An Exploration of How Health Professionals Create eHEALTH and mHEALTH Education Interventions

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Introduction

The Joint Commission on Health Education and Promotion Terminology (2002) 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). To that effect, 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 (Glanz, Rimer, & Viswanath, 2008; Simons-Morton, Greene, & Gottlieb, 1995).

The channels of delivery of the health education interventions varies to include face-to-face, print, mass media, and to technology-based communication (Glanz et al., 2008). However, health communication and information delivered through the use of technology is a growing trend in health known as ehealth (Pagliari et al., 2005). Moreover, the popularity and the ubiquitous nature of mobile devices (Chen, Chang, & Wang, 2008) have opened the way to the delivery of health information through mobile devices known as mhealth. The World Health Organization (2011) reports that the use of both ehealth and mhealth is on the increase because it facilitates the dissemination of the interventions on a wide scale, and yet it enables them to be tailored to the specific needs of the learners with methods as complex as websites or as simple as emails (Norman et al., 2007). In fact, Glanz et al. (2008) describe the use of technology in health education as “an important part of the armamentarium of strategies for health education and health behavior” (p. 8).

EHealth and mHealth education interventions offer several advantages to the learner, especially when they incorporate interactivity, collaboration, and real-time support (Fukuoka, Kamitani, Bonnet, & Lindgren, 2011; Kamel Boulos & Wheeler, 2007). This active involvement makes learning meaningful and motivates learners to initiate health behavior change (Banas, 2009). However, few of the health education studies reported in the literature were able to prove their effectiveness due to poor development and implementation (Kreps & Neuhauser, 2010). Moreover, research has not proved yet which, if, and for whom ehealth interventions are effective (Baker et al., 2010). Nevertheless, investing in ehealth and mhealth education interventions is worthwhile if these interventions can show effectiveness in reaching the desired outcomes.

In order to be effective, ehealth and mhealth education interventions need to follow certain guidelines that stem from the disciplines that guide them. In that respect, health professionals draw from a variety of disciplines, specifically 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, 2004; Glanz et al., 2008; Prochaska & DiClemente, 1986; Rosenstock, Strecher, & Becker, 1988). On the other hand, the discipline of education informs health professionals about how people learn (Driscoll, 2005; Gredler, 2001; Reigeluth, 1999).
From the education perspective, the health education 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 that generally guide health education interventions, describe behavioral change without much emphasis on the learning process that result in the behavioral change (Begoray & Banister, 2005; Timmreck et al., 2010).

However, developing education materials that lead to behavioral change, health or otherwise, can benefit from guiding principles that improve their effectiveness and appeal to learners. These guiding principles, which stem from learning theories and instructional models, are portrayed through instructional design models that explain the phases of instruction design and provide rigor to produce effective, efficient, and relevant instruction (Gustafson & Branch, 2002; Gustafson & Branch, 2007). In addition, 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).

A review of the ehealth and mhealth education literature reveals that few studies report on the instructional design process used in the interventions. For example, Stevens et al. (2008) described the design, development, and implementation of a web-based intervention addressing weight loss. A team of experts selected a theoretical framework, determined the scope and the objectives of the website, designed the interface and translated the content into interactive modules. 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. The authors specified a theoretical background for the intervention. They translated the face-to-face version of the intervention into a multimedia equivalent appropriate for computer-based interventions, using the software Flash. 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 did not report on other design features used in the creation of the intervention, leaving questions to be answered on the needs assessment and formative evaluation of the intervention.

In fact, Kinzie (2005) formulated a set of instructional design strategies in an attempt to offer guidance on the design of health education interventions. These strategies drew from several health behavior models, in addition to Gagné’s nine events of instruction. However, after conducting a review of literature on adolescent smoking prevention intervention, she reported an inconsistency in the use of these strategies, pointing to the difficulties associated with comparing outcomes of interventions and proving their effectiveness.

As for the studies on mhealth interventions, they reveal that the educational emphasis is low in mobile applications (Chomutare, Fernandez-Luque, Arsand, & Hartvigsen, 2011). These interventions lack focus on the instructional message, although they provide advantages in tailoring, feedback, and support (Fukuoka et al., 2011; Whittaker et al., 2011).

Hence, 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, these efforts are not always rigorous and are do not always follow a thorough systematic approach, which can jeopardize their efforts in reaching their goals.

