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Design and Development of Simulation-based Instruction on Meaningful Use and Interprofessionalism Core Competencies in a Healthcare Team-based Learning Environment

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by

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We hereby certify that this dissertation, submitted by Elizabeth Oviawe, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctor of Philosophy.

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An Abstract of a Dissertation Submitted to Nova Southeastern University in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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Policymakers and electronic health records (EHR) experts agree that healthcare professionals lack proficiency in meaningful use of EHRs. This competency gap can result in increased medical errors. It is essential for health professions graduates to acquire skill sets that are adaptable to any electronic health information technologies including the EHRs to facilitate work process and information access. Simulation as an instructional method to create transformative learning experiences has shown promise in the medical profession. In simulations, learners are able to engage in real-life scenarios and practice their cognitive, affective, and psychomotor skills in a safe environment.

The goal was to design and develop a simulation-based instructional module on meaningful use of EHR and interprofessional collaborative practice core competencies and evaluate students' performance and satisfaction under an interprofessional team-based setting. Using a design and development research approach, a simulation-based instructional module on meaningful use of EHR and interprofessional core competencies was designed. An internal validation of the module was conducted with an expert panel of medical professionals and instructional designers. Following validation, the instructional module was developed and pilot tested with a group of 21 second- and third-year health professions students in medicine, pharmacy, and nursing in an interprofessional team-based learning environment. Students' performance on meaningful use and interprofessionalism core competencies and their satisfaction during the simulation-based training were evaluated.

The results confirmed that the students properly implemented the core competencies based on their performances during the immersive virtual patient encounter in the 3D virtual world. The analysis also showed how the students' satisfaction was met as a reaction to the guided experiential learning's (GEL) simulation-based instructional intervention, and in some instances were not sufficiently met. The analysis of the students' testimonials further confirmed their overall satisfaction with the immersive simulation experience.The findings, based on the feedback from the students and faculty in this pilot implementation, highlighted simulation-based interactive gaming instruction and the hands-on experience in a 3D virtual world guided by GEL as an effective and engaging way to train healthcare professionals in the preparation to deliver care in a safe and effective manner under interprofessional team-based settings for better patient safety and outcome.

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Chapter 1

Introduction

Background

In 2009, the Obama administration enacted programs to stimulate the economy and produce short-term economic growth and spark advances is science and technology. In the health field, The Health Information Technology for Economic and Clinical Health (HITECH) Act serves to promote such advances in the health field (Blumenthal, 2011). In particular, HITECH served as the impetus for the diffusion and adoption of Electronic Health Records (EHRs). An EHR is a repository of patient data in an electronic form, stored and transmitted securely, and accessible by multiple authorized users (I.S.O. as cited in Goveia, Van Stiphout, Cheung, Kamta, Keijsers, Valk, & Braaak., 2013). "EHRs are used in primary, secondary and tertiary care, and their main purpose is to support continuing, efficient and integrated healthcare" (p. e1551). Policymakers have created financial incentive programs to promote the use of EHRs. Up to twenty-nine billion dollars over ten years was reserved as part of the HITECH Act to help diffuse the technology of EHRs (Blumenthal, 2011). In order to receive these incentives, providers must demonstrate *meaningful use* of EHRs. Meaningful use is demonstrated by meeting specific criteria with the goal of improving health and health care (Blumenthal).

The HITECH Act and other efforts by the government, hospitals, private sector and market competition have resulted in high adoption rates of EHRs (Blumenthal & Tavenner, as cited in Goveia et al., 2013). Nonetheless, after the review of the first published cost-effectiveness results of countries and hospitals around the globe that have successfully implemented EHRs, a troubling issue was discovered. It became apparent

that the increased rates of EHR adoption did not automatically result in the reduction of healthcare cost or enhancement of quality of care. Instead an increase in medical errors and even death in some instances, have been associated with the launching of EHRs (Koppel et al.; Han et al.; Sittig et al., as cited in Goveia et al., 2013). EHR experts agree that one of the major problems is the inability of healthcare professionals to use EHR in a meaningful way that enhances the quality of patient care (Blumenthal & Tavenner, 2010; Goveia et al., 2013). However, just adopting EHRs is not sufficient to achieve the desired quality of care and improve patient outcomes and meaningful use of EHRs includes a team working relationship and communication (Graetz et al., 2015). The Affordable Care Act promotes the concept of interprofessional collaborative education and practice, with the hope that this concept will help develop well-functioning coordinated teams that will yield efficient healthcare delivery and better patient and family outcomes. However, barriers exist. For example, many healthcare professionals tend to work in silos and thus lack the skills needed to work as a team. This skill deficiency could compromise patient safety (Elsevier, 2013; Wilson et al., 2016).

According to Borycki, Joe, Armstrong, Bellwood, and Campbell (2011), medical schools are graduating students who lack understanding of the importance of the use of EHRs in their practice. This lack of understanding could further increase inadequacy in the use of this complex technology, even among those who are savvy in the use of computers. Confusion about the roles and responsibilities of each member of the team under interprofessional team-based practice is also troublesome (Borycki et al., 2011). Consensus is building that delivering a safe patient-centered and effective care that will meet the complex demand of a growing aging population will require the healthcare workforce to work in collaborative integrated teams (Wilson et al., 2016;).

It is essential for health professions graduates to acquire skill set adaptable to any electronic health information technologies and also the skills necessary to partake in an interprofessional team to facilitate work process, information access and meaningful interprofessional clinical education to promote team communication and collaboration (Wilson et al., 2016; Elsevier, 2013; Borycki et al., 2011; AHIMA & AMIA, 2008).

The search for the best way to train healthcare professionals in the preparation to deliver care in a safe and effective manner has been challenging (Wilson et al., 2016; Dastagir et al., 2012). Kushniruk, Myers, Borycki, and Kannry (2009) suggested that hands-on training could be carried out in a simulated environment to practice the art of doctor-patient interaction while documenting the patient encounter before attending to the actual patients in real-life settings. Simulation has quickly grown over the decade as a way of training healthcare professionals (Kim, Oh, Kang, & Kim, 2014). It provides such benefits as mimicking real life clinical settings, encouraging adequate performance feedback and improving students' decision-making. A simulation can serve as a medium between the theoretical and the clinical environments. Furthermore, it allows the health professionals to practice in a risk-free environment without the fear of posing a danger to the patients, thus boosting the students' confidence (Kim et al., 2014).

Problem Statement

The problem is healthcare professionals are not proficient in EHR meaningful use and interprofessional collaborative practice core competencies and existing instructional interventions that focus on this topic do not adequately address this skill deficiency (Wilson et al., 2016;; Goveia et al., 2013; Elsevier, 2013; Krupa, 2012). While some EHR training interventions have been reported in the literature, most were implemented at the time of the EHR implementation. These methods include web-based training, peer-

led training, remote phone training, classroom training, EHR functionality training, case-based training, role-based training, process-based training, and mock-clinic training, and "on the job" training (Dastagir et al., 2012; Topaz et al., 2013). One of the shortcomings of these approaches is the lack of empirical evidence of their effectiveness on the learners' performance (Craft, et al. 2013; Dastagir et al., 2012). Additionally, factors like the busy and unsettling training environment and time limitations associated with practicing healthcare professionals, and complexity of the real-life clinical settings could be other reasons for the inadequacies (Dastagir et al., 2012; March et al., 2013; Kushniruk et al., 2009; Topaz et al., 2013). Inability of the healthcare providers to work in collaborative integrated teams is another contributing factor (Wilson et al., 2016;; Elsevier, 2013).

Simulations are used often in addressing these types of instructional interventions in healthcare. A common instructional strategy that is used to guide the design of instructional simulations is experiential learning (Carter, Schijven, Aggarwal, Grantcharov, Francis, Hanna, & Jakimowicz, 2006). However, there is minimal guidance on how to design an effective simulation-based instructional module (Anderson, Aylor, Douglas, & Leonard, 2008; Craft, Feldon, & Brown, 2013).

Dissertation Goal and Research Questions

To address the lack of EHR instruction on meaningful use and interprofessionalism, as well as, the limited guidance on the use of experiential learning in healthcare, the goal was to design and develop a simulation-based instructional module on meaningful use of EHR and interprofessional collaborative practice core competencies and evaluate students' performance and satisfaction under an interprofessional team-based setting. The

target audience included 21 third-year health professions students from medicine, pharmacy and nursing.

Using a design and development research approach (Richey & Klein, 2007), a simulation-based instructional module was designed using Clark's (2004, 2008) guidelines for developing instruction using guided experiential learning (GEL). Prior to implementation, the design was validated internally (Richey & Klein, 2007) by an expert panel including medical professionals and instructional designers. Following validation, the instructional module was developed and pilot tested with a group of second and third-year health professions students in medicine, pharmacy, and nursing in an interprofessional team-based learning environment. Students' satisfaction with the simulated interactive game-based instructional module, and their performance during the virtual world interprofessional clinical skill experience were evaluated.

Research Questions

The following research questions were:

1. How can GEL be used to design a simulation-based instructional EHR module?
2. What are the reactions of experts to the proposed design and what modifications need to be made prior to implementation?
3. To what extent does a simulation-based EHR module using GEL increase student performance?
4. To what extent does a simulation-based EHR module using GEL influence student satisfaction?

Relevance and Significance

Studies on meaningful use of EHRs have mainly been carried out among practicing healthcare professionals. Although practitioners are willing to use EHRs in a meaningful way, they lack adequate training in the core competencies of meaningful use and interprofessionalism (Dastagir et al., 2012; March et al., 2013; Kushniruk et al., 2009; Topaz et al., 2013; Wilson, 2016). Practical and hands-on elements of an instructional intervention are critical to the advancement of meaningful use and interprofessional collaborative practice. Hence, there is a great need for instructional interventions to provide effective hands-on instruction in a simulated environment for the next generation of healthcare professionals, under interprofessional team-based settings. Otherwise, the interprofessional collaborative practice and effective meaningful use would be hindered, and the promise of the use of EHR and the mastery of interprofessional education with the expected outcome to reduce medical and medication errors, reduce healthcare costs, and improve the quality of care would be improbable (Blumenthal & Tavenner, 2010; Goveia et al., 2013; Elsevier, 2013;; Wilson, 2016).

Participants included 21 second- and third-year medical students from medicine, pharmacy and nursing who received instruction in an interprofessional team-based simulated environment. This approach was different from previous studies that have largely involved postgraduates and practicing healthcare professionals (Dastagir et al., 2012; March et al., 2013; Kushniruk et al., 2009; Topaz et al., 2013).

This research extended the existing knowledge base in EHR meaningful use and interprofessional instruction for students in the health professions and instructional simulation design. The objectives were to (1) improve the knowledge, skills, and attitudes relating to meaningful use of EHRs and interprofessionalism that are needed to reduce

medical and medication errors, (2) promote quality of patient-centered care under interprofessional team-based practice, and (3) provide guidance for medical educators involved in the design and validation of instructional interventions.

Barriers and Issues

The adoption of EHRs was expected to reduce medical errors, reduce healthcare costs, and improve the quality of care. Unfortunately, this expectation has not been met. It has become evident that simply implementing EHRs is not sufficient to achieve improved quality of care and patient safety. It should also include team working relationships and communication (Graetz, et al., 2015). However, barriers and issues persist such as shortage of health information technology faculty with expertise to devote the time to effective instructional development and usage around meaningful use and interprofessional education core competencies. The culture of healthcare and lack of adequate information and role models are some other factors. For example, commercial EHRs are designed to service the needs of practicing physicians. Physicians learn how to use EHRs in a production environment with no instructional component to the application. The commercial vendors of EHRs did not take into consideration the need for performance support or the need to teach students and their professors in an educational environment (Borycki et al., 2011; Joe, Otto, & Borycki, 2011; March et al., 2013; Vega, & Bernard, 2016). Working in silos has been the norm in healthcare practice. Thus, learning to work collaboratively across professions with an understanding of each other's roles and responsibilities has been challenging. Similar difficulties were encountered in this research. For example, clinical settings in the real-life are complex and trying to replicate such complexity in a simulated environment was challenging. Development of the simulation required instructional design expertise and subject matter

expertise. Input from clinicians who have the subject matter expertise was necessary to capture appropriate content for the design of the instruction. Likewise, 3D modeling and design is complex. Therefore, expertise in the design and development of 3D virtual world serious gaming content was necessary. These barriers and issues made the research problem inherently difficult to address and therefore, worthy of rigorous dissertation research.

Assumptions, Limitations and Delimitations

The subject matter experts (SMEs) who reviewed the content of the pilot simulation were experts in their respective fields. It was assumed that the information they provided during the cognitive task analysis interviews is accurate and complete. It was also assumed that the pilot test participants represented a typical group of medical, pharmacy, and nursing students in their third year. However, the population may also be a limitation given the participants represented a small sample of 21students from medicine, pharmacy, and nursing in one university. Therefore, results may not be generalizable. Delimitations included an intentional focus on three professions including medicine, pharmacy, and nursing. Other professions such as dentistry, physical therapy, social work and optometry from more than one university may be included in future studies. Another delimitation was that only two factors were measured, namely student performance and student satisfaction. Other factors such as instructional efficiency and scale were beyond the scope of this study. Finally, while Clark's (2008) GEL course and lesson structure model was used to develop the design document and prototype, all seven elements were not executed fully. That is, the sixth element is a four-phase evaluation process; however, only the first two levels were included in the design. The seventh element, transfer letter to supervisors, was also not included in the simulation design.

Acronyms and Definitions of Terms

Acronyms

ANCOVA - Analysis of Covariance

CTA – Cognitive Task Analysis

CVC - Central Venous Catheterization

eHIT – Electronic Health Information Technology

EHR – Electronic Health Record

ELT - Experiential Learning Theory

EM – Emergency Medicine

FES - Full-Environment Simulation

GEL – Guided Experiential Learning

HbA1c - Hemoglobin A1c

HITECH – Health Information Technology for Economic and Clinical Health

HPD – Health Professions Division

IADL – Instrumental activities of daily living

ICU - Intensive Care Unit

IOM - Institute of Medicine

IRB - Institutional Review Board

IPE - Interprofessional Education

IPEC - The Interprofessional Education Collaboration

KPHC - KP HealthConnect

LDL-C - Low-Density Lipoprotein Cholesterol

NSU – Nova Southeastern University

SimMedG - Simulation-based Medical Educational Game

SME - Subject Matter Experts

SSES - Satisfaction with Simulation Experience Scale

USC - University of South Carolina

RQ1 - Research Question One

RQ2 - Research Question Two

RQ3 - Research Question Three

RQ4 - Research Question Four

WHO - World Health Organization

Definitions of Terms

Delirium: Critical malfunction of mental ability causing confusion and diminished surrounding awareness (http://www.mayoclinic.org/diseases-conditions/delirium/basics/definition/con-20033982).

Dementia: A general term that describes variety of symptoms categorize as a decline in memory to the extent it reduces the ability of that person to carry out normal daily functions (http://www.alz.org/what-is-dementia.asp).

Electronic Health Record (EHR): An EHR is a repository of patient data in an electronic form, stored and transmitted securely, and accessible by multiple authorized users (I.S.O. as cited in Goveia, Van Stiphout, Cheung, Kamta, Keijsers, Valk, & Braaak., 2013).

Interprofessionalism: is the term used for two or more health professions working together to provide better patient care (Menken, 2011).

Meaningful Use: *Meaningful use* is demonstrated by meeting specific criteria with the goal of improving health and health care (Blumenthal, 2010).

Simulated Learning Environment: A simulation clinic laboratory with high-fidelity robotic mannequins, and 3D gamed-based and virtual world learning environment with virtual patients mimicking a real-life clinic setting (Author).

Teleport: An immediate movement from one location to another very quickly in Second Life® (http://wiki.secondlife.com/wiki/Teleport).

Summary

Chapter 1 described the background and context of the research problem, which is healthcare professionals' lack of proficiency in the EHR meaningful use and interprofessional core competencies and the limited availability of instructional interventions that address these skill deficiencies. The goal and the research questions were presented along with an explanation of why this research is relevant and significant. Barriers, issues, assumptions, limitations, delimitations, acronyms and definitions of terms were also presented to provide foundational information. Chapter 2 presents a review of the literature in the areas of EHR instructional interventions, healthcare interprofessional practice, instructional simulations in healthcare, and relevant theoretical and methodological models. Chapters 3 through 5 present the methodology of the research, results of the analysis, and the conclusions, implications, recommendations, and summary respectively.

Chapter 2

Review of the Literature

The following section includes a review of the literature that is relevant to the research problem, goal, and questions. This literature review is categorized as follows: EHR instructional interventions, healthcare interprofessional practice, simulations in healthcare instruction, simulations and instructional design, and design and development research.

EHR Instructional Interventions

The literature lacks evidence to suggest the best approach to EHR education and training. This section includes descriptions of studies by researchers who applied EHR education and training interventions including: Topaz, Rao, Creber, and Bowles (2013); Dastagir, Chin, McNamara, Poteraj, Battaglini, and Alstot (2012); March, Steiger, Scholl, Mohan, Hersh, and Gold (2013); Goveia, et al. (2013); Kushniruk, et al. (2009), and Frenzel (2010).

Topaz, et al. (2013) explored the use of participatory e-learning, a web-based application that is based on the principle of Web 2.0. Web 2.0 underscores collaboration, active participation, connectivity and sharing of knowledge and ideas between users. Web 2.0 encompasses an interactive learning environment where participants are further involved in their own learning through active participation. Topaz et al. (2013) opined that the EHR education should be established on the traditional theories of education. The authors developed a "conceptually sound, evidence-based, user-friendly, and interactive e-learning approach to bring relevant EHR updates to nurses" (p. 3) by using Adobe

Captivate v. 5.5 authoring tool to create a seven-minute interactive e-learning tutorial on the proper way of documenting into the EHR. Based on the statistical analysis result of 74% (1546) out of the 2080 participants (nurses) who successfully completed the interactive tutorial, Topaz et al. (2013) posited that their study on educating the nurses was a success. Nevertheless, they encountered such challenges accustomed to real-life clinical settings complexity, which was the inability to disseminate the training properly. Thus, they concluded that it is necessary to train healthcare professionals continuously in a diverse learning approach. They recommended that future research should focus on investigating the importance of additional evidence to understand the best approach to implementing effective EHR education and training.

Dastagir et al. (2012) attempted to find the best way to train clinicians to enable the optimization of the use of EHR. Dastagir et al. used peer-led EHR training, which they labeled pathway to proficiency (P2P). P2P included a three-day intensive off-site program to enhance the skills of clinicians (i.e. physicians, physician-assistants and nurse practitioners) with the objective of enhancing the EHR know-how of clinicians who were experienced users. The training was organized and delivered by physician super-users and champions who had become experts in the skill. Study participants who already had some experience using EHR were trained using the Kaiser Permanente EHR, referred to as KP HealthConnect (KPHC). A total of 155 clinicians participated, consisting of clinicians who had problems in the use of EHR. An online questionnaire consisting of five-point Likert scale was used to evaluate clinician self-perception of their efficiency, satisfaction with the system, and job satisfaction. Data were collected using the online questionnaire as a pre-test and post-test to assess clinician self-perception of their efficiency in using the system, satisfaction with the system and job satisfaction. The

participants completed the online pre-test at least a day before the training and the post-test 30 days after they received the training. Data were analyzed using statistical application, SPSS. The results of 139 participants who responded to the pre-test and that of 76 participants who responded to the post-test illustrated that 78% of the respondents preferred EHR support from their clinician peers or champions, while 2% of the participants preferred web-based support. Regarding EHR efficiency and satisfaction, there was a significant improvement in the perception of training adequacy and the ability to find orders and diagnoses easily (both p values <0.001). There was also a significant enhancement ($p<0.0001$) in the use of the EHR and acquired skills during the training. Dastagir et al. (2012) concluded that despite the successful report on the intensive three-day off-site physician-peer-led program, on-going support and further training are necessary to achieve the best possible effective meaningful use of EHRs.

A study pertaining to how simulation is used in medical education was presented by March et al. (2013). The authors investigated the use of simulation with emergency medicine students to address the problem of safety in patients' healthcare management. The goal was to teach effective use of the EHR in an intensive care unit (ICU). March et al. stated that the use of medical simulations in medical education with an emphasis on high-fidelity simulations has grown rapidly; however, little has been performed with EHR-specific simulation training. March et al. developed a new ICU-specific EHR simulated environment within an enterprise-wide certified EHR, EPIC care, to carry out their investigation. The customization of the clinical environment to test the ability of physicians to recognize medical errors in the EHR allowed creation of patient cases of multiday patient data, as opposed to single-day data previously used in training.

The participants included postgraduate medical students consisting of nine interns, ten residents and nineteen fellows (March et al., 2013). These participants were not new to the systems as they were given institution-specific training before the testing. A one-page description and synopsis of the patient were given to these participants. They were not provided information regarding the simulated medical errors in the case, which included 14 possible issues embedded in the scenario. Each participant was required to give a short presentation after the patient encounter. Participants were graded based on the number of errors they were able to identify. The participants received immediate feedback on their performances. An analysis of the differences amongst the groups (i.e. intern, resident, and fellow) was conducted using a two-tailed student t test which test and correlations through the use of Spearman's test (p value <0.05 was considered significant). The two-tailed is that when the critical area of a distribution is two sided and tests whether a sample is either greater than or less than a certain range of values.

The results illustrated that the simulation performance loosely correlated with the level of training, meaning that the rate of detection of errors increased significantly with the level of clinical training received by the participants (March et al., 2013). A limitation of this study was that it did not address how the physicians' participation in the simulation experience itself advanced their use of the EHR. March et al. (2013) concluded that physicians lack effective and quality education and training on how to use and manage the EHR interface. They suggested that it was not so much about the general training given to the healthcare professionals during the EHRs implementation, but how well they can apply the learned skills in their real-life practices. They concluded that designing a more robust educational and quality enhancement initiative around EHR simulation would enable researchers to impartially evaluate meaningful use of EHR in a

realistic setting, and simulated EHR could be used to provide the needed skills that healthcare professionals must learn (March et al., 2013).

In 2013, Goveia et al. (2013) investigated how evidence-based instructional interventions could be used to improve the meaningful use of EHRs with the hope of assisting healthcare educators channel the design of effective evidence-based educational interventions. After an extensive literature search and careful analysis of methodology, Goveia et al. (2013) found only seven articles published between 2002 and 2011 (i.e. Lusignan et al. 2002; Kirshner et al. 2004, Porcheret et al. 2004; McCain et al. 2008; Kushniruk et al. 2009; Lemmetty et al. 2009; and Stromberg et al. 2011) out of a potential set of 97 articles that aspired to improve healthcare professionals' meaningful use of EHRs through educational interventions or training (Goveia et al., 2013). The result from the review of the articles suggested that to enhance Meaningful Use, a combination of classroom training, computer-based training, and feedback shown to be most effective. Furthermore, Goveia et al. (2013) mentioned that training should be tailored to what the trainees need and be allowed to practice at their own time. Nonetheless, there is very limited evidence, so they concluded by recommending that policymakers, government, and hospitals should devote more time in the development of evidence-based educational interventions to improve Meaningful Use of EHRs.

