A COMPARATIVE ANALYSIS OF HOW SKILLS-BASED AND SCENARIO-BASED SIMULATIONS SUPPORT LEARNING WITH EFAST AS AN EXEMPLAR SKILL

by

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A Dissertation
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Doctor of Philosophy
Education

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Dedication

To Steve, Emma, Dominick, and Lucianna.

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List of Abbreviations

American College of Emergency Physicians .... ACEP
Best Evidence Medical Education .... BEME
Comprehensive Anesthesia Simulation Environment .... CASE
Computed Tomography .... CT
Diagnostic Peritoneal Lavage .... DPL
Direct Observation of Procedural Skills .... DOPS
Enhanced Focused Assessment using Sonography in Trauma .... EFAST
Embedded Standard Patient .... ESP
Emergency Medical Technician .... EMT
Guided Participation .... GP
Human Patient Simulator .... HPS
Institutes of Medicine .... IOM
Magnetic Resonance Imaging .... MRI
Nationally Registered Emergency Medical Technician .... NREMT
Operating Room .... OR
Radiology Direct Observation of Procedural Skills .... RAD-DOPS
Registered Diagnostic Medical Sonographer .... RDMS
Simulation Based Learning .... SBL
Self-Efficacy .... SE
Standard Participant .... SP
Subject Matter Expert .... SME

Abstract

A COMPARATIVE ANALYSIS OF HOW SKILLS-BASED AND SCENARIO-BASED SIMULATIONS SUPPORT LEARNING WITH EFAST AS AN EXEMPLAR SKILL,

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Dissertation Director: Dr. Anastasia Kitsantas

This study presents an investigation into how learning was supported in skills- and scenario-based simulations, and examines the influence of simulation context on the activities, guided participation, self-efficacy, and learning outcomes of student healthcare professionals. Using a mixed-methods comparative case study design, eight student healthcare professionals, naïve to ultrasound, were recruited to learn the Extended Focused Assessment using Sonography for Trauma (EFAST) exam. Following completion of a pretest evaluation of EFAST performance, students were randomly assigned to partake in either two skills-based or scenario-based simulation practice sessions. Qualitative data included video recordings of simulations, and student's written reflections. Quantitative data included the EFAST self-efficacy scale and the Radiology Direct Observation of Procedural Skills (RAD-DOPS), which assessed students' performance of the EFAST. Activity theory and guided participation informed analysis of students' engagement during participation in skills-based and scenario-based simulations. Descriptive statistics were used to examine students' performance on RAD-DOPS assessments and self-efficacy beliefs. Findings suggest that learning was supported in both simulation contexts when students, together with peers and faculty, engaged in clinically relevant activities, using culturally relevant tools and artifacts. The findings also suggest that students' activities, guided participation, learning reports, and SE differed. All students reported learning the EFAST; however, scenario-based students reported learning about their role as member of the healthcare team, and how to integrate the EFAST into patient care. Students in skills-based simulations rated their self-efficacy for EAST numerically higher than did scenario-based students. Skills-based students were rated more highly on the posttest. Recommendations for practice are discussed.

Chapter One

Simulations and simulation-based learning (SBL) in health professional education continue to gain acceptance and popularity among diverse healthcare professions, including clinical medicine, dentistry, nursing, and other allied health specialists (e.g., pre-hospital care, respiratory technology) (Cook, et al., 2011). Simulations have become increasingly popular because they (a) support efforts to improve health care provider performance in crisis events (Gaba, 2000; Gaba, Howard, Fish, Smith & Sowb, 2001); (b) can be used in lieu of practicing on actual patients when teaching novices (Bradley, 2006; Ziv, Rubin, Sidi, Berkenstadt, 2007; Ziv, Wolpe, Small, & Glick, 2003); and (c) are viewed as a solution to many challenges associated with contemporary healthcare education (Issenberg, McGaghie, Petrusa, Gordon, & Scalese, 2005; Jeffries, 2005). However, most early research aimed to prove *that* simulations support learning, rather than examining *how* learning is achieved. Therefore, two critical questions remain unanswered: How does participation in simulations contribute to learning? How do differences in simulation context influence learning and participation?