Therefore, the purpose of this study was to explore how health professionals create ehealth and mhealth education interventions to get a better understanding of the framework through which they analyze, design, develop, implement, and assess the interventions, in addition to the manner in which they use learning theories, instructional models, and elearning design principles. This paper will focus on two of the research questions explored in 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?

Methods

The study followed a qualitative approach of inquiry. A purposeful sample of 12 participants was reached, using criterion and snowballing sampling strategies (Miles & Huberman, 1994). The data collection methods consisted of interviews, planning materials, and artifacts. The interviews were analyzed using the constant comparison method (Glaser & Strauss, 1967) and the planning materials and artifacts were analyzed for corroboration of evidence from the interviews. Rigor and trustworthiness were achieved through triangulation, member checking, audit trail, and peer debriefing.
Findings

The profiles of the participants showed variation in their characteristics. Their ages ranged from 25 to 61 years. Their years of experience in ehealth and/or mhealth education interventions varied from 2 to 17 years. Their academic background varied between health related sciences, psychology, systems design, and instructional technology. The ehealth and mhealth interventions of these participants varied in topics to cover nutrition, prenatal care, diabetes, smoking, mental health, cancer prevention, sexual and reproductive health, and general health. The interventions targeted populations in the USA, Africa, Asia, Australia, and Europe, ranging between school-aged children, teenagers, and adults.

The accounts of the participants also revealed a wide variability in the way the health education professionals create their ehealth or mhealth education interventions. Due to this variability, a descriptive approach was followed to present the instructional design components, followed by a discussion on the themes emerging from the findings on research questions.

Description of the instructional design components

Overall, the participants highlighted three phases of instructional design: analysis, design, and evaluation. However, none of the participants used the systematic approach recommended in the instructional design models available in the literature (see Gustafson & Branch, 2002). Nonetheless, in their accounts, the participants elaborated on all components of the ADDIE framework, particularly on the analysis, design, and evaluation phases.

Analysis. This phase of instructional design includes a needs assessment that explores the nature of the performance problem. In health education, the performance problem is the health behavior. Therefore, this section of the findings reflects how the participants assessed the health behavior problem and how they identified their goals for designing a health education intervention that will help solve the problem. Four types of needs assessment were revealed: (1) choice of health behavior problem and related target audience, (2) assessment of health behavior needs, (3) determination of learning outcomes, and (4) learner’s analysis.

Choice of the health behavior problem and the related target audience. Four patterns emerged on how the participants selected the health behavior problem and the related target populations: (1) choice reflected the mission of the organization, such as William who focused on sexual health, the health issue his organization works on; (2) choice reflected the area of expertise or interest of the participants, such as Daniel who focused on addiction because this was his area of expertise (3) choice reflected the need of a stakeholder, such as Emily who addressed the issue of prenatal care in pregnant teenager girls because this was the need voiced by the clinic administrators; and (4) choice was dictated by a grant, such as Leah who addressed topics funded by grants she received.

The participants therefore, showed variability in the choice of the targeted health behavior problem and related populations based on 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 they used four different methods: 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.

Expressed need. Expressed needs are needs voiced by the target population (Morrison, Ross, & Kemp, 2007). In this study, the participants listened to the expressed needs of the target population through focus group discussions and informal conversations.

For example, explaining the needs assessment for the mhealth smoking campaign Leah said, “In our focus groups…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.” 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, who’s input stemmed from experiences with the target population. For example, Isabella 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. They looked at research that reported trends and issues related to the health behavior problem, its corresponding health behaviors, and the successes and failures of the approaches taken in addressing them. 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 aimed at the improvement of health. However, these interventions varied in the targeted learning outcomes. Three learning outcomes that emerged from the data are change in knowledge, in behavioral skills, and in attitude. The participants sometimes explicitly stated their desired learning outcomes and other times their accounts reflected what they wanted to achieve from their interventions.

Overall, the choice of the learning outcomes was influenced by challenges and limitations perceived by the participants in achieving them. For example Anna said, “Achieving human behavior is very difficult…. 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 also stressed the limitations by saying, “It really requires a longer engagement… and how do we do that in way that is still sufficiently lean in terms of resources and time…. It’s going to be a challenge.”

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, Carey, and Carey (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).

Although the participants 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.

**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). In this regard, the participants seemed to give great importance to learner’s analysis, revealing four patterns: (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 needs of the target population.** Three participants discussed the assessment of technology needs of their target population revealing a variation in how they did it. For example, Emily discussed with her team members how a mobile intervention would be well received by at-risk pregnant teens because of their age group. Anna expressed that since children enjoy playing video games on their computers, they will be motivated to explore her ehealth education interventions. These participants revealed how they catered to the technology preferences of their learners in order to engage them.