Kushniruk, et al. (2009) investigated the relationship between the ability of learners to learn and master the functionalities of a system like EHR, to the extent of transferring acquired skills onto real-life settings, and "how easy it is to use a system" (p.1). Five internal medicine physicians were trained on the newly implemented commercial EHR, during which two sets of scenarios were carried out. Patients' encounter documentation of history, medications, physical information (vitals), order entry, alerts checking, letters

and discharged notes entry, were carried out to meet the meaningful use requirements (Kushniruk, et al., 2009). Four weeks after a four-hour classroom session with the initial background data collected, the five participants carried out hands-on experience using the two scenarios in their real-life work settings. After the hands-on experience, data were collected about their experience through semi-structured interviews and think-aloud practice. These data were recorded, transcribed, and qualitatively analyzed to identify the effective use of the system (Kushniruk et al. 2009). All five participants satisfactorily completed the tasks for the two scenarios, showing that they met the meaningful use requirements. However, it was subsequently noticed that most of these physicians could not properly document their patients' encounters while they were actually interacting with the patients in real life (Kushniruk et al., 2009). While initial result from the training looked promising, the result after four weeks of the training raised the question about whether enough time was given to the training and whether the environment where the training took place was appropriate. The participants in Kushniruk et al.'s study asked for additional training. Therefore, Kushniruk et al. concluded that more training is needed by physicians and other healthcare professionals during and after the implementation of EHRs, which accounts for the reported gap in training the next generation of healthcare professionals on the meaningful use of EHRs. They suggested that the hands-on training could be carried out in a simulated environment to practice the art of doctor-patient interaction while documenting into the EHR before attending to actual patients in real-life settings.

Frenzel (2010) described how third-year pharmacy students could use electronic medical records (EMRs) to acquire skills in patient-centered care. The author theorized that EMRs could be used to present disease state management cases providing a unique

learner-centric method of teaching the skills of patient-centered care to pharmacy students. The study involved 12 patient cases that were created by the faculty and an EMR for the simulated patient in a pharmaceutical care laboratory course. Students used the EMR to review patient disease states, design care plans, monitor patients, and document assessment and medication. The results showed that students gained knowledge in the management of patients' diseases using EMRs for learning patient-centered care. The students agreed that an effective use of EMR could provide an opportunity for collaboration with other members of the healthcare team in managing patients' medication. They also agreed that the information presented through the EMR correlated with the subject discussed in their didactic course work (Frenzel, 2010). Nevertheless, there are limitations to this study. The author used students' self-assessments and the self-reported outcome measures, which posed some bias in the data, and hence validity issues. Frenzel (2010) concluded that the use of EMRs and simulated patients to develop the patient-centered care skills of third-year pharmacy students was successful, as evident in the study results. Nevertheless**,** to further the use of EMR, they suggested that an appropriate outcome measure could be used for future research, which could provide objective evidence for simulated patient-centered training.

Understanding how the team environment influences the adoption and efficacy of new technology is crucial as this could be the key to helping clinical practices optimize the probable benefits of EHRs. Graetz, et al. (2015) studied the effect of cohesion on primary care teams as the proof of the effect of EHR on clinical outcome has remained mixed. Graetz et al. (2015) assessed if team cohesion between the primary care teams and their association with EHR usage would cause a change in the clinical outcome for patients with diabetes. The subject included 80,611 patients with diabetes mellitus. They

combined provider-reported primary care team cohesion with lab values for the diabetics' patients that were collected during the four years staggered EHR implementation. Using multivariate model analysis with fixed patient-level, they evaluated if the team cohesion levels changed the association between the outpatient EHR use and the clinical outcomes for these patients. Changes in hemoglobin A1c (HbA1c) and low-density lipoprotein cholesterol (LDL-C) were measured. The results showed that for patients with higher cohesion primary care teams for their HbA1c, EHR usage was associated with an average decrease of 0.11% as compared with a decrease of 0.08% for patients with lower cohesion teams. For the LDL-C the result shows that, higher cohesion primary care team had a significant decrease in LDL-C (2.15 mg/dl) as opposed to those with lower cohesion teams. Graetz et al. concluded that patients that were cared for by higher cohesion primary care teams had a modest but statistically significant EHR-related improved health outcome. The result proved that maximizing the probable benefits of EHR is dependent on how well the healthcare teams work together in the care of the patient.

Healthcare and Interprofessional Practice

Given EHR is meant to promote improvements in the coordination of patient care, its practice under interprofessional team-based care is crucial to achieving the desired quality of care (IPEC, 2011). Interprofessional practice means people from different disciplines come together to meet an individual's health needs (Rokusek, 2014). Buring, et al., (2009) described interprofessional education as education that "…involves educators and learners from 2 or more health professions and their foundational disciplines who jointly create and foster a collaborative learning environment" (p. 2). The World Health Organization (WHO, 2010) defined interprofessional education as"…when

students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes" (p. 7). The interprofessional collaborative practice was defined as "when multiple health workers from different professional backgrounds work together with patients, families, [careers], and communities to deliver the highest quality of care" (p. 7). The Interprofessional Education Collaboration (IPEC) (2016) defined interprofessional competencies in healthcare as "…integrated enactment of knowledge, skills, values, and attitudes that define working together across the professions, with other health care workers, and with patients, along with families and communities, as appropriate to improve health outcomes in specific care contexts." (p. 2). In 2009, IPEC was established, consisting of United States colleges and schools in the fields of medicine, nursing, pharmacy, dentistry and public health. In 2011, IPEC published its first report titled "Core Competencies for Interprofessional Collaborative Practice, "which focused on the objective to move away from "profession-specific educational efforts to engaging students of different professions in interactive learning with each other" (IPEC, 2011 p. 3). This core competency is made up of four interprofessional collaborative practice domains (a) interprofessional teamwork and team-based practice; (b) interprofessional communication practices; (c) roles and responsibilities for collaborative practice; and (d) values and ethics for interprofessional practice (IPEC, 2011). The interprofessional practice is essential, as planning is in place for foreseeable reform in the area of interprofessional team-based practice since collaborative practice is fast becoming a key player in the future of health professions' education and effective healthcare delivery (Zorek & Raehl, 2012; WHO, 2010; IPEC, 2011; Kochar, 2012). To that extent in 2016,

IPEC board released its updates to the core competencies for interprofessional collaborative practice document with a three-fold purpose:

- "Reaffirm the value and impact of the core competencies and sub-competencies as promulgated under the auspices of IPEC" (IPEC, 2016, p. 1)
- "Organize the competencies within a singular domain of Interprofessional Collaboration, encompassing the topics of values and ethics, roles and responsibilities, interprofessional communication, and teams and teamwork" (IPEC, 2016, p. 1).
- "Broaden the interprofessional competencies to better achieve the Triple Aim (improve the patient experience of care, improve the health of populations, and reduce the per capita cost of health care), with particular reference to population health" (IPEC, 2016, p.1).

In the original IPEC document (IPEC, 2011), the four core competency domains stated above were proposed within interprofessional education (IPE), but since 2011 interprofessional collaboration has come to be accepted as its own domain. The creation of this shared classification among the healthcare professions has helped to make the efforts of educational activities, associated assessments, and evaluations more efficient and synergized (IPEC, 2016). It has "broadened the interprofessional competencies to better achieve the Triple Aim (improve the patient experience of care, improve the health of populations, and reduce the per capita cost of health care), with particular reference to population health" (IPEC, 2016, p. 1). Effective interprofessional collaborative practice (IPCP) has been acknowledged as very important to medication safety; however, the published study in this area has been very narrow. The Institute of Medicine (IOM) defined interprofessional collaboration as "a type of interprofessional work involving

health and social care professionals who come together regularly to solve problems, provide services and enhance health outcomes" (IOM, 2015, p. xii). According to WHO more that 50% of all medications have been prescribed, dispensed or administered wrongly. There have been consistent and substantial attempts to tackle this issue of medication errors but it has continued to be a challenge across the globe (WHO, 2012). In an effort to find solutions to this issue, Wilson, Levett-Jones, Gilligan, and Outram (2016) studied the perspectives and experiences regarding IPCP and medication safety of Australian nurses, pharmacists and doctors who recently graduated and were currently practicing. They evaluated specific IPCP strategies in relation to medication safety. Sixty-eight participants took part in the study. They came in with varied initial experience with IPE and majority with little or no experiences at all. The authors conducted a focus group with a semi-structured discussion with several open-ended questions to obtain information about the experiences of the participants working as a member of an interprofessional team. The team communicated with other members of the IP team about prescribing, dispensing, and administering medications. A thematic analysis of the transcript revealed that the quality of IPCP is affected by how much each member of the team understands and values the "particular skills and expertise of the others, and respects each person's unique contribution to the work of the team" (Wilson et al., 2016, p. 650).

Simulation in Healthcare Instruction

Recent advancement in the use of technology has brought further attention to the use of simulation for training. Simulation training has been in existence as far back as the early 1900s, beginning with its use in the military and aviation industry, where flight simulators were developed and used to train pilots to acquire efficiency in their crafts.

Since then, aviation simulators have advanced so much that it is now becoming difficult to differentiate its simulation experience from reality. Simulation training gives the learners opportunity to practice in a risk-free setting (Burrows, 2013). The aviation industry capitalized on the importance of simulation training, and now the healthcare industry have come to realize as well that making mistakes could be a valuable part of learning process, and simulation training would foster the learners to immediately learn from their mistakes and keep trying in this risk-free environment until the skill is mastered. Hence, the development of human patient simulators. Anderson et al. (2008) made an important distinction between simulation as a technology and simulation as an educational strategy. They defined simulation-based training as "an experiential learning strategy that invokes reflective practice. The learner is immersed in a realistic situation (scenario) created with a physical space (simulator) that replicates the real environment with fidelity sufficient to achieve suspension of disbelief on the part of the trainee" (p. 596). For example, starting from simple simulation exercises to a more complex one, simulation education could be achieved through the use of technology tools, like task trainers (low fidelity), high fidelity mannequins, virtual patients' avatars, and computer-based scenarios, as in the 3D multiplayer virtual world like Second Life®. Learners could learn how to intubate by practicing these skills on low fidelity mannequins, and they could learn how to do needle decompression on a high fidelity mannequin in a healthcare setting that is very similar to the real thing without the fear of putting the actual patient at risk, as simulation training protects the learner and enables them to perfect their skills. Similarly to Anderson et al. (2008) Lateef (2010) stated that simulation is a technique and not a technology for practice and learning to replace and amplify real world experiences with guided knowledge that is often immersive in nature, and reproduces significant

portion of real-life experiences in a completely interactive way. However, Burrows (2013) added that it is the application of the technology that makes simulation training a lot more effective. Other benefits of simulation-based training in medicine include serving as tools in learning to alleviate ethical pressures and resolve real-world problems. Also, structured learning experiences could be designed using the simulation-based education techniques, tools and strategies to aim at training healthcare professionals' teamwork competencies and practice as interprofessional medical teams, which according to Lateef (2010) "offer an additive benefit to the traditional didactic instruction, enhance performance, and possibly also help reduce errors" (p. 1). Two key studies that have reported on how simulation is used in medical education are discussed here. They include Okuda, Bryson, DeMaria, Jackbson, Quinones, Shen, and Levine (2009) and Chakravarthy, ter Haar, Bhat, McCoy, Denmark, and Lotfipour (2010).

Okuda et al. (2009) used data from reviewed articles through a MEDLINE search of original articles that are related to simulation in medical education to test their theory on simulation as an educational tool. They theorized that:

> The effectiveness of the simulator as an educational tool not only depends on the ability of the simulator to realistically emulate human physiology and physiological responses, but also depends on the specially designed facilities and the expertise of the educators to accomplish full-environment simulation (FES) that triggers these emotions (p. 332).

Some of the challenges in the current healthcare system have been that patients are known to have become gradually apprehensive that medical students and residents are practicing on them. This concern has brought to the forefront the issue of patient safety, medical errors, and more students feeling that they are not receiving adequate training in

the clinical environment. Okuda et al. (2009) stated that these current challenges could be addressed through effective integration of simulation into medical education, thus their reviews of the evidence for the utilization of simulation in medical education. Okuda et al. (2009) focused their study on the educational theory behind simulation, and its application to undergraduate and graduate medical education, and continuing medical education that sees medical learners as adult learners. They pointed out Bryan et al.'s (as cited in Okuda et al., 2009) five adult learning principles, which built on Knowles' (as cited in Okuda et al., 2009) adult learning theory that is applicable to the medical learner. They also suggested that Kolb's experiential learning model could benefit the medical learners if the model is built on concrete experience. For example, debriefing that was usually difficult to carry out in a regular clinical learning experience was successfully accomplished in a simulated environment (Savoldelli, Naik, Park, et al. as cited in Okuda, 2009). Other benefits of the use of simulation that Okuda et al. (2009) noted were that simulation-based training could be used to teach cognitive and psychomotor skills and evaluate knowledge gaps in medical students and residents. Okuda et al. (2009) concluded that the use of simulation in medical education both at the undergraduate and graduate levels has been established in various specialties, and that these technologies should be expanded to medical credentialing and certification. They also called for more studies to see if simulation-based training improves patient outcomes.

In response to Okuda et al. (2009) for continued research on simulation-based training, Chakravarthy et al. (2010) studied the use of simulation in emergency medicine (EM) medical student clerkship. Their study was based on the need to investigate both the occurrence and form of simulations that are being used to train medical students in EM clerkships. They carried out a literature search on PubMed using combinations of

keywords like education, simulator, medical students, and found few articles within the last ten years on the use of simulation in EM clerkship. Benefits of the use of simulation range from helping to strengthen students' knowledge base, evaluating their performances, enhancing their understanding of basic science, to the opportunity for the students to learn new skills while working in a safe environment. Chakravarthy et al. (2010) found that the growth of simulation training in EM residency programs shows that 122 programs out of 134 residency programs used one form of simulation equipment as a tool to train their residents in the area of professionalism and assessment. They concluded that available evidence on the simulation utility is still weak and they therefore suggested that future research should focus on (a) determining the most effective approach while comparing used educational modalities with simulation training in undergraduate medical education, and (b) assessing the influence of simulation on patient care, safety and satisfaction.

Simulations and Instructional Design

The effectiveness of any simulator that is used for instructional purposes depends largely on the instructional objectives and educational context (Cook, Hamstra, Brydges, Zendejas, Szostek, Wang, Erwin, & Hatala, 2013). Three theories that have been reported in the literature as useful in designing simulations are presented here including Gibbons, Mcconkie, Seo, and Willey's (2009) microworlds; Kolb's (1984) experiential learning theory, and Clark's (2004) guided experiential learning.

Gibbons, Mcconkie, Seo, and Willey (2009) termed simulation as a microworld which they described as a model-centered environment in which learners use tools and parts that are provided by the designer to construct a model that they could interact with through guided experimentation. This approach is in line with a recent definition of

simulation by Cook et al. (2013), where they quantified simulation as technology-enhanced educational tool which the learner physically interacts with to imitate a feature of clinical care for training and assessment reason. Similarly, Gibbons et al. (2009) clearly differentiated *instructional* simulation as the interaction of the learners with this microworld or simulation. That is learners' interactions with a dynamic, changing, computable model of which new states of such model are uncovered by the learner's action through continuous computations. Gibbons et al. (2009) believed that the design of simulation-based training should be guided by a theory-based design approach of microworlds and instructional simulations through the adoption of a common knowledge base in the area of simulation. In an attempt to add to this common knowledge base by earlier researchers (Alessi & Trollip, de Jong & Merrill, Munro, Breaux, Paltrey, Sheldon, Reigeluth & Schwartz as cited in Gibbons et al., 2009), Gibbons et al. (2009) sought to provide answers to the following research questions: (a) what are instructional simulations and microworlds? (b) what underlying structural principles relate them together? (c) what design principles apply to the entire class of instructional simulations and microworlds? In their research, they expressed the theory behind the simulation approach to instruction by depicting the design of instructional simulation architecture under seven functional titles, which were further broken down into several guiding principles as stated:

1. Content function: supply model content
2. Strategy function: implement instructional augmentations
3. Control function: provide user controls
4. Messaging function: generate message units
5. Representation function: generate and assemble representation elements

6. Media-logic function: executive representations and computations

7. Data management function: manage data resulting from interactions

Gibbons et al.'s (2009) findings illustrated that the simulation-based instruction should contain one or more dynamic models of physical or conceptual systems that engage the learner in interactive activities that will cause a change in the model state in a non-linear logic fashion. The model change could boost the instructional function as the simulation is carried out under specified instructional goals, and even under interprofessional team-based practice. Gibbons et al. (2009) concluded that the theories behind the specific principles under the seven functional titles would guide in the design of a simulation-based instruction.

Another theory that has been used frequently in the literature to support the design of simulation is experiential learning theory (ELT). Kolb (1984) is an American educational theorist who believed "learning is the process whereby knowledge is created through the transformation of experience" (p 38). Kolb's theory is comprised of four stages, which he described could begin at any stage because of the theory's cyclical model of learning; however, Kolb advised that these stages should follow each other in a continuous spiral. That is, although the learner could join in the cycle at any stage, such learner would eventually have gone round the four stages of the learning cycle at the end of the experience. Kolb's four-stage model of learning (Figure 1) as represented in his experiential learning circle are: (a) concrete experience in which the learner takes part in an experience like simulation activity, (b) reflective observation in which the learner reflects on the experience, (c) abstract conceptualization is when the learner ponders thoughts and reflection to identify the importance of the learning experience, and ponders what could have been done differently to boost the outcome, and (d) active

experimentation which entails utilizing what has been learned to manage future practice (Kolb & Kolb, 2009; Poore, Cullen, & Schaar, 2014).

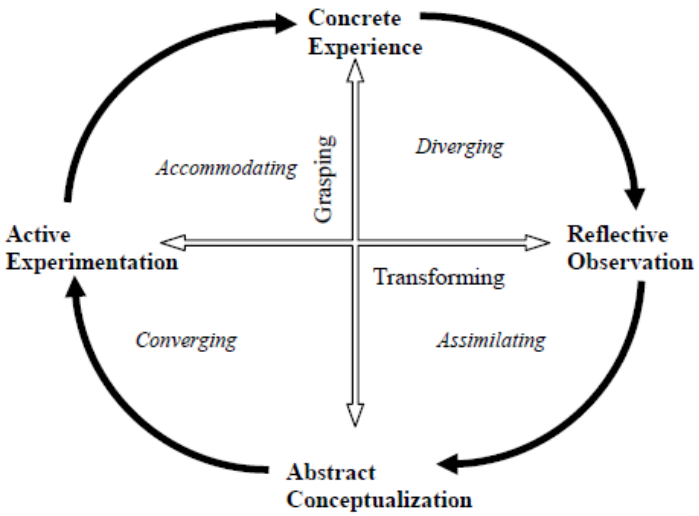

Figure 1. Experiential Learning Circle. "Experiential Learning Theory: A Dynamic, Holistic Approach to Management Learning, Education and Development," by A. Y. Kolb and D. A. Kolb, 2009, SAGE Handbook.

Kolb (1984) illustrated the use of concrete, "here-and-now" experience to test ideas, and the use of feedback to change practices and theories (pp. 21-22). Kolb joined his theory with that of Dewey, Lewin, and Piaget stressing the developmental nature of the learning exercise, research and laboratory training, and appreciation of cognitive development respectively. He named his model to emphasize this link and to highlight the significant role that experience plays in learning. Although Kolb's model is without limitations as noted by some researchers regarding the validity of the model and its generalization (Jarvis 1987; Tennant 1997). Nevertheless, other researchers have successfully applied Kolb's experiential learning model in their studies (e.g., Poore,

Cullen, & Schaar, 2014; Kim, Oh, Kang, & Kim, 2014). Kolb's theory states that learning occurs and knowledge is acquired by an individual through personal experiences or simulation, and the evaluation of the thoughts of the students as it relates to the experiential activity (Kolb, 1984).

Poore, Cullen, and Schaar (2014) used Kolb's experiential learning theory to guide the design of a simulation-based interprofessional education (IPE) module that was intended to advance the process and foundation for acquiring the knowledge that would be based on the needs of each individual learner. Poore et al. (2014) attempted to provide a solution to the issue of lack of communication and collaboration skills necessary for health profession graduates to practice effectively in a team-based environment. Lack of communication is largely attributed to the fact that students in the various health professions (e.g., medicine, pharmacy, and nursing) do not interact much with each other. Their stance on the issue aligned with Institute of Medicine (IOM) emphasis on the importance of interprofessional practice. In which IOM (2003) attributed lack of adequate training and activities at interprofessional level to deficiency in good communication, and collaboration amongst different health professions specialties during patient care, leading to poor quality of service (IOM, 2003).

According to Poore et al. (2014), several theories have been identified in the literature that could be used as guides to IPE studies. Amongst those are Knowles' adult learning theory, and Benner's novice to expert model (Barr, Kaakinen & Arwood, Sargeant, as cited in Poore et al., 2014). However, there are differences between these theories. For example in Knowles' adult learning theory, members of the group shared learning responsibilities, unlike in Benner, that did not account for learning that occurs in groups (i.e. IPE experience). In contrast, Kolb's theory addresses "individual learning

styles and presents a cyclical process that allows learners to acquire knowledge during each phase of the learning cycle" (p. e244). Poore et al. (2014) discussed operationalizing Kolb's experiential learning theory (ELT) for simulation-based interprofessional education by illustrating that simulation-based IPE instructional design could enhance communication and collaboration among health profession students. The authors affirmed that the simulation signifies the actual experience of learners under Kolb's model. Given that reflective observation occurs during and after the simulation debriefing phase, the students were able to consider the relevance of the IPE experience and application of the acquired knowledge to new condition. Poore et al. (2014) concluded that Kolb's ELT advances the process for delivering IPE and the mechanism to boost the learning of each individual student. The outcome of the Poore et al.'s (2014) study had significant implications for future implementation of IPE simulation experience, and Kolb's ELT could provide strategies for effective design, development and implementation of such simulation experiences. Other researchers that have successfully applied Kolb's experiential learning theory to their study are Kim, Oh, Kang and Kim (2014). The design and development of their study were guided by Kolb's experiential learning model.

A third theory that is gaining more traction in the design of instructional simulations is Clark's (2004) guided experiential learning (GEL). It began with a request through the federally funded project to evaluate a number of training design systems and models that are focused on a learner "experience" of problems and solutions. Clark (2004) evaluated experiential learning approaches that were currently popular at the time, such as problem-based learning, constructivist learning and inquiry-based learning, and came up with a theory that a learner can achieve the most effective training when they are trained under a

design strategy that emphasizes a high degree of structure and guidance during authentic instructional activities (Clark, 2004). That is, the trainee receives robust initial direction for learning expert-based strategies.

GEL is designed to encourage the training of flexible or adaptable experts, who can apply their skills and knowledge from their routine states to new situations when their current states shift and change. In GEL, every learner must receive both conceptual and procedural understanding about how a task should be performed and how to solve a problem under the following guidance: clear procedures, accurate demonstrations of authentic field-based problem solving, practice on increasingly difficult problems accompanied by proficient feedback to correct faulty insight (Clark, 2005, 2008). Clark (2004) based the design of GEL on design criteria by previous researchers like DeCorte (2003) and Merrill (2002) by attempting to advance the development of adaptable expertise through the application of all the empirically identified training approaches that encourage flexibility (Clark, 2004, 2005, 2008). The design process model of GEL course includes eighteen tasks that designers perform (Figure 2).

