensured their engagement and they increased the chances of achieving the desired learning outcomes.

The participants used different design processes as they worked on their interventions. This was determined by the nature of the organization they were part of and the resources available to them. The multidisciplinary approach maximized the use of resources; the expert approach was influenced by the area of expertise of the participant; the learner participation approach centered on including the learner in several phases of the creation of the intervention.

Content design. All the participants discussed how they chose the content for their interventions. Consequently, three approaches emerged: (1) subject-matter expert approach, (2) collaboration with learner approach, and (3) a mix of collaboration and subject-matter expert approach. These will be presented in descending order that represents the number of participants reporting on them.

Subject-matter expert approach. Six participants, Anna, Emily, Isabella, Leah, Ryan, and Robert exemplified how subject-matter experts, such as physicians, nurses, or dietitians, selected and finalized the content based on their knowledge and understanding of the health behavior needs of the target population.

Anna: The dietitians will set the objectives that for an age group this is normally what we wanted to teach them and so we begin to break that down.

Emily — The clinic team came up with the content…. For the content we tried a few different things, but then we came up with a template that really seemed to work and we used it for our other programs as well; and continue to use it…. The executive director at that point felt strongly that we should continue after the baby's delivered

Ryan — We put [the content] in front of our medical advisory board and we get about two approvals for questionnaire so we need at least two people to say that it looks okay.

Robert — A core group that included an educator, a nurse, a child life specialist and a teacher who wrote an initial draft of the book and the curriculum.

Isabella: — The content was… well everybody came together from the regions and the content was discussed beforehand with the responsibles in each country. So, in that phase [the physician] did provide her health knowledge together with some diabetes experts… and within the partner institutes. So it was a combined effort to come up with the content.

Leah: — [The health communication specialist] put together a pretty detailed plan. She… put together an Excel sheet to basically identify different types of messages so cognitive restructuring, encouragement, all these behavioral skills, these different types of things… and then went through and color coded all of her messages to make sure that she had the mix that she wanted across the days and across the quitting process.

These participants relied on the expertise and knowledge of the subject-matter experts to build the content of their interventions, ensuring its accuracy.

Collaboration with learner approach. Two participants**,** Lillian and William exemplified the collaboration with the target population. They explained:

Lillian — A draft and a fact sheet might be written by a clinician who obviously has a look at clinical information about depression or anxiety, or the topic of the fact sheet, but then that fact sheet is actually shown to a group of young people who look at it and provides feedback on the way that the language it uses, the way that it set out, how it actually presents the content, and then the fact sheet is revised, not diluting the clinical content but in showing that it's presented in a way that young people find engaging, that might also mean taking what is written content and turning it in to digital content phase like a video or a digital story to present the information in a different way.

William — We went out and we did some focus group discussions with the community, with young people and that helped us design and develop specific messages around sexual and reproductive health and so these messages came from the young people. We didn't develop those messages. We went out and we asked, "Hey, what are the issues that you want to learn about and what are some of the tips that you would like to get or share with other young people? What are the questions that young people are asking and how can you answer those questions?... We cut those tips and then we turned them into text messages.

Lillian and William recruited the help of their learners in building the content to make sure that it answered their needs.

Mix of collaboration and subject-matter expert approach. Daniel was the only participant who used a mixed approach towards the design of the content of his intervention. He said: "We'll write the messages for people just like 50 or 60 messages so that we'll compliment the messages people write to each other."

Additionally, Daniel used guiding questions embedded in his intervention to get feedback from the participants on the content. He said:

> The key to this program is that people write their own messages… we tried to guide people through a few questions… What we found is that people weren't writing the messages so what we did was we said, "Okay, why don't we do both? We'll write the messages for people just like 50 or 60 messages" so that will compliment the messages people write to each other. And then we realized that people weren't even… they were choosing the messages but not writing any themselves so it has been an interesting evolution"

Daniel wanted his learners to collaborate on the content of the messages. At the same time, he found that he needed to develop some of them from his perspective as an expert. Here, he supported his learners with expert-oriented content. At the same time, he motivated his learners in taking ownership of their own messages.

Learning activities design. All of the participants revealed one or more learning activities through which they delivered their content. The most common activities were:

(1) text messages, (2) multimedia, (3) interactive applications, and (4) resource centers.

Text messages. Six of the participants in this study used text-messages for their interventions. The text messages were used in the mhealth education interventions and they varied in types. For example, Isabella talked about simple text messages with no links to the web because of barriers of connectivity:

> In the first place it's really simple text messaging; because of the connectivity… it's a rural connectivity…. Many of them are just in rural areas with no Internet or very unstable Internet options so that is why we use only texts…. [The text-message] varies from strong really informational text messages to health related questions.

She also used a two-way communication because her learners had to supply their diabetes educators with certain information:

> In the first instance they would tell the diabetes educators what is their status of the diabetes and then the diabetes educators would give feedback depending on the data that is provided by the patients and give them indicators on how they can better control their diabetes or what they could.

Similarly, Leah's intervention needed an interaction between learner and learner:

> We had a component called text buddy…. One person would be paired with another person. We had instructions on the web site about how to do that. Basically how it works. How you sent messages to each other.

On the other hand, Daniel used a one-way communication to avoid dealing with legal issues:

> We don't [do] interactive messaging for our programs except every once in a while we'll ask someone a question. But we don't give them the response other [than] thanks and the reason is because of the FDA rules… once you are going beyond information, once you are getting into interactive messaging you can make the argument that you are doing an intervention.

Therefore, even with a learning activity that is as simple as text-messages, there were variations: text-message only, text-messages with links to the web, one-way communication, and two-way communication. The selection of the variation depended

on reasons such as Internet connectivity, regulations, and the desired learner's activity.

Multimedia. Four participants used videos for their ehealth education interventions.

Anna: We do have a video we launched last year… it's a basketball game. Children play, our characters play against the junk food bandits.

Robert: We developed a presentation by an expert in [the cancer] topic that would be given in class…. the in-class presentations were turned into a video and these videos just recently got added to the website.

Ryan: People really love videos and we don't have the resources to do a lot of video production so we're using a lot from Youtube in terms of open license videos that we can actually just blend into the site.

William: We did videos but what we did was instead of putting them on the website we put links on the website because we realized that a lot of young people were actually looking at media on Youtube and less so on website. So we actually created a Youtube account and we used to put the videos there that they could look at and it would then create the ability to comment on the video to allow them, you know, be able to share that video with other people as well.

So, these participants used videos either to house a game or to present additional resources on the health behavior problem. As it was evident on their websites, these videos included animations, scenarios and subject-matter expert presentations that aimed at engaging the learner and presenting the learning material in multiple ways.

Interactive applications. Several participants in this study used applications that required the learner to interact with them. Anna's website included several games where, for example, learners learned how to build a healthy meal or read food labels. On the other hand, Leah used animated frogs to reinforce the learning in her scenario-based modules. She explained:

> So for example we had a series of questions about behaviors and are they high risk, low risk or no risk for HIV and… there were frogs, animated frogs…. So we had a red frog, a yellow frog and a green frog. You're supposed to click on the green frog if it was no risk, red frog if it was high risk and so you would click on

> it and their tongue would come out. It was kind of fun to watch but basically what they were supposed to be doing was categorizing these behaviors into risk categories.

Mia talked about the game mechanics on her website where learners get rewarded for their actions and interact with other learners:

> So what we do is once a user clicks the done button we give them a reward, that's the game mechanic which takes them initial form of points and then points accumulate so you reach different levels and this is the plant that grows to the visualization of the user growing in their endeavor or personally to become a healthier person

Robert wanted to create an interactive 3D model of the lungs to provide his learners with an authentic experience:

> We are coming up with 3D versions of those [hands-on lung models] and putting them on the website…. And those models are also interactive, in the sense that you can rotate them, zoom in and there is audio narration.... see the texture of what a tumor looks like.

Ryan created online check-ups for his learners that are followed by tailored health information:

> We're actually moving towards our actual apps so right now they are web-based apps and they are very, very simple. Like, things like, the BMI calculator for body mass index or body fat calculator, calcium calculator.

William created an ecard partner notification partner system for sexually transmitted diseases:

> One of the things that we added...was an online for partner notification website…. it is critical to identify [the] sexual partners and… we try and contact those partners directly… and inform them that he or she has been diagnosed with a specific STD and recommend that they get tested as well…. We created cards for different STDs and for different situations… so the patient could… choose one of those cards depending on what STD they had and they could put in the email address of the person sending it to and the card will go to that person. When that person receive that card in the email they become aware that "Oh, I might have been exposed to this" and if they click on that card it would take them to a site which would allow them to identify local testing centers and then it would go and take tested for the STD.

These participants were keen on delivering their learning materials through applications that motivated their learners and actively involved them in the learning process.

Resource centers. Five of the participants created resource centers for their learners either in the form of services or in the form of additional information materials hoping to provide them with all the support they needed to achieve the desired health behavior. For example:

Anna: A little over a thousand print materials to again supplement and help the teacher in teaching children about the various aspects of nutrition.

Camilla: The website will -- you know, we have a lot of resources on the website and we're continually trying to build on that.

Lillian: The online wellbeing center is about creating an online hub where young people can download different tools or applications, they might be mobile applications, they might be videos, they might be like an online game that they can then use to improve or maintain their own wellbeing, right through it at the clinical end to tools and applications that actually have treatment objectives,

William: Essentially what the website did was it provided young gay men initially with STD information and HIV information. It provided them with the opportunity to do a self-assessment… it actually took them to local testing sites. Then they could actually go to those testing sites and get tested for different STDs or HIV. One of the things that we also did was…we created the ability for people to have their lab slips directly printed out or emailed from the website and we also hooked them up to prescriptions because for STDs it is one of the few diseases or conditions where doctors can actually give expedited therapy…. So it took a user all the way from information to assessment to testing to treatment.

The learning activities thus described, reveal the creativity and effort invested by the participants to enrich the learning experiences of their learners. The nature of the learning activity was influenced by the type of technology used, the connectivity issues of the target population, and the limitations in resources.

Therefore, the participants designed their interventions either by working with subject-matter experts or by collaborating with their learners. They also employed a variety of learning activities that suited their target audience and stayed within the limit of their resources.

Evaluation

The evaluation phase includes formative and summative evaluation (Dick et al., 2009; Gustafson & Branch, 2007; Morrison et al., 2007; Smith & Ragan, 2005). Through formative evaluation, instructional designers seek to test their interventions before release to the wider target audience in order to make adjustments and corrections. Through summative evaluation, they seek to measure the success of their interventions in achieving the intended objectives. Eleven of the participants conducted formative evaluation and all conducted some type of summative evaluation.

Formative evaluation. The 11 participants who did formative evaluation on their interventions revealed two patterns: (1) purpose of formative evaluation, and (2) process of formative evaluation.

Purpose of formative evaluation. Ten of the participants explained what the purpose of their formative evaluation was. In doing so, they revealed three purposes: (1) attitudes, (2) content comprehension, and (3) usability.

Attitudes. Here, the participants looked at whether their learners liked the design of the intervention. The appeal of the intervention on the learner influences their motivation and ultimately their learning performance (Dick et al., 2009). For example, Anna said, "We are we seeing increase in engagement…. So we do a lot of analytics evaluating, which areas of the website are the most popular and…what is the, you know,

the level of engagement with the website so how deep do they go when they come on to our website" and Isabella explained, "We want to see how it's taken… if the patients are actually willing and of course, able to get into the program." These participants wanted to evaluate whether their learners found their interventions engaging and relevant.

Content comprehension. Here, the participants looked at whether their learners understood the content of the intervention. Again, Anna said, "We watch and see … did the game accomplish the objective that we wanted it to accomplish…. [Did] the child understand the message that we were trying to teach them" and Ryan said, " Kind of a test is to see whether the content makes sense…. I can actually get a feel for does this look like this question is confusing." So, by evaluating content comprehension, Anna and Ryan were able to make changes to improve it.

Usability. Usability refers to the ease and efficiency of use of elearning materials and the satisfaction gained during the use (Nielsen, 1993). In this study, the participants tested usability by looking at the difficulties encountered by the learners as they moved around the intervention.

Anna: We watch and see…if [the children] know what to do and how to maneuver through the game.

Ryan: Our focus is usually completion. So if somebody starts doing something and they stop, it is usually our fault because it means that they got lost somewhere in that process or the subject thing was not intriguing enough. So we look at completion of the big end point for us … in the beginning a lot of people just stopped in the middle and that was discouraging for us.

So, these participants tested for problems of usability in order to fix them and ultimately provide an easy experience for the learners as they go about the interventions.

The 10 participants who conducted formative evaluation looked at how their learners felt about their interventions, if they understood the content, and whether they

had difficulties in navigating the intervention. They did so in order to refine and improve the intervention before finalization.

Process of formative evaluation. Nine of the participants explained how they proceed with formative evaluation. In doing so, they revealed five processes: (1) feedback from learners, (2) analytics, (3) field testing, (4) AB testing, and (5) maintenance.

Feedback from learners. One process of conducting formative evaluation was through reading feedback from the learners. For example, Anna, "We look at is, you know, our population, our visitor rate…. get feedback of what's working well." Daniel said, "We've asked people to sense like, 'What has been your favorite message?' that kind of thing." Mia said, "We do gather and read a lot of feedback from our users." Direct feedback from the learners provided information to the participants on the strengths of the interventions and the weaknesses the needed to be addressed.

Analytics. Another process of conducting formative evaluation was through tracking the behavior of the learners as they moved around the intervention.

Mia: By tracking our user's behavior, seeing if they are having any trouble in using the product.

Ryan: What I can do is I can actually watch in real time a person move through the site and I can see where they are pausing…we can actually see a heat map so where they mostly likely to click….Why is the person standing two minutes over here and, you know, the rest of the questions they spend two seconds?

By observing the behavior of the learners, the participants detected problem areas in their interventions and corrected them.

Field testing. The participants field tested their interventions using focus groups where they discussed with their learners the improvements needed to the interventions.

Anna: We have a group of children that we have in that age group, play the game give us feedback

Lillian: The product is then taken and tested again with young people. So, if it was a mobile app for example, you might run a workshop with young people at the beginning, just think about what the app might look like, what components it needs to have, all those sorts of things… So you might release the mobile app to a small group of young people initially and get them to actually test the application before it's made more widely available.

Leah: We did a field test, a beta test with our youth advisory council with the program in the field to make sure that we could bring everything together and still make it work…. we did a beta test so our technology team worked at sort of sample modules.

Robert: Once it was ready for testing, some people within our staff who had children, asked their kids to try it and we got some informal feedback.

Emily: It was a pilot program… intended to see whether this kind of operation can work.

Isabella: We want to see how [the intervention is] taken, the information that is provided, if the patients are actually willing and of course, able to get into the program, itself. And so we are in the pilot part of the project.

Here, the participants conducted a more elaborate form of formative evaluation that went from focus groups to a pilot phase extending over time.

AB testing. AB testing consists of statistically comparing two versions of a webpage in order to check which one works better for the user (Swanson, 2011). Only Mia talked about the AB testing. She explained: "We might do AB testing if you know what that is. The equivalent of a small control study where we compare to designs and see which ones users prefer or meet our goals best." In doing so, Mia collected more evidence on how her learners used the intervention, which enabled her to adjust it to meet her goals. However, Mia did point out she did not conduct AB testing on a regular basis.

Maintenance. In some instances, formative evaluation was done after the intervention was launched.

Sophie: The reality of it is it's going to be trial and error. I'm going to put this site up… and then I may find that the students then do an assessment after that and say, is this -- basically is it working? Are you able to find stuff and if it's not, then I'm going to have to change it but I'm open to that. I'm really open to having to change it… because I want it to work correctly.

Mia: Most of the time because of the nature of what we do as a start up we put out the product, we put out whatever we produce, whatever feature or new addition to the product that we want to produce. We do our best to produce our best product obviously but we put it out and we iterate on it as much as we need to, to really get it just right.

The resources available to Sophie and the nature of Mia's intervention necessitated the launching of the interventions before testing. This enabled them to adjust their intervention as needed.

