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The effect of role assignment and personality subtypes in simulation on critical thinking development, situation awareness, and perceived self-efficacy of nursing baccalaureate students.

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THE EFFECT OF ROLE ASSIGNMENT AND PERSONALITY SUBTYPES IN SIMULATION ON CRITICAL THINKING DEVELOPMENT, SITUATION AWARENESS, AND PERCEIVED SELF-EFFICACY OF NURSING BACCALAUREATE STUDENTS

By

Dustin Travis Weiler
B.S., Embry-Riddle Aeronautical University, 2014
M.S., University of Louisville, 2017

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A Thesis Approved on

January 26, 2017

By the following Thesis Committee:

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Dr. Jason Saleem

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Dr. Angela Thompson

DEDICATION

This thesis is dedicated to my mother, grandmother, and late grandfather

Ms. Amy Trout Weiler

Mrs. Linda Nock Trout

and

Mr. George Ernest Trout

who have provided me invaluable opportunities and support.

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ABSTRACT

THE EFFECT OF ROLE ASSIGNMENT AND PERSONALITY SUBTYPES IN SIMULATION ON CRITICAL THINKING DEVELOPMENT, SITUATION AWARENESS, AND PERCEIVED SELF-EFFICACY OF NURSING BACCALAUREATE STUDENTS

Dustin T. Weiler

January 26, 2017

Previous studies have evaluated the effectiveness of high fidelity patient simulators (HFPS) on nursing training. However, a gap exists on the effects of role assignment and student personality subtypes in simulation scenarios. This thesis explored the effects of role assignment and personality on critical thinking, situation awareness, and self-efficacy in baccalaureate-level nursing students. Using researcher-developed tools and altering previously validated tools to fit the simulation scenario, the effects of role assignment and personality were determined. Role assignment and personality were found to have a significant effect on critical thinking and self-efficacy, but not situation awareness. It was determined that roles that require the participant to be more involved with the simulation scenario had better performance scores than the roles that did not require the participant to be as involved. With this study, future multi-student simulation scenarios can be adjusted knowing the impact different roles and personalities can have on outcomes.

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INTRODUCTION

Simulation and computer-based immersions have consistently grown and have become more popular forms of training. Naturally, the effectiveness of this artificial training tactic is called into question and becomes the topic of research. There have been multiple studies evaluating the effectiveness, or perceived effectiveness, of training with high-fidelity patient simulators (HFPS) in the medical field. HFPS are defined as realistic full body manikins that provide real physical inputs and real environmental interaction (Gates, et al., 2012; Jeffries, 2005). However, there is a gap in research surrounding the evaluation of "intangible" nursing qualities (critical thinking, situation awareness, and self-efficacy) that are not directly addressed through research, as well as a gap in research evaluating student qualities (clinical knowledge, personality types, etc.) and a correlation to the student's performance.

Research related to simulation-based training is common in domains such as aviation, motor control, gaming, etc. However, research on simulation-based training of medical personnel, in particular baccalaureate-level nurses, still remains limited. Prior research has analyzed various simulation scenarios, use of various equipment, debriefing strategies and even implication of different training frameworks. However, with a steady increase in the number of prospective nurses (baccalaureate-level students), and shrinking availability of clinical training positions, simulated patients and clinical environments

have become more visible in nursing education than ever before (Jeffries, 2005; Nehring & Lashley, 2010; Weaver, 2011). Nursing programs may require students to participate in clinical environments in coordination with their classroom lectures in order to perfect various care skills. This requires students to work in clinical environments and gain valuable experience. With a decrease in clinical availability, high fidelity patient simulators (HFPS) are used to supplement, or even substitute, the clinical experiences (McCallum, 2007; Nehring, 2008; Weaver, 2011). Students now participate in simulated events to learn the skills and techniques covered in lecture. There are many positives to using simulation in nursing, such as the ability of student nurses to practice a skill and not endanger a real patient. This allows nurses to make mistakes and not experience the dire consequences (Ironside, 2009; Jeffries, 2005). Another positive to HFPS use is that students gain similar experiences, learn from each other, and experience continuous hands-on training.

With the addition of simulators, an added stress is added to nursing departments. These departments are responsible for developing or implementing various simulation scenarios into their curriculum. The scenarios used are responsible for supplementing lecture material to help student nurses become more effective. However, simulation can help students develop "intangible" skills that may have no correlation to desired learning objectives. Nurses generally display three qualities/skills: critical thinking, problem solving, and communication (Fero, et al., 2010; NACNEP, 1996). Critical thinking and problem solving go hand-in-hand. In the context of this study, critical thinking is the ability to evaluate a situation and make a decision that provides the best care to the

patient, and problem solving is the ability to determine a cause of patient's discomfort and decide on proper forms of care.

An additional skill nurses should have is situation awareness. Situation awareness (SA) is done in three phases: perception, comprehension, and projection (Endsley, 1995). Perception is the understanding of the surrounding environment; comprehension is understanding the significance of elements discovered through perception. Projection is the ability to project future actions, or outcomes, of the system. In nursing, SA phases would go as follows (as one example): The nurse notices alarming vital signs and the patient is unresponsive (perception). The nurse understands that the vital signs and unresponsiveness means the patient is quickly deteriorating (comprehension). Finally, the nurse knows if he/she performs some sort of care then the patient may get better (projection). Knowingly or unknowingly students develop SA through experience. This argument can be seen with driving a car. The more experience you have driving the more you become aware of your surroundings and you are then able to project what other drivers may do and you maneuver accordingly.

Self-efficacy can be directly related to self-confidence. Self-Efficacy is the perception of how prepared an individual is to successfully accomplish a task (Bambini, Washburn, and Perkins, 2009; Bandura, 1977, 1986). The level of self-efficacy is equivalent to being confident and knowing that the task at hand will be completed despite the challenges. Naturally, one would most likely want to be taken care of by a nurse with high levels of self-efficacy. Any individual with low self-confidence or self-efficacy may perform subpar and proof of this assertion can be seen in multiple arenas. For example, in sports if a player is going through a "slump" and not performing well, then that player

may begin to expect another poor performance. This mental block stops players from performing to their capabilities. Indirectly, nurses may experience the same performance deficit if they are not confident in their abilities. Little research indicates if increased levels of self-efficacy (due to simulation) carries over to live clinical environments.

Studies have focused on HFPS effectiveness and acceptance as the student backgrounds change (Grady, Kehrer, Trusty, et al., 2008). However, there have been calls in previous works to conduct further research to investigate student factors that may influence student performance in simulation experiences (Grady, et al., Ironside et al., 2009). This thesis attempts to answer those calls for research and demonstrate the effectiveness of HFPS on the participant's critical thinking skills, self-efficacy, and situation awareness, as well as identify a potential relationship between a student factor (personality type) and critical thinking, self-efficacy, and situation awareness.

LITERATURE REVIEW

Simulation scenarios allow faculty to use role playing, standardized patients, interactive media, and mannequins to train students (Ironside et al., 2009). Not only does simulation mimic the environment the students will work in, but unpredictable conditions or scenarios can be conducted as well. The theory is that HFPS helps students learn what to do in clinical situations by pushing the limits of the student's abilities (Nehring et al., 2001; Weaver, 2011). HFPS can be used to teach and assess fundamental assessment skills and basic care strategies in addition to preparing students for the unpredictability of clinical situations (Nehring et al., 2001). In an attempt to better understand any possible correlations or causations between HFPS and critical thinking, situation awareness and self-efficacy, a literature review was conducted. Articles were found using Google Scholar, PubMed and PsychINFO databases and keywords such as nursing simulation, critical thinking, situation awareness, self-efficacy, HFPS were used. Relevant findings are described in detail in the following pages.

Simulation effectiveness

Each simulation scenario is different and could be adjusted to fit the needs of the participants that will experience the simulation. That being said, a simulation scenario requires many tools to function, but also many tools to measure performance. Faculty use various tools to ascertain the adequacy of a student's performance related to specific

event-related competencies including clinical knowledge, skill performance, learner satisfaction, critical thinking, and self-efficacy (Ironside et al., 2009). These tools can vary from previously verified and commercialized tools to facilitator designed checklists and evaluations. However, these assessments tools are not responsible for a student's learning.

The theory is that HFPS helps students learn what to do in clinical situations by pushing the limits of the student's abilities. The possible repetition of a scenario with HFPS allows for the teaching of new skills and techniques in addition to practicing techniques multiple times (Nehring et al., 2001; Weaver 2011). HFPS can be used to teach and evaluate fundamental assessment skills and basic care strategies in addition to preparing students for the unpredictability of clinical situations. In addition to preparing students for the unpredictability of clinical situations, HFPS can be used to teach and assess fundamental assessment skills and basic care strategies (Nehring et al., 2001). This complete preparation for the unpredictability of clinical situations shows that simulation can be considered effective.

High-fidelity simulation has been shown to increased participant knowledge. Participants in high-fidelity simulation scenarios scored significantly higher on examinations than students that did not undergo high-fidelity simulation scenarios (Gates et al., 2012). The notion of HFPS serving as an effective substitute to the traditional clinical experience in terms of gaining clinical knowledge was supported. This increase in clinical knowledge could prove to be vital during initial assessments of patients to help expedite and more accurately determine what the patient is suffering from.

Simulator training efficiency could be affected by the scenarios being taught. A comparison study evaluated low fidelity and high fidelity simulators and their effects on learning advanced cardiac life support (ACLS). Low fidelity simulators are simply mannequins with very limited capabilities, whereas high fidelity simulators have more complex capabilities such as the ability to provide organ-specific noises and functions (Nehring, 2001). Professional and experienced participants used either low or high fidelity simulators, and the participants recommended that a topic such as ACLS should only be taught using high-fidelity simulators (Hoadley, 2009). In review, a HFPS can be more effective when the scenario being performed requires care-giving techniques versus just patient evaluation scenarios.

The Institute of Medicine encourages simulation in their 1999 report "To Err is Human: Building a Safer Health System". Through testing of trainee doctors and using the Objective Structured Clinical Examination (OSCE), it was determined that simulations are in fact beneficial, but the participant's confidence could not be successfully correlated to performance (Aliner, et al, 2006). Participants indicated a cause for lack of confidence was a result of being exposed to a technology-rich environment. Therefore, the use of simulations was found to be beneficial, but there may have been a negative or negligible effect on the participant's confidence.

Some studies have evaluated how HFPS impacts student self-confidence, clinical competence, and knowledge. A significant improvement in baccalaureate nursing student's basic knowledge after simulation participation was discovered after using the Basic Knowledge Assessment Tool-6 as an evaluation tool (Hoffman, O'Donnell, and Kim, 2007). Using the Laster Clinical Judgment Rubric, an improvement in self-

confidence and competence across the semester was found after simulation use (Blum, Borglund, Parcells, 2010). A similar study was conducted and nursing knowledge and critical thinking were found to have improved after simulation (Schubert, 2012). These studies are among many that support the notion that simulation can effectively impact self-confidence, critical thinking, knowledge, and competence; however, further investigation is needed.

Critical thinking

Critical thinking is often referred to clinical judgement, however both terms involve knowing the scenario, having background knowledge, forecasting the status of the patient in question, and considering those factors when making appropriate diagnoses or providing proper care. According to the American Philosophical Association, components of critical thinking are: interpretation, analysis, evaluation, inference, explanation, and self-regulation (Facione, 1990; Fero, 2010). However, Watson and Glaser define critical thinking simply as the ability to recognize, find evidence to support any assumptions, determine action plan by applying attitudes and knowledge (Watson & Glaser, 1980). There are many other definitions that describe what may contribute to critical thinking. However, it seems the key elements include the ability to find and comprehend relevant information, the ability to identify an association with knowledge, reasoning, cognitive skills, identification, and the exploration of alternative frames of reference (Fero, 2010). Based on the scenario used for this study, critical thinking is defined as the ability to reference clinical knowledge, find evidence from patient assessment to identify the emergency, and provide proper care based on the identification, knowledge, and evidence.

There are various ways to measure critical thinking abilities. However, nursing student's critical thinking has mostly been measured through commercially-developed instruments such as the California Critical Thinking Disposition Inventory (CCTDI) and the California Critical Thinking Skills Test (CCTST) (Fero, 2010; Rane-Szostak & Robertson, 1996). Both the CCTDI and CCTST were developed specifically for the nursing population. The CCTDI assesses the disposition to use or not to use reasoning and judgement when solving problems (Facione & Facione, 2001; Fero, 2010). Drawing conclusions in the areas of analysis, inference, evaluation, and reasoning is measured with the CCTST (Facione et al., 2002). Alternatively, critical thinking can also be measured with simulation performance. The Performance Based Development System (PBDS) requires the participant to view vignettes and describe the actions that are needed next and why (Performance Management Service, Inc., 2007). The PBDS requires the participant to gather evidence from the vignette, refer to their clinical knowledge, and reasonably provide care and be able to defend their actions.