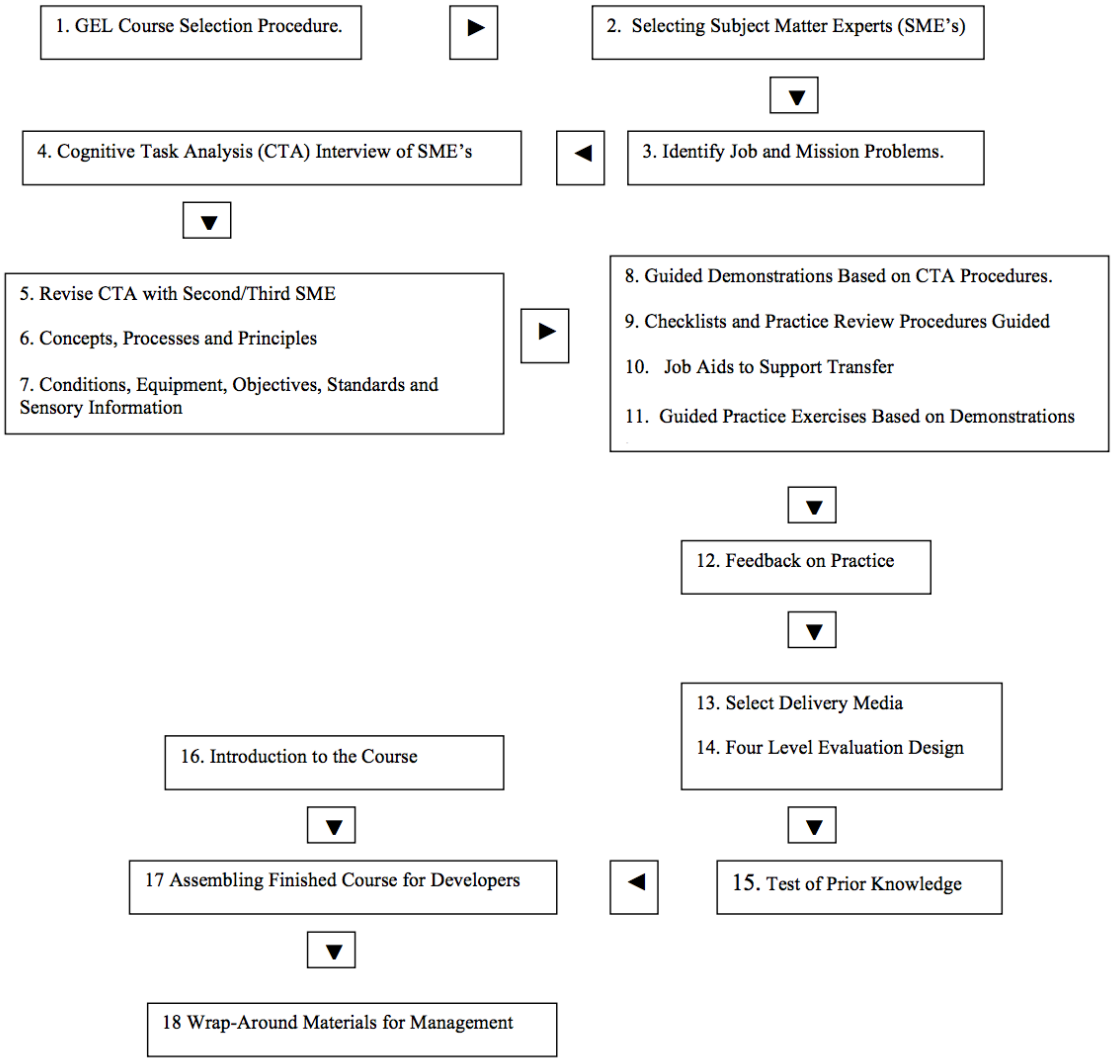

Figure 2. GEL Course Design Process Model (Clark, 2004, 2008, p. 10).

While Figure 2 shows the entire process model, Figure 3 focuses specifically on the course and lesson structure.

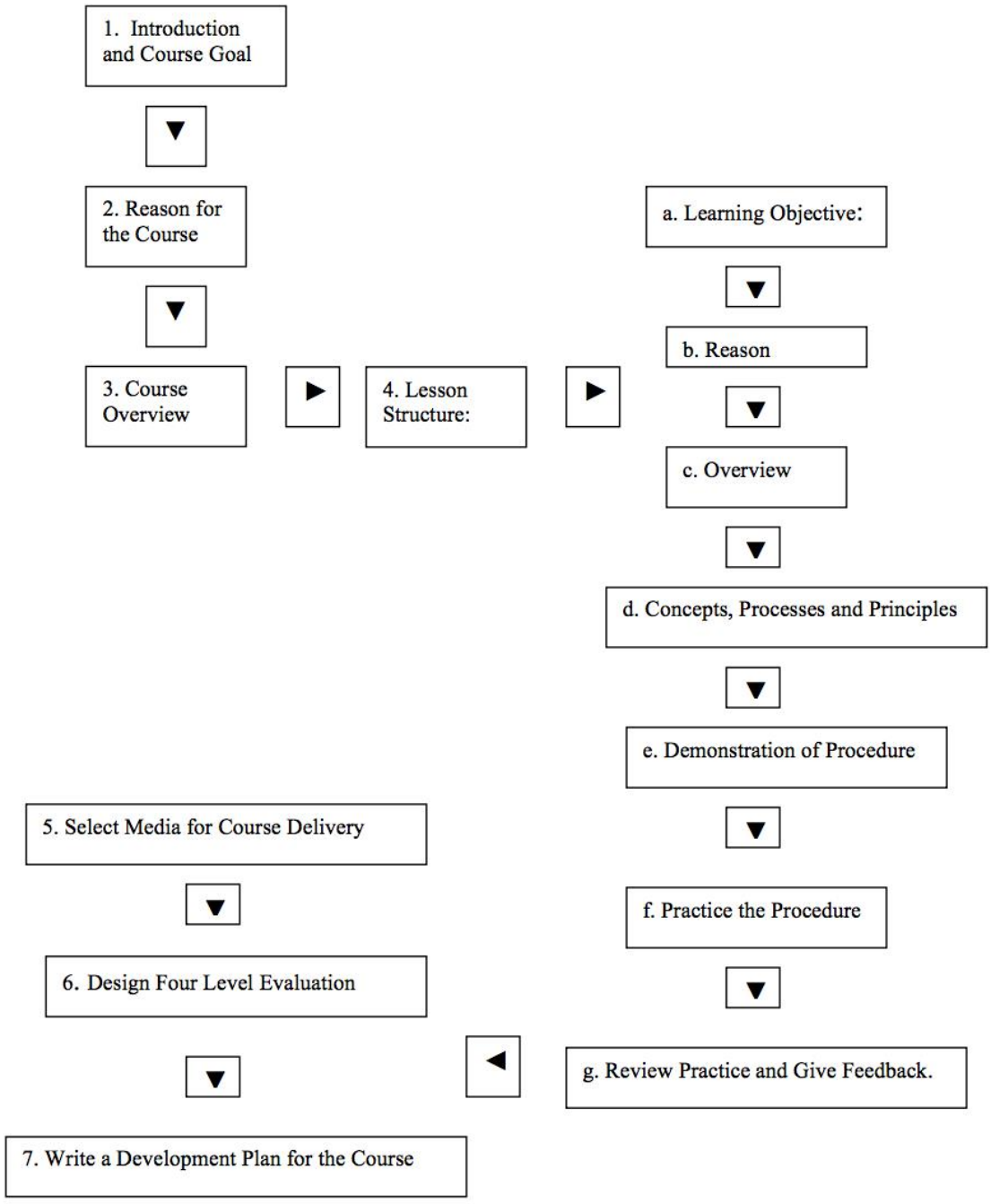

Figure 3. GEL Course and Lesson Structure Model (Clark, 2004, 2008, p. 69).

One example of the use of GEL that was noted by Clark (2005) was its use with immersive simulation and games. Immersive training is a methodology to simulations and games that delivers an outstanding "opportunity for flexible demonstration (during training) and practice (by trainees after training) of complex skills" (p. 11). The Institute

of Creative Technology, where Clark (2005) is the director, developed an immersive simulation module called the "SLIM ES3" using the GEL model. The goal of the simulation module was to "teach soldiers to be observant and aware of their surroundings when they are potentially in harms way" (p. 13).

Another example was found in the study by Craft, Feldon, and Brown (2013). Craft et al. (2013) compared two instructional design models, experiential learning theory (ELT) by Kolb (1984) and guided experiential learning (GEL) by Clark (2004). Craft et al. (2013) compared ELT and GEL to determine which method would be most effective for training the central venous catheterization (CVC) procedure. ELT is commonly used as the basis for the design and assessment of simulation-based learning and it features as a minimally guided model. However, there is currently no empirical validation of this model or direct comparison with another type of model to compare its efficiency. GEL, on the other hand, provides the learners with a high degree of guidance during the instruction in such a way that individual activity is highly structured with exact information about the targeted learning goal. In comparing these two models, Craft et al. (2013) presented two hypotheses (1) after controlling for the influence of individual differences in practice time, the estimated marginal mean on the skills checklist will be significantly higher for the GEL group than for the ELT group. (2) Participants in the ELT condition will be more likely to fail the checklist assessment because of either a score, 70% or a critical action error. They used quasi-experimental design and randomly assigned participants to either model (ELT or GEL). The sample for their study consisted of 32 participants that were enrolled in the University of South Carolina (UCS), who must demonstrate competency in performing CVC before they graduate. Twenty-one participants were first-year students, and the remaining 11 participants were second–year

students. These participants were asked to complete entry survey on arrival at the simulation center, and afterward the training video started. For the ELT group, the video showed that the learner should start with the case study, while for the GEL group, the video is meant to start with a series of overviews of the procedure followed by specific instruction on the procedure. The instrument used for the study was an evaluation checklist, which was used to evaluate the performance of the participants on the simulated CVC task through a one-way glass. Craft et al. (2013) analyzed their data using one-way, one-tailed analysis of covariance (ANCOVA) with the condition (ELT and GEL) as the independent variable. The individual's practice time was the covariance, and the dependent variable was the total checklist. The result of their analysis showed that participants in the GEL group performed significantly better that those in the ELT group. Craft et al. (2013) therefore concluded that the GEL model of instructional design is significantly more effective than ELT for simulation-based learning of the CVC procedure, which was true for their two hypotheses. However, they recommended the use of multiple programs, varied simulator model, and larger sample size for future research work to extend the generalizability to other technologies and populations. Given GEL and cognitive task analysis (CTA) will be used to guide the design of the instructional simulation, a detailed description follows.

Guided Experiential Learning (GEL) and Cognitive Task Analysis (CTA)

Guided Experiential Learning (GEL)

The GEL design model provides strong guidance that is aimed to bolster learning processes for all learners. As such, every training is an effort to assist people to learn how to achieve performance goals by guiding their planning, connectivity, and selection, monitoring of practice, feedback and adjusting their knowledge to reflect feedback. The

GEL design approach reflects mental architecture that provides accurate and complete information on all necessary actions and decisions through cognitive task analysis; an interview technique that GEL system encourages and uses to capture the unconscious knowledge from SMEs that could be used in training. The completed information captured must be rooted in learning plans packaged with guided demonstrations, practice, and feedback in the early stages of learning, especially in a new area of practice. Immersive simulations and games promised to be a suitable foundation for such demonstrations and practice of skills until mastery (Clark, 2004, 2005, 2008). Immersive training is "an approach to simulations and games that provides an excellent opportunity for flexible demonstration (during training) and practice (by trainees after training) of complex skills" which is mostly carried out in an exciting gaming environment (p. 11).

Cognitive Task Analysis (CTA)

In general, task analysis represents the "collection of procedures for defining the content of an instructional unit" (Morrison, Ross, Kalman & Kemp, 2011, p.78). Task analysis is an important step in the process of instructional design. It is a way of defining the content of instruction by breaking a skill into smaller, more manageable steps so as to teach such skill effectively (Franzone, 2009; Morrison, et al., 2011). However, while ordinary task analysis only tries to describe the obvious actions essential to accomplish a task, *cognitive* task analysis goes beyond this ordinary approach.

Cognitive task analysis (CTA) is an interview method that helps to uncover the hidden (tacit) knowledge the SMEs possess and transform that knowledge into a procedure that the learners can use. CTA communicates the decisions that are required to be made, the benchmarks for making such decisions, and the impact of the decision taken. According to Clark (2005), in guided experiential learning (GEL), CTA is the

backbone of the training design, with the expectation that with practice the learners will ultimately be able to carry out tasks like experts. CTA is a very important element in GEL design because GEL requires a clear description of all critical actions and decisions that are crucial for the learners to accomplish important learning goals. As such, if a task documentation does not contain these clear procedures, then it becomes vital to get this information from the experts through the CTA interview. SMEs, who have been highly successful at such tasks to be taught to the learners, are interviewed to extract knowledge they possess. This process could be complicated as knowledge from experts are largely unconsciously automated, which could make it difficult to extract without the extra help because most of the time experts are not always able to clearly communicate to a novice how things are done. Effective CTA interviews will help experts to better communicate how they solve problems or perform tasks. CTA includes asking the SMEs questions such as:

- Describe the problems and tasks that students should be able to solve and perform successfully after training.
- Describe the sequence of tasks students should be able to perform, and the kinds of routine problems they should be able to solve if they have learned each of the main tasks or problem solving required for this job. (e.g. what is the first task they must handle? or start with the simplest one to more complex one)
- Is there anything that students must be able to do before they perform this task (or solve this problem)? For example, must they make a decision that leads them to this task? Or is there anything they need to do after this task before they tackle the next task on your list – anything else we need to note?

Once the CTA interview is conducted, the SME reviews the lists of tasks to confirm that nothing is missing. Clark (2005) notes that task analysis done by one SME is given to another SME to review for accuracy and efficiency. Once the CTA is complete and all tasks have been reviewed for accuracy and efficiency, the design phase can begin.

Design and Development Research

According to Richey and Klein (2007), research design is the "blueprint that guides researchers throughout their project" (p. 36). The research design is a planning process that establishes the overall framework or outline of a study that attends to each phase of the research process. Nonetheless, research design is not rigid instruction for carrying out the study, as it allows the researcher to respond to emerging situations during the study, thereby permitting some flexibility in the study's implementation. Research design could vary depending largely on the study's orientation, that is, quantitative or qualitative. Hence Richey and Klein (2007) termed the design and development of research, and they described it as the use of collections of conventional approaches and strategies for both quantitative and qualitative methods. The choice of either quantitative or qualitative depends very much on the nature of the research problem and question, and also on whether the research approach will be a product and tool research or a model research. From the literature, many research methods are commonly used in design and development studies (Visser, Plomp, Amirault, & Kuiper, 2002; Kim, Oh, Kang, & Kim, 2014). For example, Kim, et al. (2014) designed a simulation-based fever management module for children with febrile convulsion. The module was designed for nursing students to practice in clinically relevant situations, where they illustrated a product and tool development study that used both quantitative and qualitative strategies. Their

strategies included case scenarios, field observation, evaluation, content analysis, and survey.

Kim et al. (2014) used a simulation-based module to educate the nursing students on comprehensive understanding of fever and fever management. Fever is an extremely common symptom found in pediatric care units, and which could easily result in febrile convulsion in children if not adequately controlled. Kim et al. (2014) anticipated that the simulation-based experiences would help the nursing students to overcome their fear of febrile seizures and allow for meaningful learning, active participation, and nursing practice that mimics a real-life clinical setting in preparation for real-life experience. Kim et al.'s (2014) study involved 147 senior students from two nursing schools in South Korea that took part in the study for six weeks. The research method used for the development of the simulation-based fever management module, together with an evaluation for treating children with febrile convulsion, included three stages:

1. Stage 1: developing the simulation-based module. This stage included the formulation of a three-step scenario script algorithm to resolve the problem with the health of the patient. That is, (a) identification of patients' condition, (b) nursing intervention, and (c) outcome evaluation and feedback. Furthermore, in this stage, items in the checklist were selected, reviewed and analyzed by expert panel, which also included the item contents of the debriefing,
2. Stage 2: developing programs for nursing students. This stage involved the simulation session setup of the high-fidelity patient simulator, the simulation room schedule and the provision of students' orientation. Observation of students' performance during the simulation and debriefing were also carried out at this stage

3. Stage 3: evaluating the simulation-based module and validating the dimensions. During this stage, the evaluation checklist was administered, and the students' performance was evaluated as a group. Additionally, student satisfaction with the simulation was measured using Levett-Jones et al. (2011) Satisfaction with Simulation Experience Scale (SSES).

The SSES was used to measure student satisfaction, and Matrix Method (Garrad, 2007) was used to analyze the debriefing data. Data were collected through an evaluation checklist that consisted of 37 items broken down into preparation assessment and scored based on 4-point Likert scale (1=beginning, 2=developing, 3=accomplished, 4=exemplary). A higher score on the evaluation checklist signified better performance on the part of the participants. A content validity test resulted in an index above 80% (Waltz & Bausell as cited in Kim et al., 2014). The results showed that the students better understood the experiences of the febrile infant caring that they will encounter in their real-life clinical practice. However, the study was limited by the small sample size and geographical location, which could hinder generalization. Kim et al. (2014) concluded that a large sample size with two or more geographical locations would provide valid and more reliable data. Kim et al. (2014) suggested the need for further research to study the effect of the checklist used under a different context using their study as a blueprint. Kim et al.'s (2014) design framework and evaluation checklist served as the blueprint for this study on the development and evaluation of simulation-based instructional EHR module for students in an inter-professional team-based learning environment. However, whereas Kim et al. based their design on Kolb's (1984) experiential learning theory, this study used Clark's (2004) guided experiential learning theory to guide the instructional design of the EHR simulation.

Summary

A detailed review of the literature on topics relevant to the research problem and goal was conducted. Relevant studies in the areas of EHR instructional interventions, healthcare interprofessional practice, simulations in healthcare instruction, simulations and instructional design, and design and development research were presented. The next chapter describes the research methodology including the overarching research design and specific methods that were used to carry out the research phases.

Chapter 3

Methodology

The problem is that healthcare professionals are not proficient in EHR meaningful use and interprofessional collaborative practice core competencies, and existing instructional interventions that focus on this topic do not adequately address this skill deficiency (Wilson et al., 2016; Goveia et al., 2013; Elsevier, 2013; Krupa, 2012). To address the lack of adequate instructional intervention on electronic health information technology and interprofessionalism, as well as, the limited guidance on the use of experiential learning in healthcare, the goal was to design and develop a simulation-based instructional module on EHR meaningful use and interprofessional core competencies, and evaluate students' performance and satisfaction under an interprofessional team-based setting. This design and development research included the development of a simulation-based instructional module to train an interprofessional cohort of health professions students in the application of EHR meaningful use and interprofessional core competencies, including communication and collaborative team-based practice. The students' performance was evaluated under an interprofessional team-based setting.

In this chapter, the research design is described in detail. The overarching research methodology, design and development, is described along with the three phases of implementation: prototype design and internal validation; instructional simulation development; and pilot testing with interprofessional student cohort. Instruments are described along with methods for testing reliability and validity. An explanation of how the design answers the research questions is provided followed by a chapter summary.

Research Design and Methods

A design and development research approach (Richey & Klein, 2007) was used as the overarching methodology. Kim et al. (2014) is an example of how design and development research work is conducted Kim et al.'s (2014) research design was used a blueprint within the context of simulation-based instruction for EHR meaningful use and interprofessional core competency. While Kim et al. used Kolb's (1984) ELT to guide their instructional design, Clark's (2004, 2008) GEL guided this instructional design. The instructional module was designed to engage students across the health professions in an interactive and simulated learning environment. The study was organized into three phases: phase 1, prototype design and internal validation; phase 2, instructional simulation development; and phase 3, pilot test with interprofessional student cohort. Following is a detailed description of each phase.

Phase 1: Prototype Design and Internal Validation

During this phase, interviews with five subject matter experts were conducted to elicit information that was needed for the development of the instructional module. The CTA procedures were used to guide the interviews (Appendix A). Next Clark's (2008) course and lesson structure model was used to create the design document and prototype of the instruction (Appendix B). Interprofessional faculty, who are the course directors, reviewed the prototype for accuracy of content, and the instructional designers reviewed the simulation design to ensure it reflected an appropriate instantiation of GEL (see Appendix C for results).

Phase 2: Instructional Simulation Development

Phase two involved the full development of the immersive simulation game in Second Life®. Second Life® is a 3D virtual world environment that the researcher's institution uses to train its medical students. For example, students can develop clinical skills through the practice of observing art. SecondLife mimicks a real-life clinical and art gallery setting where students choose avatars and interact with the virtual environment at anytime, and from anyplace, to practice their clinical skills. Specifically, the fourth year medical students create an alter-ego (avatar) of themselves, fly into the Second Life® 3D virtual world, and go into the virtual art gallery center to begin the art observations module. While in this module, the student teleports into the virtual clinic to carry out a virtual patient encounter by diagnosing the patient based on the skills accquired during the initial virtual art observation. Furthermore, the students learn how to do a contour drawing of themselves, and get their canvas placed in the virtual art observation exhibition hall. Finally, the students solve a jigsaw puzzle game, after which they teleport back to the virtual patient's clinic room to re-assess the patient based on their overall expereinces with the entire module virtual art observation session.

This instructional module involved the development of the simulation-based medical educational game (SimMedG). SimMedG is a team-based strategic action game that immerses the player into an interprofessional team-based setting. The instructional activities in this development were built using the authoring tool, Adobe Captivate. The activities included a series of embedded audio, and videos of real-life stories, and interactive gaming activities. The player goes through these initial activities to build the understanding of the concept of EHR meaningful use and interprofessional collaborative practice core competencies. Upon mastery of the concepts determined by the assessment

feedback, the player moves on to the next level of higher complexity, and plays a game that tests the comprehension of one's role and those of other professions as a part of an interprofessional team. The player continues to play until appropriate mastery level has been reached at which point the player gains access to the final level (Application Level), which is the ultimate challenge. At this level, the player is admitted into a complex 3D virtual world simulation environment called Second Life®. Here, the player applies the knowledge and experience gathered from the previous activities in this virtual world. The player assumes a certain health professional role (i.e. a physician, nurse, or pharmacist), and aims to work together with a cohort of other healthcare professionals in the treatment care plan of patient present with Type 2 diabetes and dementia. In the activity, the participants engage in the treatment management of diabetes-dementia patient to promote patient-centered care and safety under interprofessional team-based settings, while adequately observing each other's professional roles and responsibilities. Appendix D consists the links to the prototype.

Phase 3: Pilot Test with Interprofessional Student Cohort

After the instruction was designed and developed within the simulation environment, it was pilot tested with a small interprofessional cohort of students. Prior to implementing this phase, permission to conduct the study was obtained from the Institutional Review Board (IRB) at Nova Southeastern University (NSU). See Appendix E for a copy of the approval letter. Initially, the plan to recruit participants was to use simple random sampling (Gay, Mills, & Airasian, 2011) of ten students each from medicine, pharmacy, and nursing for a total of 30 NSU Health Professions Division (HPD) students who are in their third year. However, after several attempts to recruit participants using this process, it was necessary to increase recruitment efforts. Thus, a

recruitment flyer with an extra incentive (Appendix F) was created, submitted, and approved as an amendment to the IRB. The extra incentive added consist of a $10-$15 gift card from merchants like, Panera Bread, Target, Dunkin Donut, etc.