**Assessing the learners’ learning preferences.** Six of the participants depicted learning preferences among their learners depending on age, type of technology, or learning approaches. For example, 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.” Moreover, William and Robert revealed their understanding of how people learn differently and through different modalities and considered this characteristic in planning their interventions.

**Assessing the health behavior characteristics of the learner.** Seven participants discussed the health behavior characteristics of their target audience. Their assessments were mostly based on perceptions and experiences with the target audience such as lack the skill of self-motivation, inaccessibility to health care services, and lack of analytical skills in reading health information. 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. Leah, Sophie and William are examples.

Leah talked about the opinion leaders that she consulted:

- We conducted a massive quantitative survey primarily to identify what we called youth opinion leaders so these are kids that were sort of the most popular kids in each class...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.

Sophie explained the kind of feedback she collects from students:

- I'm actually getting feedback and assessment from the 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 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, participants emphasized three design aspects: design process, content design, and learning activities design.

**Design process.** All of the participants discussed the process of their designs, revealing three approaches: multidisciplinary approach, expert approach, and 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 instructional designers, content specialists, education specialists, and production specialists. 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, four participants working within large teams showed a multidisciplinary approach to design. For example Mia reported, “The design and engineering team ... brainstorm some ideas on how to best implement ... [the] goals that we have expressed earlier in the first design meeting.” William also said, “One person will become the project lead and that person then gets together a team for implementing the design and implementing the project... market and communication team... our graphic designers and our engineers.”

These participants using the multidisciplinary approach 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; Lynch & Roecker, 2007). In this study, four participants working in smaller teams approached their design from the perspective of their area of expertise. For example, for Daniel, who is a clinical psychologist and expert on behavioral change, his design was heavily based on strategies of behavioral change. He said:

- I think the interventions... have to be just time interventions.... This is where the users... 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.

A lot of what we do is based on... 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 it actually starts … feeding the database with that information which will then allow us to
target you with personalized information.

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

**Learner participation approach.** A 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 exemplified this approach the
most. She explained:

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… so they’re never starting from the blank slide.

William also used the learner participation approach through focus groups with his target population. It is
important to note that William used the multidisciplinary approach as well, showing that multidisciplinary and
expert approaches have to be exclusive from each other; however, learner participation approach can be inclusive
to both.

So, Lillian and William 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: subject-matter expert approach, collaboration with learner approach, and a
mix of collaboration and subject-matter expert approach.

**Subject-matter expert approach.** Six participants, 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. For example, Anna said, “The dietitians will set the objectives
that for an age group this is normally what we wanted to teach them.” Isabella reported, “ [The physician] did
provide her health knowledge together with some diabetes experts.” More systematically, Leah said, “[The health
communication specialist] put together … an Excel sheet to basically identify different types of messages so
cognitive restructuring, encouragement, all these behavioral skills.”

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.** The two participants who exemplified the collaboration with the
target population were Lillian and William. These are the same participants who showed a learner participation
approach on the design process earlier.

Lillian: A draft and a fact sheet might be written by a clinician… then that fact sheet is actually
shown to a group of young people who looks at it and provides feedback on the way that
the language it used, the way that it set out, how it actually presents the content, and then
the fact sheet is revised.

William: We did some focus group discussions with the community, with young people and that
helped us design and develop specific messages… so these messages came from the
young people…. 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? … 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. Their approach revealed their belief in the value of partnering with the learners all aspects of the design.
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:

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…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.

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: text messages, multimedia, interactive applications, and resource centers.

Text messages. Six of the participants in this study used text-messages for their mhealth education interventions. However, these text messages varied in types. For example, Isabella talked about simple text messages with no links to the web because of barriers of connectivity. She also used a two-way communication because her learners had to supply their diabetes educators with certain information and receive feedback accordingly. 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…. 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…because of the FDA rules… once you are going beyond information… 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 used a basketball game where children play against junk food bandits. Robert developed videos presented by experts on cancer, Ryan directed his learners to open license YouTube videos, and William developed his own YouTube videos.

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.
- Leah used animated, color-coded frogs to reinforce the learning in her scenario-based modules.
- Robert created an interactive 3D model of the lungs to provide his learners with an authentic experience of healthy and smokers’ lung.
- Ryan created online check-ups for his learners such as Body Mass Index and calcium calculators that were followed by tailored health information.
- Mia explained about the game mechanics on her website where learners accumulate points that are visualized through a plant that grows as more points are earned.
- William created an ecards partner notification partner system for sexually transmitted diseases (STD), where diagnosed teenagers send ecards to their partners to inform them of possible exposure to STDs, so they can in turn go and get tested.