Therefore, the participants conducting formative evaluation looked at whether their interventions appealed to their learners, whether the content was comprehensible, and whether the learners felt comfortable navigating through the interventions. They assessed these elements with various methods and used the results to improve their interventions.

Summative evaluation. All of the participants in the study performed some type of summative evaluation. Consequently, three processes emerged: (1) focus of summative evaluation, (2) process of summative evaluation, and (3) period of summative evaluation.

Focus of summative evaluation. All of the participants explained the focus of summative evaluation of their interventions. In doing so, they revealed three foci of

evaluation: (1) knowledge and attitudes, (2) health behavior change, and (3) usability and engagement.

Knowledge and attitudes. Only three of the participants reported on the evaluation of knowledge and attitude change from the intervention.

Lillian: We do have the capacity to actually collect data…and what we're hoping is that will help us understand better the impacts [knowledge and attitudes] that these tools and applications have over a period of time.

Leah: They would go into an exercise where they would need to sort of demonstrate that they had learned their skills… We do have the data so that we can subsequently sort of zoom in—for example, we have got all of these answers wrong on you know one particular exercise demonstrated they really had no idea what's going on that type of thing.

Robert: One of the things that we wanted to do is not only increase their knowledge but also we want to see whether they can retain that knowledge…. This year we're going to begin measuring attitude changes and from that we're going to see what additional things we need to incorporate into the program that would affect attitude.

These participants collected data on the changes of knowledge and attitudes to measure the impact of their intervention on these two domains of learning.

Health behavior change. Although only three participants talked about their evaluation of knowledge and attitudes, eight participants discussed how they measured the behavior change using a variety of methods. Emily and William tracked the use health services, which was one of the objectives of their interventions. Emily explained, " We looked at 20 patients [in the pilot phase] and they had a 9% increase in attendance compared to a similar cohort that didn't enroll in the text message." William said, "We're able to track whether they had seen an increase in the number of people coming in for testing through the campaign." Camilla and Isabella looked at the actual improvement of the health condition targeted in her intervention. Camilla said:

> Through… surveys is where we… collected these facts. It's interesting because we find that… the number of students that say they do not drink alcohol at all in a typical week has actually gone up. And so, that's another good fact for us to use so, that's basically how we collect the data.

Also, Isabella said. "We're looking at…the health of the patient. And then as the project goes along we're looking at how the health is perceived by the patient, as well as some harder indicators of their… current diabetes health." On other hand, Daniel, Leah, and Lillian asked their learners to report on their behavioral change. Daniel said, "We just do user perceptions of change.... We ask people overall how have you changed." Leah also said, "In terms of behavior change it does look like we were able to move the needle a bit…. Behaviorally we did affect behavior change." As for Lillian, she explained, "We evaluate] change in behavior as well, but often it's retrospective, so it's actually asking young people to indicate whether they believe that their behavior has changed." These participants collected data on behavioral changes that resulted from their intervention. Some of them did do so through direct data collection, others used a self-reporting method. However, information on behavioral changes strengthens the evidence of success of the interventions.

Usability and engagement. Ten of the participants talked about evaluating the learner's engagement and usability of the intervention.

Anna: We have also collected testimonials. We have over 2500 testimonials… feedback on how these have used the site and that has been their experience and so we have and a anecdotal information through testimonials…. we also do surveys once a year in which we reach out and at the time our main focus is on the survey but we want to gauge and then of course the other thing we look at is, you know, our population, our visitor rate. Is it growing? Are we getting more referrals to the site, you know, back wings? Are we seeing increase in engagement…. We actually have over 8000 Twitter followers and also we have about 1200 Facebook. We haven't done as much work on Facebook. We have been on Twitter longer. But we do have a large community of parents, educators, mainly

dieticians, community leaders that are involved in nutrition with children and then of course a great deal of parents who are focused on that topic or interested to follow us.

Leah: From a logistical perspective, we have retention rates over 90% and this includes kids getting expelled, suspended—it's kind of all over the place, it's crazy but at six months we have more than 90% completion, which is pretty awesome.

Mia: We have great engagement numbers actually… we definitely have a great percentage of our users saying beyond 30, 60 and even 90 days and I will say we have super users who have been with us a 100, 200, 300+ days.

Sophie: What we find is that a lot of students are starting to come to us and ask questions.

Robert: There are few hundred teachers and educators [on the] online [forum].

So, not only did the participants measure the impact of their interventions, they also tracked the level of engagement of their learners in order to assess their level of interest and motivation. The more motivated the learners are in following up with the intervention, the better the learning outcome.

Process of summative evaluation. Four of the participants who reported conducting a summative evaluation discussed the research-oriented approach they took.

Camilla: We gather data from '99 through 2004 and… the coalition that I belong to …is a coalition of higher education institutions.. We got grants and we're able to start doing … a nationally-done survey. We can compare ourselves to national data and then we collect [state] data so we can compare ourselves in [state] also which gives us a lot of power.

Leah: [About the ehealth intervention] We went on to the field with the randomized control trial. [About the mhealth interventions] the control group received just as many text messages but it was about fitness and sleep and it was a blinded control group. They didn't know they were in a control group because we sort of talked about quitting smoking but it wasn't based on research so we didn't expect it to work but what we were hoping actually is that we would sort of increase their fitness improve our sleep pattern.

Mia: From a very scientific standpoint, I can happily report that we are in the midst of running our first clinical trial where we will be evaluating or

assessing the effect on well being that [our intervention] has.

William: [We] collaborated very deeply with academia and these other researchers… to do some really heavy research which is.… The five year study that just concluded last year and we are in the process of writing articles and disseminating the reports.

The rest of the participants either did not discuss their summative approach in details in this study or used informal methods such as Daniel who said, "We ask people overall how have you changed." These participants who discussed the process of their summative evaluation showed a desire to have empirical evidence on the impact of their interventions.

Period of evaluation. Nine of the participants talked about the period that their summative evaluation covered. The participants continuously monitored the feedback from the learners and the behavioral interactions with the interventions. Additionally, when the research-based approach was taken, short term and long-term evaluation were implemented. Short-term evaluation took place after the completion of the intervention whereas long-term evaluation went from four weeks after the completion of the intervention, to 3-6 months later, to yearly, and even to a five year period. Lillian said, "Certainly all of the ones that we are developing through the CRC will be really rigorously evaluated over the next five years." And Leah said, "So at baseline, at three months and at six months we asked about—and it may not come through behavioral whether or not they had sex and if so, did they use condom in the last 90 days I think is what we focused on.

Hence, the participants did conduct a type of summative evaluation with different levels of rigor and extending over different period of times. They also aimed at

measuring changes in knowledge, attitudes, health behavior, and they kept tracking the usage and engagement of their interventions by the target audiences.

Overall, in conducting formative and summative evaluation, the participants revealed the value they place on having effective interventions that are liked and understood by their audiences.

Chapter Summary

The description of the process through which the participants created their interventions revealed their incorporation of essential elements of instructional design discussed in the literature. Although they did not follow an instructional design model to create their interventions, they elaborated on the phases of analysis, design, and evaluation. The process varied among the participants depending on their skills and resources. In the analysis phase, the participants defined the targeted health behavior, they determined the learning outcomes, they conducted learner's analysis, they assessed the health behavior needs, and they performed goal analysis. In the design phase, they worked with subject-matter experts or collaborated with their learners to design a variety of learning activities that suited their target. In the evaluation phase, they conducted formative evaluation to assess attitude, comprehension, and usability of the intervention by their learners. They also conducted summative evaluation, with different levels of rigor and extending over different period of times, to measure changes in knowledge, attitudes, health behavior, and they kept tracking the usage and engagement of their interventions by the target audiences.

One can conclude, that health professionals involved in the creation of ehealth and mhealth education interventions are invested in producing effective ones but limited

by their resources, knowledge, and experiences with such interventions. Unlike instructional designers who are focused on solving an instructional problem, health educators focus on solving health behavior problems to which they offer learning solutions and other solutions such as provision of services. This is could be one reason why, in spite of a good analysis and evaluation, some of the interventions in this study did not reveal learning activities embedded in clear instructional strategies.

CHAPTER 5

DISCUSSION

This chapter discusses the themes that emerged from the findings. In chapter 4, a descriptive approach was taken to present the findings due the large amount of data and the variability it revealed. In this chapter, themes are presented and discussed under the related research questions.

RQ 1: How Do Health Professionals Use Theories and Models from the Field of Education to Create eHealth and mHealth Education Interventions?

Three main learning theories map the terrain of learning and instruction. These are behaviorism, cognitivism, and constructivist learning theory (Driscoll, 2005). Under behaviorism, learning is an observable behavioral change resulting from the effects of the interplay of stimuli, responses, and reinforcements. Under cognitivism, learning is a mental process dependent on information processing and cognitive load. Under constructivist learning theory, learning is social, authentic, and is constructed by the learner through discovery. Learning theories describe the process of learning but they do not provide guidance on designing events that facilitate learning. It is the instructional models that direct and facilitate the planning of instruction (Reigeluth, 1999; Reigeluth & Carr-Chellman, 2009; Reigeluth & Keller, 2009). However, they are not rigorous enough to reveal the effectiveness, efficiency, and relevancy of the instruction. The solution to this shortage is the development of a systematic approach to planning instruction (Gustafson & Branch, 2007). Models that present a systematic approach to instructional design are known as instructional design models. Therefore, designing

instruction that optimizes learning is best done when a systematic approach to design is used, with defined instructional models and rooted in a learning theory.

The findings of this study revealed that none of the participants used a specific learning theory, an instructional model, or an instructional design model in creating their ehealth or mhealth education interventions. However, the participants discussed in great details the learning approaches they incorporated in these interventions. Based on their description of the learning approaches, four themes emerged on the instructional strategies used on the interventions: (1) connections to behaviorist approaches to learning, (2) connections to cognitivist approaches to learning, (3) connections to constructivist approaches to learning, and (4) unspecified learning theories. The following is a description of how these themes emerged.

Connections to behaviorist approaches to learning. The participants indicated the use of a behaviorist learning activity in their interventions by offering some type of reinforcement to the learning process. For example, Anna and Leah offered points for goals achieved or skills learned. Mia also offered points, badges, and access to a premium version for her intervention when learners achieved their goals. Behaviorism emphasizes the interplay of stimuli, responses, and reinforcements in the learning process (Gredler, 2001; Skinner 1985). These are techniques the participants used to motivate and support the learning in their interventions. It is important to note that most of the five participants, who used these behaviorist techniques, also used constructivist instructional strategies. In fact, learning theories are not necessarily exclusive of one another. Events belonging to more than one theoretical approach become integrated in the design of the same instruction (Cronjé, 2006). In this respect, although these participants used

behaviorist techniques, their interventions did not fall strictly under the behaviorist learning theory. In contrast, they blended techniques and activities from more than one theory in order to optimize the learning experience of their learners.

Connections to cognitivist approaches to learning. The participants talked about the importance of using an instructional strategy that controls the amount of information presented to the learner. This strategy falls under the cognitive load theory of cognitivism. Cognitivism in general and cognitive load theory in particular emphasize the relationship between the amount of information in instruction design and the information-processing and memory-storing in learning (Sweller & Chandler, 1991; Sweller et al., 1998). Cognitive load theory states that processing and storing new information is affected by certain design elements of instruction that overload the short-term memory in the brain. (Paas et al., 2007). So under cognitivism, learning is a mental process dependent on information processing and cognitive load. Although the participants did not mention cognitive load in specific terms, they were very much aware of the issues involved with it. For example, Emily said about the text messages in her intervention, "So, we went through that content development. We wanted it to be light…. we didn't want to inundate the patient." Likewise, Lillian related what her learners needed, "I guess the feedback that often comes from young people is that they want that content to be split into smaller chunks." Similarly, Leah talked about how she had to redesign her learning activity to avoid cognitive load, "The scenarios were very text based… [The learners] were so exhausted. It was too much reading and it wasn't interesting enough and so we had to go back to the drawing board." Ryan talked about user fatigue and how providing too many options lessen the learners' interest. Therefore,

in designing their interventions, the participants avoided long texts that required a lot of heavy reading; they did not provide too many choices that created a sense of loss in the learner; and they simplified and chunked the information presented.

These participants showed awareness to the importance of cognitive load in instruction design. However, none of them clearly specified the cognitive load theory and its effects on information processing. More so, none of them discussed the use of cognitivist instructional models, such as Gagné's nine learning events (Gagné, 1980; Smith & Ragan, 1996). Understandably, these participants are not trained in the field of education and instructional design. Nonetheless, their emphasis on cognitive load is important to note. It indicates a step in the direction of sound instructional design that could be strengthened with a deeper understanding of how learning materials have to be structured, organized, and sequenced to facilitate learning (Ertmer & Newby, 1993).

Connections to constructivist approaches to learning. The participants discussed instructional strategies that showed similarities to a constructivist approach to learning, where learning is student-centered and knowledge is constructed with multiple perspectives and with multiple representations and within authentic experiences (Duffy & Cunningham, 2005; Jonassen et al., 2007). These instructional strategies are problem-solving, learning by doing, active learning, authentic experiences, and goal setting. The following presents each of these strategies and describe how they align with similar instructional strategies reported in the literature.

Problem-solving. Problem solving is an instructional strategy that requires learners to combine previously acquired knowledge with thinking strategies in order to gain new knowledge through finding solutions to the problem (Savery, 2009; Smith &

Ragan, 2005). The design of the problems varies depending on its nature and its complexity (Jonassen, 2010; Smith & Ragan, 2005). Jonassen (1997, 2010) describes two types of problems: well-structured and ill-structured problems. He explains that solving well-structured problems is an application to rules previously studied and they are mostly used in academic settings. On the other hand, ill-structured problems represent problems encountered in real life that have more than one solution, that require the learner to make personal judgment. In this study, Anna, Leah, and Ryan discussed the use of problem-solving in their interventions. Anna talked about decision-making through nutrition education games, such as trying to create a healthy recipe for pancakes. Leah described a problem-solving strategy built within a scenario where learners are guided to make choices that lead to healthy relationships. On the other hand, Ryan envisioned his learners going through solving their health problems by synthesizing the information he provided in his intervention. He said:

> So the user has to actually take the initiative to realize that basically we are providing personalized information and then from there I would say that it's… almost gets into the more of their problem solving area which is, "Okay, I know I have high blood pressure. It's not controlled and these guys are, you know, touching me with information that is telling me that this is, you know, shortening my life stance. How am I going actually get to solving that problem?" And from that point these apps are coming to come into play and they're going to help follow this overtime.

These participants approached problem-solving in different ways. Anna and Leah embedded the problem in a scenario or game that they have designed, allowing their learner to construct new knowledge as they proceed through the interventions. As for Ryan, who did not actually embed the problem-solving activity in his intervention, provided his learners with the knowledge they needed in order to apply it in solving authentic world problems in real life. Though different in design, the problems that

Anna, Lean, and Ryan discussed align with the ill-structured problems described by Jonassen (1997, 2010). These problems are situated in authentic settings, represent real life situations and allow the learner to think about choices and learn about consequences.

Learning by doing. Learning by doing is an approach to designing instruction where learners acquire knowledge and skills through authentic experiences situated in real-life contexts. Schank (1993) explains that meaningful learning occurs when one performs a goal-oriented task in contrast to remembering facts about how the task must be performed. Similarly, Lindsey and Berger (2009) discuss an experiential approach to instruction where learners learn from being actively involved in authentic experiences. In this study, Mia specified a do-learn approach for her intervention. She explained: "What we do is take a do-learn approach… we believe that by doing [the users] will learn more about themselves, their health and their ability to do something to improve their health."