There are various ways to measure general critical thinking abilities without the focus on nursing backgrounds. The Watson-Glaser Critical Thinking Appraisal (WGCTA) has been reported to predict success in professions or instructional programs that require critical thinking to play an important role in success (Bauwens & Gerhard, 1987). WGCTA is based on a critical thinking conceptualization from Dressel and Mayhew (1954) where critical thinking is described as the ability to define a problem, select pertinent information, recognize stated and unstated assumptions, formulate relevant and promising hypotheses, and draw valid conclusions and judge validity of inferences. More specifically, the WGCTA measures critical thinking that includes 1)

attitudes of inquiry that involve an ability to recognize the existence of problems, and an acceptance of the general need for evidence in support of what is asserted to be true; 2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and 3) skills in employing and applying the above attitudes and knowledge (Bauwens & Gerhard, 1987). Fero et al. in 2010 used the WGCTA to determine if critical thinking improved after HFPS use. It was determined that there existed a statistically significant relationship between critical thinking abilities and performance in the simulation. However, the authors claimed there were limitations to the study such as increased anxiety for the participants, small sample size (N=36), and some students chose not to participate. Finally, Fero et al. called for future studies to identify and support possible correlations between critical thinking and performance in simulation.

Critical thinking can be measured by evaluating how an experienced individual would approach the scenario compared to a novice. The critical thinking process of an experienced individual can be understood and evaluated through use of a Critical Decision Method (CDM). This tool is a semi-structured interview tool that probes for key points that lead to certain decisions (Stanton, et al., 2005). Ideally a CDM would be conducted with a subject matter expert (SME) so the researcher(s) have a better understanding of the decision making process required in the field of interest. Also, the CDM can be conducted with a participant after a simulation to help researcher(s) understand the participant's decision making and thought process. When used effectively, this tool helps identify weaknesses in critical thinking and can identify what topics future simulations should focus on. The limitations of a CDM are that they are time consuming

to conduct and evaluate and a basic understanding of the scenario being evaluated is useful to gather specific information during the semi-structured interview. A CDM can be an effective tool to understand the participant's thought processes in comparison to a SME's thought process in the same situation. It is important to understand the potential impact utilizing a CDM can have, but a CDM was not completed for this study because it would involve invasive methods such as an additional post-simulation interview with multiple participants. This would minimize simulation time for the participant and was not ideal for running multiple simulations with multiple participants throughout the study.

Self-efficacy

Previous studies reported in the literature have evaluated the ability of simulators to improve students' self-efficacy. Self-efficacy is an indicator of a person's perception of how well he or she is prepared to successfully accomplish a task (Bambini et al., 2009; Bandura, 1977, 1986). Self-efficacy is essentially the way a participant views their own probability of accomplishing a task. HFPS have been shown to increase students' confidence after simulation session(s) (Abdo & Ravert, 2006; Bearnson & Wiker, 2005; Burns et al., 2010; Jeffries & Rizzolo, 2006; Kuznar, 2007; Smith & Roehrs, 2009). A participant with high self-efficacy is equivalent to a student being confident in their abilities and knowing they will complete the task at hand despite the challenges. Self-efficacy improves after use of a HFPS scenario (Bambini, et al., 2009; Goldenberg, et al., 2005; Kameg et al., 2010).

The effects of HFPS on students' perceived self-efficacy have been demonstrated and portions of these studies were considered when developing this study. Although the studies mentioned thus far supported notions that self-efficacy improved, one study

reported that participants did not feel that these simulations should be directly substituted for real-world experience (Kameg et al., 2010). It was found that participants did feel more confident, but still preferred real world interactions and training. This questions whether the improved perceptions of self-efficacy can be attributed to the realism of HFPS or attributed to the notion that the participant simply had the opportunity to practice. Although there is no outlined causation between HFPS and increased self-efficacy, there is evidence to support a correlation of HFPS and improvement in perceived self-efficacy.

The research that does exist, however, is rather broad and focuses on HFPS with multiple participants at once, but does not look at evaluating how different roles played by the participant can affect self-efficacy. Due to the increase in number of nursing students, more students need to go through the same simulation experience. In order to provide each student with the same educational opportunities, some scenarios require the participants to play multiple roles in the simulation. It is unclear as to how the role importance and participation level required for each scenario may affect the level of perceived self-efficacy.

Situation Awareness

Situation awareness involves being aware of more than just numerous pieces of data, it involves situation understanding and projection of future states in light of the operator's goal (Endsley, 1995). In order to measure situation awareness, Endsley developed the Situation Awareness Global Assessment Technique (SAGAT) in order to assess the three levels of situation awareness (perception of the elements, comprehension of their meaning, and projection of the future status). The SAGAT consists of various

queries that require the participant to answer questions based on a scenario at a particular point in time. The SAGAT tool is one of the most widely validated situation awareness techniques available (Stanton, et al., 2005). SAGAT has been used in multiple studies ranging from pilots, to driving simulators, to nuclear power plant operators (Stanton, et al., 2005). All scenarios used the same SAGAT structure, with just slight alterations to the queries used to focus on industry-related items (i.e. asking about aircraft for pilots, asking about car locations for drivers, asking about various information for power plant operators). Applying this definition of situation awareness to nursing means to perceive patient current status and health history, comprehend the seriousness of symptoms, and project possible patient outcomes based on types of care.

However, there exist articles that dispute Mica Endsley's definition of situation awareness and the subsequent SAGAT tool developed by Endsley. Sarter and Woods (1991) argued that Endsley's description of situation awareness and the three associated levels claim that the expectancies related to level three facilitate perception, but also involves the potential for ignoring or misinterpreting the unexpected. An inappropriate projection of future system states, the likelihood of missing unpredicted events increases due to inadequately directing attentional resources (Sarter & Woods, 1991). In addition to the possibility of missed unpredicted events, Sarter and Woods claimed that all three levels do involve a variety of information-processing stages where shortcomings are likely due to obstacles such as narrowed perceptual focus or increased distractibility. The result thus becomes only a snapshot of a momentary situation, not a complete observance of the entire situation. Although Sarter and Woods seem to have raised plausible arguments as to the incompleteness of Endsley's situation awareness explanation, it

should be noted that these arguments (similar to the Endsley definition of situation awareness) are based on the application of these ideas to aviation, and not healthcare.

Exploration of many other definitions of situation awareness were being developed concurrently with Endsley's situation awareness definition. These various definitions look to specify the components or contents of situation awareness and they reference the temporal dimension of situation awareness (Sarter & Woods, 1991). Situation awareness was mainly explored within descriptions of scenarios varying from abstract descriptions (Whitaker & Klein, 1988) to detailed descriptions (Harwood, Barnett, & Wickens, 1988). An important aspect to the temporal dimension of situation awareness is understanding that situation awareness assessments are made by maintaining an active model of the world that is continuously updated based on current events (Harwood, et al., 1988). This description of how situation awareness changes over time is considered when designing how situation awareness will be measured in this study.

There is a belief that situation awareness improves after simulation use, but there lacks a nursing-relevant situation awareness measurement tool (Lavoie et al., 2015). There is a need for more research dedicated to developing tools to measure and develop situation awareness (Lavoie, et al., 2015; McKenna, et al., 2014; O'Meara, et al., 2014). Lavoie et al. has developed an instrument to use for situation awareness measurement in the healthcare domain, but calls for future research to determine the instrument's effectiveness. Alternative methods to develop situation awareness, such as eye tracking and video debriefing usage, are concepts still being matured (O'Meara et al., 2014). In summary, there are multiple plausible avenues to assess and measure situation awareness (especially in the aviation domain), but few have been applied to healthcare training.

Using widely accepted situation awareness methods, in particular the SAGAT, but manipulating aspects of the measurements to reflect healthcare principles could be the simple and slight change needed to effectively measure situation awareness within healthcare.

Until these concepts and instruments are developed, using proven situation awareness instruments (such as SAGAT), or modified versions of them, have been used and considered valid (McKenna, et al., 2014). Although there is an understanding of situation awareness, more research is needed on how to reliably measure situation awareness performance in the nursing domain.

Personality

Personality can be measured or determined by using a variety of personality indicator tests. The key in determining which personality test is subjective based upon the situation and desired outcomes. In order to determine the proper personality test to be used for this study, a literature review was conducted on three different tests: The Myers-Briggs Test Indicator (MBTI), the "Big 5", and the Strengthsfinder 2.0. The proper identification of the personality test was based on how well the test results describes the abilities and limitations of teamwork, situation awareness, critical thinking (thought process), and self-efficacy (confidence) of the participant.

MBTI. The MBTI provides an output of four letters that best describe the user's personality. Four separate bipolar indices comprising of two mutually exclusive preferences make-up the MBTI: extroversion (E) and introversion (I) on the first index, sensing (S) and intuition (N) on the second, thinking (T) and feeling (F) on the third, and judging (J) and perception (P) on the fourth (Roush & Atwater, 1992). The main

objective is to identify the four preferences that reflect the habitual choice between the two options on each index (Myers & McCaulley, 1985). The following descriptions of each preference is a summative review from both Roush & Atwater (1992) and Myers and McCaulley (1985). Extraverts communicate easily, rely on the environment for stimulation and guidance, whereas introverts prefer solitude and privacy and tend to rely on concepts and ideas instead of the environment for guidance. Sensing prefers to gather information through the five major senses, focus on reality of the present moment, and emphasize detail. In contrast, intuition tends to look for relationships and meanings across data, are innovative, and focus on theory and focus on the theoretical and abstract. The thinking preference relies on a cause-and-effect mentality and apply objective analysis to the situation. Feeling perspective relies on the subjective and emphasizes on the relative merits of personal and group values. Finally, the judging perspective represents those who rely on structure and stop taking in information once enough information has been taken in to make a decision. The perception preference tends to keep options open and flexible and delays on decisions as long as possible to take in as much information as possible in hopes to make better decisions.

Big 5. The five factor model emerged early and has slowly become changed and adapted over time. McDougall in 1935 first noted that "Personality can be broadly analyzed into five categories: intellect, character, temperament, disposition, and temper" (Barrick & Mount, 1991). Then by 1963 Norman labeled the factors of personality to be: extraversion, emotional stability, agreeableness, conscientiousness, and culture. These factors are commonly referred to as "Norman's Big Five" or "Big Five" (Barrick & Mount, 1991). However, some researchers claim that these factors are imprecise

specifications of the various dimensions of personality (Briggs, 1989; Waller & Ben-Porath, 1987), especially in regards to extraversion, where Hogan (1986) suggests extraversion be split into sociability and ambition (Barrick & Mount, 1991).

Traits associated with extraversion (in terms of the Big Five) are sociable, assertive, and ambitious. Emotional stability is generally associated with unstable feelings such as anxiety, depression, and insecurity. Agreeableness or likeability is defined as courteous, cooperative, and tolerant. Conscientiousness has been debated and when multiple beliefs of the associated traits are combined, conscientiousness is associated with responsible, organized, and volitional variables such as persevering and hardworking. Finally, culture has been the most debated factor of the big five and goes by multiple names depending on the researcher using the big five taxonomy. The emergence and understanding of this taxonomy is important in understanding personnel psychology and understanding personnel differences (Barrick & Mount, 1991).

Strengthsfinder 2.0. The Strengthsfinder 2.0, developed by a team at Gallup Inc., is focused on identifying the strengths individuals have. This assessment has 34 themes that the individual can be assigned to and shows what your strengths are. Some examples of the 34 themes are analytical, empathy, individualization, positivity, and self-assurance (Rath, 2007). This assessment is additionally designed to identify a person's strengths and thus indicate what position they would thrive in when beginning a job or career in an industry. Each strength is a measurement of talent (a natural way of thinking, feeling, behaving) multiplied by investment (time spent practicing, developing your skills, and building knowledge base) (Rath, 2007). Strengthsfinder also helps identify an individual's weaknesses which may lead to better team assignments. This does not

identify weaknesses in investment but solely in talent. Thus, a prime strategy would be to team up with one or more individuals with talent in areas that you lack (Rath, 2007).