Simulation: History and Context

Although simulations in the health professions are intermittently described in the medical education literature, they have only recently gained widespread acceptance and adoption (Gardner & Raemer, 2008). Like simulations in other domains, such as aviation, nuclear power production, and the military, simulations and SBL in healthcare initially gained acceptance because they could be used when education or systems testing were too costly or dangerous to undertake during real-world practice (Bradley, 2006; Ziv, et al., 2003). For example, in the mid-1980s a team of anesthesiologists at Stanford University sought to examine the role that inadequate responses from anesthesiologists and the operation room (OR) team played in rates of morbidity and mortality. Realizing that they couldn't study the phenomena using actual patients, they developed the Comprehensive Anesthesia Simulation Environment (CASE), a human patient simulator (HPS). The CASE HPS mimicked human functions such as breathing, exhalation of carbon dioxide, heart tones, and lung sounds. Incorporating an HPS that had physiologic responses similar to those of a person allowed anesthesiologists and the OR team to take their cues from the HPS and physiological monitors. As a result, participants were able to work in much the same way they would in the clinical setting, which Gaba et al. (2001) reasoned was more authentic.

In the process, Gaba et al. (2001) learned that effective response to crisis events required skills and knowledge most anesthesiologists were not taught during traditional medical education. For example, they identified that team leadership, effective communication, and task prioritization skills were integral to successfully managing crisis events. They reasoned that although incidences of adverse reactions were somewhat common, they did not occur frequently enough for any one anesthesiologist to gain expertise. In addition, when an adverse reaction did occur, it is was deemed too high-risk to allow less experienced clinicians to engage, further hindering how future generations were trained. Gaba et al. (2001) also realized that although reducing the incidence of adverse reactions was a laudable goal, doing so would eventually result in fewer clinical incidents, which introduced the added challenge of ensuring that clinicians maintained their newly learned skills. Thus, simulation was viewed as a solution to both teaching crisis response strategies and helping practitioners maintain their skills.

Furthermore, simulations gained popularity in other high-risk domains, including difficult airway management in the emergency department (Mayo, Hackney, Mueck, Ribaudo, & Schneider, 2004); shoulder dystocia during and postpartum hemorrhage management after labor and delivery (Draycott et al., 2008); and response to cardiac arrest (Wayne et al., 2008). These early experiences helped frame simulations and SBL as an acceptable alternative in high-risk, low-frequency events.

Moreover, SBL was further bolstered when the Institute of Medicine (IOM) published its landmark report "To Err is Human" in 1999, exposing medical error (both acts of commission and omission) as a leading cause of patient injury and death in the United States (Kohn, Corrigan, & Donaldson, 2000). Policy makers and early adopters of SBL reasoned that simulations could be used to allow novices opportunities to learn and practice new skills in advance of clinical experiences (Ziv, Small, & Wolpe, 2000). Soon after, Ziv et al. (2000), and Aron and Headrick (2002) argued that allowing untrained or minimally trained clinicians to practice on actual patients created an unacceptable risk when a patient simulator was available. Thus, the patient safety movement further fueled the advancement of simulations in healthcare by framing them as an important patient safety strategy. This perspective subsequently led to the call for research and evidence that determined if participation in simulations contributed to improvements in safety and quality in patient care.

Integrating SBL in undergraduate and post-graduate education gained popularity when stakeholders in the education of health professionals realized that simulations and SBL could solve several problems commonly associated with contemporary health professional education. For example, novice learners are increasingly shut out of directly caring for patients during their clinical rotations. This roadblock occurs because of the increased complexity of contemporary clinical care, shorter hospital stays, and increased competition for clinical sites (Benner, Sutphen, Leonard, & Day, 2009; Cook, Irby & O'Brien, 2010;Gaba, 2004; Issenberg et al., 2005; Jeffries, 2005). Therefore, students engaging in clinical rotations are often limited if the complexity of the patient's diagnosis or care is beyond the capabilities of the student (Benner et al., 2009; Gaba, 2004; Jeffries, 2005).