Moreover, Schank, Fano, Bell, and Jona (1993) emphasize the importance of setting concrete and achievable goals. Mia also talked about goals. She said, "We are setting small goals and we know people can reach everyday and feel good about themselves and… eventually… taking a proactive approach to protecting and improving their health and well being." Additionally, Lindsey and Berger (2009) argue that learners must reflect on their experiences. In Mia's intervention, after learners complete a goal-oriented task, they are asked to share with other users how they achieved it and reflect on each other's experiences. She explains, "The user themselves willingly share to others to either give ideas or just exchange and be social about their activity or their actions towards improving their health." In describing her intervention, Mia did not specify an instructional model or strategy. Her intervention did not include all the design elements

of Goal-Based Scenario (GBS) of the learning by doing approach described by Schank et al. (1993). Also, her intervention did not cover all the principles of experiential learning discussed by Lindsey and Berger (2009). However, Mia's intervention mirrored the general learning concepts of learning by doing and goal-based activities, placed in authentic real-life settings and then reflected upon by the learners.

Active learning. No clear definition exists in the literature for active learning (Bonwell & Eison, 1991; Center for Teaching and Learning, University of Minnesota, 2008). However, active learning has been described as an instructional approach that actively engages the learner in the learning process, through the use of higher order thinking skills, and through "instructional activities involving students in doing things and thinking about what they are doing" (Bonwell & Eison, 1991, p.1). Explaining the rationale behind the instructional approach in his intervention, Robert discussed his choice of activities that aimed at creating an active learning experience for the learners. He said, "You have the textbook, but you also have some interactive games… a crossword puzzle, … the glossary, when you hover over the word it gives you the correct pronunciation… There is [an interactive] microscope online." In fact, Bonwell and Eison (1991) list visual-based instruction, problem-solving, and simulations as examples of active learning strategies. So, within this broad concept of active learning, Robert embedded in his interventions activities that required his learners to think, do, and problem-solve. He also used visual displays and simulations. He, therefore, designed active learning-based instruction.

Authentic experiences. Authentic experiences mean experiences that resemble real-life experiences. Jonassen (1999) states that scholars differ over how real the

learning experience should be in order to be considered authentic. However, Lindsey and Berger (1999) explain that there are various degrees of authenticity. Furthermore, Herrington, Oliver, and Reeves (2003) identify real-world relevance, ill-structured complex tasks, opportunity to reflect, and diversity of solutions and outcomes as characteristics of authentic activities. In this study, Anna and Mia explained how they provided authentic experiences in their interventions.

Anna: We use those characters [in the game] to sort of create a little world in which we try to help children, you know, see how other little children as our characters interact and learn about nutrition so they are…their little role models.

Mia: Our decision to provide our users with an intervention that is realistic and genuine. So realistically, not everyone can work out half an hour to an hour everyday or go to the gym. Realistically, we will not always be eating well everyday etc. and genuine because it is really about the user, what they can do, what they want to do and work on to improve their lives and what they are interested in working on.

So, Anna used characters in a game that simulated real-life and Mia designed activities that are situated in real-life. By doing so, both Anna and Mia designed learning activities that were relevant to their learners and represented ill-structured tasks. These activities also required reflection about outcomes. Therefore, Anna and Mia learning activities represented authentic experiences.

Goal setting. Discussing their goal-setting theory, Locke and Lathman (2002) explain the interplay between goal setting and performance. They posit that goals direct the attention to relevant activities, they are energizing, they affect persistence, and they lead to discovery. Likewise, Schank et al. (1999) explain that learning occurs as people achieve set goals. In this study, Anna and Mia used goal setting as a strategy where learners take control of their learning.

Anna: We are looking to add more interactivity on the child site where… older child…have an option of entering in goals or we'll have goals set … each month a different topic in which we will focus on and we'll give them points for serving in a goal and like, can fill a tracking sheet online.

Mia: Those game mechanics are very effective at keeping people engaged and setting themselves goals and feeling rewarded for the effort that they put in, in completing those actions.

So, Anna encouraged her learners to achieve set goals or goals they determined themselves and then follow their progress through a tracking sheet. Mia, on the other hand, set goals for her learners and used game tactics to motivate them in achieving their goals. The goal setting approach used by Anna and Mia might not be as elaborate as the description of Locke and Lathman (2002) and Schank et al. (1999); however, by embedding it in their interventions, they increased the motivation of their learners and enhanced their learning and performance.

The instructional strategies described by the participants echo many characteristics of the constructivist approach to learning. Although they did not name specific constructivist instructional models described in the literature, such as problem-based learning, case-based scenario, or anchored instruction (Hmelo-Silver & Barrows, 2000; Savery, 2006; The Cognition and Technology Group at Vanderbilt, Schank et al., 1999), the participants designed learning activities that aligned with the basic tenets of the constructivist approach to learning. In addition, although the participants labeled the instructional strategies differently, an overlap between the strategies exists because they reflected the basic tenets of the constructivist approach to learning. Jonassen (1999) explains that constructivist learning must first focus on "a problem, a project, or a question" (p. 217) that drives the learning. The problem, project, or question must be contextualized, engaging, and motivating. In this study, the instructional strategies chosen

by the participants included problems or questions their learners must solve. In addition, these activities were contextualized in authentic settings; they were engaging, and motivating.

The participants who made connections to constructivist approaches to learning answer to the concerns raised by health behavior and health education scholars who saw the need for a shift from teaching facts to teaching people how to learn by teaching thinking skills and focusing on the learner (Clark, 2010; Greenberg, 2010; Keyser & Broadbear, 2010; Ubbes et al., 2010; Welle et al., 2010). This indicates a trend to a move in the direction desired in this field. The impact of such a move on health behavior outcomes needs to be explored.

Unspecified learning theories. Even though the participants indicated connections to a learning theory or another through the descriptions of the instructional strategies they used, none clearly pointed it out. However, Daniel and Isabella were the closest in explicating the theoretical perspective to the learning approach they used.

Daniel did refer to the use of a combination of theories that are based in psychology and that constitute the backbone of learning theories, such as the elaboration likelihood model, the persuasive communication theory, and the goal setting theory. He said, "So the combination… are the ones that… are helping us create [the intervention]." On the other hand, Isabella expressed her approach to informal learning in the design of her intervention. She said, "I am a strong believer in participation being a motivator to increase informal learning."

So, Daniel used a combination of theories that was facilitated by his academic training in clinical psychology. Isabella showed a preference to a learning approach that

is not always clearly defined in the literature (Cross, 2009; Hart, 2009). This theme reflects the influence of the professional theoretical background of the participants and their personal preferences on the selection and use of learning theories in their interventions.

Summary

The themes emerging on learning theories and instructional models reflect to some degree vagueness and disconnectedness in the views of the participants on these theories and models. However, these themes here do not necessarily mean that the participants are not cognizant of learning theories and instructional models but they mean that the participants prioritize looking at the instructional strategies instead. In their description of the instructional strategies of their interventions, the participants showed a preference to constructivist approaches to learning because of the detailed information they provided in this regard. They also emphasized the importance of cognitive load. In addition, they added, though sparingly, behaviorist techniques in their interventions. The participants who touched upon a theoretical approach in their intervention varied between using a combination of learning theories to a personal preference of a learning approach. Although the instructional and learning approaches the participants described connect to learning theories, the participants did not intentionally use a learning theory. Nor did they choose an instructional model. More so, they did not follow an instructional design model to create their interventions. However, in their description of the processes of creating their interventions, the participants elaborated on the phases of analysis, design, and evaluation. The findings suggest that the participants in this study did not take a scholarly approach in looking at the learning theories, instructional model, and

instructional design models while creating their interventions. However, they did follow a design process that touched on the essential elements of instructional design (analysis, design, evaluation). Moreover, they invested efforts in creating learning activities that reflected instructional models of different learning theories. The focus on instructional strategies reflects a genuine effort in creating successful learning experiences. However, embedding these strategies in instructional models that have been researched in the literature, and framing them in learning theories can facilitate the design process of the interventions and yield better learning outcomes.

RQ 2: How Do Health Professionals Use Principles of eLearning and mLearning Design to Create eHealth and mHealth Education Interventions?

Successful elearning is not limited to the incorporation of technology in the learning materials. It must essentially incorporate sound learning design that is based on a good understanding of how people learn and on creating learning instances that maximize learning, using the advantages provided by technology (Clark & Mayer, 2003; Fee, 2009, Lynch & Roecker; Phillips et al., 2012). Some of the learning design characteristics specific to elearning are collaboration, learner control, navigation, interaction, and provision of help. Additionally, certain design principles are recommended when multimedia, such as graphics and videos are incorporated. These principles are multimedia principle, contiguity principle, modality principle, redundancy principle, and coherence principle (Clark & Mayer, 2003).

All of the participants in this study talked about different aspects of elearning design they took into consideration when creating their interventions. As a result, seven patterns emerged. These patterns are presented in a descending order reflecting the

number of participants reporting on them. The patterns are: (1) interaction, (2) learner control, (3) provision of help, (4) use of multimedia, (5) engagement, (6) user friendliness, and (7) visual appeal.

Interaction. Using interaction in elearning allows the active engagement of the learner through knowledge construction and representation (Hill et al., 2004). Three types of interactions are identified in the literature: learner-content, learner-expert, and learner-learner (Alessi & Trollip, 2001; Hill et al., 2004; Moore, 1989). In this study, all of the participants aimed at creating a form of interaction for their learners. Interaction encompassed learner-content, learner-expert, and learner-learner, paralleling the types of interaction described in the literature.

Learner-content. Learner-content interaction is the learner's interaction with the materials provided in the elearning environment (Hill et al., 2004; Moore, 1989). Ten of the participants discussed the learner-content interaction. However, although some of the mhealth education interventions relied on passive receiving of information by the learner, most of the other interventions provided a considerable amount of learner-content interactions in various forms and at different levels. For example, Emily discussed the passive receiving of information by her learners, "Patients did not need to do anything except look at their phone…nothing that would require the patient to do really anything." On the other hand, other participants provided active interactions with the content through navigation clicks and links. For example, Sophie included links to other sources of information and Ryan remarked, " People like big buttons and they like clicking on them." At a more complex level of development, Anna included nutrition video games; Leah created animated frogs for questions and answers on HIV risk behaviors; Robert

created an interactive 3D model of the lungs; and Ryan designed online check-ups for his learners.

So, the learner-content interaction ranged from almost complete passivity to following links to complete engagement with interactive applications. More interactivity was apparent in the ehealth interventions than the mhealth interventions. This is probably due to the text-message design adopted for the mhealth interventions. However, most of the participants showed awareness of this form of interaction and worked at maximizing its effect on learning when it was technologically possible.

Learner-expert. The learner-expert interaction is the interaction between the learner and the teacher or instructor who provides feedback, support, and motivation. (Hill et al., 2004; Moore, 1989). In this study, four participants showed this form of interaction. This interaction was either one-way going from the health professional to the learner or two-way going back and forth between the health professional and the learner. The participants who chose the one-way interaction talked about barriers that prevented a two-way interaction. For example Daniel explained, "We don't [do] interactive messages because of the FDA rules, once you are going beyond information, once you are getting into interactive messaging you can make the argument that you are doing an intervention." On the other hand, Camilla said, " I don't have time to do a lot of [social networking]…. I'd like to get someone that can take that over." However, other participants included a two-way communication either through exchanges of text-messages like Isabella's diabetes intervention who explained, "[The patients] would tell the diabetes educators what is their status of the diabetes and then the diabetes educators would give feedback depending on the data that is provided by the patients", or through

popular social networking platforms like Ryan who said, "We have, you know, Facebook and Twitter and all these things like that on the side…. being able to ask or listen to questions from our users."

Moore (1989) describes the learner-expert interaction as essential to learning because it motivates learners and maintains their level of interest. However, challenges of time, resources, and in the case of health, legal liability can prevent a rich learner-expert interaction that enhances the learning process.

Learner-learner. The learner-learner interaction is the collaborative work between learners to exchange information, construct knowledge, or support each other (Hill et al., 2004; Moore, 1989). Five participants explained how their interventions included learner-learner interaction. This form of interaction was designed to encourage social networking between the learners. Here, the participants either linked their interventions to popular social networking sites such as Twitter and Facebook, or they created their own internal forum for the learners to interact with each other. For example, Lillian said:

> There's also I guess an online community component to that particular project where young people can come together with other young people should talk about their experience. It's moderated by their peers, so other young people are trained are supported to be able to moderate and keep that community safe.

On the other hand, William said:

> So we've actually linked or provided linkages on some of those websites to parallel social media pages for example Facebook. So we did a campaign … and for that purpose we developed social linkages on Myspace and Facebook. We had a Twitter account as well that sent out information about teen pregnancy prevention.

So, almost half of the participants in this study provided a form of learner-learner interaction through social networks. In fact, Veletsianos and Navarrete (2012) report that

when learners interact with each other through social platforms, they value the collaboration and support of their peers and they find opportunities to extend their learning. However, as with learner-expert interaction, learner-learner interaction requires time and resources, assets not available to all the participants in this study.

The type of interaction that was mostly revealed in this study is the learner-content interaction, where the participants aimed at creating engaging interventions through interactivity. The other two forms of interactions were less apparent, mainly because of shortage in resources.

Learner control. Learners prefer to have more control in elearning environments because it allows them to choose the strategies through which they progress in the learning environment (Inan et al., 2010). Learners can be provided control over the sequence of the content and the pace of movement (Alessi & Trollip, 2001). It is recommended to allow learners to move freely back and forth in the elearning environment and to control the pace through which they proceed through it (Alessi & Trollip, 2001; Clark & Mayer, 2003). All of the participants in this study gave their learner control in the interventions. However, the extent of that control varied for each of the intervention. For instance, the learner could stop receiving the messages at anytime, and they can even ignore the messages in the mhealth interventions as Emily said, "They can opt out at anytime…. they can write stop and the messages would stop." In addition, the learners had control over navigation. Robert explained, "So unlike other websites that are very structured pathways [our intervention] allows the child to pick."

So, the participants did not lock their learners in a structured interaction from start to finish. On the contrary, they provided them with the freedom of navigation and

selection of actions. In doing so, the participants adhered to the recommendations present in the literature on learner control (Alessi & Trollip, 2001; Clark & Mayer, 2003).

Provision of help. Alessi and Trollip (2001) discuss the importance of providing help in the elearning instruction to facilitate the user experience. They differentiate between informational help that support the learning process through additional resources and procedural help that support the learner in navigation. In this study, nine participants provided informational help. For example, Anna, Camilla, and Sophie provided additional information through printed materials or other electronic formats. Lillian and William provided resources in terms of services needed by the learners such as a database for clinics. Lillian explained how she aimed at creating an online wellbeing hub:

> The online wellbeing center is about creating an online hub where young people can download different tools or applications, they might be mobile applications, they might be videos, they might be like an online game that they can then use to improve or maintain their own wellbeing, right through it at the clinical end to tools and applications that actually have treatment objectives.

On the other hand, William talked about the database of clinics he made available to his learners:

> But also providing young people with the choice and the opportunity to actually learn online and have resources available to them online that they can access anytime is what our objective has been…. We made that database available to the subscribers so they could text in clinics and their zip codes and it would tell them the closest clinics in that zip code that they could go to and access.

In addition, these participants provided opportunities to reply to learners' inquiries through submission of question online.

As for procedural help, all of the participants creating ehealth interventions provided it through a help tab.

Therefore, the participants enriched the learning experience in their interventions by providing both informational and procedural, the type of help recommended in the literature (Alessi & Trollip, 2001).

Use of multimedia. Multimedia includes pictures, graphics, videos, and sound. It basically consists of types of information that are not presented through text. The use of multimedia in elearning has the potential of enhancing the learning process (Alessi & Trollip, 2001; Clark & Mayer, 2011). Nine of the participants in this study talked about the importance of including multimedia elements in their intervention. They perceived it to facilitate and reinforce the learning process. For example, Daniel explained, "I am actually talking more about a broader intervention that includes audio, video and interactive media…. There is a dramatic shift in how people process information… audio and video are much more powerful than text." Similarly, Ryan expressed his belief about the effect of videos on learning, " So we know that people really love videos… I think video in terms of method and improve the learning of our users is very, very effective." Sophie, on the other hand, favored the use of pictures and videos because of her target population of college students. She said, "I find that this…. generation is very media savvy… and passive reading… does not appeal to them. So, it needs to be something that has got pictures and things going on and stuff happening."