Once the Strengthsfinder 2.0 is completed, the responses are compared to the 5,000-plus Strengths Insights database and your theme descriptions are reported. The report also includes the top five themes that best describe you in addition to a team strengths grid for mapping the talents of those around you in an attempt to help build optimal teams. The assessment takes approximately 30 minutes with each response being timed out after 20 seconds. This is done because Gallup found that instinctual, top-of-mind responses are more revealing than responses given if you debated each question (Rath, 2007). The downside to Strengthsfinder 2.0 is that each assessment takes approximately 30 minutes and then simulation groupings and roles would then have to be assigned based upon responses for optimal results.

Comparison. There have been a multitude of studies in the 1980s and 1990s that explored the differences and even potential overlaps between personality measurement tools. Furnham (1996) found that there are multiple overlaps between the Big Five and the MBTI. However, McCrae and Costa (1989) are critical of the MBTI because it does not give comprehensive information on all subscales. This is vital because according to McCrae and Costa, this is needed in order to properly assess those who score close to the middle between the two options for each subscale in the MBTI (Furnham, 1996). After a review of personality-based studies, a trend was noticed that questions about the MBTI validity or completeness in evaluation of a personality determination is a result of being compared to a five-factor model. It also becomes clear that there seems to be an identification of flaws in the MBTI simply because the five-factor personality model has

an additional factor and that additional factor partially correlates to multiple factors identified in the MBTI.

The Strengthsfinder 2.0 is in a league all by itself. Although it gives you results based on your individual personality, it has seen success mostly with team assignment. The scenario being completed by the participants in this study is more of a hybrid individual and team oriented scenario with limited time for a 30-minute assessment. Then in order to establish the teams and roles based on the Strengthsfinder results the researcher would have to know how to best review the results and put the participants together based on the findings. Although in theory this personality assessment may yield optimal results, based upon study logistics, this personality assessment was not used, but is suggested for future studies.

In review, the MBTI, the Big Five personality model, and the Strengthsfinder 2.0 are all acceptable and widely used methods to determine various personality types. However, this study uses the MBTI simply because of the requirements of the study, logistics of the study, and the end-goal of the study. The simulation scenario that will be used (and described in the Methods chapter) is designed to be an individual effort then evolve into a small-team scenario. Strengthsfinder 2.0 would best be used for the small team portion of the simulation, but not the simulation as a whole – including the individual portions. Both the Big Five or MBTI could be used regardless of individual or small-team scenarios. The MBTI is used because the subscales best represent the factors of interest in this study: self-efficacy, critical thinking, and situation awareness. Based upon interpretations of previously cited works, the E/I subscale could most likely be associated with self-efficacy, T/F and/or J/P associated with critical thinking, and S/N

associated with situation awareness. Although these subscales have not been quantitatively mapped to self-efficacy, critical thinking, and situation awareness, this study hopes to show a relationship between the subscales and the factors of interest.

Attention and Performance

Attention is commonly defined as a cognitive process that allocates limited-capacity brain resources selectively to one aspect of sensory information (Huang, & Watanabe, 2012). There exists a common theory called the spotlight or zoom-lens metaphor where our attention is focused on a certain aspect of the environment and information about that selective area is more efficiently processed. Our visual system processes task-relevant information more efficiently when there are no additional distracting tasks (Huang & Watanabe, 2012).

There have been multiple studies completed looking at attention and the possible correlation to task performance. However, a majority of these studies have been conducted with aviation and driving tasks. For example, it was found that attention was correlated with task-performance; this correlated relationship remained true through practice and when attention and practice were combined when looking at predicting performance, attention only accounted for 40% of the variation (Arthur, Strong, et al., 1993). Although the cited study involved a space-related training game, it demonstrated that the amount of attention given to a task does correlate to task performance. In other words, the more attention that is given to a task, the better the performance and the more accurate the prediction. In addition, this study looked at how training also helps the prediction of the task performance, and findings indicated that both training and the level of attention given to a task correlated to performance. This is an important finding for this

study because it provides prior study support for the belief that certain roles in the simulation will perform differently based on the amount of attention the role requires and the amount of practice (or activity) each role requires.

The Yerkes-Dodson law was formulated in 1908 and it states that an inverted U-shape relationship exists between arousal level and anxiety level and the effects made on performance (Hanoch &Vitouch, 2004). Essentially, there exists an optimal level of arousal between low and high levels of arousal that result in the strongest possible performance. Too high of an arousal level is believed to yield lower levels of performance due to anxiety whereas low levels of arousal is said to yield low performance because there is a lack of interest in the end result. A visual representation of the Yerkes-Dodson law can be seen in Figure 1.

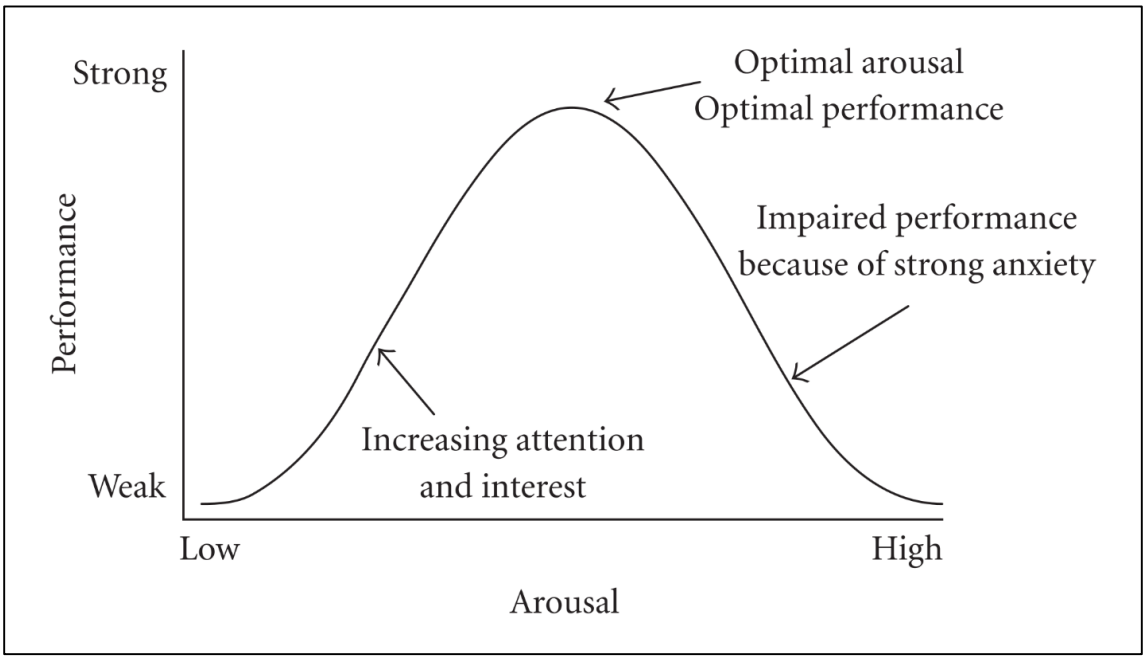

Figure 1: Yerkes-Dodson Law

Imagine working on a thesis project in addition to taking a full course load. If there is a lack of workload management and procrastination exists, then by the end of the

semester multiple projects and tests all come at once. According to the Yerkes-Dodson law, performance on each task would be less than optimal simply because anxiety exists and a rush to complete all the tasks at hand controls performance. However, a lack of interest in a project would yield lower performance as well simply because the desire to apply proper amounts of effort into the project does not exist, and performance is affected. This law is important to consider when examining how role assignment in a simulation session affects outcomes. For example, a role that bears most of the burden may have an arousal level that is much too high for optimal performance and another role could have the opposite effect.

In review, the amount of attention required to give to a training situation and the amount of arousal that each role requires of a participant may have an effect on performance. This performance effect is displayed by the Yerkes-Dodson law and the attention factor has been explored in studies conducted in aviation and driving, but not necessarily in healthcare. If these findings were applied to healthcare training then we should expect to see that a role that does not require as much attention to detail, or focus on scenario development, then that role may not yield a performance increase that is expected. Therefore, an "optimal" role in a simulated scenario in healthcare should most likely involve interactions with the patient (simulated or not simulated) and rely on personal observations during the scenario instead of relying on the other participants' observations.

HYPOTHESES

Based on the review of the literature, the following hypotheses are predicted:

(1) Participants are expected to display a statistically significant increase in self-efficacy and critical thinking abilities after completing the HFPS scenario.

(2) Roles assigned for the simulation will have a statistically significant difference on perceived self-efficacy, situation awareness, and critical thinking abilities. In addition, roles that require the most patient involvement will yield the greatest change in pre vs. post-simulation results in self-efficacy and critical thinking.

(3) A relationship between personality subtypes (from the MBTI) and HFPS scenario outcomes (i.e., higher confidence scores in self-efficacy and higher situation awareness and critical thinking scores) will be identified and supported. That is, a particular personality subscale will generate statistically significant higher scores in situation awareness and critical thinking assessments and more confident responses in the self-efficacy assessment.

Multiple studies have indicated that HFPS, and the scenarios used, have improved self-efficacy, situation awareness, and critical thinking. The exact causation behind the increase is not clear, but the additional scenario-specific experience that most participants do not obtain in live clinical scenarios or in lectures seems to be responsible. Therefore, the additional experience and realism associated with HFPS should cause the participant

to feel more confident in their abilities and think more critically in order to develop more accurate inferences based on the information they have gathered and provide better care. Hypothesis (1) was built on findings from previous studies and the age-old notion that "practice makes perfect".

The effects of various roles in nursing student simulation have not been widely explored (if at all). The above assumption of role assignment yielding significantly different scores was made based on prior research about attention and performance. Also, a thorough understanding of the role requirements for the scenario used in this study was vital in order to understand the amount of arousal (interest) and attention that is needed for the desired performance. It was understood that two roles would have the bulk of the interaction with the simulation (lead nurse and secondary nurse) and one role (documenter) is responsible for documenting milestones within the scenario. The other two roles play a minor role in the simulation and could even rely on others in the simulation area for any assistance. Hypothesis (2) was derived from the knowledge that two out of five possible roles will have little influence on the simulation and after reviewing studies based on arousal levels and performance, there is reason to believe that specific roles would have more of a difference on simulation outcomes (critical thinking, situation awareness, and self-efficacy scores) based on involvement, participant arousal, and participant performance.

Finally, personality is a student factor that has become overlooked by research studies. Most of the student-factor based studies have focused on gender, clinical knowledge, and previous experience. Personality and the generalized traits associated with personality types have not been evaluated in training, thus creating a research gap.

More specifically, various personality types may have different effects on decision making, recollection of knowledge, interaction with patients and/or other medical personnel, and reactions to adverse situations. However, before identifying which personality types result in which behaviors, it must be demonstrated that personality types have an effect on performance in the nursing field. Hypothesis (3) has a foundation that relies on the assumption that different personality subscales have some form of relationship with simulation outcomes. Therefore, it is believed that certain personality subscales could relate to higher marks in certain outcomes when compared to alternative subscales. Based upon the review of the literature, the E/I subscale could most likely be associated with self-efficacy, S/N associated with situation awareness, and T/F and/or J/P associated with critical thinking. With the knowledge that every participant is different, there is reason to believe that performance may be related to trends of others with similar personality subscales.

METHODS

Participants

Participants for this IRB-approved study were 69 third-year baccalaureate level nursing students. The participants completed the same core coursework, but may have taken different electives. Each participant likely has had different clinical experiences by earning their clinical time at different locations. The scenario used is required for the course the participants were completing at the time of the study (March, 2016); therefore, each participant has had the same preparation work and lecture prior to completing the simulation.

Experimental Design

This study was a single factor design with five levels. The factor was the role performed in the simulation with the five levels being the possible roles participants were assigned. Participants were randomly assigned one of the five following roles prior to the simulation scenario: lead nurse, secondary nurse, documenter, medication nurse, and caller. The response considered was the pre and post simulation critical thinking assessment scores, pre and post simulation self-efficacy responses, and the post-simulation scores of the situation awareness assessment (SAGAT).

Also, participants completed a personality assessment (MBTI) prior to beginning the simulation. Both the researcher and the simulation facilitator were blinded to the personality data until after the simulation so as to not affect role assignment and

simulation observation. The responses stayed the same, but were organized based upon the MBTI personality results and evaluated by individual subscale for possible relationships.

Facilities, Equipment, Materials

The study took place at the Nursing Simulation Center at the University of Louisville. All students used the same equipment to complete the assigned task(s) during the simulation scenarios. The HFPS used was the METIman Patient Simulator from CAE Healthcare, which allows the facilitator to speak through the simulated patient, enabling participants to have a sense of realism by communicating directly with the patient.