The duration of phase three including pilot testing and data collection of the instructional module lasted approximately 13 weeks and included the following activities.

- **Pre-Assessment:** After participants completed the informed consent, they completed a pre-assessment survey, which took an average of 25 minutes. A detailed description of this assessment instrument is presented under the Instrumentation section.
- **Foundational Knowledge and Skills:** Following the pre-assessment, participants completed online game-based activities designed to build their understanding of basic concepts relating to EHR meaningful use and competencies relating to interprofessional collaborative practice. Completion of these activities took an average of 42 minutes.
- **Student Orientation:** Following this basic training students participated in a brief orientation which included how to work the 3D virtual world environment, and obtain scenario information regarding the past history, chief complaint, and present health condition of the virtual patient.
- **Pilot Test:** Students were provided with background information about the patient (i.e. synopsis, history). They were given five minutes to review the case scenario in the EHR. Then they worked as a member of an interprofessional team to come up with a treatment care plan for the patient. The interprofessional faculty reviewed the participants' performance and provided the participants with

feedback and debriefing comments. The virtual world experience took participants approximately one hour to complete.

Instrumentation

The following instruments were used in phase 3 to collect the data on the students' experience and performance with the instructional simulation:

Pre-Assessment

A validated pre-assessment survey developed by Brock, et al. (2010) was adapted for the purpose of this study and administered via Opinio, a web-based survey tool. This pre-assessment was used to measure participants' entry knowledge (See Appendix G).

Evaluation Checklist

Student performance was evaluated through observations by Dr. Joseph DeGaetano (Medicine), Dr. Jaime Riskin (Pharmacy), Dr. Caroline Smikle (Nursing), and Dr. Genevieve Hale (Pharmacy) using an evaluation checklist adapted from Kim et al. (2014). Kim et al.'s evaluation checklist, which focused mainly on nursing process, was modified and extended to include interprofessional competency goals. The authors granted permission to use the checklist and modify it for the purpose of this study (See Appendix H. The modified evaluation checklist was reviewed by experts including Naushira Pandya, M.D. CMD, FACP, Dr. Jaime Riskin, PharmD, BCPS, Dr. Cecilia Rokusek, EdD, Dr. Lisa Soontupe, EdD, RN, Dr. Joseph DeGaetano, DO, MSEd, FAAFP, FACOFP to ensure validity and reliability.

Satisfaction of Simulations Experience Scale (SSES):

Developed by Levett-Jones et al. (2011), the SSES was used to measure students' satisfaction. See Appendix I for authors' permission and the instrument. This instrument was adapted to assess the students' experience with the EHR meaningful use and

interprofessional core competencies gaming activities and the virtual world interprofessional clinical skills experience. The instrument was administered in two parts. Part 1 asked for participants' feedback on the instructional gaming activities and the experience during the virtual world patient encounter. Part 2 included the feedback of the debriefing experience.

Alignment of Methods with Research Questions

Following is a summary of how the research methods aligned with the research questions:

1. To answer research question one (RQ1), "How can GEL be used to design a simulation based instructional EHR module?" a review of the research literature pertaining to EHR instructional interventions, simulations in healthcare instruction, simulation design for instruction delivery, structured literature review with a focus on GEL, and healthcare interprofessional practice was conducted.
2. For research question two (RQ2), "What are the reactions of experts to the proposed design and what modifications need to be made prior to implementation?" a design document of the instructional EHR module with embedded case scenarios, evaluation checklist items, and debriefing contents according to GEL design was completed and reviewed by healthcare and instructional design experts. Modifications and revisions resulting from this review were made and the resulting design document (Appendix B) was used to guide the development of the simulation.
3. The third research question (RQ3), "To what extent does a simulation-based EHR module using GEL increase student performance?" was answered by first measuring the participants' entry competence/performance using the pre-

assessment survey by Brock, et al. (2010). Kim et al.'s (2014) evaluation checklist (adapted to evaluate interprofessional competency goals) was used to evaluate students' competence/performance after completing the instruction.

4. To answer the fourth research question (RQ4), "To what extent does a simulation-based EHR module using GEL influence student satisfaction?" the satisfaction of simulation experience scale (SSES) developed by Levett-Jones et al. (2011) was used to determine the level of student satisfaction with the simulation experience.

Data Analysis

A literature review was conducted to answer RQ1. The data collected for RQ2 resulted in the design of the document (Appendix B). For RQ3 and RQ4, quantitative and qualitative data were collected and analyzed. Results are presented in chapter 4.

Summary

The chapter contains the full description of the design and development research methodology. The research was carried out in three phases: 1) prototype design and internal validation, 2) instructional simulation development, and 3) pilot test with interprofessional student cohort. Each phase was described in terms of what was done, how it was done, and what instruments were used. An explanation of how the research methods align with the research questions was provided as well as how the data were analyzed. Chapter 4 presents the results of each phase.

Chapter 4

Results

There is a consensus amongst electronic health records (EHR) experts and policymakers that lack of adequate instructional intervention required for healthcare professionals to become proficient in the meaningful use of EHR core competencies constitutes the major reason behind the problem of increased medical errors and mortality in delivery of healthcare. Healthcare professionals are not proficient in EHR meaningful use and interprofessional collaborative practice core competencies and existing instructional interventions that focus on this topic do not adequately address this skill deficiency (Wilson et al., 2016; Goveia et al., 2013; Elsevier, 2013; Krupa, 2012). The goal was to design and develop a simulation-based instructional module on meaningful use of EHR and interprofessional collaborative practice core competencies and evaluate students' performance and satisfaction under an interprofessional team-based setting. Guided by a design and development research approach (Richey & Klein, 2007) this research was implemented in three phases. First, a simulation-based instructional EHR module was designed and validated internally by an expert panel of medical professionals and instructional designers. Second, using the design document, the instruction was developed. Finally, the instruction was pilot tested with a group of 21 second- and third-year health professions students in medicine, pharmacy, and nursing in an interprofessional team-based learning environment. Students' performance on meaningful use of EHR core competencies and their satisfaction during the simulation-based training was evaluated.

Findings

Results of phases one and two were presented in Chapter 3. This chapter presents the results of the final phase, the pilot implementation of the instruction with the interprofessional student cohort and the evaluation of student performance and satisfaction.

Phase 3: Pilot Test with Interprofessional Student Cohort

As mentioned in Chapter 3, the original recruitment plan was modified due to lack of response following several attempts to implement simple random sampling (Gay, Mills, & Airasian, 2011) of ten students each from medicine, pharmacy, and nursing for a total of 30 third-year NSU Health Professions Division (HPD) students. A recruitment flyer (Appendix E) was created, submitted, and approved as an amendment to the IRB. The students who voluntarily chose to participate in the research were recruited. This recuritment method was volatile and even with the incentive of a $10-$15 gift card, the attrition rate was high. For example, 54 students across the interprofessional cohort of students from medicine, pharmacy and nursing were recruited. Thirty one students started the activities; however, only 21 interprofessional students fully completed the activities. Thus falling nine participants short of the 30 students originally proposed for the pilot test.

The pilot test began with the participants completing the pre-assessment suvey and it ends with the participants completing both the game-based instructional activity and the virtual world interprofessional clinical skills activity. There were two parts to the instruction. First, the participants completed an interactive simulation-based instructional module where they were exposed to game-based instructional activities on meaningful use and interprofessionalism core competencies. Upon successful completion of these

activities the participants were given access to the second part of the instruction, which was the application of the concepts they mastered from the first part of the instruction to the virtual patient encounter activity in the 3D virtual world under interprofessional team-based setting.

The instruments that were used to collect the data included a pre-assessment survey (quantitative data), interprofessional evaluation checklist (mixed data), and the SSES (mixed data). Descriptive statistics were used to analyze the quantitative data and the qualitative data were analyzed by coding the data and organizing the codes by themes.

Pre-assessment Survey Results

The pre-assessment survey was used to measure the participants' entry knowledge and perceptions before the instruction. Thirty one participants completed the survey; however, analysis was based on only the 21 participants who completed all the research activities.

Of the 21 participants who completed the pre-assessment survey, 16 were female and 5 were male. The mean age of these students was 25 (M=25.33, SD = 5.52) with ten participants between ages 23-25. Five participants were between the ages of 20-22; three participants were between the ages of 26-28; and one participant fell in each of the following age ranges, 29-31, 32-34, and 44-46. Statistical analysis of all questions 1-51 is provided in Appendix J. The following results relate specifically to the core competencies that were addressed in the instruction, namely teams and teamwork, interprofessional communication, roles and responsibilities, medication reconciliation, patient-specific education, and clinical lab test results.

Teams and Teamwork.

Working effectively with a team of healtchare professionals can improve patient care. This is especially true as modern healthcare becomes more complex. With regard to participants' familiarity with *working* as part of an interprofessional team, over half (52%) were familiar (*n*=7) and very familiar (*n*=4). However, when asked how familiar they were *training* as part of an interprofessional team, only 38% were familiar (*n*=5) and very familiar (*n*=3) and nearly all participants (86%) indicated they were looking forward to the training. Ninety percent agreed (*n*=8) or strongly agreed (*n*=11) that learning with other students help them become a more effective member of a healthcare team while 90% agreed (*n*=4) or strongly agreed (*n*=15) that patients ultimately benefit if interprofessional healthcare students learn together to solve patient problems.

Interprofessional Communication.

Interprofessional communication is important when providing team-based care because each member of the team needs to be able to effectively communicate with the other members on the team. These team members have different backgrounds, skills levels, and expertise. Thus, communication can be challenging. When asked about interprofessional communication, there was strong agreement with regard to the statement that shared learning with other healthcare students increases one's ability to understand clinical problems (i.e., agreed, *n*=8 and strongly agreed, *n*=11). Sixty-seven percent of participants either agreed (*n*=3) or strongly agreed (*n*=14) that the interprofessional healthcare team training exercises help them appreciate other professionals. Seventy-one percent also agreed (*n*=9) or strongly agreed (*n*=6) that they are able to effectively coordinate tasks and activities on a team. Finally, 100% (agreed,

n=6; strongly agreed, *n*=15) agreed that teams that do not communicate effectively, significantly increase their risk of committing errors and 95% believe poor communication is the most common cause of reported errors (agreed, *n*=11; strongly agreed, *n*=9).

Roles and Responsibilities.

Understanding the roles and responsibilities of oneself and each other ensures that everyone on the team knows who is doing what. With regard to this competency, all participants (100%) agreed (n=7) or strongly agreed (n=14) that team members should understand the work of their fellow team members in order to be effective. In addition, 80% agreed (*n*=3) or strongly agreed (*n*=14) that interprofessional healthcare team training excersises help them appreciate other professionals.

Medication Reconciliation.

Medical reconciliation is the process of comparing the list of medications in the patient's medical record with an external list that the patient, hospital, or other provider provides. When asked about their ability to create accurate medication reconciliation, 47% (n= 10) felt confident that they could perform this task.

Patient-specific Education.

Educational resources that meet the specific needs of the patient help improve patient care. Therefore, it is important for health professionals to value this concept. When participants were asked whether it was important to ask patients and their families for feedback regarding patient care, 90% either agreed (*n*=10) or strongly agreed (*n*=9). Furthermore, 100% (agree, *n*=6; strongly agree, *n*=15) agreed that patients are a critical component of the care team.

Clinical Lab Test Results.

Accurately inputting clinical lab test results into an EHR as structured data is imperative. Properly doing so improves patient care and prevents medical errors. When participants were asked about clinical lab test results, all but one participant (95%) agreed (*n*=7) or strongly agreed (*n*=13) that incomplete lab and test results in a patient's record could impact patient safety.

Interprofessional Evaluation Checklist Results

The interprofessional evaluation checklist instrument was used to collect data from the interprofessional faculty on the student performance during the virtual world interprofessional clinical skill activity in Second Life®. A complete table of the descriptive analysis is in Appendix K.

Following is the proportion analysis (relative frequency) illustrating the extent (degree) to which the performance of the student sample either confirm or not confirm the mastery of the EHR meaningful use and interprofessionalism core competencies as a reaction to GEL's simulation-based instructional intervention. Students' performance were recorded on a scale from 1-5 where 1 = not implemented, 2 = improperly implemented, 3 = averagely implemented, 4 = properly implemented, and 5 = exemplary. The results in Table 1 illustrate the performances of the interprofessional cohort of students based on the specific core competencies applied during the virtual world patient encounter as observed by the interprofessional faculty.

Interprofessional Communication and Teams and Teamwork Core Competencies.

The checklist that was used when the nurse participants notify the physician participants of the patient's conditions and receives treatment order, shows that 57%

(*n*=12) of the students for whom this checklist was applicable, properly implemented interprofessional communication and teams and teamwork core competencies during the virtual patient encounter. While 5% (*n*=1) avergely implemented and another 5% (*n*=1) improperly implemented the competencies.

Roles/Responsibilities Competency.

The faculty observed if the nurse participants applied standard nursing protocol to implement the role/responsibilities core competency. The results show that 52% (*n*=11) properly implemented the competency, while 5% (*n*=1) averagely implemented and 10% (*n*=2) did not apply standard nursing protocol.

Medication Reconciliation Competency.

For the checklist that relates to medication reconciliation competency, 81% of the students (*n*=3) exemplary and (*n*=14) properly implemented the competency by adequately reviewing prior medications history of the patient. Two (10%) and one (5%) participants averagely and improperly implemented the medication reconciliation competecy respectively.

Clinical Lab-Test Results.

Physician orders lab test checklist for students for whom this checklist was applicable, shows that 52% of the students (*n*=3) exemplary and (*n*=8) properly implemented the competency.

Patient-Specific Education.

The interprofessional faculty observed the participants to check if they provided specific education to the patient and caregiver. The results show that 72% of all the students (*n*=5) scored exemplary implemented and (*n*=10) scored properly implemented

the competency. While 14% (*n*=3) averagely implemented and 5% (*n*=1) did not implement the competency.

Statistical analysis of all checklist questions 1-24 and the in-text (question 25) analysis are provided in Appendices K and L respectively.

Table 1

Descriptives and Proportion Analysis of the Interprofessional Evaluation Checklist

Checklists	N	Mean	Std. Deviation	Variance	Core Competencies Addressed	Properly/Exemplary Implemented	Averagely Implemented	Not/Improperly Implemented
Nurse notifies doctor & receive treatment order if needed (Must fulfil/discuss at least ONE), a. Administration of fever and blood sugar therapy, b. Explain the purpose and method of blood sugar therapy (Explain to caregiver), c. Perform accucheck check blood sugar level.	14	3.79	0.58	0.34	Interprofessional Communication, Teams and Teamwork	57%	5%	5%
Apply standard nursing protocol, (Must fulfil/discuss at least ONE), a. start IV point, b. give initial medication, c. draw blood	14	3.50	1.09	1.19	Role/Responsibilities	52%	5%	10%
Review prior medications history to identify any drug related problems, (Must fulfil/discuss at least ONE) a. Aspirin 81mg PO daily, b. Diphenhydramine (Benadryl) 50mg PO HS c. Canagliflozin / metformin 150/1000mg (Invokamet) PO BID with meals	20	3.95	0.69	0.47	Medication Reconciliation	81%	10%	5%
Physician orders lab test, review the clinical lab-test results, (Must fulfil/discuss at least ONE), a. CBC differential, BMP, CMP, blood cultures times 2 (consider Sepsis), Urinalysis culture and sensitivity, order Chest Xray, EKG, and Cardiac Enzymes,	13	4.00	0.82	0.67	Clinical Lab-Test Results	52%	5%	5%
Physician orders medications	11	3.55	0.93	0.87	Medication Reconciliation	38%	10%	5%
Preparation of prescribed medications, (Must fulfil/discuss at least ONE) Pharmacy Care; a. Compare prior medication list to physician's order, b. Review order received for errors, omissions and drug interaction, c. Communicate any discrepancies or therapeutic interventions to the Physician, and/or the Nurse	18	3.56	1.50	2.26	Medication Reconciliation	62%	5%	19%
Nursing care (Must fulfil/discuss at least ONE) a. Administer prescribed medications, b. Educate patient and caregiver (aide), c. Promote fluid intake in not NPO	14	2.93	1.49	2.23	Medication Reconciliation, Patient-Specific Education	43%	0%	23%
Monitors vital signs and patient as necessary for changes in patient status, SaO2, HR, body temperature, EKG, Monitors consciousness level, & dehydration signs	19	3.79	1.13	1.29	Role/Responsibilities	67%	10%	14%
(Must fulfil/discuss at least ONE), a. Provide comfortable resting environment, b. Provide education to patient and care giver as needed, c. Document as necessary in the patients record via Chat	19	3.95	0.97	0.94	Patient-Specific Education	72%	14%	5%
(Must fulfil/discuss at least ONE) a. Check normal range of body temperature & vital signs, b. Check HR, body Temperature, SaO2 & level of consciousness	19	3.63	1.12	1.25	Role/Responsibilities	62%	19%	11%
(Must fulfil/discuss at least ONE) a. Check recurrence of dehydration, b. Improve caregiver's understanding about the patient's condition	20	3.55	1.39	1.94	Patient-Specific Education	71%	5%	19%

Debriefing is a very crucial approach in healthcare education where faculty are able to identifiy students who are having difficulties (e.g. during the simulation session) and provide feedback to help improve their performance. The debriefing comments provided in the study were categorized into themes that exhibit the competencies that the students should be addressing. Table 2 illustrates the analysis of these debriefing comments, and the results show the proportion to which the faculty debriefed on specific competencies to guide the students' performance. For example, the interprofessional faculty cohort debriefed on the Medication Reconciliation competency 11% of the time.

Table 2

Proportion Analysis of the Debriefing Comments of the Students' Performances

Themes	Codes	Q25FreeText - Debriefing comments	N/S	code applied
		good development of ddx and tx plan excellent patient education provided pt probably in DKA...must be vigilant as to the severity of the presenting illness labs must be continually monitored after insulin is provided remember that this patient requires significant amounts of fluid resuscitation	1	RR
Medication Reconciliation	MR	Clinical Lab test	2	CT
Roles/Responsibilities	RR	Communicate with others	3	IC
Clinical Lab – Test Results	CT	Team interaction	4	TT
Interprofessional Communication	IC	integrate patient-centered education	5	PE
Teams and Teamwork	TT	audio was very hard to hear critical diagnosis were identified critical interventions were accomplished	6	RR
Patient-Specific Education	PE	Clinical Lab test	7	CT
		Communicate with others	8	IC
		Team interaction	9	TT
		integrate patient-centered education	10	PE
		Thorough, thought through each issue and tried to address to the best of her ability. Worked well with the other members of the team and also did a good job with building rapport with the patient. Very proud of you Joanne.	11	MR
		understand role/responsibilites of self and others	12	RR
		Communicate with others	13	IC
		Team interaction	14	TT
		integrate patient-centered education	15	PE
		excellent identification of patient problem list which then lead to good development of ddxs and tx plan good team work....all caregivers were appropriately involved good rapport established with the patient with an appropriate explanation of his management issues	16	MR
			17	RR
		Clinical Lab test	18	CT
		Communicate with others	19	IC
		Team interaction	20	TT
		integrate patient-centered education	21	PE

Statistics	
Themes	**Frequency**
Medication Reconciliation	11
Roles/Responsibilities	20
Clinical Lab – Test Results	9
Interprofessional Communication	19
Teams and Teamwork	19
Patient-Specific Education	20
Total	98
Themes	**Proportion**
Medication Reconciliation	11%
Roles/Responsibilities	20%
Clinical Lab – Test Results	9%
Interprofessional Communication	19%
Teams and Teamwork	19%
Patient-Specific Education	20%
Total	100%

Satisfaction with Simulation Experience Scale Results

The Satisfaction with Simulations Experience Scale (SSES) was used to collect both quantitative and qualitative data from the participants to measure their satisfaction with the simulation experience. There were three parts to the scale including clinical reasoning (5 questions), clinical learning (14 questions), and debrief and reflection (13 questions) for a total of 32 questions. All twenty-one participants completed the debrief and reflection. Nineteen of 21 completed the clinical reasoning and clinical learning questions. Tables 3, 4 and 5 include the descriptive statistics for the clinical reasoning, clinical learning, and debrief and reflection respectively. On a scale of 1 = strongly disagree and 5 = strongly agree, these statistics and proportion analysis illustrate to what extent participants were satisfied with the simulation-based experience.

Table 3.

SSES – Clinical Reasoning

Questions	N	Mean	Std. Deviation	Variance	Strongly Agree/Agree	Neutral/ Unsure	Strongly Disagree/ Disagree
The simulation developed my clinical reasoning skills	19	4.32	0.48	0.23	100%	0%	0%
The simulation developed my clinical decision making ability	19	4.26	0.65	0.43	90%	11%	0%
The simulation enabled me to demonstrate my clinical reasoning skills	19	4.53	0.51	0.26	100%	0%	0%
The simulation helped me to recognize patient deterioration early	19	3.68	0.89	0.78	53%	42%	5%
This was a valuable learning experience	19	4.42	0.51	0.26	100%	0%	0%

Table 4.

SSES Clinical Learning

Questions	N	Mean	Std. Deviation	Variance	Strongly Agree/Agree	Neutral/ Unsure	Strongly Disagree/ Disagree
The simulation caused me to reflect on my clinical ability	19	4.63	0.50	0.25	100%	0%	0%
The simulation tested my clinical ability	19	4.53	0.61	0.37	95%	5%	0%
The simulation helped me to recognize my clinical strengths and weaknesses	19	4.21	0.71	0.51	84%	16%	0%
The interactive lessons and the "wanna be a millionaire" game gave me a better understanding of my role as part of a healthcare team	19	3.79	1.03	1.06	58%	32%	11%
I had a better understanding of the Interprofessional Team Communication through the video and gaming activities	19	4.05	0.85	0.72	79%	16%	5%
I enjoy learning through game-based simulated activities	19	3.95	1.18	1.39	74%	5%	21%
After learning through the game-based activities I can easily facilitate communication between team members.	19	3.84	0.83	0.70	68%	26%	5%
After playing the Wanna be a Millionaire game i feel I can create accurate medication reconciliation.	17	3.29	0.92	0.85	32%	42%	16%
The EHR competencies gaming activities gave me a better understanding of the importance of the Meaningful Use Core Competencies, especially being able to integrate patient-centered education into a treatment plan.	19	3.89	0.74	0.54	68%	32%	0%
The interactive game-based lesson of the true-life story video and games provided realistic scenario to the danger of incomplete lab and test results in patient's record that could severely impart patient safety.	19	4.47	0.61	0.37	95%	5%	0%
I can now name the Core Interprofessional Competencies	19	4.05	0.71	0.50	79%	21%	0%
The session enabled me to understand and apply verbal and non-verbal effective communication.	19	4.32	0.67	0.45	89%	11%	0%
The session highlighted the EHR meaningful use core competency and I now understand its importance to patient safety	19	4.21	0.71	0.51	84%	16%	0%
I now understand the importance of team-based practice in patient care	19	4.37	0.76	0.58	85%	16%	0%

Table 5.