Additionally, clinical rotations rely heavily on chance experience because it is impossible to predict which types of patients students will encounter, thus resulting in unpredictable student experiences. At the same time, for many clinical educators, the provision of patient care remains their primary goal rather than teaching (Cook et al., 2010). The resulting divided attention translates to faculty not having an adequate amount of time to guide students' experiences. For example, demand for faculty to see patients quickly means that they have less time to teach, or offer students feedback; thus learners miss out on important learning opportunities (Gaba, 2004; Jeffries, 2005).

Challenges in contemporary clinical care and the education of health professionals have further contributed to the advancement of simulations and SBL by framing it as an instructional strategy that allows educators to provide students and faculty with reliable, scalable, instructional opportunities, during which time for feedback and interaction with faculty is incorporated (Ziv et al., 2007). In addition, simulations and SBL were also framed as a surrogate learning environment in lieu of clinical experiences, particularly when access to clinical rotations is limited, or when competition among healthcare professional education programs dilutes clinical experiences. For example, a recent multi-institutional, randomized controlled trial was conducted to determine if simulations and SBL could replace 25-50% of clinical rotations, while not having a detrimental effect on commonly used outcome measures (e.g., knowledge assessments, clinical competency ratings, board pass rates). The study included 10 schools of nursing across the United States, and enrolled 666 nursing students. Students were assigned to either a control group, or partook in simulation based practice in lieu of 25-50% of their clinical rotations (Hayden, Smiley, Alexander, Kardon-Edgren & Jeffries, 2014). Hayden et al., (2014) reported that students who partook in between 25 – 50% simulated clinical experiences had similar scores on knowledge assessments, clinical competency ratings, and board exam pass rates when compared to students who did not partake in simulated clinical experiences. Thus, as in the case of crisis response, using simulations and SBL to train novice professionals has become more widely accepted in health professional education.

Although these historical events (i.e., crisis team response, patient safety) were vital to the advancement of simulations and SBL in healthcare, these early priorities framed simulations and SBL as a solution. In turn, this perspective focused researchers' priorities toward ensuring *that* simulations worked, rather than examining *how* they help students learn. Therefore, exploring how simulations support learning is a vital next step in advancing the use of simulations and SBL in healthcare.

The Need to Examine How Simulations Support Learning

In addition to demonstrating that simulations would support learning, early efforts also aimed to ascertain that simulations would not have detrimental effects on traditional learning outcomes, such as knowledge and skills performance, and student's self-beliefs (e.g., self-confidence, self-efficacy) when compared to clinical rotations. This early focus was driven by historical beliefs that clinical rotations are the gold standard for high-quality health professional education (Benner, et al., 2009; Cook et al., 2010). Since then, numerous reviews of simulation studies suggest that simulations and SBL lead to greater improvements in knowledge, skills performance, self-confidence, and self-efficacy when compared to clinical experiences (Cant & Cooper 2010; Cook et al., 2010; McGaghie, Issenberg, Cohen, Barsuk, & Wayne, 2011;). However, these reviews have all relied upon retrospective analysis, rather than directly examining students' activities, participation, or the guidance that students receive during participation.

Furthermore, participation in simulations is also associated with improvements in students' self-confidence and self-efficacy for a wide range of clinically relevant skills, including communication, patient assessment, interpretation of diagnostic findings, and team-related performance. For example, Kameg, Howard, Clochesy, Mitchell, and Suresky (2010) found that students reported improvements in their self-efficacy for communicating and developing therapeutic relationships with patients diagnosed with mental illness after participating in two scenario-based simulations. Similarly, Goldenberg and Iwasiw (2005) also found that students' self-efficacy for teaching patients about their self-care improved after the students participated in two scenario-based simulations.