These participants valued the effect of multimedia on the learning and the appeal of the intervention. However, none of them discussed the principles of Clark and Mayer (2003) of multimedia, contiguity, modality, redundancy, and coherence. Nevertheless, examining their websites revealed adherence to most of these principles. It is important to note that even though some of the participants recruited the services of graphic designers,

the manner in which they used multimedia was not affected by whether graphic designers participated in the design or not.

Engagement. Engaging learning experiences are ones that provide opportunities for interaction and exploration and are perceived as relevant to the learner (Taylor & Parsons, 2011). Clark and Mayer (2011) differentiate between behavioral engagement and psychological engagement. Behavioral engagement refers to the physical actions the learner takes while learning, such as clicking a button, and psychological engagement refers to the cognitive processes of learning. They posit that learning occurs when both types of engagement are high. In this study, learner engagement was valued by seven participants. For example Leah, explaining why she used animated frogs in her intervention, she said:

> If you basically just talk at people which is essentially what you're doing, if you just give them boring text screens then they won't pay attention and so in order to engage them and then also increase the learning effect, it has to be engaging and then you have to sort of reinforce what it is that they're learning.

On the other hand Mia explained, "Our number one goal is to develop an intervention where people can be engaged…. You won't have an impact because they don't stick around it long enough… we are also using game mechanics to keep them engaged and motivated." Similarly, Ryan said, "[We] focus on making something that is visually stunning, something that, you know, is vibrant and colorful will make it so that people are less likely to be bored of what you're doing."

Leah, Mia, and Ryan exemplify how the participants cared to create engaging interventions. However, they revealed more focus on engagement through physical interactions and visual appeal than engagement through the design of the cognitive tasks.

User friendliness. User friendly elearning or mlearning materials allow the user to access information easily and navigate through the materials easily (Alessi & Trollip, 2001). In fact, user friendliness relates to usability. As Nielsen (1993) posits, usability measures the ease, efficiency, and satisfaction of use. Five participants articulated their sensitivity to a user friendly experience of their intervention. They worked at creating a good interface that made the interaction with the intervention intuitive and easy to use. For example, Camilla said, "I like [the website] to be not cluttered because the more cluttered it is and the more options you have, the less easy it is to navigate so, that's something that I look for." Likewise, Sophie explained:

> [The website is] more familiar to them and easier for them to understand… [It] allows the students to look at the site and go, here's the information I wanted to find, here's how I find it, here's where it is now, here's the information, how can I interact with it.

So, these participants took care in creating interventions that are user-friendly and easily navigable, reflecting the recommended practices of elearning design (Alessi & Trollip, 2001). This pattern relates to the formative evaluation on usability conducted by the participants to detect the difficulties encountered by the learners as they moved around the interventions.

Visual appeal. Visually appealing interventions include elements such as pictures, graphics, animations and color that attract the attention of the learners and enhance learning (Alessi & Trollip, 2001; Clark & Mayer, 2011). In this study, three of the participants stressed the importance of visual appeal in their intervention and worked hard at accomplishing it. Anna talked about a visual appearance and animated characters, "We're making every game that is a different one, otherwise it won't be visually engaging for the child…. We use characters that are spokesperson because children are

naturally more attracted to characters"; Leah talked about using graphics, " [The modules were] displayed in a visually interesting manner so there were graphics and all these things"; and Ryan stressed the importance of the choice of colors in his intervention, "Our colors are a big thing for us…. We use blue because it has a calming effect and then we use green a lot as a call to action."

So, these participants not only worked at creating a learning experience for their learners, but they aimed at making it visually appealing in order to motivate and engage their learners.

Summary

The participants in this study showed an extensive use of the essential design principles of elearning portrayed in the literature (Alessi & Trollip, 2001; Hill et al., 2004; Moore, 1989). They gave their learners control over navigation, they provided help and resources, they used graphics and videos, they valued learner engagement, and they created user friendly and visually appealing interventions. However, the participants applied elements of elearning design in varying degrees due to lack of resources of manpower and time, as reported by them. The approaches to design discussed in the previous chapter (multidisciplinary, expert, and learner) might have influenced the use of the elearning design principles.

RQ 3: How Do Health Professionals Use Theories and Models from the Field of Health Behavior and Health Education to Create eHealth and mHealth Education Interventions?

Factors that affect the health status of people are multiple. These factors are called the determinants of health (Nutbeam, 1998). The complexity of the interplay

between the health determinants and health behavior lead to the emergence of several theories and models that explained why people behave the way they do in health-related matters (Glanz et al., 2008). Although over sixty theories and models of health behavior and health education were reported in the literature, only few have been used on a wide scale. The three most popular theories and models reported by Glanz et al. (2008) are the health belief model, the social cognitive theory, and the transtheoretical model. The health belief model focuses on the perceptions and beliefs held by an individual regarding health behavior (Rosenstock et al.,1988). The social cognitive theory emphasizes interplay of behavior, environmental factors, and personal characteristics with a focus on self-efficacy (Bandura, 1978, 1998, 2004). The transtheoretical model stresses the stages and processes of health behavior change (Prochaska & DiClemente, 1986).

The findings of this study revealed that the participants used health behavior theories and models in their interventions in various ways. As a result, three themes emerged. These themes are presented in a descending order reflecting the number of participants reporting on them. They are (1) no use of health behavior theory or model, (2), use of a mix of health behavior theories or models, and (3) use of a particular health behavior theory or model. The following presents how the participants approached these different themes in their interventions.

No use of health behavior theory or model. Six participants did not specify a particular health behavior model they used in their interventions. For example, Anna saw her intervention as complimentary to other nutrition education program and thus did not see a need in incorporating a health behavior change model in her intervention. She said, "We leave that for the programs… they have their mind of how they are going to change

behavior." Camilla was not familiar with the health behavior theories and models but relied on her experience in the field to design her intervention. She explained, "I haven't given much thought to any of the theories or theorist that have influenced me. I guess I've had so much experience." Sophie stated that she does not use a health behavior theory or model but she mentioned her reliance on the Wellness Wheel, which is not a health behavior model but a wellness model (Hattie, Myers, & Sweeney, 2004). On the other hand, Robert was aware of the health behavior models but chose not to incorporate any of them because of lack of evidence of their success. He explained:

> We have not included not at this point a lot of behavior change, although it's a long-term goal to include that…. There are different models of behavior change that are out there… But the earlier results of our literature review is not encouraging. There are many may studies that have failed that have shown no or unintended outcomes.

The participants who chose not to use a health behavior theory or model in their interventions did so for several reasons. Either because they felt that their intervention complemented other more comprehensive health behavior change interventions, like Anna; or because they were not knowledgeable about these theories and models, like Camilla and Sophie; or because they did not find proof in the literature about the validity of outcomes of these theories and models, like Robert.

This theme suggests that health professionals who create ehealth and mhealth education interventions are not always health education specialists and therefore do not have a strong handle on the theories and models of health behavioral change. On the other hand, it also reflects the problems associated with these theories and models reported in the literature. The theories of health behavior have not been able to guide health interventions effectively due to lack of empirical testing in complex social settings

(Noar & Zimmerman, 2005; Rothman, 2004). Moreover, there are numerous theories in the field of health behavior but little consensus on which theories are superior to others (Noar & Zimmerman, 2005).

Use of a mix of theories or models. Four of the participants referred to the use of a mix of theories and models choosing the constructs that fit their interventions best. Often, the participants mentioned the use of some of the constructs in the models such as the stages of change in the transtheoretical model. The choice of these models was based on the participant's belief in its success, the needs of the target population, or the target health behavior.

For example, Daniel elaborated extensively on his description of the health behavior theories and models used. Concerning the stages of change and self-modeling he said:

> Based on the behavioral change literature, this is why you want to change, what would you say to yourself if you were considering not changing, what are your new behaviors.... We're slowly learning … what kind of messages do you send to what individual based on where they are in the change process that is not based on something called the stages of change or these models but based on critical moments such as one time when someone is feeling highly captive. Behavioral models don't look at that and they're looking at a process of changing how people change overtime rather than the critical moments in the change process that's what we call them and that's what we are trying to really get a better understanding of.

He also explained how he borrowed from many theories and models but believed that the transtheoretical model is the overarching theme of his intervention.

Leah specified two health behavior theories/models based on the health behavior that she was targeting. On the HIV prevention web-based intervention in Uganda she said:

> We had our theoretical model of behavior change with the information-motivation-behavior model of HIV preventive behavior so it basically says kids need to have information about how to prevent HIV, they need to have motivation. They need to have a reason why they wanted to do these things and they also have to have behavioral skills.

Leah later explained that the information-motivation-behavior model is based on the theory of reasoned action and the theory of planned behavior. On the mobile-based smoking intervention she said:

> It was based upon cognitive behavioral therapy because that's what a lot of the content in smoking cessation is based on and then put together an Excel sheet to basically identify different types of messages so cognitive restructuring, encouragement, all these behavioral skills, these different types of things.

Lillian reported on the mix of theories and models used in her interventions:

> We started to use a real combination of [behavioral change theories] to draft to the projects…. We used theory of planned action and social cognitive theory. So, social cognitive theory being very much about the development of self efficacy and a sense of mastery over particular activities and then planned action being much more about that behavioral intention and looking at attitudes and norms around that behavior… but like I said we sort of have drawn bits and pieces as we [have] gone along.

She clarified that the reason for using a mix of theories and models is to respond to the needs of her target population, which might fit under different theoretical frameworks. Mia, also reported on the mix of theories that she used and said, "So we are using kind of cherry picking the concept and ideas that we think are most relevant to produce the intervention that we have a vision for." When asked about the models she "cherry-picks" from she replied, "Usually they are a combination but most of them are social network science or social psychology, health psychology and a little bit of medicine behavior change." She added, "I think we all have a bit of a sense of no model or theory has been incredibly efficient so far or every model… has insights and information in some effect but can be improved upon."

By choosing to use different health behavior theories and models or certain constructs of these theories and models, the participants revealed malleability in adjusting the health behavior theoretical framework of their interventions. This malleability allowed them to adjust to the needs of their target populations, such as Lillian, or to the health determinants of the health problem they are addressing, such as Leah, or to their perceived efficiency of the theories and models, such as Daniel and Mia. Beside the transtheoretical model and the social cognitive theory most commonly reported in the literature (Glanz et al., 2008), these participants mentioned the use of cognitive behavioral therapy, which emphasizes the effects of thinking patterns on behavior (National Alliance on Mental Illness, 2003) and the theory of reasoned action and the theory of planned behavior, which emphasize the importance of intentions and attitudes in health behavior (Glanz et al., 2008).

Use of a particular health behavior theory or model. Among the 12 participants, only William indicated the use of one health behavior theory in his interventions. He said:

> We do definitely look at theories of change; behavioral change and we're looking at behavior change programs… As far as theories of behavioral change are concerned, a very commonly used behavioral change theory that we apply… is transtheoretical model of behavioral change because especially the young people, depending on their exposure and other structural factors, they could be at various different levels of behavioral change. So applying the same strategy to everybody across the field doesn't seem to make sense because we need to pick out where the predominant majority for young population is and then take them from that step to cross… in the right direction.

He added:

> We've been a big fan of the transtheoretical approach for behavior change… the principles are really solid and there has been lot of success stories around using that certain model.

The transtheoretical model is currently a very popular model in the field of behavior change (Sharma & Romas, 2012; Sutton, 2001). William found this model to be a perfect fit for his interventions and for the target population he addressed. He explained how he has used this model successfully in the past and how he found it easily applicable to online programs and mobile programs. So, the theme emerging from William's use of a particular theory or model suggests that when health professionals find evident success of a certain model and when they achieve a comfort level of its use due to their experience with it, they are likely to adopt it for all their interventions.

The theme reflected by these participants is also reported in the literature. The presence of numerous health behavior theories and models is problematic for the health education scholars and practitioners. One of these problems is the number of variables used in the different models and theories. Cummings et al., (1980) identified 109 variables from fourteen different models and argued that the different models and theories overlap in their constructs and create confusion around them. Likewise, Noar and Zimmerman (2005) reported similarities in the constructs of the theories but difference in terminology that lead to what they called "a fragmentation rather than cumulative knowledge" (p. 276). Another problem is the lack of empirical evidence on the success of these theories and models (Noar & Zimmerman, 2005; Rothman, 2004). With the confusion over the constructs and the lack of empirical evidence, health professionals find themselves "cherry picking" as Mia put it.

Summary

This overview of the participants' approaches to health theories and models shows a clear variability in their use. This variability tended to be influenced by the area

of expertise of the participants. The participants trained in the areas of public health or psychology, or whose teams included members with similar expertise, discussed their use of health behavior models in great details. However, even among the participants cognizant of the health behavior models, not all favored the use of a specific one. The array of health behavior theories and models indicated the use of the transtheoretical model, the social cognitive theory, theory of reasoned action, theory of planned behavior, and theories based on cognitive therapies. Nonetheless, the transtheoretical model was most favored and the model to which the participants most referred.

Chapter Summary

The themes emerging from the research questions showed a variability in how the participants used education theories and models, principles of elearning and mlearning design, and health behavior and health education theories and models from to create ehealth and mhealth interventions. However, in general, the participants used elements of instructional design (analysis, design, evaluation) but did not use an instructional design model. Moreover, they invested efforts in creating learning activities that reflected instructional models of different learning theories but did not specify particular models or theories. As for the elearning design principles, the participants covered essential aspects depending on the resources they had. In the use of health behavior and health education models, they varied depending on their area of expertise and the experience with the models.

CHAPTER 6

IMPLICATIONS AND LIMITATIONS

This chapter will present the implications for practice and the implications for research suggested by the findings. It will also present the limitations of the study.

Implications

The findings of this study suggest implications for practice for health professionals involved in the creation of ehealth and mhealth education interventions. They also suggest implications for further research to guide and improve the practice.

Implications for practice. The interviews with the participants revealed a great variability in the creation of the ehealth and mhealth education interventions. This variability is due to the varied professional backgrounds of the participants and their different experiences in the field of health education. Three types of variability were revealed: (1) variability in the process of creating ehealth and mhealth education interventions, (2) variability in the nature of the ehealth and mhealth education interventions intervention, and (3) variability in the function of the ehealth and mhealth education interventions. For the process of creating the interventions, the participants used a multidisciplinary approach, an expert approach, or a learner participation approach. For the nature of the intervention, the participants created ehealth interventions, mhealth interventions, or a combination of both. They also used a variety of learning activities, such as text messages, multimedia, interactive applications, and resource centers. As for the variability in the function of the intervention, the participants created single-stand-alone interventions that focused on specific health behavior

problems, complimentary interventions that supported other programs, or multi-projects interventions that answered to several grants and funds.

This variability in the landscape of creation of ehealth and mhealth education interventions suggests four implications for practice: (1) guidebook for the creation of ehealth and mhealth education interventions, (2) repository for health education learning objects, (3) establishment of community of practice, and (4) dissemination of best practices.

A guidebook for the creation of ehealth and mhealth education interventions. None of the participants discussed the use of instructional models or instructional design models, which facilitate the learning process and the creation of instruction (Gustafson & Branch, 2002; Reigeluth & Carr-Chellman, 2009). However, all of the participants showed phases of analysis, design, and evaluation; they created a variety of learning activities to achieve their objectives; and they implemented certain principles of elearning design. On the other hand, most of the participants reported the use of a mix of health behavior theories and models — if any were used at all. Therefore, these participants and other health education professionals interested in creating ehealth and mhealth education interventions would benefit from guidelines that help them structure their work through an instructional design process. Lillian talked about developing a guidebook for central design for her project partners. Similar to her idea, a guidebook can be developed to serve as a reference for all health professionals interested in the design of ehealth and mhealth education interventions, regardless of their professional backgrounds and experience in the fields.