SSES Debrief and Reflection

Question	N	Mean	Std. Deviation	Variance	Strongly Agree/Agree	Neutral/Unsure	Strongly Disagree/Disagree
The facilitator provided constructive criticism during the debriefing	21	4.48	0.60	0.36	95%	5%	0%
The facilitator summarized important issues during the debriefing	21	4.48	0.51	0.26	100%	0%	0%
I had the opportunity to reflect on and discuss my performance during the debriefing	19	4.11	0.81	0.65	76%	10%	5%
The debriefing provided an opportunity to ask questions	19	4.21	0.85	0.73	76%	10%	5%
The facilitator provided feedback that helped me to develop my clinical reasoning skills	21	4.33	0.66	0.43	90%	10%	0%
Reflecting on and discussing the simulation enhanced my learning	21	4.38	0.67	0.45	90%	10%	0%
The facilitator's questions helped me to learn	20	4.40	0.60	0.36	90%	5%	0%
I received feedback during the debriefing that helped me to learn	21	4.52	0.60	0.36	95%	5%	0%
The facilitator made me feel comfortable and at ease during the debriefing	20	4.60	0.60	0.36	90%	5%	0%

Open-Ended Questions

The students were asked in an open-ended question to describe their experiences during the interprofessional virtual patient encounter in the Second Life® virtual world. The results of the analysis based on identified themes show that ninety-four percent of the students described their experiences as either very satisfied (70%), or satisfied (24%). With regards to what the students think of the virtual experience and the benefit of using

this medium to promote interprofessional team-based clinical skill experience, ninety-four percent of the students consider it to be either very beneficial and satisfying (80%) or beneficial and satisfying (14%). Overall the students stated that the immersive simulation-based virtual world experience helped to promote their mastering of the core competencies namely, teams and teamwork, interprofessional communication, and roles/responsibilities as evident in the stated testimonials from students and faculty quoted below.

"I think this was an excellent medium to promote interprofessional teamwork, as it simulated a real life situation and allowed us to respond as if it were in a real life situation." (Student 1)

"Improved patient care is the benefit and training students will help them incorporate in later professional life."(Student 2)

"That was really cool! Thank you for letting me participate. It was particularly interesting to me that the team with more healthcare professional students did better with communication (in my opinion)." (Faculty 1).

"This medium is extremely beneficial. Team members can only rely on each other's expertise and not be distracted by perceptions such as cultural, racial, or political differences." (Student 3)

"It will help students practice communication skills with other professionals in the medical field." (Student 4)

"The medium allows for greater convenience when it comes to facilitating engagement." (Student 5)

"Being my first experience like this, I really enjoyed it. It stimulated critical thinking and revealed areas for me to improve on." (Student 6)

"The virtual experience is definitely more fun and less nerve wracking than in person experiences. I think it will definitely help instill and build confidence in people who are scared or nervous about the simulation experience." (Student 7)

"I think it's a great idea. Some tweaking may be necessary to improve the flow of the case and students will need to develop a comfort with it." (Student 8)

"All universities that deal with health care should incorporate this into their curriculum. It was absolutely perfect. I would love to do it more often and learn more and more. Hopefully, this can be transformed into something people can use on their own to study and that the program will be designed to do what I did today but alone with multiple scenarios. THANK YOU for creating this. You are about to revolutionize how different health care fields join together as one to guarantee a higher chance of a better treatment plan for the patient." (Student 9)

"Excellent! I think that will be a great addition for the HPD Colleges." (Faculty 1)

Summary

In this chapter, the results of the research were presented. Specifically, the results for phase 3, the pilot test with the interprofessional student cohort were discussed. The the instruments that were used to collect the data included a pre-assessment survey (quantitative data), interprofessional evaluation checklist (mixed data), and the SSES (mixed data). Tables illustrating the descriptive statistics that were used to analyze the quantitative data and verbatim statements that represented the results of the the qualitative data analysis were presented. The next chapter presents conclusions, implications, recommendations for future research, and a sumary of the study.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

The use of simulation was explored as a way to train health professions students in the skills of meaningful use of health information technology and interprofessionalism to promote reduction in medical and medication errors and improve patient outcomes. A simulation-based instructional module was developed to train the health professions students from medicine, pharmacy and nursing in a pilot study. The instruction consisted of interactive gaming activities that extended to the application of knowledge acquired in an interprofessional virtual clinical skills experience in a 3D virtual world. In this simulated world, the students applied the specific core competencies of meaningful use of EHR and interprofessionalism in the treatment care plan of a 79-year-old male with 20 years history of Type 2 diabetes with recent onset of dementia. A cohort of twenty-one health professions students from medicine, pharmacy and nursing participated in the pilot.

Conclusions

This section includes a summary of the major conclusions. This section is organized by the four research questions.

Research Question One

A structured literature review was done to answer the first research question, "How can GEL be used to design a simulation-based instructional module?" Articles based on the topics of EHR instructional interventions, healthcare interprofessional practice, simulations in healthcare instruction, and simulation design for instruction delivery, were reviewed with a focus on GEL to illustrate how GEL could be used to

design a simulation-based instructional module. The review resulted in the understanding of GEL as a highly structured form of experiential learning. GEL's course and lesson structure model were adopted to design and develop a simulation-based instructional module that was delivered in an interprofessional team-based setting.

Research Question Two

The design document (Appendix B) was developed to answer the second research question, "What are the reactions of experts to the proposed design and what modifications need to be made prior to implementation?" The reactions of the experts resulted in the design document with clear goal and objectives. This design document reflect the sequence of tasks that students should be able to follow, skills to address, leveraging the students' initial knowledge and reflect appropriate instantiation of GEL's seven steps.

Research Question Three

A pre-assessment and an interprofessional evaluation checklist were used to collect data that were subsequently analyzed to answer the third research question, "To what extent does a simulation-based instructional module using GEL increase students' performance in the application of the core competencies?" Nine of the participants came into the study with no familiarity with training as part of an interprofessional team. Seven respondents were uncertain and agreed that they cannot create accurate medication reconciliation, and eight respondents were not skilled in integrating patient-centered education into a patient care plan. However, 17 respondents agreed that opportunity to train under interprofessional team would be beneficial to understanding each other's roles and resposibilities, and moreso, 19 respondents agreed that it would be beneficial to resolving clinical problems and improved patient outcome.

During the virtual world patient encounter, 11 respondents properly applied accurate medication reconciliation (a meaningful use core competency) while ten respondents did not. For the roles and responsibilites interprofessionalism core competency, 20 respondents properly applied the competency while one respondent did not. Interprofessional communication, team and teamwork have 19 respondents adequately applying these interprofessionalism core competencies and two respondents did not. 20 respondents were able to adequately integrate patient-centered education a meaningful use core competency into the treatment care plan of the simulated virtual world patient while one student did not. However, for the clinical lab-test result meaningful use competency, only nine respondents properly applied this competecy and 12 respondents either did not adequately apply this competency or it was not applicable to their roles and responsibilites.

Research Question Four

The SSES was used to collect data that answered the fourth research question, "To what extent does the simulation-based module using GEL influence student satisfaction?" All participants agreed that the simulation-based training was a valuable experience. Ninety-four percent of the participants were satisfied with the experience during the interprofessional virtual patient encounter in the Second Life® virtual world. Specifically, the participants agreed that the simulation-based virtual world experience promoted interprofessional team-based clinical skills and other interprofessionalism core competencies and thus were satisfied with the experience. Six percent of the participants were less satisfied with the experience. All of the participants were satisfied with the facilitator summarizing important issues during the debriefing and ninety percent of them

were satisfied with the facilitator providing debriefing feedback. Ten percent of the respondents were less satisfied.

Implications

The extent to which the performance of the student sample either confirms or does not confirm the mastery of the EHR meaningful use and interprofessionalism core competencies as a reaction to GEL's simulation-based instructional intervention was promising and proven to be worthy of further exploration as shown from the results. The participants' mastery of the core compencies was reflected in their performaces during their experiences in the simulated virtual world patient encounter. The simulation-based instructional interactive gaming activities and the hands-on activities in the virtual world allowed the students to develop and demonstrate their clinical reasoning skills, and build their interprofessional collaborative practice skills. Students that were previously unfamiliar with training as part of interprofessional teams, became efficient in the application of the interprofessionalism core competencies. In addition, students that could not create medication reconciliation and integrate patient-centered education became proficient and were able to apply these EHR meaningful use core competencies during the virtual world patient encounter. The results also highlight the importance of roles and responsibilities of the healthcare professional as part of an interprofessional team in the care of a patient. For example, the mastery of clinical lab-test result competency is customarily more applicable to medical students than the pharmacy or nursing. However, the application of GEL based training enabled these students to see their roles and responsibilities as not limited but expanded through shared learning with other healthcare students. Shared learning promotes effective interprofessional team care of patient for better outcome. The students considered the simulation-based gaming activities and

hands-on experience in the Second Life® virtual world a valuable one. The results show how the students' satisfaction was met or not met as a reaction to GEL's simulation-based instructional intervention. The students considered the medium of instruction (i.e., simulation) and hands-on practice beneficial and useful. The students learned to better interact with students from other professions and communicate effectively. They learned to depend on each other's expertise and put into consideration the point of view of other professions in the care plan of the patient without any prejudice or distraction by cultural barriers.

The results align with Kushniruk, Myers, Borycki, and Kannry's (2009) suggestion that hands-on training could be carried out in a simulated environment to practice the art of doctor-patient interaction. These findings are encouraging in that not only do they confirm Kushniruk et al.'s (2009) suggestion but also provide a possible solution to the concern raised by Wilson et al., (2016) and Dastagir et al., (2012). Their concern was the challenge of finding the best way to train healthcare professionals to acquire the competencies necessary to deliver care in a safe and effective manner (Wilson et al., 2016; Dastagir et al., 2012). The findings, based on the feedback from the students and faculty in this pilot implementation, highlighted simulation-based interactive gaming instruction and the hands-on experience in a 3D virtual world guided by GEL as an effective and engaging way to train healthcare professionals in the preparation to deliver care in a safe and effective manner under interprofessional team-based settings for better patient safety and outcome.

Recommendations

The findings show that GEL theory has a great potential in the effective design and development of a unique interprofessional, simulation-based instructional module

and activities that provide the learners close to a real-life clinical skills experience that would have been otherwise too complex to accomplish in other ways. The GEL design model is about strengthening the learning process through strong guidance that will help learners to achieve performance goals. The GEL approach to design of instruction is based on accurate and complete information on all necessary actions and decisions that are captured from the expert via the CTA interview technique. This information captured from the experts formed the backbone of the instruction rooted in a lesson designed (e.g. for a novice) with guided demonstrations, practice, and immediate feedback. The complex process of healthcare delivery under interprofessional collaborative integrated teams for a safe patient-centered and quality care is demanding. Training future healthcare professional to meet this complex demand has been challenging; however, immersive technologies such as simulation have shown positive results (Burrows, 2013; Chakravarthy et al. 2010; Okuda et al. 2009; Clark, 2004, 2005, 2008). Immersive 3D virtual world simulation and gaming based on GEL theory has proven to be a promising delivery medium for effective training of the future generation of healthcare professionals in preparation to meet today's complex healthcare demands.

The next step would be to expand this study to a larger audience by including interprofessional cohorts of students from other professions including, occupational therapy, physical therapy, physician assistants, social workers, and biomedical informatics. Automate the virtual patient in the Second Life® 3D virtual world with pre-programmed voice-integration rather than having a standardized patient (patient instructor) behind the scene type in responses for the virtual patient. Additionally, only five out of the seven elements of the Clark's (2008) GEL course and lesson structure model were used to develop the design document and prototype. Therefore, the study

could be extended to cover the last two-phase evaluation process of the GEL's sixth element and the seventh element to measure instructional efficiency and patient outcome in a future longitudinal study.

Summary

It became necessary to find the best way to train future healthcare professionals to master the specific core competencies of meaningful use of health information technology and interprofessionalism for effective patient safety and improved outcome. Hence, the goal was to design and develop a simulation-based instructional module on meaningful use of EHR and interprofessional collaborative practice core competencies to address this problem. The students' performance and satisfaction were evaluated under an interprofessional team-based setting. To answer research question one, the literature was reviewed and categorized according to the following topics: EHR instructional interventions, simulations in healthcare instruction, healthcare interprofessional practice, simulations and instructional design, and design and development research. The literature was reviewed with a focus on Clark's (2004, 2005, 2008) guided experiential learning (GEL) theory and how it can be used to design the instructional module.

Experiential learning is commonly used as a guide in the design and development of healthcare simulation (Carter, Schijven, Aggarwal, Grantcharov, Francis, Hanna, & Jakimowicz, 2006). However, GEL, which is a highly structured form of experientiallearning, has led to positive results in training novice learners on healthcare practices (Craft et al. (2013). Thus, GEL guided the design and development of the simulation-based interactive gaming module and the activities in the immersive 3D virtual world.

The GEL process model provides specific design guidance for the development of learning experiences that captures accurate and complete information on all necessary actions and decisions through Cognitive Task Analysis (CTA).

CTA, an innovative interview technique, was used to capture the tacit knowledge from subject matter experts (SMEs), which was then transformed into interactive instructional procedures and activities used by the learners (see Appendix A). Based on GEL's design model, the lesson plan packaged with guided demonstrations, practice and instant feedback resulted into a design document and prototype of the instruction (see Appendix B). The design document and prototype were reviewed by experts from health professions for content accuracy and by instructional designers for the instantiation of GEL. The reactions of experts to the design and recommended modifications as noted in Appendix C were reflected in the final design before implementation. Thus answering the research question two.

After IRB approval, a total of fifty-four interprofessional students were recruited from medicine, pharmacy, and nursing. Thirty-one students went through the orientation and started the research activities. However, only twenty-one participants fully completed the activities. The activities included game-based interprofessional education (IPE) training and activities, and a hands-on activity in an immersive 3D virtual world simulated environment called Second Life®. The students' performance and satisfaction was measured and the data were collected via a pre-assessment survey, interprofessional evaluation checklist, and a satisfaction with simulation experience scale (SSES). Data collected via these instruments were analyzed to answer the research questions three and four.

The core competencies addressed in the study and measured from the students' performance and satisfaction included specific EHR meaningful use competencies – medication reconciliation, clinical lab-test results, patient-centered education, and interprofessional core competencies – roles and responsibility, interprofessional communication, and teams and teamwork. Pre-assessment data showed that the students came into the study in agreement that, teams do not communicate effectively, thus significantly increase their risk of committing errors, and that poor communication is the most common cause of reported errors. The students also agreed that collaboration is essential, working together to solve patients' problems is essential as well as mutual support and roles and responsibilities. However, a considerable number of students came into the study with no prior experience with training as part of interprofessional teams, nor could they create accurate medication reconciliation or integrate patient-centered education in the patient plan.

After the simulation-based instructional intervention, the extent to which this intervention influenced the students' performance and satisfaction were measured. The analysis of the data confirmed that the students properly implemented the core competencies based on their performances during the immersive virtual patient encounter in the 3D virtual world. The analysis also showed how the students' satisfaction was met as a reaction to the GEL's simulation-based instructional intervention, and in some instances was not sufficiently met. The students' testimonials further confirmed their overall satisfaction with the immersive simulation experience.

Nevertheless, there were some limitations in the study. The sample population for this pilot study was small. It consisted of a twenty-one student cohort from medicine, pharmacy and nursing in their second and third year and who were attending the same

university. Thus, the results may not be generalizable. Additionally, there was a deliberate focus on three health professions, which was a delimitation. Including other professions in a future study with a larger number of participants is recommended. The findings confirm the expectation that the immersive simulation-based instruction and activities intervention based on GEL would help the students master the required core competencies in the meaningful use and interprofessionalism for effective patient-centered care and quality outcomes. These findings add to the body of knowledge in information systems and instructional design and technology. It is hoped that these findings will provide guidance for medical educators in the design and validation of a structured instructional intervention.

Appendix A

The design of the simulation-based instructional module according to guided experiential learning (GEL) theory – Cognitive Task Analysis Interview Summary

Overview:

Total number of five subject matter experts (SMEs) from Nova Southeastern University's colleges of medicine, pharmacy, and nursing representing the interprofessional cohort were interviewed to acquire descriptions of problems and tasks that the learners should be able to solve and perform effectively after the training. This CTA process included CTA interview of SME and revising of CTA with the second SME to gather the following information as detailed in the workflow in Figure 4. The SMEs provided detailed answers to the below six CTA based interview questions to gather information that was used to develop the interprofessional clinical case-scenario activities.

1. Step by step description of "how to" accomplish the goal detailing necessary actions and decisions expected to perform the task or solve the problem. i.e. procedure
2. Alternative procedures that could be used, and criteria needed to choose between these alternatives
3. Capturing conceptual knowledge, i.e. concepts, processes, principles and acquiring information about the tasks, i.e. necessary equipment, and materials
4. Acquiring information about performance standards, i.e. how quickly, cheaply, and with what "quality" indicators must the learner perform this task?
5. Capturing sensory information, i.e. does the learner need to recognize a smell, taste, texture, sound or unusual visual event during the process?
6. Obtain information about performance goal of the specific part of the procedure, i.e. how to determine, for example, that a learner would be able to perform the procedure adequately, i.e. states the objective

SME Selection:

SMEs from the college of medicine, pharmacy, and nursing representing the interprofessional cohort were selected based on the following criteria according to Clark (2008):

1. Has an established track record of highly successful accomplishment of the goal or mission being taught in the GEL course (as opposed to merely having established "job experience" over time)
2. Has consistently solved job-related problems and achieved goals that bright and capable novices have not been able to accomplish
3. Has the reputation of broad knowledge (as opposed to very narrow experience and knowledge) of the job or mission (including related jobs and missions).
4. Has the reputation of cooperativeness and/or is willing to tolerate the frustration of being asked to explain very familiar information at a very specific level of detail and to read and correct written descriptions of your interview

The SMEs include:

1. Naushira Pandya, M.D. CMD, FACP, (Medicine)
2. Joseph DeGaetano, DO, MSEd, FAAFP, FACOFP (Medicine)
3. Jaime Riskin, PharmD, BCPS (Pharmacy)
4. Lisa Soontupe, EdD, RN (Nursing)
5. Michael Behrens, MSN, RN (Nursing, ER)

Workflow:

The following flowchart represents the workflow for the CTA interview process:

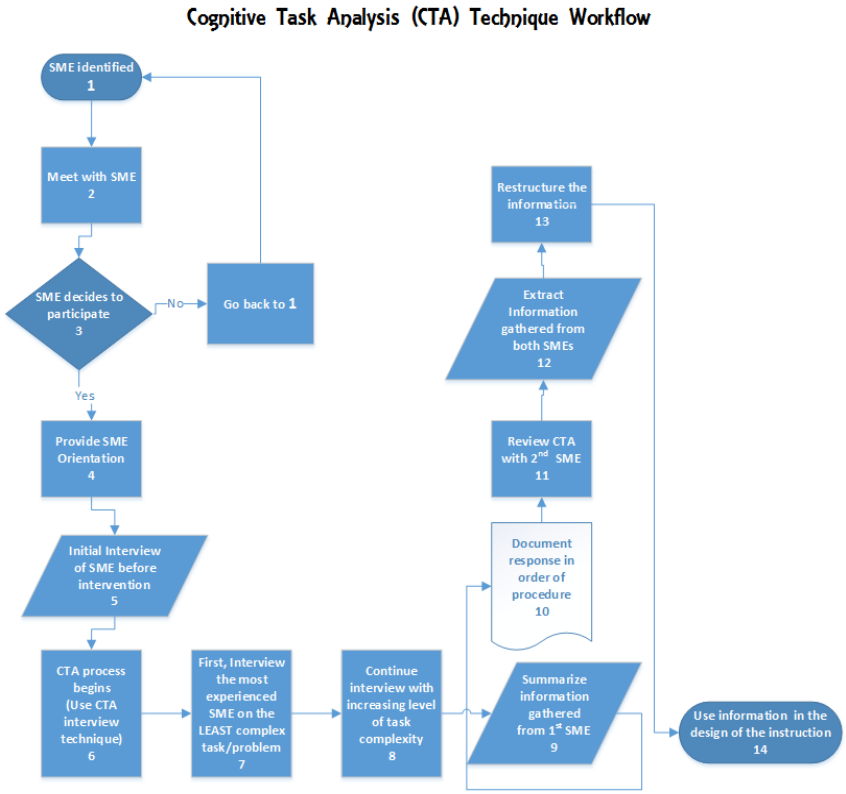

Figure 4. Cognitive Task Analysis Process according to GEL

Interview Summary:
Following is a summary of the interview results. This information was used to create the case-scenario used for Objective #6: Apply the specific core competencies of Meaningful Use of EHR and interprofessionalism in the treatment management plan and assessment of a 79-year-old male with 20 years history of type 2 diabetes and who recently developed dementia.

The Scenario (Demonstration and Application of skills learned)
Frank Baggs a 79 years old African-American male patient with a 20-year history of type 2 diabetes with recent onset of dementia was brought to the ER because he fell. He sustained a hematoma on his hip and was in a state of confusion. Initial assessment from the ER found to have a high fever of 104^{o}F and high blood sugar of 550mg/dl and dehydration was diagnosed. He complained that his abdomen hurt, and flanks were painful. Frank lives at home with an aide and was brought to the ER by the aide.

Interprofessional Case-Scenario

1. Step by step description of "how to" accomplish the goal detailing necessary actions and decisions expected to perform the task or solve the problem. i.e. procedure

Competencies addressed	Medicine	Pharmacy	Nursing
Medication Reconciliation Roles/Responsibilities Clinical Lab – Test Results Interprofessional Communication Teams and Teamwork Patient-Specific Education	• Identify the problem: Chief complaint: high fever and fall, abdomen and flank pain • The physician will look for the reason behind the high fever and fall, but initially could order medication to bring down the fever, while obtaining a medical history from the patient and aide. Obtain medication history, and could order Tylenol for fever and other pain medication • History taken: The physician will gather information on the history of present illness (HPI) including medication history, and past medical history (PMH), Social history (SH), Review of System (ROS) and any other symptoms (SX) • The physician examine the patient. Including cognitive assessment based on delirium protocol (CAM) and dementia protocol (MMSE) Differential diagnosis: The physician proceeds to gather as much information from patient and/or care giver to differentiate between conditions that share similar symptoms. Think about causes of fever. Why the patient fell, is this dementia? Or is this	• Pharmacy will assist with / perform thorough medication history, including allergies • Pharmacy will review prior medications to identify any **D**rug-**R**elated **P**roblems (DRPs; see below for list) • The pharmacist will perform daily monitoring of any pertinent data (including but not limited to symptom management, clinical improvement and pertinent laboratory / diagnostic results) which pertain to medication therapy and provide any therapeutic interventions as indicated to the appropriate healthcare professional • The pharmacist will compare prior medication list to physician's orders to identify any DRPs (medication reconciliation);	• The triage ER nurse documents patient's initial assessments • The triage nurse asks the aide, who brought the patient to the ER about the patient's current medication, *but the aide had no clue,* however he gave the name of the pharmacy • The triage nurse assigns the patient to a room in the ER. Assesses vital signs and level of consciousness. Temp 104^0F, HR=110bpm, R=28, BP=110/60, Pain score=6/10 • The ER nurse at the bedside initiates standard safety measures for a confused patient who is also a high risk for falls. • Based on the initial assessment of the patient, the ER nurse draws blood, checks the patient's sugar level, apply 2 liter O2 and cardiac monitoring; start IV, initiate ordered fluid replacement therapy, and then administers the initial medication and request lab test according to the ER

	delirium? Or could it electrolyte problem, high blood sugar, dehydration • The physician places lab orders to narrow down the diagnosis. The lab order includes; CBC differential, BMP, CMP, blood cultures times 2 (consider Sepsis), Urinalysis culture and sensitivity, order Chest X-ray, EKG, and Cardiac Enzymes, and order X-ray of the hip to rule out fracture. • The physician reviews the Clinical Lab –Test results to confirm diagnosis. Lab consisted with HHS, HbA1c within the normal range, TChol is 182, HDL is 42 • The physician places treatment orders to stabilize the patient, include IV fluids to hydrate, interpretation of stat labs - UA, CMP, and CBC, etc. Order antibiotics be given via IV, insulin, and check x-ray to ensure no fracture • The physician ordered medications based on previous med list history and the patient's current diagnosis. Also, review home medications, noting any inconsistencies. The physician document all order into the her	this is to be done at any change in level of care and at discharge • The pharmacist review the order received (*through the eRX system*) before verification and dispensing to identify and address any errors and omissions, drug-interactions (with patient's profile), or other DRPs • Pharmacist will check all pharmaceutical preparations for accuracy (i.e. look-alike-sound-alike errors, compounding errors, calculation errors) • The pharmacist will communicate any discrepancies or therapeutic interventions identified to the proper healthcare professional • The pharmacist will document all therapeutic interventions with outcomes when applicable within the pharmacy computer system	nursing standard protocol as relevant to patient's symptoms and conditions • The ER nurse called for the physician to see the patient. • The ER nurse contacts the retail pharmacy to gather further information on the patient's current medication. • ER Nurse follows through on new order request by the physician with the lab technician, and the pharmacy • The ER nurse checks with physician for further direction and orders. • The ER nurse notifies the physician of the available lab test results for review. • The ER nurse reviews the medication order before administering the medications. While continuing to implement physician orders and monitor patient for instability • The ER nurse the physician of any inconsistencies found with the medication

	• The physician admit the patient to the hospital, and notifies the inpatient team • The inpatient team physician places an inpatient order; diet, activity, frequency of blood glucose check, vital signs and labs • Patient specific education to patient and/ or the aide includes explanation of working diagnosis, possible UTI, dehydration • Day 2-3 at the hospital, the physician explains the avoidance of Benadryl. Consider changing Canagliflozin medication, but could continue to take metformin by itself, and may need insulin	• Pharmacist will provide medication counseling to patient upon admission, each day of hospital stay and upon discharge	• The ER nurse continues to observe and monitor the patient for changes in status, and implement further orders • The ER nurse documents the medication information into the nursing intake/admission assessment form in the EHR.