Simulations also influence students' self-confidence. For example, Van Schaik, Plant, Diane, Tsang, and O'Sullivan (2011) found that the confidence of medical students and nurses for responding to pediatric resuscitation events (e.g., calling for help, performing cardiopulmonary resuscitation (CPR), gathering the proper equipment, and team leadership) all increased with regular participation in a scenario-based simulations. Subsequently, their confidence led residents to participate in more scenario-based simulations. In another example, Barsuk, McGaghie, Cohen, O'Leary, and Wayne (2009) found that after two one–hour skills-based simulation practice sessions, residents reported improvements in their self-confidence for placing central lines. A subsequent analysis of students' actual clinical practice indicated that students who engaged in skills-based simulation practice inserted more central lines during their one-month rotation in the intensive care unit when compared to historical controls who received no simulation training. These results suggest that participating in simulations helps students engage more fully in their clinical rotations, which reframes simulations as more than just a solution to common healthcare education challenges.

More recently, some researchers have reframed simulations and SBL as complementary to clinical rotations and classroom experiences. For example, Szpak and

Kameg (2011), and Mikkelsen, Reime, and Harris (2008) view SBL as a way to augment classroom learning and clinical experiences by employing simulations and SBL to help students gain a deeper understanding of the complexities of clinical care, and to prepare them in advance of clinical experiences. Mikkelsen et al., (2008) found that participating in a series of three scenario-based simulations helped nursing students appreciate the complexity of caring for patients undergoing isolation precautions.

Additionally, Szpak and Kameg (2011) used scenario-based simulations to prepare nursing students for their mental health clinical rotations after learning that students were reluctant to participate in the clinical setting. Nursing students who completed two scenario-based simulations reported a significant reduction in anxiety, while also reporting feeling more prepared for their future clinical rotations. Importantly, both Mikkelsen et al., (2008) and Szpack and Kameg (2011) reposition SBL as an instructional strategy that enhances traditional clinical and classroom activities, and that reframes simulations as having an important intermediate role in the larger learning gestalt of health professional education. Thus, understanding how simulations and SBL support learning may provide important insight into how to integrate simulations and SBL with the other learning experiences students have in order to improve their clinical rotations.

Summing up, these studies suggest that simulations not only result in improvements in learning outcomes, students' self-beliefs, and anxiety reduction; however, these studies did not examine *how* participation in simulations contributed to these improvements. Therefore, this study examines how student healthcare professionals participate in simulations in order to gain a deeper understanding of the types of activities they engaged in that may contribute to improvements in knowledge, performance, and self-efficacy.

What is known about how simulations support learning. Early efforts to explain how SBL supports learning have emphasized the provision of feedback, repetitive practice, and interactions with faculty and peers. Feedback is the most frequently cited variable that contributes to learning in the simulation

Feedback. Often regarded as the most valuable learning experience students engage in during SBL experiences (Fanning & Gaba, 2007; Issenberg et al., 2005), feedback is often classified as being formative or summative, and arising from multiple sources. For example, McGaghie, Siddall, Mazmanian, and Myers, (2009) classified feedback as being either *formative* (i.e., feedback that summarizes a student's development at a particular time) or *summative* (i.e., feedback that is given after an assessment and is focused on the outcome). They found that most feedback given during simulations is formative because the majority of simulations are used to improve students' knowledge and performance. Fanning and Gaba (2007) suggest that feedback in simulations stems from faculty, simulators that react to students' treatments, and video used as a tutorial. Moreover, both faculty and learners report that simulations facilitate the feedback process because (a) there are fewer clinical distractions; (b) faculty are able to give more elaborate feedback, and that feedback is most often given by specific, expert faculty; and (c) sessions usually emphasize specific goals, thereby allowing for focused attention (Issenberg et al., 2005).

However, despite these efforts to classify the types of feedback delivered during simulations and SBL, it is rarely a topic of study. For example, Raemer et al. (2011) attempted a meta-analysis to examine the contributions of feedback to learning in simulations. However, they were unable to conduct a systematic review because few studies directly addressed the topic of reflection and feedback in simulation. Despite this gap in the literature, they were able to identify that post-simulation debriefings in scenario-based simulations are commonly conducted; however, the types of feedback given during simulations and SBL are not well described. Therefore, little is known about the types of feedback students receive during practice, nor how or when it is given when faculty are present.