This guidebook would include an overview of the systematic process of instructional design, such as an explanation of the ADDIE framework (Gustafson & Branch, 2007). Moreover, the guidebook will cover the theoretical foundations of learning, with a description of the development of instructional strategies and evaluation instruments related to each learning theory (Dick et al., 2009; Morrison et al., 2007; Smith & Ragan, 2005). In addition, the guidebook will explain the constructs of the most popular health behavior and health education models and how they can be used to create health education interventions (Glanz et al., 2008; Sharma & Romas, 2011). Last but not least, the guidebook will cover the principles of elearning design. By combining all the elements needed for the successful creation of ehealth and mhealth interventions, a guidebook as the one described can support the work of these heath professionals who have different professional backgrounds and different level of expertise on the matter. The literature of instructional design is mostly focused on academic and workforce settings (Reiser & Dempsey, 2007). Moreover, the literature on health behavior and health education covers aspects of learning only occasionally (Bartholomew, Parcel, Kok, Gottlieb, & Frenandez, 2011). However, rarely does this literature describe a complete instructional design process (Card et al., 2011; Kinzie, 2005; Stevens et al., 2008).

A repository for health education learning objects. Some of the participants provided in their interventions resources, such as lesson plans and printable worksheets for the use by other health and non-health educators in other learning contexts. Others have developed interactive applications that target one or two objectives that can also be used separately in other interventions, such as the nutrition games of Anna, the 3D lung model of Robert, and the checkups of Ryan. In instructional design literature, these

materials are known as learning objects. Wiley (2000) defines a learning object as "any digital resource that can be reused to support learning" (p.7). In order to support learning, the learning objects need to possess certain design characteristics such as granularity and adaptability discussed by Gibbons, Nelson, and Richards (2000), Tono and Lee (2011), and Wiley (2000). Moreover, for these learning objects to be reused across electronic platforms, they need to follow certain technical standards such as the military and technical elearning standards (i.e., Sharable Content Objects Reference Model [SCORM]). These learning objects will then be referred to as sharable content objects (Lehman, 2007; Reiser & Dempsey, 2007)

Sharable content objects are tagged and stored in a repository for retrieval and use by educators or learners, commonly referred to as a learning objects repository (LOR). It would be interesting and valuable to create such a repository for digital health education resources for two main reasons. One is to prevent the duplication of efforts and increase efficiency. Second, is to give those health professionals who are investing efforts in creating such resources visibility in the field. Actually, some of the challenges expressed by several participants are the marketing efforts that they have to make to promote their interventions in addition to the competition with bigger organizations that are more visible in Internet searches.

One similar repository for health education resources is the Health Education Assets Library (HEAL), which stores multimedia items for medical professionals (Lehman, 2007). Likewise, a repository for health education materials created for use in health education interventions can be created.

The establishment of a community of practice. Health professionals involved in the creation of ehealth and mhealth education interventions come from different backgrounds and bring with them different expertise, which was reflected in this study. This is evident because of the multidisciplinary nature of health behavior. Therefore, it would be important and valuable to create a community of practice between these health professionals. Wenger (2009) defines communities of practice as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (p.1). He identifies problem solving, seeking experiences, reusing assets, and discussing developments as some of the activities that members of community of practice collaborate on.

Communities of practice have been established in the fields of education, business, and professional organizations among others (Wenger, 2009). In health, the Community of Practice for Public Health Improvement (COPPHI) is one example where open forum meetings are held, coaching opportunities are offered, and online database is made available for public health departments (National Network of Public Health Institutes, 2010). Wenger, McDermott, and Snyder (2002) state that communities of practice help their members overcome challenges, access expertise, and build confidence and a sense of belonging. So, a health education community of practice would support these health professionals in overcoming challenges they face, learn form each other's experiences, and exchange the variety of skills they bring with them. It can also offer workshops, webinars, and continuing education opportunities to help strengthen the instructional design skills of the health professionals creating these interventions. This is

specifically meaningful for health professionals who work in small teams and would benefit greatly from health professionals working in multidisciplinary teams.

Dissemination of best practices. Some of the participants in this study have been able to report positive health behavior outcomes as a result of their interventions. Therefore, documenting the instructional design process from analysis to design to evaluation and sharing this knowledge through publications or other formants will help disseminate best practices of creating ehealth and mhealth interventions.

Leah, Lillian, Mia, and William were working within these routes and similar work should be encouraged for all participants. The Health e-Technologies Initiative created by the Robert Wood Johnson Foundation in 2002 identified the need to standardize approaches to evaluation and the need clarify theories of behavioral change as important elements in proving the effectiveness of ehealth interventions (Health e-Technologies Initiative, 2012). Similarly, and through an extensive review of the literature on the evaluation of health information applications in eHealth, Kreps and Neuhauser (2010) identified active involvement of the user, the reach of diverse populations, tailoring information, and addressing the special interest and characteristics of the learners as important communication directions for the design of effective health information technologies.

Finally, the group Consolidated Standards of Reporting Trials (CONSORT) established criteria for improving the quality of randomized control trial reports in health care research (Baker et al. 2010; CONSORT, 2012). Baker et al. (2010) encouraged evaluators of ehealth interventions to consider CONSORT recommendations to strengthen the quality of their findings. Therefore, the identification of design elements

and the sound evaluative reporting of the interventions are essential in proving their effectiveness. The findings of this study reinforce this point. The more the participants documented their work and the more they conducted evidence-based evaluation measures, the more they were able to report on the effectiveness of their interventions.

However, the documentation and the reporting on the findings seemed to be closely related to grants and funds that supported their interventions. Teams that lacked funds or human resources were not able to conduct short-term and long-term evaluations. For example, Anna expressed a desire to partner with institutions that can provide finding and expertise in evidence-based studies to measure behavioral change resulting from her intervention. Therefore, another implication for practice is to link funding sources and research institutions to the health professionals creating ehealth and mhealth interventions. Through evaluative research, these health professionals will be able to continually improve on their interventions. Additionally, by obtaining evidence of success of their interventions, they will be encouraged to maintain them for a longer period of time.

Implications for further research. The findings of this study highlight four implications for further research. The first implication would be an in-depth study on the variability of the different approaches of creating ehealth and mhealth interventions taken by health professionals: the multidisciplinary team approach, the expert approach, and the learner participation approach. Each of these approaches can be a case study that furthers the understanding of the characteristics of this type of approach (Creswell, 2007). Additionally, comparative case studies (Stake, 2003) could be conducted to clarify further the variability between these approaches and the effect it has on the instructional

design process and the impact of the related interventions. On other hand, surveying a larger number of participants on their approaches could lead to more evidence-base results.

The second implication is to study ehealth and mhealth interventions separately. The study revealed a reliance on using mhealth as a quick communication medium, such as for text messages, and in some instances when further interaction was desired, learners would be taken to a website. Mobile devices can offer more than just text messages. For example, games, applications, and collaboration tools can be designed for mobile devices (Attewell, 2004). In fact, several participants mentioned attempts at building health education games and applications for mobile devices. Therefore, it would be valuable to explore how to diversify the instructional strategies for health behavior change on mobile devices and what impact it would have on it. Moreover, the ubiquitous nature of mobile devices could influence the nature of and the perceptions to learning (Attewell et al., 2009; Chen et al., 2008) In fact, Leah mentioned that her young audience were more likely to use their mobile devices to access the website she drove them to rather than using a laptop. Mobile learning environments provide informal, just-in time type of learning (Gagnon, 2011). It would also be valuable to investigate how these characteristics impact health behavior change. Research on development and implementation of ehealth and mhealth interventions must continue in order to build evidence on their effectiveness in the literature (Baker et al., 2010; Kreps & Neuhauser, 2010).

The third implication for further research would be to study how learning theories and models intertwine with health behavior theories and models. Timmreck et al. (2010)

state that although education is a founding principle of most of the health promotion efforts, it is the behavioral sciences/psychology that enter strongly in the picture to create an "entangled thicket" (p. 71) making the distinction between the contribution of the two difficult to define. Additionally, Begoray and Banister (2005) state that health interventions have a lot to benefit from the field of education and posit that health professionals overlook educational theories. The findings showed that, although the participants used a variety of instructional strategies, they did not focus on learning theories and models while creating their interventions. The findings also suggested that the participants did not always rely on health behavior theories and models. Behavioral change is the result of learning experiences (Driscoll, 2005). In health behavior, these learning experiences are influenced by the theoretical perspectives of learning as well as the theoretical perspectives of health behavior (Glanz et al., 2008; Timmreck, 2010). Since the health promotion literature rarely looks at these two theoretical perspectives simultaneously (Begoray & Banister, 2005; Timmreck, 2010), researching the interplay between them would bridge the gap between the literature on learning and that of health behavior.

Finally, it would be worthwhile to study the impact of the different instructional strategies used in the interventions of this study on behavioral change. As the findings showed, the participants showed a preference to constructivist approaches to learning in their choice of instructional strategies, they emphasized the importance of cognitive load, and, they added behaviorist techniques in their interventions. Proponents of the different learning theories and instructional models write prolifically about their effects on learning outcomes (Duffy & Cunnigham, 2005; Gagné, 1980; Jonassen, 1999; Skinner,

1985; Sweller, 1994). On the hand, heath education scholars see a need for a shift from teaching facts to teaching people how to learn by teaching thinking skills and focusing on the learner, (Clark, 2010; Greenberg, 2010; Keyser & Broadbear, 2010; Ubbes et al., 2010; Welle et al., 2010). In other words, these scholars are recommending a shift from behaviorist to constructivist approaches to learning. Conducting evaluative research (Esterberg, 2002) on the different instructional strategies presented in this study can reveal how these strategies and the learning theories they connect to impact the learning and health behavior change processes

Limitations

This study has several limitations. First, because of its qualitative nature, this study's findings should not be generalized (Crotty, 2009) to other health professionals creating ehealth and mhealth education interventions. However, the purpose of this study was exploratory in nature, aiming at an in-depth account of the participants (Janescik, 2000). This was especially important because the literature on similar studies is scarce (Card et al., 2011; Kinzie, 2005; Stevens et al., 2008).

Second, the findings reflected only the accounts of the twelve participants who were willing to be interviewed out of the 34 who were contacted. There is a possibility that interviews with other health professionals could have led to other findings. However, the researcher made an effort to include variability in the sample in order to strengthen the exploration of the research questions.

Third, the planning materials collected from the participants varied in quality and quantity. This was dictated by the nature of documentation kept by each of the participants and could not be overcome. Although the lack of documentation might have

affected the triangulation of the data, it showed one aspect of how the participants proceeded in the creation of their interventions.

Fourth, the study generated a large amount of data because of the broad scope of the research questions extending over the three disciplines of learning, elearning design, and heath behavior and health education. Additionally, the sample revealed a broad spectrum of expertise behind the creation of ehealth ad mhealth interventions. These two factors led to a large variability in the findings. The researcher chose to focus on the emerging themes in this variability to answer to the exploratory nature of the study. However, other themes could have emerged if the variability in the findings was not extensive.

Chapter Summary

The variability in the findings suggests four implications for practice: (1) guidebook for the creation of ehealth and mhealth education interventions, (2) repository for health education learning objects, (3) establishment of community of practice, and (4) dissemination of best practices. It also suggest implications for research through an in-depth study on the variability of the different approaches of creating ehealth and mhealth, continued research on development and implementation of ehealth and mhealth interventions and an exploration of the diversification of the instructional strategies for health behavior change on mobile devices, a study on how learning theories and models intertwine with health behavior theories and models, and a study on the impact of the different instructional strategies on health behavioral change. The limitations of this study are lack of generalizability and extensive variability.

References

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology*, *27*(3), 379-87. doi:10.1037/0278-6133.27.3.379

Abraham, C., & Sheeran, P. (2005). The health belief model. In M. Conner & P. Norman (Eds). *Predicting health behaviour: Research and practice with social cognition models.* (pp. 29-80). Buckingham, England: Open University Press.

Ahern, D. K. (2007). Challenges and opportunities of eHealth research. *American Journal of Preventive Medicine, 32*(5, Supplement 1), 75-82.

Alessi, S. M., & Trollip, S. R. (2001). *Multimedia for learning: methods and development* (3rd ed.). Needham Heights, MA: Allyn and Bacon.

Alexander, P., Schallert, D. L., & Reynolds, R. E. (2009). What is learning anyway? A topographical perspective considered. *Educational Psychologist*, *3*, 176-192.

Alonso, F., Lopez, G., Manrique, D., & Vines, J. M. (2005). An instructional model for web-based e-learning education with a blended learning process approach. *British Journal of Educational Technology*, *36*(2), 217-235. doi:10.1111/j.1467-8535.2005.00454.x

Anderson, J. (1983). *The architecture of cognition*. Cambridge, MA: Harvard University Press .

Atkinson, N. L., & Gold, R. S. (2002). The promise and challenge of eHealth interventions. *American Journal of Health Behavior*, *26*(6), 494-503. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12437024

Atkinson, N., Saperstein, S., & Pleis, J. (2009). Using the Internet for health-related activities: Findings from a national probability sample. *Journal of Medical Internet Research*, *11*(1), e4. Retrieved from http://www.jmir.org/2009/1/e4/

Attewell, (2005). Mobile technologies and learning: A technology update and m-learning project summary. Retrieved from http://www.m-learning.org/archive/docs/The%20m-learning%20project%20-%20technology%20update%20and%20project%20summary.pdf

Attewell, J., Savill-Smith, C., & Douch, R. (2009). *The impact of mobile learning: Examining what it means for teaching and learning*. *Training*. London, UK: LSN.

Ausubel, D. P. (1963). *The psychology of meaningful verbal learning.* New York, NY: Grune & Stratton.

Baker, T. B., Gustafson, D. H., Shaw, B., Hawkins, R., Pingree, S., Roberts, L., & Strecher, V. (2010). Relevance of CONSORT reporting criteria for research on eHealth interventions. *Patient Education and Counseling, 81*(Supplement 1), 77-86.

Banas, J. (2009). Applied use of a health communications model to generate interest in learning. *Mid-Western Educational Researcher*, *22*(4), 9-18.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191-215. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/847061

Bandura, A. (1978). The self system in reciprocal determinism. *American Psychologist*, *33*(4), 344-358.

Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychology & Health*, *13*(4), 623-649. doi:10.1080/08870449808407422

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, *52*, 1-26. doi:10.1146/annurev.psych.52.1.1

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, *31*(2), 143-64. doi:10.1177/1090198104263660

Bandura, A. (2005). The primacy of self-regulation in health promotion. *Applied Psychology*, *54*(2), 245-254. doi:10.1111/j.1464-0597.2005.00208.x

Barron, B., Schwartz, D. L., Vye, N. J., Moore, A., Petrosino, T., Zech, L., & Bransford, J. D. (1998). Doing with understanding: Lessons from research on problem and project based-learning. *The Journal of the Learning Sciences*, 7, 271-311.

Bartholomew, L. K., Parcel, G.S., Kok, G., Gottlieb, N.H., & Fernandez, M. E. (2011). *Planning health promotion programs: an intervention mapping approach* (3rd ed.). San Francisco, CA: Jossey-Bass.

Begoray, D. L., & Banister, E. (2005). Using curriculum design principles to improve health education for adolescent girls. *Health Care for Women International*, *26*(4), 295-307. doi:10.1080/07399330590925808

Beilaczyc, K., & Collins, A. (2009). Learning communities in classrooms: A reconceptualization of educational practice. In C. M. Reigeluth (Ed). *Instructional design theories and models* (Volume II ed., pp. 2169-292). Mahwah, N.J.: Lawrence Erlbaum Associates.

Belland, J. C. (1998). Designing effective instruction by Jerrold E. Kemp; Gary R. Morrison; Steven M. Ross. *Educational Technology Research & Development*, *46*(2), 98-99. doi:10.1080/09602011.2011.622865

Benight, C. C., & Bandura, A. (2004). Social cognitive theory of posttraumatic recovery: The role of perceived self-efficacy. *Behaviour Research and Therapy*, *42*(10), 1129-48. doi:10.1016/j.brat.2003.08.008

Bensley, L. B. Jr. (2010). This I believe: A philosophy of health education. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 3-6). San Francisco, CA: Jossey-Bass.

Bichelmeyer, B. A. (2005). The ADDIE "Model" - A Metaphor for the Lack of Clarity in the Field of IDT. IDT Record. Retrieved from http://www.indiana.edu/~idt/shortpapers/documents/aect2004.htm

Binder, C., & Watkins, C. L. (1990). Precision teaching and direct instruction: Measurably superior instructional technology in schools. *Performance Improvement Quarterly*, *3*(4), 74-96.