2. Alternative procedures that could be used and criteria needed to choose between these alternatives. **Are there other ways the students could perform the above process?**

- **Physicians** gather "problems" from a detailed history and physical exam. Problems are then translated into a differential diagnosis. The workup of the problem and treatment then occurs based upon the differentials identified.
- **Pharmacists** can perform medication histories and identify drug-related problems to relay to the healthcare team
- **Nurses** observe and monitor patient status and notified physician of any changes.

3. Capturing conceptual knowledge, i.e. concepts, processes, principles and acquiring information about the tasks, i.e. necessary equipment, and materials.
   a. List necessary equipment and supplies that would be used during this patient encounter
   - **Medicine** would require, Stethoscope, otoscope, ophthalmoscope, bp cuff, thermometer, monitor for other vitals (respirations etc.),

- **Pharmacy** would not need equipment / supplies other than access to the patient's medical record and the order entry program (e.g. EHR system)
- **Nursing** would need stethoscope, penlight. watch, supplies and equipment necessary to assess vital signs, administer oxygen, initiate cardiac monitoring, initiate oxygenation monitoring, initiate infusion therapies, obtain blood and urine specimens.

b. What are the concepts/theories and principles/ethics that are necessary for the students to apply during this patient encounter?
   - **Medicine:** Appropriate and detailed history and physical exam skills, empathy, well developed medical knowledge base, that is understand the interpretation of labs, how-to differentiate between delirium versus dementia. Thoroughness in gathering appropriate details from aide, and other outside sources of information.
   - **Pharmacy:** Drug related problems (DRPs): I ESCAPED CPR (Interactions (drug-drug, drug-food, drug-disease), Effect (meaning the right drug, the right dose- if it is not working, do we need to change medications, add adjunctive therapy, etc.), Side effects/toxicities, Contraindications/precautions, Allergies (including reaction to allergen), Pregnancy/breastfeeding, Elimination (hepatic/renal adjustments), Dosing (over/under dosing), Compliance/adherence (this could include improper administration of medications), Purpose (are the drugs given for proper indication and also are there problems that need medication), Route (is this medication given via the most appropriate and effective route)
     - Use health and wellness principles when providing patient care, including methods to enhance adherence
     - Provide accurate, evidence-based health and drug information to patients and caretakers when providing medication education as well as the healthcare team
     - Accurately prepare, label, dispense, distribute and/or administer (i.e. immunizations) prescriptions and medication orders
   - **Nursing:**
     - Perform hand hygiene before and after contact with the patient
     - Performs assessments using correct technique
     - Assess and monitors vital signs
     - Identifies and reports significant and abnormal findings
     - Use the nursing process- assess, diagnose plan, implement and evaluate patient's status and response to nursing and medical interventions.
     - Documents vital signs, assessments and finding in the patients' medical record
     - Communicate effectively to the healthcare team using I-SBAR-R format

4. Acquiring information about performance standards, i.e. **how quickly, cheaply, and with what "quality" indicators must the learner perform this task?** E.g.: Students are expected to integrate content from e.g. gastrointestinal system class in preparation for simulation and while participating in simulation activities.

Medicine

Students need to be in awareness of adverse events in hospital that could result in penalty i.e. falls with injuries, pressure ulcers or bedsores, UTI with foley catheters that could increase patient's length of stay (LOS) or cost. The students should be aware that they cannot be ordering unnecessary tests and procedures

Pharmacy

- Pharmacodynamics lectures (covering antidiabetic medications, anticholinergic medications, antiplatelet medications)
- Pharmacokinetics lectures (regarding geriatrics, particularly)
- Pharmacotherapeutics lectures (overview of laboratory values, patient assessment, chronic and acute exacerbations of diabetes mellitus, geriatric medicine)
- Communications lectures
- Physical assessment course
- Patient Care Management Laboratory series (patient interviews, patient counseling, patient assessment and development/communication of care plan)

Nursing

- Use experience from nursing theory, pharmacology, pathophysiology, health assessment class, and clinical experiences.

5. Capturing sensory Information (i.e. **Does the learner need to recognize a smell, taste, texture, sound or unusual visual event during this process of patient encounter?)**

Medicine:

- Students capture patient information not only from a thorough history and physical exam but also from direct observation of the patient, the patient's mannerisms, and all sensory stimuli. Check for skin sores. Observe any changes in the patient, i.e. less verbal, less alert, by identifying any barriers to verbal and non-verbal communication. Check lung and bowels sounds.

Pharmacy:

- Students should be able to identify any barriers to adherence via verbal and non-verbal communication, students should also be able to build rapport with the patient and develop mechanisms to enhance motivation to adhere to treatment plan

Nursing:

- Students should be able to identify abnormal findings and report to physician. . Such as any barrier to verbal and non-verbal communication, and endeavor to communicate effectively with patient.

6. Obtain information about performance goal of the specific part of the procedure, i.e. how to determine, for example, that a learner would be able to perform the procedure adequately, i.e. states the objective
    a. **States the learning objectives for the specific tasks involve in this patient encounter.**

Medicine students will:

- Interpret patient vital signs appropriately
- Gather a thorough and detailed history
- Perform an appropriate focused physical exam
- Develop an appropriate problem list from the history and physical exam
- Develop an appropriate differential diagnosis
- Perform an appropriate work up (e.g. labs, diagnostic studies etc.) based upon the differential diagnosis
- Articulate an appropriate treatment plan based upon the diagnosis identified
- Understand need for early discharge planning
- Understand need for maintaining functional status
- Understand their roles and responsibility while working under interprofessional healthcare team.
- Be able to communicate effectively with both the patient and the healthcare team
- Demonstrate ethical and professional behavior including empathy, and development of interprofessional team relationships
- Demonstrate effective communication skills (verbal, non-verbal and written) in interactions with patients, families, caregivers and healthcare team

Pharmacy students will:

- Assess and manage drug-related problems
- Effectively gather both subjective and objective patient data from various sources
- Use subjective and objective patient data to define health and drug-related problems
- Describe commonly used medications, formulations and drug products
- Demonstrate ethical and professional behavior including empathy, and development of interprofessional team relationships
- Demonstrate effective communication skills (verbal, non-verbal and written) in interactions with patients, families, caregivers and healthcare team

Nursing students will

- Perform a focused assessment to identify the patients' nursing diagnosis to formulate a nursing plan of care, evaluate patient's state of mind, e.g. fright, pain, or anger, and Show empathy to provide reassurance

- Perform initial assessment and intervention to stabilize the patient
- Demonstrate the understanding of emergency room standing nursing orders e.g. order routine metabolic panel lab test, CBC, electrolyte, urinalysis, glucose testing.
- Differentiate between nursing interventions (independent) and medical interventions (dependent)
- Demonstrate appropriate verbal and non-verbal communication with patient, caregiver and healthcare team
- Utilize therapeutic communication techniques to alleviate patient anxiety

Appendix B

Design Document for the

Simulation-based Instructional Module for Students in an

Inter-professional Team-based Learning Environment –

The Design Structure

Overview of Course and Lesson Structure:

Clark's (2008) course and lesson structure model was used to develop the design document and prototype.

These guidelines include the following:

1. Introduction and Course Goal
2. Reason for the Course
3. Course Overview
4. Lesson Structure:
    a. Learning Objective
    b. Reason
    c. Overview
    d. Concepts, Processes, and Principles
    e. Demonstration of Procedure
    f. Practice the Procedure
    g. Review Practice and Give Feedback
5. Select Media for Course Delivery
6. Design Four Level Evaluation
7. Write a Transfer Letter for Supervisors. That is, Challenging, competency-based tests that include reactions (trainee confidence and value for the learning) and learning performance (memory for conceptual knowledge and application skill for all procedures)

Course Title: Interprofessional and eHealth IT Core Competencies: Keys to Enhanced Patient-centered Care and Safety.

1. Introduction and Course Goal

After completing the module, health profession students will be able to demonstrate and apply the knowledge, skills and attitudes essential to carry out quality patient-centered care and safety under interprofessional collaborative practice.

Students will use the immersive simulation module to identify, observe and respect each other's roles and responsibilities in the treatment care of a diabetes-dementia patient under collaborative team-based practice.

2. Reason for the Course

The purpose of this instructional module is to improve students' engagement and cognitive skills during interprofessional clinical skills experience to achieve the required core competencies in the "meaningful use" of EHRs and interprofessionalism. As a result of the acquired skills, it is expected that the application of such skills will promote quality of patient-centered care and safety through the reduction of medical errors.

With the increasing adoption of EHR, it is evident that "meaningful use" is not limited to the IT systems, but also applies to the ability of the users to acquire the core competencies necessary to achieve Meaningful Use that will, in turn, improve patients' quality of care and outcome ("HealthIT", 2013, 2014). Additionally interprofessional collaborative practice is essential to this cause. The Institute of Medicine (IOM) attributed lack of adequate training and activities at an interprofessional level to a deficiency in good communication and collaboration amongst different health professions specialties during patient care thereby leading to poor quality of service (IOM, 2003). Further reviews of literature have also shown that interprofessional education and collaborative practice is fast becoming a major key player in the future of health professions' education and effective healthcare delivery in the United States and around the globe (Zorek & Raehl, 2012; WHO, 2010; IPEC, 2011; Kochar, 2012). As such, interprofessional education collaboration (IPEC) was established with the aim to move away from "profession-specific educational efforts to engage students from different professions in interactive learning with each other" to acquire the necessary interprofessional core competencies including as noted below (IPEC, 2011, p. 3). For example, health professionals need to understand each other's roles and responsibilities adequately to practice effectively in a team-based environment as it may help saves patients' lives.

Health professions students through proper instructional programs could achieve these required knowledge, skills, and attitudes to minimize the risk of medical errors (Hersh, 2010). Therefore, it is expected that when presented with GEL designed immersive simulation module, the interprofessional cohort of participants will learn to adequately apply specific EHR task core competencies and Interprofessionalism in the treatment management of a diabetes patient who also has dementia, (i.e. who developed dementia later in life). They will also learn to identify, observe and respect each other's roles and responsibilities in the treatment care of a diabetes patient under collaborative team-based practice.

3. Course Overview

The course will begin with lessons on core interprofessional competencies domain and EHR core competencies of Meaningful Use. The lesson will then connect with teamwork behaviors, roles and responsibilities, and interprofessional communication in the application of the core competencies in patient care.

4. Lesson Structure

Learning Objectives:

Upon completion of the instructional module, s**tudents will:**

1. Name the four interprofessional core competency domains.
2. Explain their individual roles and responsibilities and also those of the other healthcare professions students from other disciplines on the team.
3. Identify and give examples of verbal and non-verbal communication that help to increase effective communication with patient and their families and among other health professionals in a team-based environment.

4. Distinguish between teamwork behaviors and solitary behaviors of shared goal for quality of patient care.
5. Name core competency objectives of Meaningful Use for eligible professional/provider.
6. Apply the specific core competencies of Meaningful Use of EHR and interprofessionalism in the treatment management plan and assessment of a 79-year-old African-American female with 20 years history of type 2 diabetes and who recently developed dementia.

4.1a. Objective #1: Name the four interprofessional core competency domains.

4.1b. Reason: Further reviews of literature have shown that interprofessional education and collaborative practice is fast becoming a major key player in the future of health professions' education and effective healthcare delivery in the United States and around the globe (Zorek & Raehl, 2012; WHO, 2010; IPEC, 2011; Kochar, 2012).

4.1c. Overview: Interprofessional education collaboration (IPEC) was established with the aim to move away from "profession-specific educational efforts, to engage students from different professions in interactive learning with each other" to acquire the necessary interprofessional core competencies (IPEC, 2011, p. 3). The interprofessional core competency domains are shown in Figure 7 below, out of which the three highlighted domains in the figure would addressed in this study:

- Roles/Responsibilities
- Interprofessional Communication
- Teams and Teamwork

4.1d. Concepts, Processes, and Principles: Concepts will be presented and learners will be asked to recall them.

4.1e. Demonstration: Show a graphical representation of the core competencies. Use arrow shaped rectangle to focus on three specific core domains:

1. Roles/Responsibilities
2. Interprofessional Communication
3. Teams and Teamwork

4.1f. Practice: Have learner name the interprofessional core competency domain through a recall game activity.

4.1g. Review Practice and Feedback: Immediate feedback will be provided for correct and incorrect answers.

4.2a. Objective #2: Explain their individual roles and responsibilities and also those of the other healthcare professions students from other disciplines on the team.

4.2b. Reason: Health professionals need to understand each other's roles and responsibilities adequately to practice effectively in a team-based environment as it may help saves patients' lives.

4.2c. Overview: The aim to move away from "profession-specific educational efforts, to engage students from different professions in interactive learning with each other" informs the establishment of IPEC in order to acquire the necessary interprofessional core competencies (IPEC, 2011, p. 3).

4.2d. Concepts, Processes, and Principles: The learners will be presented with the guiding principles regarding roles and responsibilities and will be asked to describe them.

4.2e. Demonstration: Using computer generated slides presentation, describe the rules that guide roles and responsibilities. State the roles and responsibilities for each profession (e.g. Medicine, Pharmacy, and Nursing).

4.2f. Practice: Through a drag and drop game activity, have the students work in teams from medicine, pharmacy and nursing to explain each other's role and responsibility in a team-based practice.

4.2g. Review Practice and Feedback: Immediate feedback will be provided for correct and incorrect answers.

4.3a. Objective #3: Identify and give examples of verbal and non-verbal communication that help to increase effective communication with patient and their families and among other health professionals in a team-based environment.

4.3b. Reason: Institute of Medicine (IOM) attributed lack of adequate training and activities at an interprofessional level to a deficiency in good communication and collaboration amongst different health professions specialties during patient care thereby leading to poor quality of service (IOM, 2003).

4.3c. Overview: Interprofessional collaborative practice promotes effective communication among health professionals, and with patients and their families. Several literatures reviews have shown that IPEC would play a key role in the future of health professions' education and effective healthcare delivery in the United States and around the globe (Zorek & Raehl, 2012; WHO, 2010; IPEC, 2011; Kochar, 2012)

4.3d. Concepts, Processes, and Principles: Learners will be presented with common examples of communication through computer generated callouts representation to illustrate the concept and process of verbal and non-verbal communication.

4.3e. Demonstration: Present common examples of communication through computer generated bars representation as it relates to communicating with patient and families, and among other health professionals.

4.3f. Practice: Ask the learner to identify examples of verbal and non-verbal communication. Present the learner with a video vignette of a case scenario. Ask the learners to discuss what went "Wrong" in the scenario, and how effective communication could have been applied.

4.3g. Review of Practice and Feedback: Immediate feedback will be provided for correct and incorrect answers.

4.4a. Objective #4: Distinguish between teamwork behaviors and solitary behaviors of shared goal for quality of patient care.

4.4b. Reason: Team and Teamwork competency domain has become an important core competency domain that the health professions students must master (IPEC, 2011).

4.4c. Overview: Interprofessional collaborative practice promotes effective team and teamwork among health professionals, and in the treatment management of patients. Several literatures reviews have shown that mastery of the core competencies is crucial as it would play a key role in the future of health professions' education and effective healthcare delivery in the United States and around the globe (Zorek & Raehl, 2012; WHO, 2010; IPEC, 2011; Kochar, 2012).

4.4d. Concepts, Processes, and Procedures: Learners will be presented with the concept of interprofessional teamwork with definitions, and will be asked to recall this concept.

4.4e. Demonstration: Present the learner with the concept of interprofessional teamwork with definitions through computer generated slides. Provide visual representation of teamwork and solitary behavior with best examples.

4.4f. Practice: Learners will watch scenario video of a case of "situation of uncertainty", and then carry out online game activity with indicators to identify teamwork behavior from solitary behavior.

4.4g. Review of Practice and Feedback: Immediate feedback will be provided for correct and incorrect answers.

4.5a. **Objective #5:** Name core competency objectives of Meaningful Use for eligible professional/provider.

4.5b. Reason: With the increasing adoption of EHR, it is evident that "meaningful use" is not limited to the IT systems, but also applies to the ability of the users to acquire the core competencies necessary to achieve Meaningful Use that will, in turn, improve patients' quality of care and outcome ("HealthIT", 2013, 2014). The Meaningful Use of EHR is summarized under three stages as illustrated in figure 5 below.

4.5c. Overview: The Core competencies of Meaningful Use of EHR are detailed in figure 6. These core measures are necessary to promote the federal government mandated Health Information Technology for Economic and Clinical Health Act (HITECH) agenda of improved health outcome, and are aligned with the below five patient-driven domains.

- Improve Quality, Safety, Efficiency
- Engage Patients & Families
- Improve Care Coordination
- Improve Public and Population Health

- Ensure Privacy and Security for Personal Health Information

4.5d. Concepts, Processes, and Principles: Concepts will be presented and learners will be asked to recall them.

4.5e. Demonstration: Present the concept of "meaningful use" through computer generated slides. Show a graphical representation of the core competencies. Use highlighted rectangle and notes to provide detail information on these three specific core objectives:

1. Clinical Lab – Test Results
2. Medication Reconciliation
3. Patient-Specific Education

4.5f. Practice: Have learner name the specific three core measure through a recall game activity**.** Have learner match the concepts names with appropriate examples.

4.5g. Review of Practice and Feedback: Immediate feedback will be provided for correct and incorrect answers.

4.6a. Objective #6: Apply the specific core competencies of Meaningful Use of EHR and interprofessionalism in the treatment management plan and assessment of a 79-year-old male with 20 years history of type 2 diabetes and who recently developed dementia.

4.6b. Reason: It is essential that health professions students achieve the required knowledge, skills, and attitudes through proper instructional programs to minimize the risk of medical errors (Hersh, 2010).

4.6c. Overview: The immersive simulation module based on guided experiential learning (GEL) will foster the understanding of interprofessional and meaningful use core competencies. It is expected that the interprofessional cohort of participants will learn to adequately apply specific EHR task core competencies and Interprofessionalism in the treatment management of a diabetes patient who also has dementia, (i.e. who developed dementia later in life). They will also learn to identify, observe and respect each other's roles and responsibilities in the treatment care of a diabetes patient under collaborative team-based practice.

4.6d. Concepts, Processes, and Principles:
New concepts are presented to the learners with task-related examples which will include visual illustration. The learners would be asked to recall and apply the concepts.

4.6e. Demonstration: Show 15mins video on treatment for a patient with type 2 diabetes, and dementia.

4.6f. Practice: Present the learner with simulation-based medical educational game (SimMedG). In the game, the learner assumes particular health professional role to complete the simulation-based instructional module on the treatment assessment and management of diabetes-dementia patient.

Successful completion of the tutorial game will grant learner access to the Hands-on activity in the 3D immersive simulated environment called Second Life®. In this virtual world, learner works in student teams from medicine, nursing, and pharmacy, review the chart of the virtual patient in the EHR, discuss treatment plan, and work together in the treatment management of diabetes-dementia patient under interprofessional team-based settings.

4.6g. Review of Practice and Feedback: Immediate feedback will be provided for correct and incorrect answers.

5. Select Media and Course Delivery

The course would be delivered through both online and computer-based applications. Specifically, presentation slides, videos, Blackboard learning management system, 3D virtual world and gaming platform, Adobe Captivate. The equipment and materials necessary to perform the tasks include access to an EHR system for review of patient medication and reconciliation, clinical-lab test results information and documentation where applicable.

6. Design Four Levels Evaluation

GEL course consist of four levels of evaluation namely:

a. Level 1: Reaction questionnaires at the end of each lesson
b. Level 2: Procedural checklists for procedures for use during practice exercises and tests of conceptual knowledge where it is taught
c. Level 3: A plan for transfer evaluation to see if trainees use the skills on their job effectively after training
d. Level 4: A plan for results evaluation if your supervisor requests it.

For the purpose of this study, only two levels evaluation would be detailed (i.e. Level 1 and 2). Level three and four are beyond the scope of this project.

7. Write a transfer letter for supervisors. This section involves confirmatory letter that highlights that the learners have acquired the level of competency through the GEL training experience knowledge of which could be transferred and applied to their jobs or practice in real-life setting. This section of GEL is beyond the scope of this study.

Stage 1: Meaningful use criteria focus on:	Stage 2: Meaningful use criteria focus on:	Stage 3: Meaningful use criteria focus on:
Electronically capturing health information in a standardized format	More rigorous health information exchange (HIE)	Improving quality, safety, and efficiency, leading to improved health outcomes
Using that information to track key clinical conditions	Increased requirements for e-prescribing and incorporating lab results	Decision support for national high-priority conditions
Communicating that information for care coordination processes	Electronic transmission of patient care summaries across multiple settings	Patient access to self-management tools
Initiating the reporting of clinical quality measures and public health information	More patient-controlled data	Access to comprehensive patient data through patient-centered HIE
Using information to engage patients and their families in their care		Improving population health

Figure 5. Meaningful Use of EHR Stages by HealthIT.gov, 2014

Figure 6. Meaningful Use Core Competencies by HealthIT.gov, 2014

Figure 7. Core competencies for interprofessional collaborative practice by Interprofessional Education Collaboration (IPEC), 2011

Equipment and Materials Required to Perform the Procedure
Learners need access to example files of procedures, checklists, and conceptual knowledge included in the course and the capability to create new text files on the computer, access to an EHR system for review of patient medication, clinical-lab test results information and documentation where applicable, and an introductory video.