Practice and repetition. Regular opportunities for repeated practice of a designated skill are another common feature of SBL reported to support learning. For example, McGaghie, Issenberg, Petrusa, and Scalese (2006) conducted a review to evaluate the impact of practice on improvements in learning outcomes. McGaghie et al. (2006) found that *repeated practice,* defined as multiple trials toward skills acquisition, was associated with greater gains in knowledge and performance. They also noted a dose-response relationship in which more practice yielded improved results in the studies they examined. In a more recent review, which included 14 studies selected from 3,742, McGaghie, et al. (2011) found that simulation interventions that included repeated practice, well-defined learning objectives, increasing levels of difficulty, and rigorous monitoring resulted in improved gains in knowledge and performance when compared to traditional clinical experiences.

Moreover, students and faculty often report that simulations support learning because they allow students to repeat their performance of diverse clinically relevant skills. For example, Walton, Chute, and Ball (2011) examined students' and faculty's perceptions of how simulations support learning. Students and faculty alike reported that practice and repetition helped learning during simulations. For example, students stated that repetition of processes included replaying a scenario or the steps of a procedure in their head, verbalizing steps, and practicing a procedure or skills repeatedly (Walton et al., 2011). Although practice is often reported as important to supporting the learning process during the simulations and SBL, none of these studies directly examined students' activities during practice. Examining how students actually practice will add important evidence and context to how simulations and SBL support learning.

Interactions among faculty and peers. More recent research and efforts to describe how learning is supported in simulations and SBL suggest that it is complex and dynamic, and likely stemming from multiple sources. For example, Cook et al. (2013) conducted a systematic review of 289 studies, drawn from a pool of 10,903, to determine which instructional strategies yielded the greatest improvements in learning. However, they were unable to identify specific design features (e.g., range of difficulty, repetitive practice, and distributed practice) that contributed to greater gains in learning due to large inconsistencies in effect sizes. Cook et al. (2013) concluded that these differences resulted complex variables that influence simulations, such as learners, learning environment, operational definitions, and study methods.

Moreover, Dieckmann, Manser, Wehner, and Rall (2007b) argue that simulations employ more than a physical model, or patient simulator, but that simulation settings are "spatiotemporally and socially limited environments, where people interact in a goal-oriented way with each other" (Dieckmann et al., 2007b, p. 149). Dieckmann, Gaba, and Rall (2007a) contend that simulations contain several important elements that support learning, including interactions with human actors (e.g., standard patients, embedded standard participants), and access to culturally relevant devices (i.e., ultrasound device, vital signs monitor) and artifacts (i.e., diagnostic findings). These additional elements are not just important for increasing the reality of the simulation, but are important because they provide learners with the opportunity to gain an understanding of the social practice of medical care in addition to learning prescribed skills or knowledge.

In another example, Walton et al. (2011) examined students' and faculty's perceptions of how simulations support learning using a grounded theory approach. Students reported that diverse activities helped them learn, including repeated practice, observation of faculty and peers, and faculty guidance, (Walton et al., 2011). Faculty reported that they supported students by encouraging repeated practice, giving other forms of encouragement, and explaining skills and procedures to name a few (Walton et al., 2011).

In summary, simulations are complex learning environments that support multiple forms of teaching and learning strategies which include, access to feedback from faculty, repeated practice, and opportunities to observe peers and faculty model. In addition, simulations and SBL also foster interactions between diverse actors, such as peers and faculty and peers, which further support learning through interpersonal communication. However, a detailed analysis of the types of feedback, and practice, and interpersonal interactions that students, faculty and other simulation actors engage in have not been probed sufficiently. Therefore, this study directly examines how students engage in simulations in order to examine how simulations and SBL support learning. To this end, this study directly examines students' activities and the interpersonal interactions they engage in.

The Need to Understand how Simulation Context Influences Learning Processes

Simulation-based learning in health professional education employs two primary types of simulations: skills-based simulations and scenario-based simulations. Skills-based and scenario-based simulations are among the most popular genres of simulations, and their differences can be distinguished based on their goals, and implementation practices (McGaghie et al., 2011).