Data collection materials included: a performance checklist, a researcher-developed critical thinking assessment, a researcher-modified SAGAT, and a researcher-developed self-efficacy survey. Each document was modified or developed to correspond with the healthcare scenario being performed. These modifications were done with guidance and input from subject-matter experts (SMEs) -- the simulation director and course instructor.

Critical Thinking Assessment. In order to evaluate the ability of the participant to properly evaluate a situation and think critically to generate solutions, a critical thinking assessment was created. Using aspects of the PBDS as a model and guidance from SMEs, a postpartum hemorrhage scenario was developed to test critical thinking. The scenario was explained on paper and the participant was asked to identify the potential postpartum emergencies the patient may be suffering from (hemorrhaging, infection, or pre-eclampsia). In addition, the participants were asked to identify who they should contact for help providing care, the procedure when communicating with other healthcare

professionals, the immediate care they need to provide to the deteriorating patient, and what factors or knowledge did they use when responding to the scenario. Their response was in the form of an open-ended essay. The scenario and response requirements were kept the same from pre-simulation to post-simulation. This assessment can be found in Appendix D.

The scoring rubric for the assessment was also developed by the author. Each pre and post simulation assessment was graded on a 0-5 scale with 0 representing no correct identification of possible postpartum emergencies and 5 representing correct and complete responses. Scores were given in increments of 1 if the participant could correctly provide answers to the aforementioned five criteria. This method was applied because responses would build on each other.

Self-efficacy scale. This scale follows the layout and scale requirements used for the general self-efficacy scale developed by Schwarzer and Jerusalem (1981). However, the researcher-developed scale contains modified statements focused on the participant's past experiences, perception of clinical knowledge, and confidence with the skills needed to complete the simulation. It is a 10-item assessment with scores ranging from 1-7 (1 being not confident and 7 being very confident). This assessment can be found in Appendix B.

Situation Awareness Global Assessment Technique (SAGAT). SAGAT focuses on three levels of situation awareness: perception, comprehension, and projection. For this study, the original SAGAT queries were adjusted to fit the simulation scenario. The structure, levels, and focuses of the SAGAT queries remain unchanged. This modified SAGAT has five queries for perception, three queries for comprehension, and three

queries for projection for a total of eleven queries. This assessment can be found in Appendix C.

Modified Briggs-Myer Personality Assessment. A shortened version of the Briggs-Myer personality assessment (MBTI) was used. An abbreviated version of this assessment was used in order to lessen the workload on the participants before the actual simulation event and stay within a time schedule while at the simulation center. This assessment can be found in Appendix A.

Performance checklist. The performance checklist was completed by the simulation facilitator and used strictly to note observations and organize the debriefing session. The checklist was not used in any data analysis, but was reviewed to note observations in the discussion section.

Scenario Description

Each scenario was performed with a group of approximately five participants where each participant was randomly assigned one of five roles: lead nurse, secondary nurse, documenter, medication nurse, or provider call nurse. The simulated patient was 39 years of age and gave birth vaginally within the past couple of hours. Utilizing clinical knowledge gained from class lectures, a patient chart, and an assessment of the patient, the lead nurse needed to provide proper care. Once the lead nurse provided adequate care, the simulation was halted and the scenario was altered. The changes included: a time lapse of approximately an hour, a drop in O_2 levels and blood pressure, an increase in pulse rate and the amount of blood coming from the patient, and a feeling of light-headedness; thus simulating a postpartum hemorrhage scenario. The secondary nurse became the main caregiver and continued care. In an ideal scenario, the secondary nurse

would push the “call” button to get additional help from the other participants after realizing the patient is hemorrhaging. While other participants are helping to provide care, the provider call nurse would contact the “health care provider” and receive care orders. Next, the participants worked together to complete the care orders in an organized and timely fashion. Once (and if) the care orders were completed, the facilitator ended the scenario and a debriefing session began immediately.

This simulation was used because it not only tested the individual ability of the participant, but also required the participant to work as part of a team to provide care. Additionally, this simulation offered a wide range of actions and difficulties the participants could experience as a result of role assignment. Although there is no set level of difficulty due to the natural variation of perceived difficulty experienced by participants, it can be argued that the documenter role was most labor intensive and difficult, followed by the secondary nurse, lead nurse, caller, and medication nurse. Logistically, this scenario was used because it fit the desired requirements of this study: high-fidelity simulator, large sample size, and baccalaureate-level students.

Procedure

Once the participant arrived at the simulation center, the participant was briefed on the study and signed an informed consent form in order to participate. Prior to entering the simulation area, the participant completed the MBTI, self-efficacy survey, and critical thinking assessment. Each participant had a maximum of five minutes to complete the critical thinking assessment. Then the participant was assigned to a group and a role for the simulation. Once all of the roles were filled, the aforementioned simulation scenario was started. Once the simulation concluded, the participant was removed from the area

and completed the SAGAT. The participant was brought back to the simulation area for the debriefing session based upon the facilitators notes on the performance checklist. Additionally, the researcher took observation notes during the simulation, but those notes were not utilized during the debriefing. Upon completion, the participant completed the post-simulation critical thinking assessment and self-efficacy survey. The participant had a maximum of five minutes to complete the critical thinking assessment. Once the final two data collection materials were completed, the participant was thanked for their time and effort and was dismissed from the simulation area.

Analysis

All statistical analyses were conducted using Minitab version 17. The critical thinking and self-efficacy data, which was ordinal in nature, were collected from the same participants before and after the HFPS scenario; therefore, the non-parametric Wilcoxon Signed Rank test was used to test for statistically significant differences within the mean scores. The Wilcoxon Signed Rank test was used to individually compare the pre- and post-simulation scores for each of the five roles and personality subsets. Also, an additional test comparing all of the roles and subsets against each other was conducted as well. Finally, a Kruskal-Wallis test was performed on strictly the post-simulation scores, which were also ordinal in nature, to investigate if certain roles had a significant difference on post-simulation scores. The significance level (alpha) was set at .05 for all statistical analyses.

The situation awareness data was analyzed based on accuracy of the answers given. If correct answers were given, a full point was awarded; partial credit was awarded if there were multiple possible responses to the queries; zero points were given if a

question was left blank or the answer provided was incorrect; for a maximum possible score of eleven. Roles and SAGAT scores were compared using an analysis of variance (ANOVA) test to determine if roles had a significant effect on SAGAT scores. Additionally, SAGAT scores were organized based on personality type and charted in an attempt to note any potential relationship between personality type on situation awareness scores.

Self-Efficacy responses were analyzed by question instead of by an overall score based on the participant responses. This measurement ideology was used because the questionnaire was developed based upon actions and performance expectations of the participants as they move through the scenario. Therefore, each question would indicate which portions of the simulation (patient assessment, providing care, etc.) yielded differences in pre- vs. post-simulation.

Finally, the analysis took on four different comparisons: pre- vs. post-simulation scores; pre- vs. post-simulation scores for each individual role and for each individual personality subtype; pre- vs. post-simulation scores compared across all of the roles and all of the subtypes; and strictly the post-simulation scores compared to all the roles and the personality subtypes. This method was used to determine if the HFPS (regardless of role assignment and personality subtype) revealed a difference in outcome scores, to determine if an individual role or personality subtype indicated a difference in outcome scores, and if any role or personality subtype indicated greater (or more positive) responses than the respective counterparts.

RESULTS

Due to various complications in the data collection portion of the study, some of the materials completed by the participants had to be excluded from analysis (this will be covered in the limitations subsection in the Discussion). Table 1 shows the number of successfully completed (pre- and post-simulation) data collection materials that were used for analysis.

Table 1: Number of Collection Materials used in Analysis

Data Collection Materials	Number Successfully Completed
MBTI	53
SAGAT	33
Self-Efficacy	54
Critical Thinking	49

Critical Thinking

The roles of lead nurse, secondary nurse, and documenter had a significantly greater difference post-simulation scores by way of the Wilcoxon Signed Rank test (Table 2). The role of caller trended toward significance. The role of medication nurse was found to not be significant. Finally, there was a statistically significant difference in pre and post simulation scores considering all roles combined (Table 2).

The Kruskal-Wallis test was used to determine if role-type effected the post-simulation critical thinking scores. This test showed that there was no significant difference on post-simulation critical thinking scores based on role type, with $p = 0.541$ (adjusted for ties). This is not represented in any of the tables below.

Table 3 shows the results of each personality subtype and the potential effect the subtype had on pre and post simulation critical thinking. In Table 4, the proper subscales (E/I, vs. S/N, vs. T/F, vs. J/P) were compared against each other, using the post scores, and there was no significant difference found.

Table 2: Overview of Critical Thinking Scores by Role

Role Tested	Pre-Sim Median	Post-Sim Median	p-value	N
Lead Nurse	2.5	3	0.022*	12
Secondary Nurse	2	3	0.036*	10
Documenter	2	3	0.009*	11
Medication	2	3	0.100	9
Caller	2	3	0.059	7
All	2	3	<0.001*	49

Note. Critical thinking was graded on a 0-5 scale with 0 representing no correct identification of possible postpartum emergencies and 5 representing correct and complete responses.
Note. * indicates significance

Table 3: Overview of Critical Thinking Scores Based on Personality Subtype

Subtype	N	p-value	Pre-Sim Mean	Post-Sim Mean	Pre-Sim Median	Post-Sim Median
E	20	0.002*	2.55	3.25	3	3
I	14	0.022*	2.0714	2.9286	2	3
N	8	0.100	2.5	3.125	2.5	3
S	26	<0.001*	2.3077	3.1154	2	3
J	23	0.002*	2.4348	3.1739	2	3
P	11	0.022*	2.1818	3	2	3
F	22	0.002*	2.4545	3.1364	2.5	3
T	12	0.022*	2.1667	3.0833	2	3

Note. * indicates significance

Table 4: Personality Subscale Comparison on Critical Thinking Scores

Personality Type Subscales	Sample size (N)	p-value	Significance?
E vs. I	34	0.264	No
N vs. S	34	0.913	No
J vs. P	34	0.426	No
F vs. T	34	0.922	No

In summary, analysis demonstrated that the simulation by itself and the roles of lead nurse, secondary nurse, and documenter were determined to have a significant effect on post-simulation critical thinking scores.

Self-Efficacy

Self-efficacy responses were analyzed individually by question by comparing the pre-simulation responses to the post-simulation responses. In addition, each response was categorized based on the role and personality type of the participant. The number of questions that indicated a significant increase, nearly significant increase and no significant increase are displayed in Table 5. These pre vs. post-simulation responses were analyzed using a Wilcoxon Signed Rank test for significance, and the post-simulation scores for all the roles were analyzed using a Kruskal-Wallis and are shown in the last row in Table 5. A frequency comparison of pre- and post-simulation self-efficacy responses (including each question answered for each participant) is shown graphically in Figure 2. Figures 3-6 display the average post-simulation responses (by question) comparing two subtypes similar to the methods in the MBTI. Table 6 displays the number of questions for each subtype that displayed a significant difference when comparing pre- and post-simulation responses.

Table 5: Number of Roles and Pre- vs. Post-Simulation on Self-Efficacy Question Responses

Role	Significant response frequency ($p \leq 0.050$)	Near significant response frequency ($0.051 \leq p \leq 0.100$)	Non-significant response frequency ($p > 0.100$)
Lead Nurse	9	1	4
2nd Nurse	1	0	13
Documenter	4	2	8
Medication	3	4	7
Caller	3	0	11
All	2	0	12

Note. The self-efficacy assessment can be found in Appendix B
Note. Each role totals to the number of self-efficacy assessment questions, 14.