Appendix C

Expert Review Questionnaire and Results

Interprofessional faculty, who are the course directors, will review the prototype for accuracy of content, and the instructional designers will review the simulation design to ensure it reflects an appropriate instantiation of GEL. The questionnaires and the feedback from the expert reviews are provided below.

The Questionnaires

Subject Matter Experts Content Review Questionnaire

1. Name: _____ Title:_____Date:_____

2. What is your profession?
   ○ Medicine ○ Pharmacy ○ Nursing

3. How long have you been in healthcare practice?
   ○ 1 – 4yrs ○ 5 – 10yrs ○ 11 – 15yrs ○ 15+

Please validate the content of the case scenario activities by providing your response to the questions below.

Do you think the content of the case scenario?

4. Captures the problems and tasks that the students should be able to successfully perform
   ○ Yes ○ No ○ Not Sure
   Explain:
   _____

5. Reflects the sequence of tasks that the students should be able to follow
   ○ Yes ○ No ○ Not Sure
   Explain:
   _____

6. Is it complete, and does it address the skills you want the student to master
   ○ Yes ○ No ○ Not Sure
   Explain:
   _____

7. Does it achieve the learning objectives?
   ○ Yes ○ No ○ Not Sure
   Explain:
   _____

8. Allows the students to apply their initial knowledge
   ○ Yes ○ No ○ Not Sure
   Explain:
   _____

Instructional Designer's Expert Review Questionnaire

1. Name: _____ Date: _____

2. What is your profession?
   ○ Educator ○ Instructional Designer

3. How long have you worked as an instructional designer?
   ○ 1 – 4yrs ○ 5 – 10yrs ○ 11 – 15yrs ○ 15+

Validate the design of the simulation-based instructional module following the seven steps of GEL design as shown above

4. Does the design reflect appropriate instantiation of GEL's seven steps?
   ○ Yes ○ No ○ Not Sure
   Explain:

The Feedback from the Expert Reviews

Electronic Health Information Technology: Design and Development of a Simulation-based Instructional Module for Students in an Interprofessional Team-based Learning Environment

by

Elizabeth Oviawe

A dissertation proposal submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Information Systems

College of Engineering and Computing
Nova Southeastern University

2017

Subject Matter Experts Content Review Questionnaire

1. Name: [redacted] Date: 7/28/17

2. What is your profession?
   ⊗ Medicine ○ Pharmacy ○ Nursing

3. How long have you been in healthcare practice?
   ○ 1 – 4yrs ○ 5 – 10yrs ○ 11 – 15yrs ⊗ 15+

Please validate the content of the case scenario activities by providing your response to the questions below.

Do you think the content of the case scenario?

4. Captures the problems and tasks that the students should be able to successfully perform
   ⊗ Yes ○ No ○ Not Sure
   Explain:

5. Reflects the sequence of tasks that the students should be able to follow
   ○ Yes ○ No ⊗ Not Sure
   Explain:
   Sequence modified + discussed

1

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6. Is complete, and address the skills you want the students to master
   ○ Yes ○ No ○ Not Sure
   Explain:

7. Allows the students to apply their initial knowledge
   ○ Yes ○ No ○ Not Sure
   Explain:

8. Achieves the learning objectives for the specific tasks (see page #3 for the list of objectives)
   ○ Yes ○ No ○ Not Sure
   Explain:

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2017

Subject Matter Experts Content Review Questionnaire

---

1. Name [redacted] Date: 4/5/17

2. What is your profession?
   ○ Medicine ◉ Pharmacy ○ Nursing

3. How long have you been in healthcare practice?
   ○ 1 – 4yrs ○ 5 – 10yrs ◉ 11 – 15yrs ○ 15+

Please validate the content of the case scenario activities by providing your response to the questions below.

Do you think the content of the case scenario?

4. Captures the problems and tasks that the students should be able to successfully perform
   ◉ Yes ○ No ○ Not Sure
   Explain:

   _____

   _____

5. Reflects the sequence of tasks that the students should be able to follow
   ◉ Yes ○ No ○ Not Sure
   Explain:

   _____

6. Is complete, and address the skills you want the students to master
   ◉ Yes ○ No ○ Not Sure
   Explain:

7. Allows the students to apply their initial knowledge
   ◉ Yes ○ No ○ Not Sure
   Explain:

8. Achieves the learning objectives for the specific tasks (see page #3 for the list of objectives)
   ◉ Yes ○ No ○ Not Sure
   Explain:

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2017

Subject Matter Experts Content Review Questionnaire

---

1. Name: [redacted] Date: 4-4-17

2. What is your profession?
   ○ Medicine ○ Pharmacy ✓ Nursing

3. How long have you been in healthcare practice?
   ○ 1 – 4yrs ○ 5 – 10yrs ○ 11 – 15yrs ✓ 15+

Please validate the content of the case scenario activities by providing your response to the questions below.

Do you think the content of the case scenario?

4. Captures the problems and tasks that the students should be able to successfully perform
   ✓ Yes ○ No ○ Not Sure
   Explain:

   The case study depicts a typical patient presenting to the ED

5. Reflects the sequence of tasks that the students should be able to follow
   ✓ Yes ○ No ○ Not Sure
   Explain:

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6. Is complete, and address the skills you want the students to master
   ✓ Yes ○ No ○ Not Sure
   Explain:

   The sequencing and tasks/skills are typical of what ED nurses perform routinely

7. Allows the students to apply their initial knowledge
   ✓ Yes ○ No ○ Not Sure
   Explain:

8. Achieves the learning objectives for the specific tasks (see page #3 for the list of objectives)
   ✓ Yes ○ No ○ Not Sure
   Explain:

Instructional Designer's Expert Review Questionnaire

The design of the instruction is technology-based. It is web-based, and includes the following session: introductory tutorial on collaborative practice, meaningful use, drill-and-practice and virtual simulation activity.

The development of the instruction is based on Guided Experiential Learning (GEL) theory by Clark (2004, 2005, 2008). The GEL design model provides strong guidance that is aimed to bolster learning processes for all learners. Clark's (2008) course and lesson structure model guideline was adopted in the development of this prototype to illustrate the instantiation of GEL's seven elements.

These seven elements include the following:

1. Introduction and Course Goal
2. Reason for the Course
3. Course Overview
4. Lesson Structure:
    a. Learning Objective
    b. Reason
    c. Overview
    d. Concepts, Processes, and Principles
    e. Demonstration of Procedure
    f. Practice the Procedure
    g. Review Practice and Give Feedback
5. Select Media for Course Delivery
6. Design Four Level Evaluation
7. Write a Transfer Letter for Supervisors. That is, Challenging, competency-based tests that include reactions (trainee confidence and value for the learning) and learning performance (memory for conceptual knowledge and application skill for all procedures).

Only five elements would be fully executed in this design. The sixth element is a four-phase evaluation process; but only the first two levels will be included in the design. The third and fourth levels of the sixth element and the seventh element are beyond the scope of this study.

---

1. Name: [redacted]_____ Date: 02/21/2017_____

2. What is your profession?
   ○ Educator X Instructional Designer

3. How long have you worked as an instructional designer?
   ○ 1 – 4yrs ○ 5 – 10yrs X 11 – 15yrs ○ 15+

Validate the design prototype of the simulation-based instructional module following the seven steps of GEL design as shown above

4. Does the design reflect appropriate instantiation of GEL's seven steps?
   X Yes ○ No ○ Not Sure

   Explain: The online course follows the seven steps of GEL, the content and activities map back to the objectives, and the course is interactive.

Elizabeth Oviawe, PhD. candidate February 21st, 2017
Expert Review – Instructional Design (Dissertation)

Electronic Health Information Technology: Design and Development of a Simulation-based Instructional Module for Students in an Interprofessional Team-based Learning Environment

by

Elizabeth Oviawe

A dissertation proposal submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Information Systems

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2017

Instructional Designer's Expert Review Questionnaire

The design of the instruction is technology-based. It is web-based, and includes the following session: introductory tutorial on collaborative practice, meaningful use, drill-and-practice and virtual simulation activity.

The development of the instruction is based on Guided Experiential Learning (GEL) theory by Clark (2004, 2005, 2008). The GEL design model provides strong guidance that is aimed to bolster learning processes for all learners. Clark's (2008) course and lesson structure model guideline was adopted in the development of this prototype to illustrate the instantiation of GEL's seven elements.

These seven elements include the following:

1. Introduction and Course Goal
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4. Lesson Structure:
    a. Learning Objective
    b. Reason
    c. Overview
    d. Concepts, Processes, and Principles
    e. Demonstration of Procedure
    f. Practice the Procedure
    g. Review Practice and Give Feedback
5. Select Media for Course Delivery
6. Design Four Level Evaluation
7. Write a Transfer Letter for Supervisors. That is, Challenging, competency-based tests that include reactions (trainee confidence and value for the learning) and learning performance (memory for conceptual knowledge and application skill for all procedures).

Only five elements would be fully executed in this design. The sixth element is a four-phase evaluation process; but only the first two levels will be included in the design. The third and fourth levels of the sixth element and the seventh element are beyond the scope of this study.

Elizabeth Oviawe, PhD. candidate — April 7th, 2017
Expert Review – Instructional Design (Dissertation)

Electronic Health Information Technology: Design and Development of a Simulation-based Instructional Module for Students in an Interprofessional Team-based Learning Environment

by

Elizabeth Oviawe

A dissertation proposal submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Information Systems

College of Engineering and Computing
Nova Southeastern University

2017

Instructional Designer's Expert Review Questionnaire

1. Name: [redacted] Date: 4/7/2017

2. What is your profession?
   ○ Educator **X** Instructional Designer

3. How long have you worked as an instructional designer?
   ○ 1 – 4yrs ○ 5 – 10yrs **X** 11 – 15yrs ○ 15+

Validate the design prototype of the simulation-based instructional module following the seven steps of GEL design as shown above

4. Does the design reflect appropriate instantiation of GEL's seven steps?
   ○ Yes ○ No **X** Not Sure
   Explain: "I think so" is the choice I would select to this question if it were offered. It appears to cover most if not all of the steps. But without having a synopsis/outline of the course upfront and now (for recall), it's difficult to recall every aspect having seen it only once (and with the latency that occurred during the presentation due to bandwidth issues). From what I recall last night, it did introduce the topic well, provide low level content knowledge up front, demo, provide practice using games, and then apply it in the 2nd Life environment. I was only able to hear some of the audio so I can't fully attest to the utility of the video presentations by the instructor, but it seemed quite appropriate to this design model. I very much liked how the lesson was put together Liz! ☺

Appendix D

Links to the Simulation-Based Instructional Module Prototype

Game-based Interprofessional Education (IPE) Training and Activities

https://www.nova.edu/portal/mededcom/LizODissPrototype/LizODissPrototype.htm

Patient-centered clinical skills experience activity in Virtual World (Second Life®)

http://prezi.com/sluprh47fb8e/?utm_campaign=share&utm_medium=copy&rc=ex0share

Appendix E

IRB Approval Letter

NOVA SOUTHEASTERN UNIVERSITY
Institutional Review Board

MEMORANDUM

To: **Elizabeth Oviawe, Ph.D(c), Ed.S., M.S.**
College of Engineering and Computing

From: **Ling Wang, Ph.D.,**
Center Representative, Institutional Review Board

Date: **February 16, 2017**

Re: **IRB #: 2017-107; Title, "Electronic Health Information Technology: Design and Development of a Simulation-based Instructional Module for Students in an Inter-professional Team-based Learning Environment"**

I have reviewed the above-referenced research protocol at the center level. Based on the information provided, I have determined that this study is exempt from further IRB review under **45 CFR 46.101(b) (Exempt Category 1)**. You may proceed with your study as described to the IRB. As principal investigator, you must adhere to the following requirements:

1) CONSENT: If recruitment procedures include consent forms, they must be obtained in such a manner that they are clearly understood by the subjects and the process affords subjects the opportunity to ask questions, obtain detailed answers from those directly involved in the research, and have sufficient time to consider their participation after they have been provided this information. The subjects must be given a copy of the signed consent document, and a copy must be placed in a secure file separate from de-identified participant information. Record of informed consent must be retained for a minimum of three years from the conclusion of the study.

2) ADVERSE EVENTS/UNANTICIPATED PROBLEMS: The principal investigator is required to notify the IRB chair and me (954-262-5369 and Ling Wang, Ph.D., respectively) of any adverse reactions or unanticipated events that may develop as a result of this study. Reactions or events may include, but are not limited to, injury, depression as a result of participation in the study, life-threatening situation, death, or loss of confidentiality/anonymity of subject. Approval may be withdrawn if the problem is serious.

3) AMENDMENTS: Any changes in the study (e.g., procedures, number or types of subjects, consent forms, investigators, etc.) must be approved by the IRB prior to implementation. Please be advised that changes in a study may require further review depending on the nature of the change. Please contact me with any questions regarding amendments or changes to your study.

The NSU IRB is in compliance with the requirements for the protection of human subjects prescribed in Part 46 of Title 45 of the Code of Federal Regulations (45 CFR 46) revised June 18, 1991.

Cc: Marti Snyder, Ph.D.

Appendix F

Recruitment Flyer


It's Game Time!
Wanna be a Millionaire Healthcare Professional!
Calling for PARTICIPANTS
You are eligible to participate in this study if you are a 2nd or 3rd Year Student in the:
• College of Osteopathic Medicine
• College of Pharmacy
• College of Nursing
The Study involves Interactive Game-based and Virtual Simulation-based Interprofessional Clinical Skill Experience.
Participation is completely Voluntary
So HURRY-UP and VOLUNTEER!!!
Participants would be COMPENSATED for their time!
To Participate or for more Information,
Please call 954-262-1414
Now, Choose your Profession to Begin
Physician
Nurse
Pharmacist

Appendix G

Pre-Assessment

Mon 1/23/2017 1:27 PM

Doug Brock <dmbrock@uw.edu>

Re: Request for Permission to use for Pre/Post Assessment Tool

To Elizabeth Oviawe

Bing Maps

Hi Liz,

Yes, please feel free to adapt the pre/post assessment tool to your work's needs.

Thanks for your interest!

-Doug

Doug Brock, PhD
Associate Professor
Department of Family Medicine & MEDEX Northwest
Adjunct, Department of Biomedical Informatics and Medical Education
University of Washington
(206) 616-1736

From: Elizabeth Oviawe <oviawe@nova.edu>
Date: Sunday, January 22, 2017 at 6:05 PM
To: Doug Brock <dmbrock@uw.edu>
Subject: Request for Permission to use for Pre/Post Assessment Tool

Dear Dr. Brock et al,

My name is Elizabeth Oviawe. I am a Ph.D. candidate in the program of Computing Technology in Education at Nova Southeastern University College of Engineering and Computing.

This email serves to seek your permission to adapt your Pre/Post Assessment Tool in my proposed dissertation research.

I look forward to your favorable response.

Thank You,

Regards.....Liz

Elizabeth Oviawe, Ph. D (c)
College of Engineering and Computing
Nova Southeastern University College of Osteopathic Medicine
3200 S. University Drive, Ft. Lauderdale FL 33328

COM Quality Enhancement Programs (QEP)
A – Academical Societies
R - Research Fellowships
C - Clinical Education Programs

Pre-Assessment: Simulation-based Instructional Module for Students in an Inter-professional Team-based Learning

1. **Demographics**

Sex: Male ____ Female ____

Age: ____

Did you have healthcare work experience prior to entering your program (e.g., as a respiratory therapist):

Yes ____ No ____

2. **Familiarity working and training with teams**

	Very Unfamiliar	Unfamiliar	Neutral	Familiar	Very Familiar
How familiar are you with WORKING as part of an interprofessional team?					
How familiar are you with TRAINING as part of an interprofessional team?					

3. **Interprofessional Training**

In less than a few (days, weeks) you'll be participating in an interprofessional training opportunity

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I'm looking forward to the Interprofessional Team Communication Training.					

4. **Benefits of Training**

Students experience varying benefits from working with students from other professions. Please answer each of the following with regard to how you benefit from working with other healthcare students. NOTE: If you have never had such experience select Not Applicable (N/A)

	N/A	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Learning with other students helps me become a more effective member of a healthcare team.						
Patients ultimately benefit if interprofessional healthcare students learn together to solve patient problems.						

Shared learning with other healthcare students increases my ability to understand clinical problems.						
Interprofessional healthcare team training exercises help me appreciate other professionals.						

5. Learning and Performance

Sometimes we learn more quickly or perform better doing tasks we enjoy, while at other times we may enjoy something that we don't easily learn or necessarily perform well at. For each of the following questions answer with regard to both how much you enjoy something and with regard to how well you tend to learn and perform. NOTE: If you have never had such experience select Not Applicable (N/A).

	N/A	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I enjoy learning in team based healthcare activities.						
I perform well in team based healthcare activities.						
I enjoy learning in simulated environments.						
I perform well in simulated environments.						
I enjoy learning opportunities that bring together students from other professions.						
I perform well in settings that bring together students from other professions.						

6. Skills

We all have skills we're great at and other skills where we could use some assistance. For the following questions answer with regard to your level of confidence. NOTE: If you have never had such experience select Not Applicable (N/A).

	N/A	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I can work effectively in teams.						
I can contribute valuable insight to teams.						
I can easily facilitate communication between team members.						
I am not effective at delegating responsibility for tasks.						

I can effectively coordinate tasks and activities of a team.						
I am able to resolve conflicts between individuals effectively.						
I do not feel I can create accurate medication reconciliation.						
Integrating patient-centered education into a plan is something I am not very good at.						

7. Team Structure

	N/A	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is important to ask patients and their families for feedback regarding patient care.						
Patients are a critical component of the care team.						
A team's mission is of greater value than the goals of individual team members.						
Effective team members can anticipate the needs of other team members.						
High-performing teams in healthcare share common characteristics with high-performing teams in other industries.						

8. Mutual Support (Roles and Responsibilities)

	N/A	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
To be effective, team members should understand the work of their fellow team members.						
Individuals can be taught how to scan the environment for important situational cues.						
Monitoring patients provides an important contribution to effective team performance.						
Offering to help a fellow team member with his/her individual work tasks is an effective tool for improving team performance.						
Incomplete lab and test results in patient's record could impart patient safety.						
It is appropriate to continue to assert a patient safety concern until you are certain that it has been heard.						
Personal conflicts between team members do not affect patient safety.						

9. Communication

	N/A	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Teams that do not communicate effectively, significantly increase their risk of committing errors.						
Poor communication is the most common cause of reported errors.						
Adverse events may be reduced by maintaining an information exchange with patients and their families.						
I prefer to work with team members who ask questions about information I provide.						
It is important to have a standardized method for sharing information when handing off patients.						
It is nearly impossible to train individuals how to be better communicators.						

10. Essential Practice Characteristics

For each of the following please state whether the issue is essential to interprofessional practice or is not essential to interprofessional practice. NOTE: If you are not sure, select "Don't Know"

	Essential	Not Essential	Don't Know
Collaboration.			
Working together to solve patients' problems			
Reducing errors.			
Improving quality of care.			
Anticipating the needs of other team members.			
Mutual Support/Roles and Responsibilities.			
Patient advocacy.			
Standardizing handoffs.			
Asking for assistance when needed.			
Expressing concerns about patient safety.			

Thank you for your participation!

Pre-Assessment Questionnaire. Adapted from "Pre/Post Assessment Tool" developed by Brock, Abu-Rish, Vorvick, Wilson, Liner, Schaad, Blondon (2010). Center for Health Sciences Interprofessional Education, Research and Practice

Appendix H

Interprofessional Evaluation Checklist

From: 김신정 [mailto:ksj@hallym.ac.kr]
Sent: Sunday, January 22, 2017 10:21 PM
To: Elizabeth Oviawe <oviawe@nova.edu>
Subject: RE:RE: Permission Request to Adapt Evaluation Checklist

Dear Elizabeth,

Yes, you can use.

Warm Regards,
Shin-Jeong Kim

---------- Original Message ----------
> **From :** Elizabeth Oviawe <oviawe@nova.edu>
> **To :** ksj@hallym.ac.kr <ksj@hallym.ac.kr>,ohjina@inje.ac.kr <ohjina@inje.ac.kr>,
> **Cc :**
> **Sent :** 2017-01-23 오전 11:11:04
> **Subject :** RE: Permission Request to Adapt Evaluation Checklist

Hello Drs. Kim, Oh et al.

With reference to your research article titled: Development And Evaluation Of Simulation-Based Fever Management Module For Children With Febrile Convulsion. I hereby seek permission to adapt your Evaluation Checklist in my proposed dissertation research.

I look forward to you favorable response.

Thank you!

Regards.....Liz

History/Assessment *Critical* *Thinking*	**Exemplary**	**Properly implemented**	**Averagely implemented**	**Improperly implemented**	**Not implemented**	**Not applicable**
Preparatory Washing hands Prepare needed materials Introducing self to the patient & his/her caregivers Identify patient by name card and/or bracelet Identify medical appliances belonging to patient Check the chief complaint Identify past history Social history Family history Review of system Identify symptoms related to chief complaint - other symptoms beside fever, e.g. confusion, nausea, vomiting Physical Exams: a. Inspection: skin color, warmth, perspiration, pallor, chilling b. Palpation: cold extremities c. Percuss of systems d. Auscultate systems e. Vital signs: temperature, pulse, respiration f. Dehydration signs: diminished urine output, skin turgor, level of capillary compensation, activity level, dehydrated lip & mucus of mouth, sunken eye(s), absent tears g. Check for symptoms h. Check pulse, cardiorespiratory monitoring equipment i. Check mouth, neck, lungs, heart, abdomen, feet, back, buttocks, pressure sores						
Problem identification *Critical thinking*						

Medical/Nursing/Pharmacy problems: Identifies interrelated medical, nursing, medication (pharmacy) problems Potential physical injury related to inability of mental alertness Hyperthermia, Hyperglycemic, Urinary tract infection (UTI), Sepsis, Dehydration, Myocardia Infraction (MI), Hyperosmolar state Fluid & electrolyte imbalance Caregiver/Family member anxiety related to lack of knowledge about patient's current condition						
Interventions *Critical thinking (priority interventions)*						
Fever reduction therapy, blood sugar therapy, medication therapy, cognitive behavioral therapy Notify doctor & receive treatment order if needed a. Administration of fever and blood sugar therapy b. Explain the purpose and method of blood sugar therapy (Explain to caregiver) c. Perform accucheck check blood sugar level. d. Apply standard nursing protocol a. start IV point, b. give initial medication, c. draw blood e. Review prior medications history to identify any drug related problems a. Aspirin 81mg PO daily b. Diphenhydramine (Benadryl) 50mg PO HS c. Canagliflozin / metformin 150/1000mg (Invokamet) PO BID with meals f. Physician orders lab test, review the clinical lab-test results a. CBC differential, BMP, CMP, blood cultures times 2 (consider Sepsis), Urinalysis culture and sensitivity, order Chest X-ray, EKG, and Cardiac Enzymes, and order X-ray of the hip to rule out fracture. b. HbA1c = 6.1 c. TChol = 184, HDL = 43						

g. Physician orders medications Preparation of prescribed medications Pharmacy Care a. Compare prior medication list to physician's order b. Review order received for errors, omissions and drug interaction c. Communicate any discrepancies or therapeutic interventions to the Physician, and/or the Nurse Nursing care for temperature control a. Administer prescribed medications b. Educate patient and caregiver (aide) c. Lower the room temperature d. Apply cold compress e. Remove excess linens and clothing f. Promote fluid intake in not NPO Monitor vital signs and patient as necessary for changes in patient status, SaO2, HR, body temperature, EKG monitoring, consciousness level, & dehydration signs Provide comfortable resting environment Provide education to patient and care giver as needed Document as necessary in the patients record						
Evaluations *Critical thinking*						
Check normal range of body temperature & vital signs Check HR, body Temperature, SaO2 & level of consciousness Check recurrence of dehydration Improve caregiver's understanding about the patient's condition						

Note: Likert scale ratings as follows: 0 (not applicable), 1 (not implemented), 2 (improperly implemented), 3 (averagely implemented), 4 (properly implemented), and 5 (exemplary).