Skills-based simulations, which are the most commonly studied genre, enable participants to focus their attention on developing focused psychomotor skills as they learn the steps and processes of an interventional procedure. Skills-based simulations rely upon the use of inanimate part-task models (e.g., an arm used to teach the location of veins that can be accessed for drawing blood), live animals, human cadavers, organ parts, or standard patients (Reznick & MacRea, 2006). However, they do not include the human actors typically found in the clinical setting, such as other health care practitioners.

Skills-based simulations are typically implemented by aggregating two to six participants together with a faculty member, during which practice is often preceded by a lecture, discussion of practice goals, modeling by faculty, and then followed by individual or group practice on a designated model. Length of practice varies greatly, ranging from 15 minutes to 8 hours (McGaghie, Issenberg, Petrusa, & Scalese, 2006). However, length of practice is often pre-selected by faculty (Brydges, Carnahan, Safir, & Dubrowski, 2009). Success in skills-based simulations is usually measured using predetermined skills assessment checklists completed by faculty (McGaghie et al., 2011), and can be conducted in the simulated environment, or in the clinical setting.

Skills-based simulations are believed to support learning by encouraging repetitive practice, feedback from expert faculty, and a mastery orientation; learning goals and objectives are focused on faculty-designed tasks. For example, McGaghie et al. (2011) conducted a meta-analysis comparing studies that met their deliberate practice standards against studies of traditional clinical learning. This meta-analysis included a total of 14 studies, enrolling 633 participants, in which 13 of 14 included studies described skills-based simulation interventions such as lumbar puncture, airway management, or central line insertion. The authors found that studies that met these criteria resulted in a moderate effect size of ($d = 0.71$), thereby favoring high-quality skills-based simulations containing these instructional design features over clinical experiences.

By contrast, scenario-based simulations are usually employed to support team training (Small, et al., 1999), identify latent threats in hospital or health care environments (Hamman et al., 2009), and teach assessment and communication skills (Jeffries, 2005). For example, scenario-based simulations are holistic representations of patient encounters, representing the key characteristics, behaviors, and functions of a designated system, which are played out over time as participants partake in the scenario in a designated role (Battista & Sheridan, 2014). Scenario-based simulations typically incorporate a wider range of culturally relevant tools and artifacts than one may expect to find in the clinical setting (e.g., ultrasound device, physical findings such as a wound, and vital signs that require interpretation) (Dieckmann et al., 2007b). Scenario-based simulations also employ multiple actors, including standard patients, and embedded standard participants (ESP). For example, in a scenario-based simulations an SP is assigned to portray the role of the patient who requires care, whereas ESPs enact the roles and responsibilities of other healthcare providers, such as a nurse or a physician.

Scenario-based simulations are implemented by assigning participants to designated roles, such as primary nurse or resident. Faculty then share a narrative history of the events associated with the patient situation that participants are about to engage in to signal that the simulation is about to begin and to further situate the learning experience in a realistic context. Following this, participants are encouraged to treat the simulation as if it were an actual clinical event (Dieckmann et al., 2007a). Participants are often allowed to determine the sequence of events during engagement, and often engage individually or with their peers assigned to different roles.

Learning in scenario-based simulations is argued to occur primarily during a post-scenario debriefing, when participants and faculty gather to systematically reflect on the events that occurred during the event (Fanning & Gaba, 2007; Rudolph, Simon, Rivard, Dufresne, & Raemer, 2007). However, in a recent pilot study (Battista & Sheridan,

2014) found that scenario-based simulations support students' practice of three types of clinically relevant activities, including the use of tools and props (e.g., stethoscope, patient simulator); performance of structured interventions (e.g., giving a medication, assessment technique); and engaging in social interactions (e.g., situational management, social and emotional support).

Despite these differences, SBL research rarely disaggregates skills-based and scenario-based simulations (Cook et al., 2011; Issenberg et al., 2005; Norman, Dore, & Grierson, 2012). Therefore, we know little about how differences in simulation context influence what is learned, and how learning is achieved. In this study, I propose comparing differences in what is learned, and how students engage by examining students' activities and their interpersonal interactions as simulations proceed.