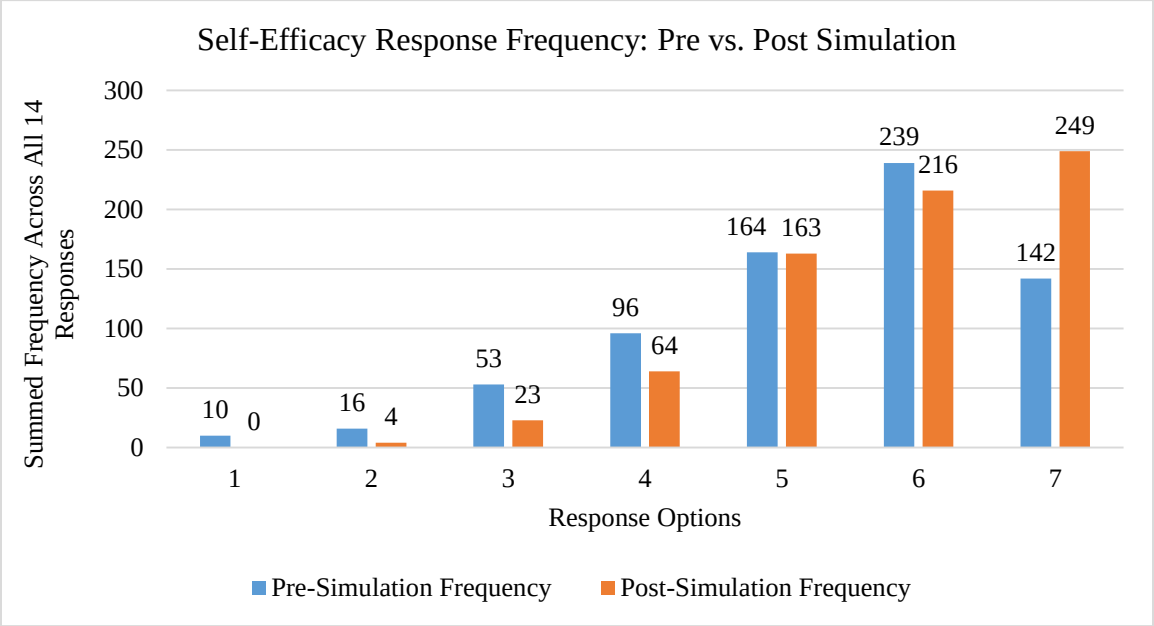

Figure 2: Self-Efficacy Responses by Frequency: Pre- vs. Post-Simulation

Note: 1 = Not Confident, 4 = Neutral, 7 = Very Confident

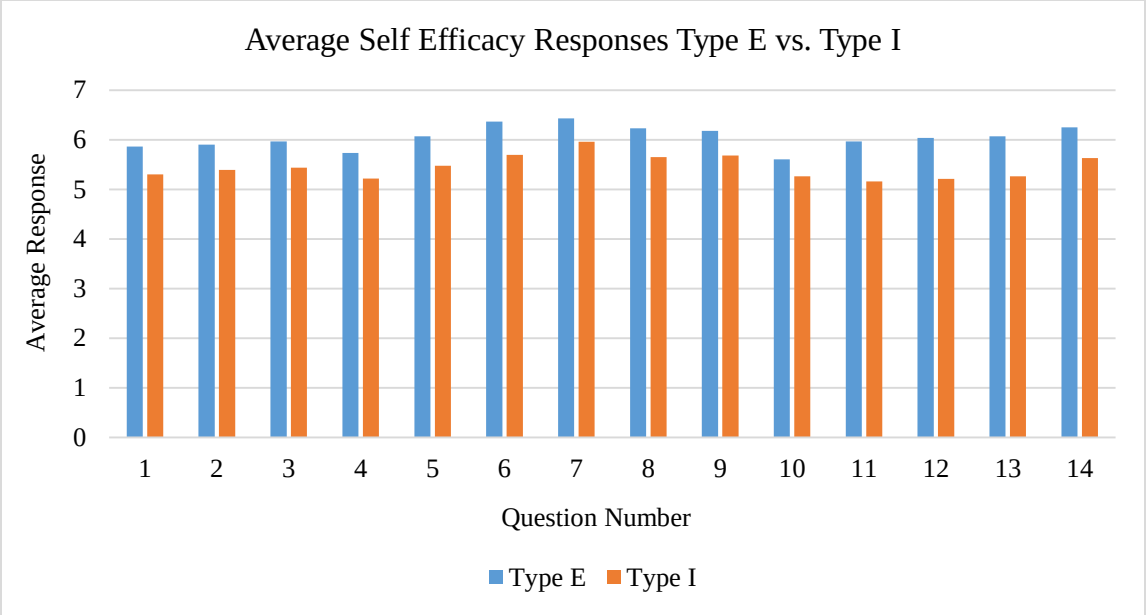

Figure 3: Average Self-Efficacy Responses per Question - Type E vs. Type I

Note. Self-Efficacy Assessment can be found in Appendix B

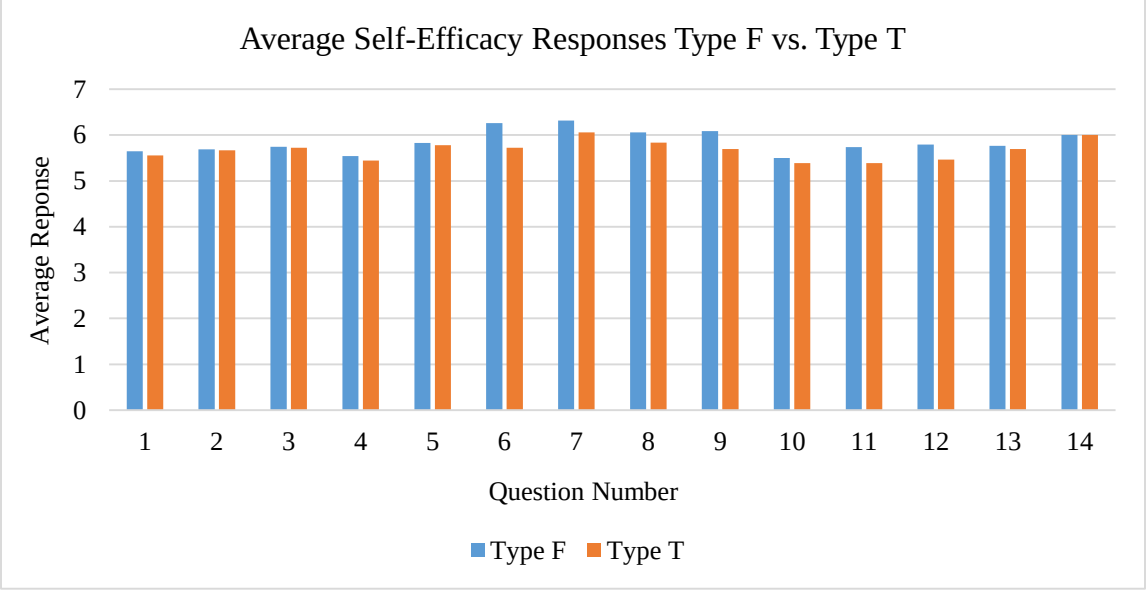

Figure 4: Average Self-Efficacy Responses per Question - Type F vs. Type T

Note. Self-Efficacy Assessment can be found in Appendix B

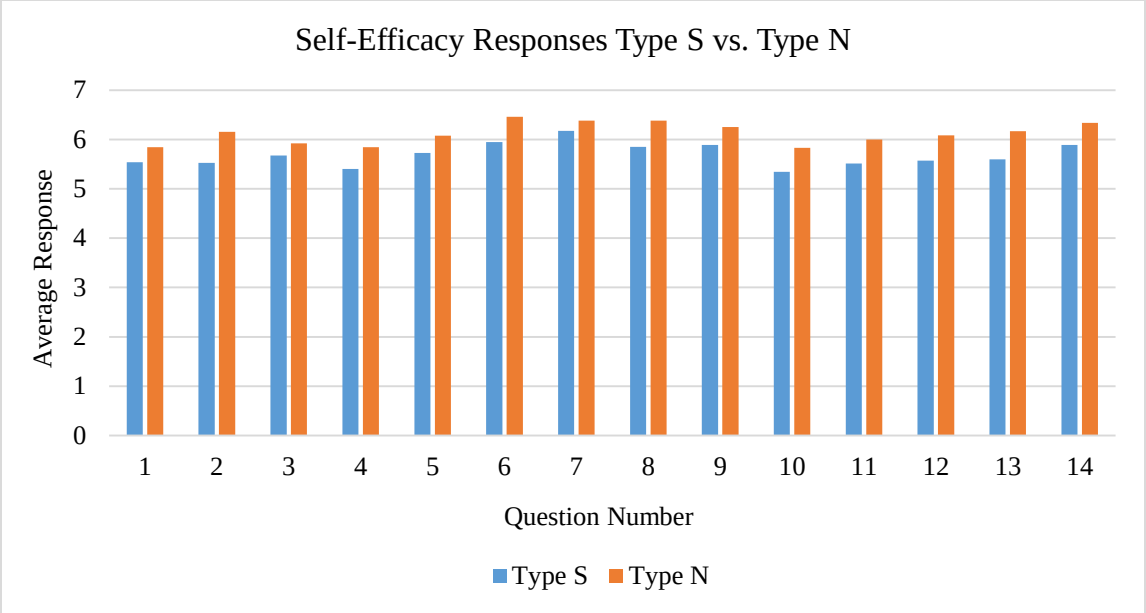

Figure 5: Average Self-Efficacy Responses per Question - Type S vs. Type N

Note. Self-Efficacy Assessment can be found in Appendix B

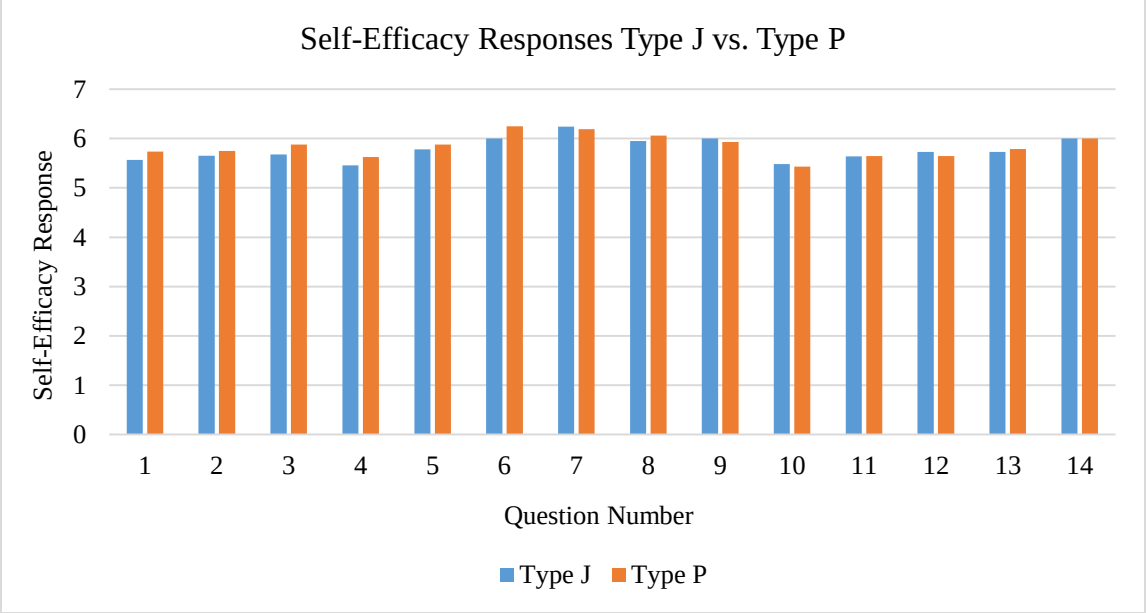

Figure 6: Average Self-Efficacy Responses per Question - Type J vs. Type P

Note. Self-Efficacy Assessment can be found in Appendix B

Table 6: Number of Pre- and Post-Simulation Self-Efficacy Question Responses by Personality Subtype

Subtype	N	Significant response frequency ($p \leq 0.050$)	Near significant response frequency ($0.050 < p \leq 0.100$)	Non-significant response frequency ($p > 0.100$)
E	30	8	4	2
I	23	8	3	3
N	13	6	3	5
S	40	10	1	3
J	37	12	0	2
P	16	5	1	8
F	35	10	1	3
T	18	9	2	3
All	212	0	0	14

Situation Awareness

ANOVA was used to measure the significance of role assignment on SAGAT scores. An ANOVA was also used to measure any possible significance between personality types and SAGAT scores. The results for the effect of roles on SAGAT scores is shown in Table 7 and the results of the effect of personality type on SAGAT scores is shown in Table 8. For Table 7, when using an ANOVA the "DF" stands for degrees of freedom, "Adj. SS" is the adjusted sum of squares and the "Adj. MS" is the adjusted mean of squares.

Table 7: ANOVA Table for Role vs. SAGAT Scores

Source	DF	Adj. SS	Adj MS	F-Value	p-value
Role	4	9.585	2.396	1.24	0.317
Error	29	56.130	1.936		
Total	33	65.715			

Table 8: ANOVA Results Comparing Personality Subtypes and SAGAT Scores

Subtypes	Sample Size	p-value	Significant?
E vs. I	E – 21 I – 12	0.714	No
N vs. S	N – 8 S – 25	0.883	No
J vs. P	J – 23 P – 10	0.089	No
F vs. T	F – 20 T – 13	0.163	No

DISCUSSION

Although some of the results do not indicate a significant impact or difference in the indirect skills used in the simulation, this study provides insight on some aspects of this particular simulation scenario and likely other scenarios as well. In review, the results show that neither role assignment nor personality type had a significant effect on situation awareness (SAGAT scores). However, results for self-efficacy and critical thinking show that both role assignment and personality type increased the self-efficacy ratings of a participant and improved the critical thinking skills of a participant. These results suggest further research would be useful toward improving HFPS scenarios not by improving the simulator or the scenario but by addressing the needs, weaknesses, and abilities of the participant simply by knowing their personality and assigning the participant to the proper role to more effectively improve the performance of a participant.