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 had over a thousand print materials to help the nutrition teachers. Camilla shared health websites with her learners. Lillian created “an online hub where young people can download different tools or applications.” William’s website provided “young gay men…with STD information and HIV information…the opportunity to do a self-assessment… took them to local testing sites… the ability for people to have their lab slips directly printed out or emailed from the website.”
The learning activities thus described, reveal the creativity and efforts 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, connectivity issues of the target population, and limitations in resources.

Therefore, the participants designed their interventions either by working with specialists or 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. Here also, the participants showed variability in conducting evaluation. 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 described the purpose of their formative evaluation and its process. The purpose of the formative evaluation was to measure attitudes, content comprehension, and usability. For attitudes, the participants looked at whether their learners liked the design of the intervention. For example, Anna said, “We do a lot of analytics evaluating which areas of the website are the most popular and… the level of engagement with the website”. For content comprehension, the participants looked at whether their learners understood the content of the intervention. For example, Ryan said, “[We wanted] to see whether the content makes sense.” As for usability (Nielsen, 1993), the participants looked at the difficulties encountered by the learners as they moved around the intervention. Again, Anna explained, “We watch and see…if [the children] know what to do and how to maneuver through the game.”

Describing the process of formative evaluation, the participants used feedback from their learners, such as Daniel who said, “We’ve asked people to sense like, ‘What has been your favorite message?’ that kind of thing.” They also used analytics as Ryan described, “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.” In addition, they field tested their interventions using focus groups where they discussed with their learners the improvements needed to the interventions. For example, Lillian explained, “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.” One participant, Mia, used AB testing to compare two versions of a webpage in order to check which one works better for the user (Swanson, 2011). Finally, for some participants, formative evaluation was done through the maintenance of the website after launching as Sophie explained, “The reality of it is it’s going to be trial and error. I’m going to put this site up… then do an assessment… basically is it working?”

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. In their accounts, they described the focus of their summative evaluation, its process, and the period over which it extended. The focus of the summative evaluation included measuring changes in knowledge and attitudes; changes in health behavior, such as Emily and William who tracked the change in health services use as a result of their interventions; and the learner’s engagement and usability of the intervention over extended period of time measured through testimonials and retention rates. The process of summative evaluation discussed by four of the participants only, included research-oriented approaches showing a desire to have empirical evidence on the impact of their interventions. The period of the summative evaluation ranged from continuous monitoring of the feedback from the learners and the behavioral interactions with the interventions to the more research-based approach through short term evaluation at the completion of the intervention or long-term evaluation that went from four weeks after the completion of the intervention, to 3-6 months later, to yearly, and even to a five year period.

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. Even when resources were limited, the participants made the effort to gather indicators to assess their interventions. However, the type of evaluation implemented by the participants was influenced by their academic background and the resources available to them.
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.

**Health professionals use of education theories and models**

On how health professionals use theories and models from the field of education to create their interventions, the findings revealed that none of the participants used a specific learning theory or an instructional model. However, the participants discussed the learning approaches and the instructional strategies they incorporated in their interventions. Consequently, four themes emerged: connections to behaviorist approaches to learning, connections to cognitivist approaches to learning, and connections to constructivist approaches to learning.

**Connections to behaviorist approaches to learning.** Here, 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. It is important to note that most of the five participants, who used these behaviorist techniques, also used constructivist instructional strategies. 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.** Here, the participants talked about the importance of using an instructional strategy that controls the amount of information presented to the learner. Although the participants did not mention cognitive load in specific terms (Sweller & Chandler, 1991; Sweller et al., 1998), 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.” 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.

The participants’ 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 were problem-solving, learning by doing, active learning, authentic experiences, and goal setting. For example, Anna talked about decision-making through nutrition education games, such as trying to create a healthy recipe for pancakes, Mia specified a do-learn approach for her intervention, and Robert discussed his choice of activities that aimed at creating an active learning experience for the learners. Although they did not name specific constructivist instructional models described in the literature, the participants designed learning activities that aligned with 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.