Goals and Research Questions

The purpose of this study is to expand our understanding of how learning is supported in skills-based and scenario-based simulations, and to identify ways in which these different contexts influence procedural self-reports of learning, self-efficacy for Enhanced Focused Assessment with Sonography in Trauma (EFAST), and their performance of the EFAST exam.

My research questions were:

1. How do student healthcare professionals engage in skills-based and scenario-based simulations used to prepare healthcare professionals to perform the EFAST exam?
    a. Are there between group similarities and differences in students activities?
    b. Are there between group similarities and differences in guided participation?
2. What do student healthcare professionals report that they learn from participating in skills-based and scenario-based simulations?
    a. Are there differences in what students report learning?
3. Are there between group differences in student healthcare professionals' self-efficacy for learning or performance of EFAST?

Definitions

Auscultation - the act of listening.

Cardiopulmonary - relating to the heart and the lungs.

Central Line - an intra-venous (IV) line that is inserted into a large vein, typically in the neck or near the heart, for therapeutic or diagnostic purposes.

Cephalad - toward the head or anterior end of the body.

Description - included instances of faculty offering verbal descriptions of objects, activities, processes, and images.

Diagnostic Findings - are the results of medical tests performed to aid in the diagnosis or detection of disease.

Diagnostic Peritoneal Lavage (DPL) - a surgical diagnostic procedure to determine if there is free floating fluid (most often blood) in the abdominal cavity.

Diagnostic Questioning - an intentional interaction, in which (usually) the health care provider is seeking specific information from the patient and/or their support person(s) to formulate a diagnosis or assess the impact of a therapy.

Difficult Airway Management - clinical situation in which a conventionally trained healthcare practitioner experiences difficulty with mask ventilation, difficulty with tracheal intubation, or both.

Eclampsia - condition in which one or more convulsions occur in a pregnant woman suffering from high blood pressure, often followed by coma and posing a threat to the health of mother and baby.

Education and Counseling - providing the patient with information about findings from an assessment, or instances where the patient is engaged in order to assist them in participating in their own care.

Elaboration - included utterances in which faculty incorporated verbal details about objects, activities, processes, and images in order to add complexity.

Embedded Standard Participant (ESP) - "a person who is assigned to play a role in a simulation encounter, to carry out scenario-specific tasks, and to help guide the scenario" (Sanko et al., 2013, p. 215). Embedded standard participants are trained actors who are compensated to portray these roles.

Encouragement - included instances of faculty giving students support or confidence when students had achieved the desired goal

Enhanced Focused Assessment with Sonography in Trauma (EFAST) - a rapid bedside ultrasound examination performed by surgeons, emergency physicians, and certain paramedics as a screening test for blood around the heart (pericardial effusion) or abdominal organs (hemoperitoneum) after trauma.

Gesture - a movement of part of the body, especially a hand or the head, to express an idea or meaning.

Hepatorenal Space - the space that separates the liver from the right kidney. As a potential space, the recess is not filled with fluid under normal conditions.

Independent Participation - included instances of students engaging in hands-on practice of a structured intervention, but the visual gaze, body positioning, or social interactions of faculty and peers were not directed toward the designated student.

Joint Participation - includes less formal arrangements, where people work collaboratively to complete everyday tasks.

Knobology - the functionality of controls on an instrument that are relevant to their application.

Lumbar Puncture - the procedure of taking fluid from the spine in the lower back through a hollow needle, usually done for diagnostic purposes.

Modeling - includes instances where faculty demonstrate the steps and processes of designated skills.

Nationally Registered Emergency Medical Technician (NREMT) - a person who is specially trained and certified to administer basic emergency services to victims of trauma or acute illness before and during transportation to a hospital or other healthcare facility.

Observation - includes instances where people attend to the skillful activities of others, whether they be peers, or adults.

Palpation - the act of feeling with the hand.

Paramedic - a medical professional who provides medical care to sustain life in the pre-hospital environment at the point of illness or injury.