Critical Thinking

The intended purpose of this study was to provide evidence of the impact HFPS has on critical thinking abilities. Traditional lectures provide nursing students with clinical knowledge foundation, but it is up to the nursing student to develop an understanding and application for the knowledge gained. Critical thinking incorporates knowledge, awareness, and understanding to help provide optimal care. However, every nursing student is different; some may have weak understanding of knowledge shared in

lectures, whereas others may have experience and instincts that help provide optimal care. The diversification in skills, knowledge, and backgrounds within a simulation group would theoretically allow students to learn from each other in addition to learning from the simulation and the facilitator.

Quality of experience refers to how involved the student was and how much student's abilities improved due to the simulation. When a simulation must incorporate multiple students, it is obvious that every student cannot be the main nurse. Thus supporting roles need to be used in order to keep the other students involved and contributing in a positive manner.

A common argument is that the only way a participant would truly gain experience is by being heavily involved in the simulation exercise. This means that a participant who plays the role of lead nurse would gain more valuable experience than a participant that plays a role that mostly observes the scenario as it is played out. However, there have not been many studies to address this argument. Causes for the lack of research can be attributed to the existence of numerous different simulation scenarios used by nursing training programs and assessment tools used in combination with the scenario.

Statistically speaking, roles in this postpartum hemorrhage scenario did have a significant difference when critical thinking skills were assessed. In addition, through simulation observation and debriefing observation, it should be noted that roles that required more patient involvement led to higher quantity and quality of input throughout the session. During the simulation, the tendency of the lead nurse to serve as a leader and be continuously involved throughout the simulation occurred in nearly every simulation.

In addition, the documenter participant tended to be involved simply because they were in charge of recording actions, vitals, and important communication milestones. This task requires the participant to observe carefully and follow along with the simulation. Finally, the secondary nurse needed to pay close attention to the lead nurse during the first half of the simulation in order to understand the situation prior to them taking over as the main nurse in the second half of the scenario. Once the secondary nurse took over they tended to provide more input and "talk aloud" in order to generate conversations with the other participants in the room. After reviewing observation notes, it became clear that in this scenario with the level of participants used, the roles of lead and secondary nurse and documenter invited more involvement, which may have led to increased critical thinking scores.

Interpreting the non-significant findings may be more difficult. Recall that the non-significant findings were that the medication and the caller roles were found to not have a statistically significant difference on critical thinking scores after the simulation. There could be multiple factors responsible for those results.

One factor could be the variation in the requirements of the roles. The roles of lead nurse, second nurse, and documenter required intense observation and involvement since those roles are in direct involvement with the simulated patient's outcome. The medication nurse had one true responsibility: administer the medication given in the orders from the "health care provider". Observation in the simulation was not necessarily optional, but at the same time there is no true motivation to intently observe because the medication role does not necessarily rely on the other roles. The medication role could literally just sit and wait until it was time to administer the orders, administer the

medication, then go back to standing in the back. The participant who plays the role of medication would have to be called upon by other participants or involve him/her self in order to be directly involved in the simulation outcome.

Next, the caller role also has little direct involvement with the outcome of the simulation. The responsibility of the caller was to call the healthcare provider when the secondary nurse had exhausted all the care options and needed to receive care orders from the provider. While calling the provider, it was observed that the caller had access to the other participants to help answer some of the provider's questions. Not only is this unrealistic in the real-world, it allows the caller to use other participants as a crutch. If the caller does not record all pertinent information during the simulation, there is no consequence because other participants are there to assist. This means that the caller does not necessarily have to observe with the intensity as the documenter. In addition, the caller is not required to provide care in anyway. Once the call is complete, unless one of the other participants request assistance or involve the caller, the caller then no longer had any more responsibility in the simulation.

In review, each role should require vigilant observations and continuous involvement in order to entice the participant to be completely involved mentally and physically in the simulation. With this particular scenario, most of the roles accomplish that feat. The only changes that could be addressed are adding to the requirements or procedures for the medication and caller roles. One possible solution would be to combine the two roles into one role and have the additional participant use the checklist and grade the performance of the team. This would encourage complete observation in order to complete the checklist and the combined role would have to be involved for

nearly the entire simulation. Another solution would be to have the caller leave the simulation role to make the call, which would rely on the caller's observations. This means the caller must have correctly observed the situation and be involved in the process.

There is reason to believe that role assignment has a difference on the post-simulation critical thinking scores. Every role had some form of overall increase in both median and mean scores for all 49 participants; only two roles out of a possible five were not statistically significant. It is also noted that the roles that had the significant difference bore a majority of the simulation involvement. Those roles accounted for most of the patient interaction and documentation of care given. This yields a simplistic conclusion that bears further examination: the involvement of the role in the simulation yields higher critical thinking scores.

Consider the caller role, medication nurse role, and personality subtype N and the respective results found when considering critical thinking. The other three roles and the seven other personality subtypes, indicated a significant difference. However, it should be noted that the significance values of p=0.059 (caller role) and 0.100 (medication nurse role, subtype N) trend towards significance. Despite this study setting the alpha level at 0.05, alpha could have been relaxed to 0.07 or 0.100 in order to accommodate the unpredictability in human performance. If the alpha level was relaxed in this study than subtype N would also show a significant difference in the pre- vs. post- simulation critical thinking comparison, and all of the subtypes show display a significant difference.

Finally, it should be noted that the findings and the subsequent discussion are completely based on a limited participant group and one particular simulation scenario. A

change in participant group or a change in simulation and the related simulation roles may or may not support the findings described above.

Self-Efficacy

Self-efficacy is similar to self-confidence and could have a drastic effect on performance. In addition, there are a multitude of strategies that can improve one's self-efficacy such as practicing a skill, studying the skill, and much more. It is important for a nurse to feel confident in his/her abilities while providing care for a patient. This study sheds some light on how role assignment in a simulated scenario can, or cannot, improve self-efficacy.

In this particular post-partum hemorrhage scenario, three out of the five roles showed great increase in self-efficacy scores when pre and post-simulation scores are compared. The Roles of lead nurse, documenter, and medication showed increased self-efficacy levels for 10, 6, and 7 questions (respectively) out of a possible 14. The secondary nurse and caller only showed an increase in 1 and 3 questions (respectively) out of a possible 14. These results shed some light on the impact of role assignment, but raises questions as well. Previously, there has been mention of the fact that more practice would theoretically improve self-efficacy. Therefore, there is an expectation that the roles that are the most involved in the scenario would show the greatest improvement; so, in this case the lead nurse, second nurse, and the documenter would be expected to show the greatest increase in self-efficacy. Only two of those three roles supported that notion, and the medication role also showed a large improvement despite not really having to be involved in the scenario until the scenario was nearing the end, and the total contribution of the medication role does not last longer than five minutes of the usual 30-minute

simulation. The second nurse and the caller roles did not show much increase in self-efficacy at all. Theoretically, the second nurse would have been expected to show more of an increase across more questions based on that role's heavy involvement in patient care. The caller had little input and served more as an observation role than having a significant hand in the success or failure of the simulation. Therefore, with more observation than practice, it was no surprise that the self-efficacy scores did not improve over more questions after the simulation.

Another factor in perceived self-efficacy levels lies within the participant themselves. There are individuals in any population that have a sense of self-confidence about themselves or their abilities. If you were to observe their performance of a task that they are confident in and compare it to someone with little or no confidence in their performance of the same task, the behavior of the two individuals, and possibly the outcomes of the two tasks, would most likely be completely different. Granted, this is assuming the confident individual has not inaccurately judged their capabilities. Personality and experience are said to be a cause of this confidence. Therefore, personality traits were used to determine if personality had a significant difference on self-efficacy responses and the results do not disappoint.

Each MBTI personality subscale showed an increase between pre and post-simulation responses in at least 6 self-efficacy questions out of a possible 14. Recall that each subscale has two possible types a person can fall into (E vs. I, N vs. S, J vs. P, and F vs. T); therefore, the number of questions that revealed a significant increase can help determine which personality subscale may have the greatest difference on perceived self-efficacy as it relates to post-partum hemorrhaging. E/I both had 8 questions displaying a

significant increase, S had 10, whereas N had 6. J had 12 compared to 5 for P, F had 10 and T had 9. Based on the aforementioned data, if a participant displayed a personality subscale type that is aligned with S, J, or F, then it can be assumed that their self-efficacy would improve more than those who display personality subscale types N, P, T with E and I being equal. The importance of these results is that for a post-partum hemorrhage scenario among this participant pool, the increase in perceived self-efficacy could be predicted, or expected, based on the participant's personality subscale types, which can facilitate team assignments and help design meaningful debriefing sessions.

Moreover, self-efficacy questions 9 and 12 showed a significant difference when all roles were considered, whereas questions 4 and 9 showed a significant difference for each subscale tested. This means that participants showed a significant increase in confidence when topics such as drawing conclusions based on assessments, documenting care actions provided, and formulating long and short term care goals for the patient are considered. Alternatively, question 14 showed no significant difference when roles were considered, and questions 5 and 6 also showed no significant difference when each personality subscale was tested. Thus meaning that when considering the ability to address needs and desires of a patient while providing care, identifying when additional help is needed, and relying on past experiences to assess and care for the patient, the participants experienced no statistical difference. The lack of difference could be a result of an overconfidence phenomena experienced by the participants. For questions 5, 6, and 14, most participants indicated 6 or 7 on the confidence scale in the pre-simulation assessment. Therefore, with little room to change in confidence once the post-simulation assessment was completed, a significance was not found. Additionally, the participant's

pre-simulation confidence may have been increased as a result of the simulation preparation work. As required by their course, participants have to complete simulation preparation work in order to be eligible to participate in the simulation.

Self-efficacy is a trait that may get overlooked in the nursing field because nurses deal with various situations that can take them on a rollercoaster of emotions. The ability to stay confident in your abilities as a nurse is difficult to measure and there is no quantitative method to measure confidence. The goal of simulation is to provide a safe area to practice scenarios that nurses could face in the clinical environment without causing injury (or death) to a patient. This "protection" of the patient also serves as "protection" of the nurse's self-efficacy as well. While practicing, a human life is not at risk so if the simulation has failed, a nurse's self-efficacy is not as damaged as it may be if a human life was lost. That does not mean if a simulation has failed, then a nurse's self-efficacy would not be damaged. Rather, the damage is controllable and fixable with more practice until the simulation is passed. Despite failing or passing, a simulation self-efficacy of a nurse will increase without the risk, and now with more of an understanding of role assignment and personality types, further research can be done to find more ways to improve self-efficacy levels in nursing students.

Situation Awareness

In multiple high stress occupations, individuals are taught situation awareness in an attempt to help find solutions to problems that may not be obvious. Pertaining to nursing, situation awareness is vital because it requires a nurse to be aware of the patient, the environment around the patient, and all outside factors that could help or hinder their ability to provide care. In the described post-partum hemorrhage scenario, a high degree

of situation awareness was needed in order to properly document the health of the patient, the symptoms being suffered, care given, and the result of the care provided. A nurse would have to document similar information in a patient chart, thus meaning that proper and complete situation awareness needs to be given during the simulation.

Situation awareness could be affected by many factors, including role assignment and personality type. Role assignment and personality type have not been explored as possible factors that could positively or negatively affect situation awareness. The above results show that neither role assignment nor personality type had a significant effect on situation awareness. This was a surprising result especially when considering role assignment. Referencing the Yerkes-Dodson law, an individual is more attentive and performance is higher when they are involved and working on a task that is not unbearably difficult but not extraordinarily easy. There was an expectation that the lead nurse, second nurse, and the documenter roles would significantly impact situation awareness because those three roles are invested and crucial to the success of the simulation. On the other hand, the caller and medication roles were necessary only at certain points in the simulation so there may be a lack of interest and a lack of situation awareness. However, that was not the case for this particular simulation scenario, as revealed by the lack of statistical significance between roles and SAGAT scores.