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. 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. The findings suggest that the participants did not take a scholarly approach in looking at the learning theories and instructional model while creating their interventions. However, they invested efforts in creating learning activities that reflected instructional models of different learning theories. This focus on instructional strategies reflects a genuine effort in creating successful learning experiences, which if embedded in instructional models and framed within learning theories that have been researched in the literature, could facilitate the design process of the interventions and yield better learning outcomes.
Health professionals use of elearning design principles

On how health professionals use principles of elearning and mlearning design to create their interventions, the participants showed an extensive use of essential elearning design principles that are portrayed in the literature (Alessi & Trollip, 2001; Hill et al., 2004; Moore, 1989). In this regard, seven patterns emerged: learner-content, learner-expert, and learner-learner interaction; learner control over navigation, provision of help and resources, use of multimedia, engagement, user friendliness, and visual appeal. However, these participants applied elements of elearning design in varying degrees depending on the availability of resources of manpower and time to them. Once again, they showed an application of good elearning design, without necessarily being driven by the research-based principles that lie behind it.

Conclusion

The description of the process through which the participants created their interventions revealed their incorporation of essential elements of instructional design described in the literature. Although they did not follow specific instructional design models, they elaborated on the phases of analysis, design, and evaluation. York and Ertmer (2011) posit that even seasoned instructional designers do not adhere to specific instructional design models, but use instructional design heuristics based on experiences in the field. Similarly, Visscher-Voerman and Gustafson (2004) reported that experienced instructional designers using ADDIE, deviate from it and implement it in different ways. Interestingly, none of these participants in this study was an instructional designer, which explains why none of them referred to the use of a specific instructional design model. However, they did seem to employ a heuristic approach in the design of their intervention. This is a noteworthy finding for non-instructional designers working in the field of health education attempting to design instruction without training, and it is one worth investigating in order to understand the factors behind it. On the other hand, the fact that the participants leaned towards constructivist and cognitivist approaches in their interventions is a promising finding for the field of health education. Historically, health education focused on the transmission of knowledge through a teacher-centered approach (Keyser & Broadbear, 2010). However, scholars in the field voiced concerns over the need to teach thinking skills and to support the learner in the decision-making process of behavioral change, to shift the learning paradigm of health education towards a more cognitive-based and collaborative approach (Greenberg, 2010; Keyser & Broadbear, 2010; Welle et al., 2010). Therefore, these participants showed an alignment with the hopes and recommendations of health education scholars for the paradigm shift in health education.

Implications for Practice

Novice instructional designers, as our participants are, need the guidance of instructional design models until they become experienced in the process, in order to get the foundation in knowledge and skills (Dick, 1996; Nichols, 1995; York & Ertmer, 2011). 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. As a group, the participants showed a design process that covered the basic components of instructional design. However, individually, they showed a great level of variability in the methods and the extent to which they designed their interventions, based on their academic background, type and context of interventions, and the resources available to them. Since none of the participants is a trained instructional designer, they and similar health professionals would benefit from the development of an instructional design guidebook tailored specifically to them to enable them to create their ehealth and mhealth education interventions more effectively (Gustafson & Branch, 2002). This is especially important, because the literature on instructional design is mostly focused on academic and workforce settings (Reiser, 2007) and the literature on health behavior and health education covers only occasionally aspects of learning and rarely the instructional design process (Bartholomew, Parcel, Kok, Gottlieb, & Frenandez, 2011; Card et al., 2011; Kinzie, 2005; Stevens et al., 2008).

Moreover, health professionals would also benefit from a repository for health education learning objects. Wiley (2000) defines a learning object as “any digital resource that can be reused to support learning” (p. 7). By following certain technical standards, these digital resources can be reused across multiple electronic platforms as sharable content objects (Lehman, 2007; Reiser, 2007). Consequently, such a repository would prevent duplication of efforts, increase efficiency, give health professionals visibility in the field, and provide other health professionals with limited resources access to learning objects that they can use in their interventions.

Additionally, health professionals creating ehealth and mhealth interventions can gain from the establishment of a community of practice to overcome challenges and learn from each other’s experiences (Wenger,
This is specifically meaningful for health professionals who work in small teams and can benefit greatly from health professionals working in multidisciplinary teams.

**Implications for further research**

Investigating the decision-making process of health professionals as they create their interventions can shed light on the factors behind their heuristic approach, even without training in instructional design (York & Ertmer, 2011). Furthermore, the variability of the design approaches of the participants warrants further examination in order to explain the impact of the variability on the quality and effectiveness of the interventions. Additionally, comparative studies can be conducted between mhealth and ehealth interventions to shed light on similarities and differences in the design process and effect on health behavior.

**References**