Blanchard, M., Metcalf, A., Degney, J., Herrman, H., & Burns, J. (2008). Rethinking the digital divide: Findings from a study of marginalised young people's information communication technology (ICT) use. *Youth Studies Australia*, *27*(4), 35-42.

Bonwell. C.C, Eison, J. A. (1991). *Active learning: Creating excitement in the classroom*. Retrieved form ERIC database (ED340272).

Brooke, M. L., Bell, R. W., & Oppenheimer, M. J. (1976). How Does a Team Approach the Task of Instructional Materials Design?, *59*(8), 338-345.

Brouwer, W. (2008). An exploration of factors related to dissemination of and exposure to Internet-delivered behavior change interventions aimed at adults: A Delphi study approach. *Journal of Medical Internet Research 10*(2). Retrieved from http://www.jmir.org/2008/2/e10/

Burton, J. K., Moore, D. M. M., & Magliaro, S. G. (1996). Behaviorism and instructional technology. In D. H. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology* (1st ed., pp. 46-69). NewYork, NY: Simons & Schuster MacMillan.

Card, J. J., Kuhn, T., Solomon, J., Benner, T. A., Wingood, G. M., & DiClemente, R. J. (2011). Translating an effective group-based HIV prevention program to a program delivered primarily by a computer: Methods and outcomes. *AIDS Education and Prevention, 23*(2), 159-174. doi:10.1521/aeap.2011.23.2.159

Care, W. D., & Scanlan, J. M. (2001). Planning and Managing the Development of Courses for Distance Delivery: Results From Qualitative Study. *Online Journal of Distance Learning Administration*, *4*(2). Retrieved from http://www.westga.edu/~distance/ojdla/summer42/care42.html

Center for Teaching and Learning (2008). Active learning. Retrieved from http://www1.umn.edu/ohr/teachlearn/resources/active/

Centers for Disease Control and Prevention (2011). CDC organization. Retrieved from http://www.cdc.gov/about/organization/cio.htm

Champion, V. L., & Skinner, C. S. (2008). The health belief model. In K. Glanz, B. K., Rimer, & K. & Viswanath, K (Eds). *Health behavior and health education: theory, research, and practice* (pp. 45-65). San Francisco, CA: Jossey-Bass.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London: Sage Publications.

Chen, G. D., Chang, C. K., & Wang, C. Y. (2008). Ubiquitous learning website: Scaffold learners by mobile devices with information-aware techniques. *Computers & Education*, *50*(1), 77-90. doi:10.1016/j.compedu.2006.03.004

Chomutare, T., Fernandez-Luque, L., Arsand, E., & Hartvigsen, G. (2011). Features of mobile diabetes applications: Review of the literature and analysis of current applications compared against evidence-based guidelines. *Journal of Medical Internet Research, 13*(2). Retrieved from http://www.jmir.org/2011/3/e65/

Clark, N. M. (2010). Health educators and the future: Lead, follow or get out of the way. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 55-66). San Francisco, CA: Jossey-Bass.

Clark, R. C., & Mayer, R. E. (2003). *e-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. San Francisco, CA: Pfeiffer.

Collins, A. (1988). *Cognitive apprenticeship and instructional technology* (Technical Report No. 6899). Retrieved from Education Resources Information Center website: *http://www.eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED331465&ERICExtSearch_SearchType_0=no&accno=ED331465*

Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator*, *15*(3), 6-11.

Comer, L., & Grassley, J. S. (2010). A smoking cessation website for childbearing adolescents. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 39*(6), 695-702.

CONSORT, (2012). The CONSORT statement. Retrieved from http://www.consort-statement.org/consort-statement/

Corry, M. D., Frick, T. W., Hansen, L., & Corry, D. M. D. (1997). Usability Testing of, *45*(4), 65-76.

Cousineau, T., Houle, B., Bromberg, J., Fernandez, K. C., & Kling, W. C. (2007). A pilot study of an online workplace nutrition program: The value of participant input in program development. *Journal of Nutrition Education and Behavior*, *40*(3), 160-7. doi:10.1016/j.jneb.2007.04.376

Creswell, J. W. (2007). *Qualitative inquiry and research design*. Thousands Oaks, CA: Sage.

Cronjé, J. (2006). Paradigms regained: Toward integrating objectivism and constructivism in instructional design and the learning sciences. *Educational Technology Research and Development*, *54*(4), 387-416. doi:10.1007/s11423-006-9605-1

Cross, J. (2009). Informal learning 2.0. Retrieved from http://www.internettime.com/2009/08/informal-learning-2-0/

Crotty, M. (2009). *The foundations of social research: meaning and perspective in the research process*. Thousand Oaks, CA: Sage Publications, Inc.

Cummings, K. M., Becker, M. H., & Maile, M. C. (1980). Bringing the models together: an empirical approach to combining variables used to explain health actions.

Journal of Behavioral Medicine, *3*(2), 123-45. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7420418

Curtis, S., Gesler, W., Smith, G., & Washburn, S. (2000). Approaches to sampling and case selection in qualitative research: Examples in the geography of health. *Social Science & Medicine (1982)*, *50*, 1001-1014. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10714922

Denzin, N. K., & Lincoln, Y. S. (1998). *The landscape of qualitative research: theories and issues*. Thousand Oaks, CA: Sage Publications.

Denzin, N. K., & Lincoln, Y. S. (2000). Introduction: The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds). *Handbook of qualitative research* (2nd ed., pp. 1-28). Thousand Oaks, CA: Sage Publications.

Deubel, P. (2003). An investigation of behaviorist and cognitive approaches to instructional multimedia design. *Journal of Educational Multimedia and Hypermedia*, *12*(1), 63-90.

Dick, W. (1996). The Dick and Carey model: Will it survive the decade. *Educational Technology*, *44*(3), 55-63.

Dick, W., Carey, L., & Carey, J. O. (2009). The systematic design of instruction (7th ed.). Upper Saddle River, NJ: Pearson.

Driscoll, M. P. (2005). *Psychology of learning for instruction* (3rd ed.). Boston, MA: Pearson Allyn and Bacon.

Duffy, T. M., & Cunningham, D. J. (2007). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed). *Handbook of research for*

educational communications and technology (pp. 1- 31). Bloomington, IN: The Association for Educational Communications and Technology.

Duffy, T. M., & D. H. Jonassen (1992). Constructivism: New implications for instructional technology. In T. M. Duffy & D. H. Jonasses (Eds). *Constructivism and the technology of instruction: a conversation* (pp. 1-5). Hillsdale, NJ: Lawrence Erlbaum Associates. Retrieved from http://books.google.com/books?hl=en&lr=&id=7Uv8NHvKK44C&pgis=1

Edmonds, G. S., Branch, R. C., & Mukherjee, P. (1994). A conceptual framework for comparing instructional design models. *Educational Technology Research & Development*, *42*(4), 55-72.

English, R. E. & Reigeluth, C. M. (1996). Formative research on sequencing instruction with the elaboration theory. *Educational Technology Research & Development, 44*(1), 23-42.

Ertmer, P. A., & Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 6*(4), 50-70.

Esterberg, K. G. (2002). *Qualitative methods in social research*. New York, NY: McGraw-Hill.

European Monitoring Center for Drugs and Drugs Addiction. (2010). Models and theories. Retrieved October 22, 2011, from http://www.emcdda.europa.eu/publications/perk/resources/step2a/theory#cognitive

Ezzy, D. (2002). *Qualitative analysis practice and innovation*. Crows Nest, Australia: Allen & Unwin.

Fee, K. (2009). *Delivering e-learning: A complete strategy for design, application and assessment*. London, UK: Kogan Page.

Ferney, S. L., & Marshall, A. L. (2006). Website physical activity interventions: Preferences of potential users. *Health Education Research*, *21*(4), 560-566. doi:10.1093/her/cyl013

Fischer, C. T. (2009). Bracketing in qualitative research: conceptual and practical matters. *Psychotherapy Research*, *19*(4-5), 583-90. doi:10.1080/10503300902798375

Fox, S. (2011). Health topics: 80% of Internet users look for health information online. *Pew Research Center's Internet & American Life Project*. Washington: DC.

Franklin, V., Greene, A., Waller, A., Greene, S. A., & Pagilari, C. (2008). Patients' engagement with "Sweet Talk" – A text messaging support system for young people with diabetes. *Journal of Medical Internet Research*, *10*(2). Retrieved from http://www.jmir.org/2008/2/e20/

Fukuoka, Y., Kamitani, E., Bonnet, K., & Lindgren, T. (2011). Real-time social support through a mobile virtual community to improve healthy behavior in overweight and sedentary adults: A focus group analysis. *Journal of Medical Internet Research*, *13*(3). Retrieved from http://www.jmir.org/2011/3/e49/

Gagné, R. M. (1980). Preparing the learner for new learning. *Theory into Practice*, *19*(1), 6-9.

Gagnon, D.J. (2010). Mobile learning environments. *EDUCAUSE Quarterly, 33*(3). Retrieved from http://www.educause.edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolum/MobileLearningEnvironments/213690

Gearing, R. E. (2004). Bracketing in research: a typology. *Qualitative Health Research, 14*(10), 1429-1452. doi:10.1177/1049732304270394

Gibbons, A. S., Nelson, J., & Richards, R. (2000). The nature and origin of instructional objects. In D. A. Wiley (Ed.), *The Instructional Use of Learning Objects: Online Version*. Retrieved from http://reusability.org/read/chapters/gibbons.doc

Glanz, K., & Maddock, J. (2000) On judging models and theories: Research and practice, psychology and public health. Journal of Health Psychology, 5, 151–154.

Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behavior and health education: theory, research, and practice* (4th ed.). San Francisco, CA: Jossey-Bass.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York, NY: Aldine.

Gordon, J., & Zemke, R. (2000). The Attack on ISD. *Training, 37*(4), 43-53.

Grant, M. M. (2002). Getting a grip on project-based learning: theory, cases, and recommendations. *Meridian: A Middle School Computer Technologies Journal, 5*(1). Retrieved May 15, 2002 from http://www.ncsu.edu.ezproxy.memphis.edu/meridian/win2002/514/2.html

Grant, M. M., & Branch, R. M. (2005). Project-based learning in a middle school: Tracing abilities through the artifacts of learning. *Journal of Research on Technology in Education, 38*(1), 65-98.

Gredler, M. E. (2001). *Learning and instruction: Theory into practice* (4th ed.). Upper Saddle River, NJ: Merrill Prentice-Hall.

Greenberg, J. S. (2010). Health education as freeing. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 210-205). San Francisco, CA: Jossey-Bass.

Grimley, D., Prochaska, J. O., Velicer, W. F., Blais L. M., & DiClemente, C. C. (1994). The transtheoretical model of change. In T. M. Brinthaupt & R. P. Lipka (Eds.), *Changing the self: philosophies, techniques, and experiences* (pp. 201-228). Albany, NY: SUNY Press. Retrieved from http://books.google.com/books?hl=en&lr=&id=nhrTvXVhBLMC&pgis=1

Gustafson, K. L., & Branch, R. M. (2002). *Survey of instructional development models* (4th ed.). Syracuse, NY: ERIC Clearinghouse on Information & Technology.

Gustafson, K. L., & Branch, R. M. (2007). What is instructional design. In R.A. Reiser & J.V Dempsey (Eds). *Trends and issues in instructional design and technology* (2nd ed., pp. 10-34). Upper Saddle River, NJ: Pearson/Merrill Prentice Hall.

Hanson, C., Neiger, B., & Mcintyre, E. (2008). Integrating Web 2.0 in Health Education Preparation and Practice. *American Journal of Health Education, 39*(3), 157-166.

Harasim, L. M. (2012). *Learning theory and online technology*. New York, NY: Routledge.

Hart, J. (2009). Towards a definition of informal learning. Retrieved from http://janeknight.typepad.com/socialmedia/2009/08/towards-a-definition-of-informal-learning.html

Hattie, J. A., Myers, J. E., & Sweeney, T. J. (2004). A factor structure of wellness: Theory, assessment, analysis, and practice. *Journal of Counseling & Development*, *82*(3), 354-364. doi:10.1002/j.1556-6678.2004.tb00321.x

Health e-Technologies Initiative (2012). About health e-technologies initiative. Retrieved from http://www.hetinitiative.org/

HealthyPeople.gov (2011). Health Communication and Health Information Technology. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=18http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=18

Herrington, J., Oliver, R., & Reeves, T.C. (2003). Patterns of engagement in authentic learning environments. *Australian Journal of Educational Technology, 19*(1), 59-71.

Hesse, B. W., & Shneiderman, B. (2007). eHealth research from the user's perspective. *American Journal of Preventive Medicine, 32*(5, Supplement 1), 97-103.

Hill, J. R., Wiley, D., Nelson, L. M., & Han, S. (2004). Exploring research on Internet-based learning: From infrastructure to interactions. In D. H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (2nd ed., pp. 433-460). Mahwah, NJ: Lawrence Erlbaum Associates.

Hmelo-Silver, C. E., & Barrows, H. S. (2006). Goals and strategies of a problem-based learning facilitator. *Interdisciplinary Journal of Problem-based Learning, 1*, 21-39.

Hoyman, H. S. (2010). Human ecology and human education. In J. M. Black, S. Furney,

H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 227-242). San Francisco, CA: Jossey-Bass.

http://www.ewenger.com/theory/

http://www.ncbi.nlm.nih.gov.ezproxy.memphis.edu/pmc/articles/PMC2956229/.

http://www.ncbi.nlm.nih.gov.ezproxy.memphis.edu/pmc/articles/PMC2956229/.

http://www.ncbi.nlm.nih.gov.ezproxy.memphis.edu/pmc/articles/PMC2956229/.

Huitt, W. G., Monetti, D. M., & Hummel, J. H. (2009). Direct approach to instruction. . In C. M. Reigeluth & A.A. Carr-Chellman (Eds). *Instructional-design theories and models.* (Volume III ed., pp. 73-97). New York, NY: Taylor & Francis.

Hung, D. (2001). Theories of learning and computer-mediated instructional technologies. *Education*. doi:10.1080/0952398011010511

Hung, W., Jonassen, D., & Liu, R. (2007). Problem-based learning. In J.M. Spector, D. Merrill, J.V. Merrienboer, & M.P. Driscoll (Eds). *Handbook of research on educational communication and technology* (pp. 485-506). Routledge/Taylor and Francis Group.

Inan, F. A., Flores, R., & Grant, M. M. (2010). Perspectives on the Design and Evaluation of Adaptive Web Based Learning Environments, *1*(2), 148-159.

Joint Committee on Health Education and Promotion Terminology (2002). Report of the 2000 Joint Committee on Health Education and Promotion Terminology. *Journal of School Health*, *72*(1), 3-8.

Jonassen, D. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed). *Instructional design theories and models* (Volume II ed., pp. 215-239). Mahwah, NJ: Lawrence Erlbaum Associates.

Jonassen, D. H. (1997). Instructional design models for well-structured and ill-structured problem-solving learning outcomes. *Educational Technology Research and Development*, *45*(1), 65-94.

Jonassen, D. H. (2010). Research issues in problem solving. In S. Michael (Ed.), *The 11th International Conference on Education Research New Educational Paradigm for Learning and Instruction* (pp. 1-15). Anaheim, CA.

Jonassen, D., Cernusca, D., & Ionas, G. (2007). Constructivism and instructional design: The emergence of the learning sciences and design research. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (2nd ed., pp. 45-52). Upper Saddle River, NJ: Pearson.

Kamel Boulos, M. N., & Wheeler, S. (2007). The emerging Web 2.0 social software: An enabling suite of sociable technologies in health and health care education1. *Health Information & Libraries Journal, 24*(1), 2-23.