The lack of significant effect of personality type on situation awareness was not as surprising, but did create more questions than answers. Certain personality types look for facts and evidence in an environment whereas other types infer based on prior knowledge. There was an expectation to see personality types score significantly different in terms of situation awareness due to the different ways information is gathered. In this

scenario, most of the required information had to be found through investigation of the patient and the surrounding area; therefore, the personality types that gather information from the environment were expected to score significantly higher. However, the results do not support that expectation, which could have been a result of some experimental limitations related to the situation awareness measurement technique or personality type identification test.

Overview

Outside of the data collection materials that were analyzed, each simulation session (including the debriefing) was observed and major trends and points of interest were recorded and should be addressed to help further explain some of the results. A total of 16 simulations were run over the course of four days. Over those four days, there were a total of three different simulation facilitators interacting with the participants and conducting the debriefing. Every session was different based on the participant's reactions to the scenario so each facilitator interacted with the simulation in different ways. One facilitator tried to give subtle hints to help "jumpstart" the simulation, another was relatively hands off and took notes of both positive and negative care techniques that participants demonstrated, whereas the third facilitator seemed focused on techniques of the care provided and skipped (or abbreviated) some of the minor details – such as proper communication over the phone, medication administration, and blood bank policies. Besides the facilitators and their various approaches, each simulation scenario displayed similar shortcomings and positive aspects.

One major shortcoming of HFPS, or any simulation, is that the sense of realism is lacking. In this case the simulator was a machine and although it had a human voice and

accurately represented human anatomy, the simulator lacked realism in a few aspects. Most notably, the skin was plastic, a motor was running the simulator which causes difficulty when listening to the chest cavity, and there is no direct human interaction between simulator and participant, just indirectly through speakers. Another shortcoming of the simulation was that all five participants were in the room at one time and although they are not supposed to interact with each other until the "call" button is pushed, they all tended to lean on each other for help. Facilitators would have to continuously remind the participants that they are to work alone until the proper protocol to get help was followed. Similarly, when the caller was "calling" the primary care provider (the facilitator), the other participants would contribute details the caller would forget to include or the caller would retain real time answers to the facilitator's questions. This is unrealistic on two fronts. One, nurses generally make provider calls from the nurse's station and only one nurse does the communicating so that one nurse would be responsible for having all the necessary information and they would not have four other nurses with them to call the provider. Two, the caller cannot get real time information of the patient from the nurse's station, and they have to rely on the accuracy of the information they have at hand. Despite the shortcomings, participants completed the simulation and acted as normal as possible.

Another interesting aspect of this simulation is how participants do not necessarily hold true to their assigned role. In a few simulations there were one or two participants that either had experience in post-partum emergencies, or had a need to be in control, and took the lead despite their assigned role. In many simulations there were participants that acted in more of an observatory manner and did not become involved

until their role was required. Other participants were heavily involved, but not necessarily in charge. It became clear that some participants truly prepared for the simulation and knew most of the material and were relied upon for each role; however, in some occurrences this "jack of all trades" was not necessarily in charge or took control, but rather provided help where it was needed. Communication amongst the teams varied in both frequency, quality, and strategy. The cause for this variation in communication could not be pinpointed in this study, but could serve as a potential research topic in the future.

In review, situation awareness seems to be unaffected by role assignment and personality type, whereas certain aspects of self-efficacy and critical thinking skills seem to be positively affected by role assignment and personality type. This knowledge is deemed useful when conducting a simulation requires multiple participants due to the lack of time required for each participant to complete the simulation individually. Having this knowledge could assist simulation facilitators in assigning roles and teams for simulation once the weaknesses and strengths of each participant is known and considered. Developing a systematic approach using these findings can help weaker students improve their abilities by working with a stronger participant in a different role. However, the stronger student still gets to participate and possibly improve their abilities through the added experience and assisting a participant that needs direction. Typically, random role assignment is used, but there is a potential weakness with this strategy. In random role assignment, a weaker student could be assigned a role such as medication and have little to no interaction in the simulation and thus limited training can occur. Implementing and considering these findings in a systematic approach could be used to

more effectively and efficiently develop each participant's abilities instead of randomly assigning roles; this can be verified or nullified through future research.

Future Research

Future research should look to expand on this particular study. Expansion should include a more variable participant group not limited to just third year baccalaureate-level nursing students. Further expansion of this study should look at how different simulation factors can impact the development of critical thinking, self-efficacy, and situation awareness. Other research topics should include a longitudinal study that reveals how the development of these skills in simulation translate to performance in real-world clinical scenarios. Finally, continuing research is needed to determine how participant role selection, personality types, and team interactions could affect developmental outcomes. Determining if there is a strategy to more effectively arrange and assign teams for simulation could be useful in developing all-around stronger nursing students in all aspects of nursing.

Critical thinking has been studied in multiple environments, but needs more attention in the medical field and specifically amongst nursing training techniques. Research focusing on the affects different scenarios, simulation fidelity (low vs. medium vs. high), and inclusion of virtual/augmented reality technology on the development of critical thinking should be at the forefront. Secondly, research should be conducted to look at how participant factors that were not the focus of this study, such as: age, gender, previous clinical experience, and clinical knowledge, may affect critical thinking development and simulation performance. Finally, research exploring the transition of

critical thinking abilities in simulation training to real-world scenarios would be vital in determining the true effectiveness of simulation training and critical thinking.

Self-efficacy is often an underrated skill due to the fear over overconfidence affecting performance. However, it should be considered an important skill that should be developed and built upon in order to produce confident and skillful nurses upon graduation. Future research should be done to identify what factors have an impact on self-efficacy during simulation. In addition to identifying the factors of self-efficacy, research should continue to focus on which aspects of simulation can positively affect self-efficacy and design simulation scenarios and technology focused on enhancing those aspects. Finally, research should also try to determine how self-efficacy in the simulation arena translates to real-world clinical scenarios.

Situation awareness is often "perfected" through practice. Common sense would suggest that to improve this skill, a nursing student should continuously go through simulation. However, that solution is not necessarily feasible. Therefore, additional research should be devoted to developing simulation scenarios and technology that can help enhance situation awareness, and require the students to rely on that skill for success in the scenario. However, there seems to be few validated strategies to quantify situation awareness abilities in healthcare, better yet in nursing simulation. However, there exists validated strategies such as SAGAT and other quantitative and qualitative methods. For example, SAGAT was developed, validated, and heavily utilized in aviation simulation scenarios. Without an interchangeable situation awareness measurement method, specifically for the various nursing simulation scenarios, determining situation awareness abilities in these training scenarios will continue to be difficult.

Personality was among some of the many participant background traits that has been relatively ignored when assessing simulation effectiveness and nursing education. Although this study only scratches the surface of this research gap, it should show that research on this topic is plausible. Continuing research on personality traits and the impacts they may have in team-designed simulation training is important in helping to determine if a methodology in role assignment and team building can exist. Discovering more about the participant and the various factors that can affect the participant's behavior and performance in simulation is vital in future development of simulation scenarios and technology.

As previously mentioned, future research could benefit from determining how the outcomes of simulation can translate to real-world clinical scenarios. Longitudinal studies that focus on skills such as critical thinking and situation awareness can help determine if these skills developed in simulation properly and completely translate to real-world performance. Although the students would have practiced real-world experiences in simulation scenarios, simulation may not effectively prepare students for a real-life patient. The lack of realism that exists with simulation may hinder how skills are transferred to the medical ward. Specifically, it would be beneficial for future research to determine how simulation translates to real life performance. This could highlight some shortcomings that exist with simulation and lead to development of more effective simulation scenarios and technology.

Limitations

Limitations in this study can be found mostly in the researcher-developed data collection materials simply because the materials used have not been completely

validated. Due to time constraints within the simulation center, some commercially developed assessments were not plausible. Other limitations exist within the participant pool, simulation structure, and the various sample sizes.

Commercially developed assessments are validated and usually very helpful. Some commercially developed critical thinking assessments such as the Watson-Glaser Critical Thinking Appraisal (WGCTA) or the nursing specific California Critical Thinking Disposition Inventory (CCTDI) and California Critical Thinking Skills Test (CCTST) were considered, but not used. These assessments take more time to complete than what was allotted in the simulation rotation. In addition, these assessments did not focus on the topic at hand (postpartum emergency care), but on nursing and critical thinking skills in general. Using one of the commercially developed materials may have added some validity to the study, but these forms of assessments were not developed with this scenario in mind. Validated situation awareness tools considered were the Situation Awareness Global Assessment Technique (SAGAT), Situation Awareness Rating Technique (SART), and Situation Awareness Rating Scales (SARS). The SART and SARS were excluded because they were subjective measures relying on scaled responses form the participant. The participant's perception of their abilities may indirectly effect the results of SART and SARS, thus meaning the results may not accurately reflect the participant's actual situation awareness abilities, but rather the participant's perceived abilities, which was not the objective of the study. Finally, the SAGAT was determined to be useful in terms of being a quantitative and objective method allowing researchers to quantify situation awareness skills based on correct/incorrect answers to situation-related questions. However, the SAGAT questions had to be modified to fit the nursing situation

instead of the aviation scenarios the SAGAT was originally designed for. Altering the questions of the SAGAT may have affected the validity of the tool, but the structure and focus on Mica Endsley's three prongs of situation awareness were unchanged in this version of the SAGAT.

Additionally, a limitation may exist with how the created assessments were graded. Grades for the critical thinking assessment were assigned based on a scale from zero to five (0-5) with higher values awarded for application of critical thinking skills on the scenario described. A scale system was used because the points of interest build on each other. If one point is wrong, the subsequent points would then become incorrect. However, other scales could have been used. Also, the assessments were only graded by one researcher (DTW). The SAGAT was graded based on right, wrong, and partial answers. If the question was answered completely and correctly a full point was awarded, where a partially correct answer was awarded half a point, and an incorrect answer was awarded zero points for a possible total of 12 points.

Other limitations could be found with participants and simulation structure. The limitation with the participants exists with the lack of variety and a potential bias to provide helpful data. The term "variety" would refer to different coursework, clinical experience, and simulation experience. Another limitation was that participants seem to vary with their involvement in the simulation. Some were involved and gave detailed answers in the assessments, whereas others seemed to be uninvolved with the simulation and some of the assessments were not fully completed. Additionally, the participants were made aware of the purpose of the study through the information provided through the informed consent form. Some participants may have completed the data collection

materials in order to provide helpful data rather than completing the materials honestly. The simulation structure had a slight limitation with the facilitator. Over four simulation days, there were three different facilitators running the simulation. Although the scenario didn't change, debriefing strategies were slightly different and one facilitator seemed to be more inclined to give hints to participants for the next step compared to the other two facilitators. The final limitation lies with varying sample sizes. This variation exists due to some students not wanting to participate in the study, some participants failing to fully complete the assessments, and some participants not staying true to their role assignment during simulation. This resulted in the varied amount of data for each assessment, role, and personality subtype. The variation was addressed with the statistical tests used, but ideally there would have been similar sample sizes.

CONCLUSION

In conclusion, the data displayed a statistically significant increase in perceived self-efficacy and critical thinking development after completing the simulation; thus, supporting hypothesis (1).

Next, statistical analysis revealed that role assignment and all of the personality subscales (except "N") did have a statistically significant difference on critical thinking assessment scores and self-efficacy, partially supporting hypothesis (2). More specifically, a significant difference was found when pre and post simulation scores were compared across independent personality subtypes. However, when just the post critical thinking scores were compared across all eight personality subscales, no significant differences across role type was found. This means that all personality subscales, except "N" displayed a significant development from pre to post scores, but no subscale scored significantly different than other subscales. As for role assignment, the roles of: lead nurse, secondary nurse, and documenter had a statistically significant difference on the post-simulation critical thinking assessment scores. Role assignment and personality subscale had a significant difference on at least one question in the self-efficacy assessment when comparing pre and post simulation responses. However, when all the roles and the post simulation responses were compared, it was determined that role assignment did not have a significant difference on the responses for any questions on the

assessment. Finally, it was determined that neither role assignment nor personality subscale had a significant difference on situation awareness scores.

Hypothesis (3) was not supported. After analyzing the data, it could be determined that a statistical significance did not exist when personality subscales were compared with post critical thinking and situation awareness scores. This means that personality subscales did not indicate statistically higher scores in critical thinking and situation awareness. When all the personality subscale responses were compared, none of the questions indicated a statistical difference for self-efficacy. However, when looking at a visual representation comparing subscales amongst each other, type E responses were higher than I, F higher than T, N higher than S, and J was about equal to P. This demonstrates that a trend may exist, despite the lack of significance.