Appendix I

Satisfaction with Simulation Experience Scale

From: Tracy Levett-Jones [mailto:tracy.levett-jones@newcastle.edu.au]
Sent: Sunday, August 14, 2016 9:31 PM
To: Elizabeth Oviawe <oviawe@nova.edu>
Subject: RE: Permission Request to Adapt your SSE scale

Hello Elizabeth
I am happy for you to use this scale with appropriate acknowledgments.
All the very best with your research.
Kind regards
Tracy

Prof. Tracy Levett-Jones
Director of the Research Centre for Health Professional Education - http://www.newcastle.edu.au/research-and-innovation/centre/health-professional-education/about-us

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E: Tracy.Levett-Jones@newcastle.edu.au
Twitter: @Prof_TLJ
Blog: proftlj.com

The University of Newcastle (UoN)
University Drive
Callaghan NSW 2308
Australia

Member of InSPIRE - http://www.inspiresimulation.net/

From: Elizabeth Oviawe [mailto:oviawe@nova.edu]
Sent: Saturday, 13 August 2016 11:15 PM
To: Tracy Levett-Jones <tracy.levett-jones@newcastle.edu.au>
Subject: Permission Request to Adapt your SSE scale

Dear Dr. Levett-Jones et al.,

My name is Elizabeth Oviawe. I am a Ph.D. candidate in the program of Computing Technology in Education at Nova Southeastern University College of Engineering and Computing.
This email serves to seek your permission to adapt your Satisfaction of Simulations Experience (SSE) scale in my proposed dissertation research.

I look forward to your favorable response.

Thank You,
Regards.....Liz
****

Elizabeth Oviawe, Ph. D (c)
College of Engineering and Computing
Nova Southeastern University College of Osteopathic Medicine
3200 S. University Drive, Ft. Lauderdale FL 33328

SATISFACTION WITH SIMULATION EXPERIENCE SCALE (SSES)

Below you will find a list of statements. Read each statement and then select the response that best indicates your level of agreement.

- **Please answer every item**, even if one seems similar to another one
- **Answer each item quickly**, without spending too much time on any one item.

Debrief and reflection						
01	The facilitator provided constructive criticism during the debriefing	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
02	The facilitator summarized important issues during the debriefing	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
03	I had the opportunity to reflect on and discuss my performance during the debriefing	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
04	The debriefing provided an opportunity to ask questions	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
05	The facilitator provided feedback that helped me to develop my clinical reasoning skills	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
06	Reflecting on and discussing the simulation enhanced my learning	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
07	The facilitator's questions helped me to learn	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
08	I received feedback during the debriefing that helped me to learn	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
09	The facilitator made me feel comfortable and at ease during the debriefing	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
Clinical reasoning						
10	The simulation developed my clinical reasoning skills	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
11	The simulation developed my clinical decision making ability	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
12	The simulation enabled me to demonstrate my clinical reasoning skills	Strongly disagree	Disagree	Unsure	Agree	Strongly agree

13	The simulation helped me to recognize patient deterioration early	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
14	This was a valuable learning experience	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
Clinical learning						
15	The simulation caused me to reflect on my clinical ability	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
16	The simulation tested my clinical ability	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
17	The simulation helped me to apply what I learned from the case study	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
18	The simulation helped me to recognize my clinical strengths and weaknesses	Strongly disagree	Disagree	Unsure	Agree	Strongly agree

This resource was created as part of an ATLC Project titled Examining the impact of simulated patients and information and communication technology on nursing students' clinical reasoning. Please acknowledge as: Levett-Jones, T., McCoy, M., Lapkin, S., Noble, D., Hoffman, K., Dempsey, J., Arthur, C. & Roche, J. (2011). The development and psychometric testing of the Satisfaction with Simulation Experience Scale. *Nurse Education Today*. *31*(7), 705-710.

Appendix J

Descriptive Statistics Analyzing of the Pre-Assessment Survey

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
How familiar are you with WORKING as part of an interprofessional team?	21	2	5	3.48	1.08	1.16
How familiar are you with TRAINING as part of an interprofessional team?	21	2	5	3.10	1.14	1.29
I'm looking forward to the Interprofessional Team Communication Training.	21	3	5	4.24	0.70	0.49
Learning with other students helps me become a more effective member of a healthcare team.	21	0	5	4.29	1.15	1.31
Patients ultimately benefit if interprofessional healthcare students learn together to solve patient problems.	21	0	5	4.48	1.17	1.36
Shared learning with other healthcare students increases my ability to understand clinical problems.	21	0	5	4.24	1.22	1.49
Interprofessional healthcare team training exercises help me appreciate other professionals.	21	0	5	4.14	1.59	2.53
I perform well in team based healthcare activities.	21	0	5	4.05	1.24	1.55
I enjoy learning in simulated environments.	21	0	5	3.76	1.48	2.19
I perform well in simulated environments.	21	0	5	3.05	1.56	2.45
I enjoy learning opportunities that bring together students from other professions.	21	0	5	4.10	1.55	2.39
I enjoy learning opportunities that bring together students from other professions.	21	0	5	3.76	1.73	2.99
I perform well in settings that bring together students from other professions.	21	0	5	3.19	1.81	3.26

I can work effectively in teams.	21	3	5	4.38	0.59	0.35
I can contribute valuable insight to teams.	21	0	5	4.05	1.07	1.15
I can easily facilitate communication between team members.	21	0	5	3.95	1.20	1.45
I am not effective at delegating responsibility for tasks.	21	1	5	2.48	1.17	1.36
I can effectively coordinate tasks and activities of a team.	21	0	5	3.81	1.21	1.46
I am able to resolve conflicts between individuals effectively.	21	3	5	4.00	0.77	0.60
I do not feel I can create accurate medication reconciliation.	21	0	5	2.14	1.35	1.83
Integrating patient-centered education into a plan is something I am not very good at.	21	0	5	2.19	1.36	1.86
Integrating patient-centered education into a plan is something I am not very good at.	21	0	5	2.19	1.36	1.86
It is important to ask patients and their families for feedback regarding patient care.	21	0	5	4.19	1.12	1.26
Patients are a critical component of the care team.	21	4	5	4.71	0.46	0.21
A team's mission is of greater value than the goals of individual team members.	21	3	5	4.62	0.59	0.35
Effective team members can anticipate the needs of other team members.	21	0	5	4.24	1.14	1.29
High-performing teams in healthcare share common characteristics with high-performing teams in other industries.	21	0	5	3.86	1.49	2.23
To be effective, team members should understand the work of their fellow team members.	21	4	5	4.67	0.48	0.23

Individuals can be taught how to scan the environment for important situational cues.	21	0	5	4.29	1.10	1.21
Monitoring patients provides an important contribution to effective team performance.	21	0	5	4.29	1.15	1.31
Offering to help a fellow team member with his/her individual work tasks is an effective tool for improving team performance.	21	0	5	4.05	1.28	1.65
Incomplete lab and test results in patient's record could impart patient safety.	21	2	5	4.52	0.75	0.56
It is appropriate to continue to assert a patient safety concern until you are certain that it has been heard.	21	3	5	4.38	0.59	0.35
Personal conflicts between team members do not affect patient safety.	21	1	5	1.86	1.01	1.03
Teams that do not communicate effectively, significantly increase their risk of committing errors.	21	4	5	4.71	0.46	0.21
Poor communication is the most common cause of reported errors.	21	3	5	4.38	0.59	0.35
Adverse events may be reduced by maintaining an information exchange with patients and their families.	21	3	5	4.33	0.66	0.43
I prefer to work with team members who ask questions about information I provide.	21	0	5	4.00	1.14	1.30
It is important to have a standardized method for sharing information when handing off patients.	21	0	5	4.38	1.12	1.25
It is nearly impossible to train individuals how to be better communicators.	21	0	5	1.76	1.22	1.49
Collaboration.	21	3	3	3.00	0.00	0.00
Working together to solve patients' problems	21	3	3	3.00	0.00	0.00
Reducing errors.	21	3	3	3.00	0.00	0.00
Improving quality of care.	21	3	3	3.00	0.00	0.00

Anticipating the needs of other team members.	21	0	3	2.71	0.78	0.61
Mutual Support/Roles and Responsibilities.	21	0	3	2.86	0.65	0.43
Patient advocacy.	21	3	3	3.00	0.00	0.00
Standardizing handoffs.	21	1	3	2.67	0.73	0.53
Asking for assistance when needed.	21	3	3	3.00	0.00	0.00
Expressing concerns about patient safety.	21	3	3	3.00	0.00	0.00

Appendix K

Descriptive Statistics and Proportion Analysis of the Interprofessional Evaluation Checklist

Descriptive Statistics							
Questions	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Core Competencies Addressed
Preparatory, (Must fulfil/discuss at least ONE) Washing hands, Prepare needed materials, Introducing self to the patient & his/her caregivers, Identify patient by name card and/or bracelet	17	1	4	2.88	1.364	1.860	Interprofessional Communication, Teams and Teamwork, Roles/Responsibilities
Check the chief complaint	20	2	5	3.95	0.826	0.682	Interprofessional Communication, Teams and Teamwork, Roles/Responsibilities
Identify past history	20	2	5	4.00	0.725	0.526	Interprofessional Communication, Teams and Teamwork, Roles/Responsibilities
Social history	19	2	5	3.89	0.737	0.544	Interprofessional Communication, Teams and Teamwork, Roles/Responsibilities
Family history	16	2	5	3.69	0.793	0.629	Interprofessional Communication, Teams and Teamwork, Roles/Responsibilities
Review of system	15	2	5	3.80	0.862	0.743	Interprofessional Communication, Teams and Teamwork, Roles/Responsibilities
Identify symptoms related to chief complaint - other symptoms beside fever, e.g. confusion, nausea, vomiting	18	1	5	3.61	1.092	1.193	Interprofessional Communication, Teams and Teamwork, Roles/Responsibilities

Physical Exams: (Must fulfil/discuss at least ONE), a. Inspection: skin color, warmth, perspiration, pallor, chilling, b. Palpation: cold extremities, c. Percuss of systems, d. Auscultate systems, e. Vital signs: temperature, pulse, respiration, f. Dehydration signs: diminished urine output, skin turgor, level of capillary compensation, activity level, dehydrated lip & mucus of mouth, sunken eye(s), absent tears, g. Check for symptoms, h. Check pulse, cardiorespiratory monitoring equipment, i. Check mouth, neck, lungs, heart, abdomen, feet, back, buttocks, pressure sores	13	1	5	3.46	1.266	1.603	Interprofessional Communication, Teams and Teamwork
Potential physical injury related to inability of mental alertness	19	1	5	3.63	1.065	1.135	Teams and Teamwork
Hyperthermia, Hyperglycemic, Urinary tract infection (UTI), Sepsis, Dehydration, Myocardia Infraction (MI), Hyperosmolar state	20	1	5	3.60	1.231	1.516	Clinical Lab-Test Results, Teams and Teamwork
Fluid & electrolyte imbalance	18	1	5	3.56	1.247	1.556	Role/Responsibilities
Caregiver/Family member anxiety related to lack of knowledge about patient's current condition	17	1	5	2.82	1.468	2.154	Patient-Specific Education

Nurse notifies doctor & receive treatment order if needed (Must fulfil/discuss at least ONE), a. Administration of fever and blood sugar therapy, b. Explain the purpose and method of blood sugar therapy (Explain to caregiver), c. Perform accucheck check blood sugar level.	14	2	4	3.79	0.579	0.335	Interprofessional Communication, Teams and Teamwork
Apply standard nursing protocol, (Must fulfil/discuss at least ONE), a. start IV point, b. give initial medication, c. draw blood	14	1	4	3.50	1.092	1.192	Role/Responsibilities
Review prior medications history to identify any drug related problems, (Must fulfil/discuss at least ONE) a. Aspirin 81mg PO daily, b. Diphenhydramine (Benadryl) 50mg PO HS c. Canagliflozin / metformin 150/1000mg (Invokamet) PO BID with meals	20	2	5	3.95	0.686	0.471	Medication Reconciliation
Physician orders lab test, review the clinical lab-test results, (Must fulfil/discuss at least ONE), a. CBC differential, BMP, CMP, blood cultures times 2 (consider Sepsis), Urinalysis culture and sensitivity, order Chest Xray, EKG, and Cardiac Enzymes,	13	2	5	4.00	0.816	0.667	Clinical Lab-Test Results
Physician orders medications	11	1	4	3.55	0.934	0.873	Medication Reconciliation

Preparation of prescribed medications, (Must fulfil/discuss at least ONE) Pharmacy Care; a. Compare prior medication list to physician's order, b. Review order received for errors, omissions and drug interaction, c. Communicate any discrepancies or therapeutic interventions to the Physician, and/or the Nurse	18	1	5	3.56	1.504	2.261	Medication Reconciliation
Nursing care (Must fulfil/discuss at least ONE) a. Administer prescribed medications, b. Educate patient and caregiver (aide), c. Promote fluid intake in not NPO	14	1	4	2.93	1.492	2.225	Medication Reconciliation, Patient-Specific Education
Monitors vital signs and patient as necessary for changes in patient status, SaO2, HR, body temperature, EKG, Monitors consciousness level, & dehydration signs	19	1	5	3.79	1.134	1.287	Role/Responsibilities
(Must fulfil/discuss at least ONE), a. Provide comfortable resting environment, b. Provide education to patient and care giver as needed, c. Document as necessary in the patients record via Chat	19	1	5	3.95	0.970	0.942	Patient-Specific Education
(Must fulfil/discuss at least ONE) a. Check normal range of body temperature & vital signs, b. Check HR, body Temperature, SaO2 & level of consciousness	19	1	5	3.63	1.116	1.246	Role/Responsibilities

(Must fulfil/discuss at least ONE) a. Check recurrence of dehydration, b. Improve caregiver's understanding about the patient's condition	20	1	5	3.55	1.395	1.945	Patient-Specific Education

Appendix L

Proportion Analysis of the Debriefing Comments of the Students' Performances

Themes	Codes
Medication Reconciliation	MR
Roles/Responsibilities	RR
Clinical Lab – Test Results	CT
Interprofessional Communication	IC
Teams and Teamwork	TT
Patient-Specific Education	PE

Q25FreeText - Debriefing comments	S/N	code applied
good development of ddx and tx plan excellent patient education provided pt probably in DKA...must be vigilant as to the severity of the presenting illness labs must be continually monitored after insulin is provided remember that this patient requires significant amounts of fluid resuscitation	1	RR
Clinical Lab test	2	CT
Communicate with others	3	IC
Team interaction	4	TT
integrate patient-centered education	5	PE
audio was very hard to hear critical diagnosis were identified critical interventions were accomplished	6	RR
Clinical Lab test	7	CT
Communicate with others	8	IC
Team interaction	9	TT
integrate patient-centered education	10	PE
Thorough, thought through each issue and tried to address to the best of her ability. Worked well with the other members of the team and also did a good job with building rapport with the patient. Very proud of you Joanne.	11	MR
understand role/responsibilites of self and others	12	RR
Communicate with others	13	IC
Team interaction	14	TT
integrate patient-centered education	15	PE
excellent identification of patient problem list which then lead to good development of ddxs and tx plan good team work....all caregivers were appropriately involved good rapport established with the patient with an appropriate explanation of his management issues	16	MR
	17	RR
Clinical Lab test	18	CT
Communicate with others	19	IC
Team interaction	20	TT
integrate patient-centered education	21	PE
Team was scattered in their thought processes engaging in random conjecture rather assessing their patient in a systematic manner and setting priorities for interventions. Poor organization.	22	RR
Clinical Lab test (checked previous lab test)	23	CT
Communicate with others	24	IC
Team interaction (limited in organization)	25	TT
integrate patient-centered education	26	PE
This team, while not thorough, did work seem to work well together. There was some good initial questioning of the patient and appropriate decision making by the MD with good delegation to the RN. However, this team was too superficial in there approach and priority setting i.e.- there was no mention of pain management for the patients abdominal or hip pain.	27	RR
Communicate with others	28	IC
Team interaction	29	TT
integrate patient-centered education	30	PE

Statistics

Themes	Frequency
Medication Reconciliation	11
Roles/Responsibilities	20
Clinical Lab – Test Results	9
Interprofessional Communication	19
Teams and Teamwork	19
Patient-Specific Education	20
Total	98

Themes	Proportion
Medication Reconciliation	11%
Roles/Responsibilities	20%
Clinical Lab – Test Results	9%
Interprofessional Communication	19%
Teams and Teamwork	19%
Patient-Specific Education	20%
Total	100%

Themes	Codes	Q25FreeText - Debriefing comments	S/N	code applied	Statistics
		This team seemed to work well together and focused, it seemed, only on the patient's hyperglycemic state. Their approach to the BS of 550 was appropriate and the actions they took were proper. However, they failed to address the patient's reason for presentation or the pain that the patient was reporting.	31	RR	
		Communicate with others	32	IC	
		Team interaction	33	TT	
		integrate patient-centered education	34	PE	
		she was extremely thorough and covered the medication-related aspects of the case we were looking for. She was correct in requesting certain labs and considerations with regards to the patient's treatment.	35	MR	
		understand role/responsibilites of self and others	36	RR	
		Clinical Lab test	37	CT	
		Communicate with others	38	IC	
		Team interaction	39	TT	
			40	PE	
		Very difficult to hear (sound goes in and out); I used the log to read through her comments. It looks like she caught on to most but not the DKA. She did not mention DKA (such as fluids, etc). She was alone so maybe if she had been on the team, someone else may have identified it.	41	MR	
		understand role/responsibilites of self and others	42	RR	
		integrate patient-centered education	43	PE	
		Great job- would have liked you to think about fluids (and especially check potassium before insulin)- it's hard to follow, so you may have done this. I like that you were thorough in your medication history and did a good job prioritizing your problems. Dig a little deeper into his medication history. Otherwise, great work Rebecca!	44	MR	
		understand role/responsibilites of self and others	45	RR	
		Communicate with others	46	IC	
		Team interaction	47	TT	
		integrate patient-centered education	48	PE	
		excellent identification and prioritization of pt problems good team work all appropriate interventions performed good anticipatory guidance	49	RR	
		Clinical Lab test	50	CT	
		Communicate with others	51	IC	
		Team interaction	52	TT	
		integrate patient-centered education	53	PE	
		good team interaction good identification of patient problems and generation of differential diagnosis and interventions good team effort and discussion with patient of care plan	54	RR	
		Clinical Lab test	55	CT	
		Communicate with others	56	IC	
		Team interaction	57	TT	
		integrate patient-centered education	58	PE	
		great team dynamic good identification of patient problems which lead to appropriate differential diagnosis development and treatment plan good discussion with patient of findings and allaying concerns	59	MR	
		understand role/responsibilites of self and others	60	RR	
		Clinical Lab test	61	CT	
		Communicate with others	62	IC	
		Team interaction	63	TT	
		integrate patient-centered education	64	PE	
		good identification of patient problems, development of differential dx, and tx plans good initial team interaction good patient education and description of the medical problems	65	RR	
		Clinical Lab test	66	CT	
		Communicate with others	67	IC	

Themes	Codes	Q25FreeText - Debriefing comments	S/N	code applied	Statistics
		Team interaction	68	TT	
		integrate patient-centered education	69	PE	
		Overall the interaction was average. The communication between medical and pharmacy student was great and both students were mindful of other members of the healthcare team to consider (i.e., OT, PT, social worker) upon follow-up. Pharmacy student checked for chief complaint and inquired on medications used at home and adherence. In general, good questions were asked to the aide, patient and other members of the healthcare team. Problems were prioritizes well also. However, remember to involve the caregiver and patient in the final decision making. Always remember to introduce yourself to create a harmonious, collaborative environment from the beginning. Several times pharmacy student seemed unsure in their decision making and few times inadequate suggestions were provided but corrected by medical student or prompted through chat conversation. As such, this is part of the learning process, and more experiences such as these would help improve confidence and see big picture in a complex patient cases. Good work!	70	MR	
		understand role/responsibilites of self and others	71	RR	
		Communicate with others	72	IC	
		Team interaction	73	TT	
		integrate patient-centered education	74	PE	
		Overall the interaction was very good. The communication between medical, nursing and pharmacy students was smooth and all students appropriately covered the pertinent foundational information needed to assess the case. Always remember to introduce yourself to create a harmonious, collaborative environment from the beginning as well as counseling about medications and lifestyle modifications to patient and caregivers. Clinically, the pharmacy student appropriately covered home and current medications as well as their indications and asked patient/aide appropriate follow-up questions. Good questions were asked to medical and nursing student throughout as well when needed. Priorities and alternative choices of medications inpatient should have been considered. However, with more practice I believe this will improve. Great job!	75	MR	
		understand role/responsibilites of self and others	76	RR	
		Communicate with others	77	IC	
		Team interaction	78	TT	
		integrate patient-centered education	79	PE	
		This team did an excellent job working together and with the patient/caregiver. Great communication. The biggest thing to improve on would be incorporating the caregiver more and assessing his/her understanding of the current situation and follow-up especially since the patient has cognitive difficulties. The pharmacy student asked appropriate questions regarding home medications, indications, effects of the medications and any questions or concerns from patient and aide. Education and counseling was done throughout, but the summary provided at the end with follow-up was done very well. There was incorrect information given regarding Percocet during the interview; however, the student took ownership of this mistake and it was corrected. Clinical knowledge will improve over time with more practice. Lastly, the pharmacy student introduced herself (unable to access if hand washing was done) and was empathetic throughout the interview. Overall, great work!	80	MR	
		understand role/responsibilites of self and others	81	RR	
		Communicate with others	82	IC	
		Team interaction	83	TT	
		integrate patient-centered education	84	PE	

Themes	Codes	Q25FreeText - Debriefing comments	S/N	code applied	Statistics
		The student did a good job in assessing the patient's medication regime. She checked with the family.	85	MR	
		understand role/responsibilites of self and others	86	RR	
		Communicate with others	87	IC	
		Team interaction	88	TT	
		integrate patient-centered education	89	PE	
		great rapport with the rest of the team good interaction with the patient	90	MR	
		understand role/responsibilites of self and others	91	RR	
		Communicate with others	92	IC	
		Team interaction	93	TT	
		integrate patient-centered education	94	PE	
		works well with the rest of the team good interaction with the patient	95	RR	
		Communicate with others	96	IC	
		Team interaction	97	TT	
		integrate patient-centered education	98	PE	

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