Kelders, S. M., Van Gemert-Pijnen, J. E. W. C., Werkman, A., Nijland, N., & Seydel, E. R. J. (2011). Effectiveness of a Web-based intervention aimed at healthy dietary and physical activity behavior: A randomized controlled trial about users and usage. *Journal of Medical Internet Research*, *13*(2). Retrieved from http://www.jmir.org/2011/2/e32/

Keyser, B. B., & Broadbear, J. T. (2010). The paradigm shift toward thinking for thinking: Perspectives, barriers, solutions, and accountability. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 109-118). San Francisco, CA: Jossey-Bass.

Kim, D., & Lee, S. (2002). Designing Collaborative Reflection Supporting Tools in e-Project –Based Learning Environments. *Journal of Interactive Learning Research, 13*(4), 375-392.

Kinzie, M. B. (2005). Instructional design strategies for health behavior change. *Patient Education and Counseling*, *56*, 3-15. doi:10.1016/j.pec.2004.02.005

Kirscht, J. P. (1974). The health belief model and illness behavior. In M.H. Becker (Ed.) *The health belief model and personal health behavior* (pp.60-81). Thorofare, NJ: Charles B. Slack.

Kowch, E. (2004). Desiging effective instruction by G. R. Morrison; S. M. Ross; J. E. Kemp. *Educational Technology Research & Development*, *52*(4), 85-90.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory Into Practice*, *41*(4), 212-218. doi:10.1207/s15430421tip4104_2

Kreps, G. L., & Neuhauser, L. (2010). New directions in eHealth communication: Opportunities and challenges. *Patient Education and Counseling, 78*(3), 329-336.

Lau, W. P., Lau, E. Y., Wong, D. P., & Ransdell, L. (2011). A systematic review of information and communication technology-based interventions for promoting physical activity behavior change in children and adolescents. *Journal of Medical Internet Research*, *13*(3). Retrieved from http://www.jmir.org/2011/3/e48/

Lehman, R. (2007). Learning object repositories. *New directions for adult and continuing education, 113*, 57-66.

Lindsey, L., & Berger, N. (2009). Experiential approach to learning. In C. M. Reigeluth & A.A. Carr-Chellman (Eds). *Instructional-design theories and models.* (Vol. III ed., pp. 117-142). New York, NY: Taylor & Francis.

Lintonen, T. P., Konu, A. I., & Seedhouse, D. (2008). Information technology in health promotion. *Health Education Research*, *23*(3), 560-566. doi:10.1093/her/cym001

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 57*(9), 705-717. doi:10.1037/0003-066X.57.9.705

Luszczynska, A., & Schwarzer, R. (2005). Social cognitive theory. In M. Conner & P. Norman (Eds). *Predicting health behaviour: Research and practice with social cognition models* (pp. 29-80). Buckingham, England: Open University Press.

Lynch, M. M., & Roecker, J. (2007). *Project managing e-learning: A handbook for successful design, delivery and management*. London, UK: Routledge.

Mager, R., & Beach, K. (1967). *Developing vocational instruction*. Belmont, CA: Pitman Learning.

Magliaro, S. G., Lockee, B. B., & Burton, J. K. (2005). Direct instruction revisited: A key model for instructional technology. *Educational Technology Research and Development*, *53*(4), 41-55. doi:10.1007/BF02504684

Maiman, L. A., & Becker, M. H. (1974). The health belief model: Origins and correlates in psychological theory. In M. H. Becker (Ed.) *The health belief model and personal health behavior* (pp.9-26). Thorofare, NJ: Charles B. Slack.

McAlister, A. L., Perry, C. L., & Parcel, G. S. (2008). How individuals, environments, and health behaviors interact: Social cognitive theory. In K. Glanz, B.K., Rimer, & K., & Viswanath, K (Eds). *Health behavior and health education: theory, research, and practice* (pp. 45-65). San Francisco, CA: Jossey-Bass.

McConnaughy, E. A, DiClemente, C. C., Prochaska, J. O., & Velicer, W. F. (1989). Stages of change in psychotherapy: A follow-up report. *Psychotherapy: Theory, Research, Practice, Training*, *26*(4), 494-503. doi:10.1037/h0085468

Mergendoller, J. R., Maxwell, N. L., & Bellisimo,Y. (2006). The effectiveness of problem-based instruction: A comparative study of instructional methods and student characteristics. *Interdisciplinary Journal of Problem-based Learning*, 1(2). Retrieved April 20, 2010 from http://docs.lib.purdue.edu/ijpbl/vol1/iss2/5

Merrill, M. D. (1983). Component display theory. In C. M. Reigeluth (Ed). *Instructional-design theories and models: An overview of their current status* (pp. 279-333). Hillsdale, NJ: Erlbaum Associates.

Meyer, B., Berger, T., Caspar, F., Beevers, C. G., Andersson, G., & Weiss, M. (2009). Effectiveness of a novel integrative online treatment for depression (Deprexis): randomized controlled trial. *Journal of Medical Internet Research*, *11*(2). Retrieved from http://www.jmir.org/2009/2/e15/

Miles, M. B., & Huberman, A. M. (1994). Qualitative Data Analysis (2nd edition). Thousand Oaks, CA: Sage Publications.

Miller, W. R., & Tonigan, J. S. (1996). Assessing drinkers' motivations for change: The Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES). *Psychology of Addictive Behaviors*, *10*(2), 81-89. doi:10.1037//0893-164X.10.2.81

Mishra, S. (2002). A design framework for online learning environments. *British Journal of Educational Technology*, *33*(4), 493-496.

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement*, *42*(5), 34-36. doi:10.1039/c0dt00304b

Moore, M. G. (1989). Three types of interactions. *American Journal of distance education*, *3*(2), 1-6.

Morrison, G. R., Ross, S. M., & Kemp, J. E. (2007). *Designing effective instruction* (5th ed.). Hoboken, NJ: J. Wiley.

National Alliance on Mental Illness, (2003). Cognitive behavior therapy. Retrieved from http://www.nami.org/Template.cfm?Section=About_Treatments_and_Supports&template=/ContentManagement/ContentDisplay.cfm&ContentID=7952

National Network of Public Health Institutes, (2010). Strengthening the community of practice for public health improvement (COPPHI). Retrieved from http://www.nnphi.org/program-areas/accreditation-and-performance-improvement/strengthening-the-community-of-practice-for-public-health-improvement

Nichols, R. G. (1995). Designing effective instruction by Jerrold E . Kemp; Gary R . Morrison; Steven M . Ross. *Educational Technology Research & Development*, *43*(3), 75-76.

Nielsen, J. (1993). *Usability engineering*. San Francisco, CA: Morgan Kaufmann Publishers.

Nijland, N., van Gemert-Pijnen, J. E., Kelders, S. M., Brandenburg1, B. J., & Seydel, E. R. (2011). Factors influencing the use of a Web-based application for supporting the self-care of patients with type 2 diabetes: A longitudinal study. *Journal of*

Medical Internet Research, *13*(3). Retrieved from http://www.jmir.org/2011/3/e71/

Noar, S. M., & Zimmerman, R. S. (2005). Health Behavior Theory and cumulative knowledge regarding health behaviors: are we moving in the right direction ? *Health Education Research*, *20*(3), 275-290. doi:10.1093/her/cyg113

Noar, S. M., Pierce, L. B., & Black, H. G. (2010). Can computer-mediated interventions change theoretical mediators of safer sex? A meta-analysis. *Human Communication Research*, *36*, 261-297. doi:10.1111/j.1468-2958.2010.01376.x

Norman, G. J., Zabinski, M. F., Adams, M. A., Rosenberg, D. E., Yaroch, A. L., & Atienza, A. A. (2007). A review of eHealth interventions for physical activity and dietary behavior change. *American Journal of Preventive Medicine, 33*(4), 336-345.

Nutbeam, D. O. N. (1998). Health promotion glossary. *Health Promotion International*, *13*(4), 349-364.

Paas, F., Renkl, A., & Sweller, J. (2004). Cognitive Load Theory: Instructional implications of the interaction between information structures and cognitive architecture. *Instructional Science*, *32*,(1), 1-8.

Pagliari, C., Sloan, D., Gregor, P., Sullivan, F., Detmer, D., Kahan., J. P., Oortwijn, W., & MacGillivrary, S. (2005). What is eHealth (4): A scoping exercise to map the field. *Journal of Medical Internet Research, 7*(1). Retrieved from http://www.jmir/org/2005/1/e9/

Paschall, M. J., Antin, T., Ringwalt, C. L., & Saltz, R. F. (2011). Evaluation of an internet-based alcohol misuse prevention course for college freshmen findings of

a randomized multi-campus trial. *American Journal of Preventive Medicine*, *41*(3), 300-308. Elsevier Inc. doi:10.1016/j.amepre.2011.03.021

Petrocelli, J. V. (2002). Processes and stages of change: Counseling with the transtheoretical model of change. *Journal of Counseling and Development*, *80*, 22-30.

Phillips, R., & McNaught, C. (2012). *Evaluating e-learning: Guiding research and practice*. New York, NY: Routledge.

Phillips, R., McNaught, C., & Kennedy, G. (2012). *Evaluating e-learning: Guiding research and practice*. London, UK: Routledge.

Posner, G. J., & Strike, K. A. (1976). A categorization scheme for principles of sequencing content. *Review of Educational Research*, 46, 665-690.

Prochaska, J. O., & DiClemente, C. C. (1986). Toward a comprehensive model of change. In N. Miller & R.W. Heather (Ed.), *Treating addictive behaviors* (pp. 3-27). New York, NY, USA: Plenum Publishing Corporation.

Prochaska, J. O, Butterworth, S., Redding, C. a, Burden, V., Perrin, N., Leo, M., Flaherty-Robb, M., et al. (2008). Initial efficacy of MI, TTM tailoring and HRI's with multiple behaviors for employee health promotion. *Preventive medicine*, *46*(3), 226-31. doi:10.1016/j.ypmed.2007.11.007

Prochaska, J. O., & Norcross, J. C. (2001). Stages of change. *Psychotherapy*, *38*(4), 443-448. doi:10.1002/jclp.20758

Prochaska, J. O., Redding, C. A., & Evers, K. E. (2008). The transtheoretical model of stages of change. In K. Glanz, B.K. Rimer, & K. Viswanath (Eds). *Health*

behavior and health education: theory, research, and practice (pp. 45-65). San Francisco, CA: Jossey-Bass. Publications, Inc.

Ragan, T. J., & Smith, P. L. (1994). Opening the black box: Instructional strategies examined. *Proceedings of Selected Research and Development Presentation*. Proceedings of the National Convention of the Association for Educational Communications and Technology, Nashville, TN. doi:ED 373749

Reigeluth, C. M. (1999). What is instructional theory and how is it changing? In C. M. Reigeluth (Ed). *Instructional design theories and models* (Volume II ed., pp. 5-29). Mahwah, NJ: Lawrence Erlbaum Associates.

Reigeluth, C. M., & Carr-Chellman, A. A. (2009). Understanding instructional theory. In C. M. Reigeluth & A.A. Carr-Chellman (Eds). *Instructional-design theories and models.* (Volume III ed., pp. 3-26). New York, NY: Taylor & Francis.

Reigeluth, C. M., & Keller, J. B. (2009). Understanding instruction. In C. M. Reigeluth & A.A. Carr-Chellman (Eds). *Instructional-design theories and models.* (Volume III ed., pp. 27-39). New York, NY: Taylor & Francis.

Reigeluth, C. M., & Moore, J. (1999). Cognitive education and the cognitive domain. In C. M. Reigeluth (Ed). *Instructional design theories and models* (Volume II ed., pp. 51-68). Mahwah, NJ: Lawrence Erlbaum Associates.

Reiser, R. A. (2007). What field did you say you where in? Defining and naming our field. In R.A. Reiser & J. V. Dempsey (Eds). *Trends and issues in instructional design and technology* (2nd ed., pp. 2-9). Upper Saddle River, NJ: Pearson/Merrill Prentice Hall.

Rosenberg, M. J. (2001). *e-Learning: Strategies for delivering knowledge in the digital age*. New York, NY: McGraw-Hill.

Rosenstock I. M. (1974). The historic origins of the health belief model. In M.H. Becker (Ed.) *The health belief model and personal health behavior* (pp.1-8). Thorofare, NJ: Charles B. Slack.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education Quarterly*, *15*(2), 175-83. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3378902

Rothman, A. J. (2004). " Is there nothing more practical than a good theory ?": Why innovations and advances in health behavior change will arise if interventions are used to test and refine theory. *International Journal of Behavioral Nutrition and Physical Activity*, *7*, 1-7. doi:10.1186/1479-5868-1-11

Savery, J. R. (2006). Overview of problem-based learning: Definitions and distinctions, *Interdisciplinary Journal of Problem-based Learning*, *1*(1). Retrieved May 10, 2010 from: http://docs.lib.purdue.edu/ijpbl/vol1/iss1/3

Schank, R. C. (1993). Goal-based scenarios: A radical look at education. *The Journal of the Learning Sciences*, *3*(4), 429-453.

Schank, R. C., Fano, A., Bell, B., & Jona, M. (1993). The design of goal-based scenarios. *The Journal of the Learning Sciences*, *3*(4), 305-345.

Shapiro, A., & Niederhauser, D. (2004). Learning from hypertext: research issues and findings. In D. H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (2nd ed., pp. 605-620). Mahwah, NJ: Erlbaum.

Sharma, M., & Romas, J. A. (2012). *Theoretical foundations of health education and health promotion* (2nd ed.). Sudberry, MA: Jones & Bartlett Learning.

Simons-Morton, B. G., Greene, W. H., & Gottlieb, N. H. (1995). *Introduction to health education and health promotion* (2nd ed.). Prospect Heights, IL: Waveland Press.

Skinner, B. F. (1966). The phylogeny and ontogeny of behavior. *Science*, *153*(3741), 1205-13. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/5918710

Skinner, B. F. (1985). Cognitive science and behaviorism. *British Journal of Psychology*, *76*, 291-310.

Smith, P. L., & Ragan, T. J. (1996). Impact of R.M. Gagné's work on instructional theory. *Proceedings of Selected Research and Development Presentation, National Convention of the Association of Educational Communications and Technology,* Indianapolis, IN.

Smith, P. L., & Ragan, T. J. (2000). The impact of R.M. Gagné's work on instructional theory. In R. C. Richey (Ed). *The legacy of Robert M. Gagné* (pp. 147-181). Syracuse, NY: ERIC Clearinghouse on Information & Technology, Syracuse University.

Smith, P. L., & Ragan, T. J. (2005). *Instructional design* (3rd ed.). Hoboken, N.J.: J. Wiley & Sons.

Spiro, R. J., Feltovich, P. J., Jacobson, M. J., & Coulson, R. L. (1991). Cognitive flexibility, constructivism , and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. Retrieved from http://phoenix.sce.fct.unl.pt/simposio/Rand_Spiro.htm

Stake, R. (2003). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), Strategies of qualitative inquiry . Thousand Oaks, CA: Sage.

Stevens, V. J., Funk, K. L., Brantley, P. J., Erlinger, T. P., Myers, V. H., Champagne, C., Bauck, A., et al. (2008). Design and implementation of an interactive website to support long-term maintenance of weight Loss. *Journal of Medical Internet Research*, *10*(1). Retrieved from http://www.jmir.org/2008/1/e1/

Stroebe, W. (2000). *Social psychology and health* (2nd ed.). Philadelphia, PA: Open University Press.

Sutton, S. (2005). Stage theories of health behavior. In M. Conner & P. Norman (Eds). *Predicting health behaviour: Research and practice with social cognition models.* (pp. 29-80). Buckingham, England: Open University Press.

Sutton, S. (2001). Back to the drawing board? A review of applications of the transtheoretical model to substance use. *Addiction, 96*(1), 175-86. doi:10.1080/09652140020017049

Swanson, L. (2011). A primer on A/B testing. Retrieved from http://www.alistapart.com/articles/a-primer-on-a-b-testing/

Sweller, J. (2007). Human cognition architecture. In J. M. Spector, D. Merrill, J. V. Merrienboer, & M. Driscoll (Eds). *Handbook of research on educational communications and technology* (pp. 369-381). Routledge.

Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction*, *4*(4), 295-312.

Sweller, J., & Chandler, P. (1991). Evidence of cognitive load theory. *Cognition and Instruction, 8,*(4), 351-362.