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APPENDIX A

Myers-Briggs Type Indicator

Directions

There are no "right" or "wrong" answers to the questions on this inventory your answers will help to show how you like to look at things and how you like to go about deciding things. Knowing your own preferences and learning about other's can help you understand what your special strengths are, what kind of work you might enjoy, and how people with different preferences can relate to each other.

Read each question carefully and select one of the two choices given, which applies to you, by circling to either "a" or "b".

Part1: Which answer comes closer to telling how you usually feel or act?

1. When you go somewhere for the day, would you rather

    a. Plan what you will do and when, or

    b. Just go?

2. If you were a teacher, would you rather teach

    a. Fact, or

    b. Theory?

3. Are you usually

    a. Talkative and outgoing, or

    b. Rather quiet and reserved?

4. Do you more often let

    a. Your heart rule your head, or

    b. Your head rule your heart?

5. In doing something that many other people do, does it appeal to you more to

    a. Invent a way of your own, or

    b. Do it in the accepted way?

6. Among your friends are you

a. Full of news about everybody, or

b. One of the last to hear what is going on?

7. Does the idea of making a list of what you should get done over a weekend

a. Appeal to you, or

b. Have no effect on you, or

c. Depress you?

8. When you have a job to do, do you

a. Organize it carefully before you start, or

b. Find out what is necessary as you go along?

9. Do you tend to have

a. Broad friendships with many different people, or

b. Deep friendship with very few people?

10. Do you have more admiration for the people who are

a. Conventional enough never to make themselves conspicuous, or

b. Too original and individual to care whether they are conspicuous or not?

11. Do you prefer to

a. Arrange picnics, parties etc., well in advance, or

b. Be free to do whatever to looks like fun when the time comes?

12. Do you usually get along better with

a. Realistic people, or

b. Imaginative people?

13. When you are with the group of people, would you usually rather

a. Join in the talk of the group or

b. Just listen to others talk?

14. Is it a higher compliment to be called

a. A person of emotion, or

b. A consistently reasonable person?

15. In reading for pleasure, do you

    a. Enjoy inferring writer's meaning, or

    b. Like writers to say exactly what they mean?

16. Do you

    a. Talk easily to almost anyone, or

    b. Find a lot to say only to certain people?

17. Does following a schedule

    a. Appeal to you, or

    b. Not appeal to you?

18. When it is settled well in advance that you will do a certain thing at a certain time, do you find it

    a. Nice to be able to plan accordingly, or

    b. A little unpleasant to be tied down?

19. Are you more successful

    a. At following a carefully worked out plan, or

    b. At dealing with the unexpected and seeing quickly what should be done?

20. Would you rather be considered

    a. A practical person, or

    b. An ingenious person?

21. In a large group, do you more often

    a. Introduce others, or

    b. Get introduced?

22. Do you usually

    a. Value sentiment more than logic, or

    b. Value logic more than sentiment?

23. Would you rather have a friend

    a. Who is always coming up with new ideas, or

    b. Who sticks to what is known?

24. Can the new people you meet tell what you are interested in

    a. Right away, or

    b. Only after they really get to know you?

25. In your daily work, do you (on this question only, if two answers are true, circle both)

    a. Usually plan your work so you won't need to work under pressure, or

    b. Rather enjoy an emergency that makes you work against time, or

    c. Hate to work under pressure?

26. Do you usually

    a. Show your feelings freely, or

    b. Keep your feelings to yourself?

Part 2: Which word in each pair appeals to you more (think what the word means, not how they look or how they sound)?

27. A. Scheduled
    B. Unplanned

28. A. Facts
    B. Ideas

29. A. Quiet
    B. Hearty

30. A. Convincing
    B. Touching

31. A. Imaginative
    B. Matter-of-fact

32. A. Benefits
    B. Blessings

33. A. Peacemaker
    B. Judge

34. A. Systematic
    B. Spontaneous

35. A. Statement
    B. Concept

36. A. Reserved
    B. Talkative

37. A. Analyze
    B. Sympathize

38. A. Create
    B. Make

39. A. Determined
    B. Devoted

40. A. Gentle
    B. Firm

41. A. Systematic
    B. Casual

42. A. Certainty
    B. Theory

43. A. Calm
    B. Lively

44. A. Justice
    B. Mercy

45. A. Fascinating
    B. Sensible

46. A. Firm-minded
    B. Warm hearted

47. A. Feeling
    B. Thinking

48. A. Literal
    B. Figurative

49. A. Foresight
    B. Compassion

50. A. Hard
    B. Soft

APPENDIX B

Simulation: Self-Efficacy Scale

Circle the value on the scale that best represents how confident you are in the following areas before you participate in the simulation. The meaning of the values are as follows:

1 = *Not Confident* 4 = *Neutral* 7 = *Very Confident*

I am confident that I can:

1. properly prepare the clinical area for patient assessment.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*

2. collect relevant information about the patient based on patient history and medical charts.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*

3. properly perform patient assessment.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*

4. draw conclusions based upon my assessment.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*

5. address the needs/desires of the patient while caring for patient.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*

6. identify when I need assistance and can communicate this need clearly.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*

7. properly provide oxygen via a face mask.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*
Neutral

8. properly carry out orders given to me by providers or doctors.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*
Neutral

9. properly document and report scenario and care actions taken.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*
Neutral

10. draw relationships among various pieces of data from a variety of sources.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*
Neutral

11. formulate a nursing diagnosis based on data collected.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*
Neutral

12. formulate short and long term care goals for patient care.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*
Neutral

13. explain nurse's actions and decisions to patient's family member(s).

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*
Neutral

14. use my past experiences to assess patients and provide proper care.

Not Confident 1 --------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 *Very Confident*
Neutral

APPENDIX C

Situation Awareness Global Assessment Technique
N461 Childbearing Family Nursing: Postpartum Hemorrhage

Level 1: Perception

What spot(s) on the patient did you find the pulse? What was the rate of the patient's pulse?

What was the patient's blood type?

Did the patient have any abnormal labs? If so, what did she test positive for?

What areas of postpartum assessment of the patient was abnormal?

Where is the baby located, and what is the status of the baby?

Level 2: Comprehension

Based on your assessment, did you anticipate any issues to arise?

After the hemorrhage started, what conclusions could you make about the patient's health status?

What were the orders given to you?

Level 3: Projection

How would the orders of care given to you provide the best care for the patient?

What would be the patient's status if the care and orders you carried out were never given?

What precautions should be taken for the next nurse on duty to provide proper care for the patient?

Briefly write points of emphasis that you think doctors and other nurses should know about this patient and the simulation outcome.

APPENDIX D

Postpartum Simulation Critical Thinking Assessment

Patient Information:

32-years old
Birth Plan: natural birth, breastfeeding
A+ blood type

Meds:

Tylenol (Acetaminophen) – 325 mg tablets, labeled
Percocet (Oxycodone and Acetaminophen) – 10/350 mg tablets, labeled
Motrin (ibuprofen) – 600 mg tablets, labeled
Hemabate (Carboprost) – 250 mcg/mL in a 5 mL injection vial, labeled
Phenergan (Promethazine) – 25 mg/mL in a 1 mL injection vial, labeled

Current situation:

1 hour prior you came in to check on patient and patient indicated pain when the fundus was massaged. The following was noted at the end of PP assessment: **Pain level**: "7/10" when fundus massaged, **Uterus**: Fundus frim @ U, **Lochia**: moderate rubra, **Episiotomy/Extremities**: none, area is swollen, pulses palpable, no edema.

As you walk in the patient states that she feels light-headed. Her vitals are as follows: **BP** – 102/54; **HR** – 109; **Resp** – 24; **Temp** – 96.7 degrees; **Pulse Ox** – 92%. You notice that blood has saturated the gown and linens.

What do you do next? What factors are you considering? If you communicate with other medical personnel, list what patient factors you must share with them. Finally, what type of care are you expecting the patient will need and what are the steps to providing that care?

CURRICULUM VITA

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EDUCATION

2017 **M.S.** Industrial Engineering, University of Louisville
Thesis: "The Effect of Role Assignment and Personality Subtypes in Simulation on Critical Thinking Development, Situation Awareness, and Perceived Self-Efficacy of Nursing Baccalaureate Students"

2014 **B.S.** Human Factors Psychology, Embry-Riddle Aeronautical University

PROFESSIONAL EXPERIENCE

Aug. 2016 – Present	Graduate Teaching Assistant Dept. of Industrial Engineering, University of Louisville
Aug. 2015 – Present	Center for Ergonomics Laboratory Manager Dept. of Industrial Engineering, University of Louisville
Sept. 2014 – Dec 2014	Undergraduate Research Assistant ACES^2 Laboratory – Human Factors Psychology Dept., Embry-Riddle Aeronautical University
June 2014 – Aug 2014	Human Factors Intern Human Solutions Inc.
Sept. 2013 – April 2014	Undergraduate Research Assistant Applied Training Sciences Laboratory – Human Factors Psychology Dept., Embry-Riddle Aeronautical University

RESEARCH INTERESTS

- Alzheimer and Dementia at home care strategies
- Geriatric patient safety
- Virtual reality in healthcare training and surgery preparation
- Patient care decision support tools
- Predictive modelling of performance nursing simulation training scenarios
- Predictive modelling of patient response to provided care

PROFESSIONAL ASSOCIATIONS

- Human Factors and Ergonomics Society (HFES), 2013 – present
    - President of HFES Chapter at the University of Louisville, 2016 – present

AWARDS AND HONORS:

- Psi Chi International Honor Society in Psychology, 2013 – present
    - Secretary of Chapter at Embry-Riddle Aeronautical University, 2013 – 2014

REFEREED JOURNAL ARTICLES

1. Doggett A., **Weiler, D. T.**, & Saleem, J. J. (2016). A comparative usability study of independent web-based personal health records. *International Journal of Human-Computer Interaction* (accepted for publication).

REFEREED CONFERENCE PROCEEDINGS PAPERS

1. **Weiler, D. T.**, & Saleem, J. J. (2016). Identifying an effect of simulation role assignment on critical thinking development in baccalaureate nursing students: A proof of concept. In *Proceedings of the Human Factors and Ergonomics Society 60th Annual Meeting*, 1818-1822.

REFEREED ABSTRACTS

1. Doggett A., **Weiler, D. T.**, & Saleem, J. J. (2016). A comparative usability study of independent web-based personal health records. [Abstract]. In *Proceedings of the Human Factors and Ergonomics Society 60th Annual Meeting*, 576-577.

UNDER REVIEW

1. Saleem, J. J., & **Weiler, D. T.,** (2016) Workload in multi-screen work stations in an information-rich environment (under review).

TEACHING ASSISTANCE

Semester	Course Number	Course Title
Fall 2016	IE 370	Engineering Economics
Fall 2016	IE 380	Work Design
Fall 2016	IE 580	Human Factors and Ergonomics
Spring 2017	IE 581	Adv. Human Factors and Ergonomics
Spring 2017	IE 590	Usability Engineering

CONFERENCE PRESENTATIONS

- 9/22/2016: Weiler, D. "Effect of Simulation Role Assignment on Critical Thinking Development in Baccalaureate Nursing Students" (Paper Podium Presentation). Human Factors and Ergonomics (HFES) 2016 International Annual Meeting, Washington, DC.

- 9/22/2016: Doggett A., Weiler, D., & Saleem, J.J. "A Comparative Usability Study of Independent Web-Based Personal Health Records (PHRs)" (Abstract Poster Presentation). Human Factors and Ergonomics (HFES) 2016 International Annual Meeting, Washington, DC. (Presented by Weiler, D.)

- 10/30/2014: Weiler, D., Barkley, T., Kramer, I., & McCleanny, M. *VICS: Voter Interactive Check-in System*. Poster session presented at the Human Factors and Ergonomics Society (HFES) 2014 International Annual Conference, Chicago IL

- 7/1/2014: Blickensderfer, B., Cruit, J., Weiler, D., Kerson, D., Montgomery, C., & Lau, M. (2014 August). *SBT for Undergraduate Nursing Students: Identifying Gaps in Research*. Poster presented at the meeting of the American Psychological Association, Washington D.C

- 3/28/2014: Weiler, D., Montgomery, C., Sorrell, C., Cruit, J., and Blickensderfer, B. (2014, April). *Simulation Based Training (SBT) in the Nursing Domain*. Paper presented at the Human Factors and Applied Psychology Student Conference, Daytona Beach, FL.

- 3/12/2014: Weiler, D., Montgomery, C., Sorrell, C., Cruit, J., and Blickensderfer, B. (2014, April). *Effective Development of Nursing Skills via Simulation Based Training (SBT).* Poster presented at Discovery Day, Daytona Beach, FL.