Sweller, J., van Merrienboer, J., & Paas, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, *10*(*3*), 251-296.

Taylor, L., & Parsons, J. (2011). Improving student engagement. *Current Issues in Education*, *14*(1), 1-32.

Taylor, L., & Parsons, J. (2011). Improving student engagement. *Current Issues in Education*, *14*(1), 1-32.

The Cognition and Technology Group at Vanderbilt. (1990). Anchored instruction and its relationship to situated cognition. *Educational Researcher*, *19*(6), 2-10. Taylor & Francis. Retrieved from http://books.google.com/books?hl=en&lr=&id=OSam7S1XhrsC&oi=fnd&pg=PA231&dq=Anchored+instruction+and+its+relationship+to+situated+cognition&ots=e0t0c5TlNK&sig=6qNRlaHBOk1BQ0tlz82LHiaB64Q

Thomas, J. W. (2000). *A review of project-based learning*. Retrieved March 3, 2010, from http://www.bie.org/research/study/review_of_project_based_learning_2000/

Timmreck, T. C., Cole, G. E., Gordon, J., & Butterwoth, D. D. (2010). Health education and health promotion: A look at the jungle of supportive fields, philosophies, and theoretical foundations. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 67-78). San Francisco, CA: Jossey-Bass.

Tono, L., Ed, M., Lee, D., & Ph, D. (2011). Learning objects: Implications for instructional designers. *International Journal of Instructional Media*, *38*(3).

Tripp, S. D. (1995). Instructional Design by P. L. Smith; T. J. Ragan. *Educational Technology Research & Development*, *43*(3), 73-74.

Ubbes, V. A., Black, J. M., & Ausherman, J. A. (2010). Teaching for understanding in health education: The role of critical and creative thinking skills within constructivism theory. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 91-107). San Francisco, CA: Jossey-Bass.

Van De Belt, T. H., Engelen, L.J., Berben, S.A., & Schoonhoven, L. (2010). Definitions of health 2.0. *Journal of Medical Internet, 11*(2). Retrieved from http://www.ncbi.nlm.nih.gov.ezproxy.memphis.edu/pmc/articles/PMC2956229/.

Veletsianos, G., & Navarrete, C. (2012). Online Social Networks as Formal Learning Environments: Learner Experiences and Activities. *International Review of Research in Open & Distance Learning, 13*(1), 144-166.

Vincini, P. (2001). The use of participatory design methods in a learner-centered design process. Retrieved from http: http://it.coe.uga.edu/itforum/paper54/paper54.html

Visscher-Voerman, I., & Gustafson, K. L. (2004). Paradigms in the theory and practice of educational and training design. *Educational Technology Research & Development*, *52*(2), 69-89.

Vrasidas, C. (2000). Constructivism versus objectivism: implications for interaction, course design, and evaluation in distance education. *International Journal of Educational Telecommunications*, *6*(4), 339-362.

Washington, DC: Pew Internet and American Life Project

Webb, T., Joseph, J., Yardley, L., & Michie, S. (2010). Using the Internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research*, *12*(1). Retrieved from http://www.jmir.org/2010/1/e4/

Welle, H. M., Russel, R. D., & Kittleson, M. J. (2010). Philosophical trends in health education: Implications for the 21st century. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 79-93). San Francisco, CA: Jossey-Bass.

Wenger, E. (2009). Communities of practice a brief introduction. Retrieved from

Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: a guide to managing knowledge*. Boston, MA: Harvard Business School Press.

Whittaker, R., Dorey, E., Bramley, D., Bullen, C., Denny, S., Elley, C. R., Maddison, R., et al. (2011). A theory-based video messaging mobile phone intervention for smoking cessation: Randomized controlled trial. *Journal of Medical Internet Research*, *13*(1). Retrieved from http://www.jmir.org/2011/1/e10/

Wiley, D. A. (2000). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. In D. A. Wiley (Ed.), *The Instructional Use of Learning Objects: Online Version*. Retrieved from http://reusability.org/read/chapters/wiley.doc

Willgoose, C. E. (2010). Health education as a basic. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds). *Philosophical foundations of health education* (pp. 17-

27). San Francisco, CA: Jossey-Bass.

Wilson, B. G., & Cole, P. (1996). Cognitive Teaching Models. (In D.H. Jonassen, Ed). *Handbook of research on educational communications and technology* (pp. 622-633). New York, NY: Macmillan.

Wilson, B., & Cole, P. (1991). A review of cognitive teaching models. *Educational Technology Research & Development*, *39*(4), 47-64.

World Health Organization (1998). *Health promotion glossary*. Geneva, Switzerland: WHO.

World Health Organization (2006). Building foundations for ehealth. Retrieved from http://www.who.int/topics/ehealth/en/

World Health Organization (2011). Frequently asked questions. Retrieved from http://www.who.int/suggestions/faq/en/index.html

World Health Organization (2011). Global Observatory for eHealth series. Retrieved from http://www.who.int/goe/publications/ehealth_series_vol3/en/index.html

World Health Organization (2011). *Safety and security on the Internet challenges and advances in Member States*. Geneva, Switzerland.

Yilmaz, K. (2011). The cognitive perspective on learning: Its theoretical underpinnings and implications for classroom practices. *Clearing House*, *84*(5), 204-212.

Zaharias, P., & Poulymenakou, A. (2006). Implementing learner-centered design: The interplay between usability and instructional design practices. *Interactive Technology and Smart Education*, *3*(2), 87-100. doi:10.1108/17415650680000055

Zulman, D. M., Kirch, M., Zheng, K., & An, L. C. (2011). Trust in the Internet as a health resource among older adults: Analysis of data from a nationally

representative survey. *Journal of Medical Internet Research*, *13*(1). Retrieved from http://www.jmir.org/2011/1/e19/

Appendix A

Interview Protocol

Hello! Thank you for consenting to participate in this study. Let me first go over the purpose of the study one more time before we start. The purpose of this study is to get a deeper understanding of how health professionals involved in the creation health education interventions on the Web or through mobile devices go about the phases of designing, developing, and implementing these interventions. Our interview will address three main ideas. The first idea is how health professionals address the learning process in the intervention. The second idea is how they address designing the interventions for use on the Web or through mobile devices and the third idea is how they address the health behavior process in the intervention. I will be taping our interview for the purpose of accuracy of the data, and I will be taking some notes. Do you have any questions for me before we start? (Give participant clarifications as needed). Great! Lets' start then.

First I will collect some demographic variables to help me describe the sample in the study.

Number of years you have been involved in the creation of health education interventions	
Number of years you have been involved in the creation of health education interventions used on the Web or on mobile devices	
Educational background	
Position in the current institution you work with	
Age	
Gender	

Introductory question

5. Can you describe to me your health intervention?

6. What is the health topic that you are trying to address?

7. Who is your target audience?

8. What are your objectives?

Research question 1

First, let's discuss how you address the learning process as you go about creating the health education interventions.

1. When you are in the process of designing your intervention, what is the learning approach that you try follow?

2. Can you elaborate on how you aim for the learner to learn the content of the intervention?

2a. In what format do you present the content to the learner?

2b. How do you envision the interaction between the learner and the content that you present to him/her?

2c. What is the role of the learner in your intervention?

3. Do you rely on a particular learning theory?

3a. If yes, what is it?

3b. Why do you choose to use it?

3c. Can you give me examples on how you incorporate the theory in your design?

4. In designing the intervention, what strategies do you use in order to facilitate the learning process?

4a. Can you give me examples on how you use the strategy to teach a particular concept or skill?

5. Do you follow a particular model?

5a. If yes, what is it?

5b. Why do you choose to use it?

5c. How do you incorporate it in the intervention?

6. If I were to follow you step-by-step through the process of creating the intervention from start to finish, what would be the phases that I would observe?

6a. How do you decide on what the intervention should address?

6b. How do you decide on the structure of the intervention regarding the content and the strategies?

6c. How do you put your plan into action?

6d. How do you evaluate the appropriateness and the effectiveness of the intervention?

7. Do you follow a particular instructional design model?

7a. If yes, what model is it?

7b. Why do you choose it?

8. Can you tell me who is involved in this whole process and what is the role of each one?

Research question 2

After we have talked about the learning process in your intervention, let us now move to discuss the particularities of creating an intervention for the Web or the mobile devices.

1. Why do you choose to use the Web or the mobile applications as a platform for your intervention?

2. In terms of the health intervention, how is it different from designing a face-to-face intervention or an intervention through print material?

3. How does designing for the Web or mobile devices differ from designing for print?

4. What types of software or applications do you choose to build your intervention with?

5. What is your opinion on using multimedia, such as images and videos in the intervention?

    5a. For what purpose do you incorporate multimedia in your intervention? (if participant is using a multimedia approach).

    5b. Why don't you use multimedia in your interventions? (if participant is not using a multimedia approach).

6. Once you choose the multimedia that you want to incorporate, how do you decide on when and how to use them in the intervention?

    6a. Can you elaborate?

7. What features do you include in your design in order to engage the learner?

    7a. Is the intervention you create collaborative? Can you explain?

    7b. Can you describe how you design the navigation?

    7c. Can you elaborate on the level of interactivity on the part of the learner? How do you design it?

    7d. How do you help the learner through the navigation process?

Research question 3

We have been talking about the learning process and the particularities of creating an intervention for the Web or the mobile devices; let's now move to the health behavior and how you address it in your intervention.

1. What approach do you use to achieve the desired health behavior outcome?

    1a. How do you motivate the learner to adopt the desired health behavior?

    1b. What aspects of the health behavior or health topic do you incorporate in the intervention to help the leaner adopt the desired health behavior?

    1c. What strategies do you use to help the learner adopt the desired health behavior?

2. Do you follow a particular health behavior theory or model?

    2a. If yes, what is it?

    2b. Why do you choose to use it?

    2c. How do you incorporate it in the intervention?

Appendix B

Planning Material Protocol

Planning material protocol for research question 1

	Yes	No	Comments
Learning theory (Driscoll, 2005)			
• Name			
• Explicitly displayed			
• Implicitly present			
• Observable features			
Instructional approach (Reigeluth, 1999; Smith & Ragan, 2005; Wilson & Cole, 1996)			
• Name			
• Explicitly displayed			
• Implicitly present			
• Observable features			
Instructional design model (Dick, Carey, & Carey, 2009; Morrison, Ross, &Kemp, 2007; Reiser, 2007; Smith & Ragan, 2005)			
• Name			
• Explicitly displayed			
• Implicitly present			
• Observable features			
Analysis			
Identification of need			
Identification of instructional need			
Identification of program goals			
Identification of instructional goals			
Learners analysis			
• Entry skills related to the health topic			
• Prior knowledge			
• Health literacy skills			
• Educational level			
• Cultural characteristics			
• Attitudes toward content			
• Attitudes towards delivery system			

Planning material protocol for research question 1

	Yes	No	Comments
• Motivation			
Context analysis			
• Environment where learning is to take place			
• Environment where learning will be applied			
Design			
Instructional analysis			
Domains covered			
Knowledge			
• Skills			
• Beliefs			
• Attitudes			
• Values			
Display of content			
• Curriculum map or task analysis			
Instructional objectives			
• Condition			
• Behavior			
• Criteria			
Instructional strategies			
• Description			
• Rationale for use			
Assessment items			
• Reflect objectives			
• Match the desired domains of learning			
• Type			
• Pretest			
• Practice tests			
• Posttest			
Development			
Delivery system			
• Description			
• Rationale			
Storyboarding			
Prototype			
Implementation			
Plan of distribution			
Evaluation			

Planning material protocol for research question 1

	Yes	No	Comments
Evaluation plan			
Formative evaluation			
• One-to-one			
• Small groups			
• Field trials			
Evaluation participants			
• Learning specialists			
• Content expert			
• Target learners			
Areas covered			
• Content			
• Clarity			
• Impact on learner			
• Feasibility			
Types of data gathered			
Summative evaluation			
Outcome analysis			
• Impact on the health behavior			
• Impact on the health organization			
Expert judgment analysis			
• Congruence analysis			
• Content analysis			
• Design analysis			
• Feasibility analysis			

Planning material protocol for research question 2

	Yes	No	Comments
Rationale for use of the platform chosen (Clark & Mayer, 2003; Fee, 2009).			
Types of software or mobile applications used			
Types of multimedia used (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
Purpose of use			

Planning material protocol for research question 2

Collaboration (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
• Learner-expert			
• Learner-learner			
Learner control (Alessi & Trollip, 2001; Clark & Mayer, 2003))			
• sequence			
• pace			
Navigation (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
• menu			
• hyperlinks			
• buttons			
Interaction (Alessi & Trollip, 2001; Moore, 1989)			
• Learner-content			
• Learner-expert			
• Learner-learner			
Provision of help and resources (Alessi & Trollip, 2001)			
Practice (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
Mobile design features			

Planning material protocol for research question 3

	Yes	No	Comments
Health behavior theory or model (Glanz, Rimer, & Viswanath, 2008)			
• Name			
• Explicitly displayed			
• Implicitly present			
• Observable features			
Health belief model (Becker, 1974)			
Explicitly displayed			
Implicitly present			
Observable constructs			

Planning material protocol for research question 2

	Yes	No	Comments
• Perceived susceptibility			
• Perceived severity			
• Perceived benefits			
• Perceived barriers			
• Cues to action			
• Self-efficacy			
Transtheoretical Model (Prochaska & DiClemente, 1986)			
Explicitly displayed			
Implicitly present			
Observable features of stages of change			
Precontemplation			
• Contemplation			
• Preparation			
• Action			
• Maintenance			
• Termination			
Social Cognitive (Bandura, 1998, 2005; Rosenstock, Strecher, & Becker, 1988)			
Explicitly displayed			
Implicitly present			
Observable features of self-regulation			
• Self-monitoring			
• Goal setting			
• Feedback			
• Self-reward			
• Self-instruction			
• Enlistment of social support			

Appendix C

Artifact Protocol

Artifact protocol for research question 1

	Yes	No	Comments
Learning theory (Driscoll, 2005)			
• Observable features			
Instructional approach (Reigeluth, 1999; Smith & Ragan, 2005; Wilson & Cole, 1996)			
• Observable features			
Instructional design model(Dick, Carey, & Carey, 2009; Morrison, Ross, & Kemp, 2007; Reiser, 2007; Smith & Ragan, 2005)			
• Observable features			

Artifact protocol for research question 2

Type of intervention:_____

	Yes	No	Comments
Types of multimedia used (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
• Purpose of use			
• Contiguity principle			
• Modality principle			
• Redundancy principle			
• Coherence principle			
Collaboration (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
• Learner-expert			
• Learner-learner			
Learner control (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
• sequence			
• pace			

Artifact protocol for research question 2

Navigation (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
• menu			
• hyperlinks			
• buttons			
	Yes	No	Comments
Interaction (Alessi & Trollip, 2001; Moore, 1989)			
• Learner-content			
• Learner-expert			
• Learner-learner			
Provision of help and resources (Alessi & Trollip, 2001)			
Practice (Alessi & Trollip, 2001; Clark & Mayer, 2003)			
Other design features			
• Text			
• Font			
• Color			
• Language			
• Cultural sensitivity			
Mobile design features			

Artifact protocol for research question 3

	Yes	No	Comments
Health behavior theory or model (Glanz, Rimer, & Viswanath, 2008)			
• Observable features			
Health belief model (Becker, 1974)			
Observable constructs			
• Perceived susceptibility			
• Perceived severity			
• Perceived benefits			
• Perceived barriers			
• Cues to action			
• Self-efficacy			

Artifact protocol for research question 3

Transtheoretical Model (Prochaska & DiClemente, 1986)			
Observable features of stages of change			
• Precontemplation			
• Contemplation			
	Yes	No	Comments
• Preparation			
• Action			
• Maintenance			
• Termination			
Social Cognitive (Bandura, 1998, 2005; Rosenstock, Strecher, & Becker, 1988)			
Observable features of self-regulation			
• Self-monitoring			
• Goal setting			
• Feedback			
• Self-reward			
• Self-instruction			
• Enlistment of social support			