Patient Safety Practices - a type of process or structured intervention whose application reduces the probability of adverse events resulting from exposure to the health care system across a range of diseases and procedures.

Pelvic Cavity - the body cavity that is bounded by the bones of the pelvis.

Pericardial Space - the area situated around the heart.

Physical Guidance - may include instances where one person physically supports the actions of another.

Postpartum Hemorrhage - the loss of more than 500 ml or 1,000 ml of blood within the first 24 hours following childbirth.

Pre-Eclampsia - a condition in pregnancy characterized by high blood pressure, sometimes with fluid retention and proteinuria.

Questioning - included instances of students and faculty asking questions, or when faculty asked students to describe their current understanding of a process or interpretation of an image.

Scenario-Based Simulations - holistic representations of patient encounters, representing the key characteristics, behaviors, and functions of a designated system, which are played out over time as participants partake in the scenario in a designated role.

Scenario Narrative - the narrative of the scenario is the structured story that the scenario is enacted by the SP and ESPs, also focused and guided participants' activities.

Shoulder Dystocia - a specific case of obstructed labor whereby after the delivery of the head, the anterior shoulder of the infant cannot pass below, or requires significant manipulation to pass below, the pubic symphysis.

Simulation - the imitative representation of the functioning of one system or process by means of the functioning of another.

Simulation-Based Learning (SBL) - a person, device, or set of conditions that attempts to present [education and] evaluation problems authentically.

Skills-Based Simulations - enable participants to focus their attention on developing focused psychomotor skills as they learn the steps and processes of an interventional procedure.

Social Interactions - interactions participants have with others in the designated context, including peers, faculty, and embedded standard participants.

Splenorenal Space - relating to, or joining the splenic and renal veins or arteries.

Standard Patient (SP) - individuals who are coached to simulate a patient or other healthcare professionals for the instruction, assessment, or practice of communication and/or examining skills of a health care provider.

Structured Interventions - processes or activities that participants perform during participation in a designated context. They are often governed by a set of pre-determined rules that guide the processes of how or when they are used.

Team Communication - included instances of communicating situational needs, verbalizing diagnostic findings, and coordinating care with other team members (e.g., nurse, trauma surgeon).

Thorax - the part of the body of a mammal between the neck and the abdomen, including the cavity enclosed by the ribs, breastbone, and dorsal vertebrae, and containing the chief organs of circulation and respiration.

Trauma Assessment - in-depth exploration of the nature and severity of the traumatic events, the consequences of those events, and current trauma-related symptoms. This includes exposing the patient, visualization, auscultation, palpation, obtaining and interpreting diagnostic findings, and engaging in patient care-related social interactions.

Tools and Props - items that are present in the simulated setting that form the system that subjects may enact with.

Verbal Guidance - may include direct efforts to instruct, incidental comments, or actions that are overheard.

Visualization - the act of viewing an object.

Zone of Proximal Development - the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.

Chapter Two

This study was informed by activity theory, guided participation, and the social cognitive theory of self-efficacy. To examine students' engagement in different simulation-based contexts, I drew from activity theory and guided participation. To examine students' self-efficacy beliefs, I drew from the social cognitive theory of self-efficacy. I describe each below.

Activity Theory

Activity theory (AT) supports the analysis of complex and dynamic activity (Yamagata-Lynch & Smaldino, 2007). The foundation of AT lies in Vygotsky's (1978) initial proposal of mediated action, which posits that subjects use culturally specific tools to control and influence their goals. Central to AT is the notion that an individual's actions can only be understood by attending to the purpose or goals that participants hold in a specific context. Vygotsky sought to maintain the relationship between the individual and the social environment, rather than view them as separate (Yamagata-Lynch & Smaldino, 2007). In AT, the units of analysis are participants' activities as embedded in a designated activity system (Nardi, 1996), such as skills-based or scenario-based simulations.

More recently, Engeström (2001) developed activity system analysis as a way to examine and map complex systems. He viewed such analysis as a way to help participants identify how their environment posed constraints or tensions on their actions so that they could improve their performance. Figure 1 depicts a visual representation of an activity system diagram.

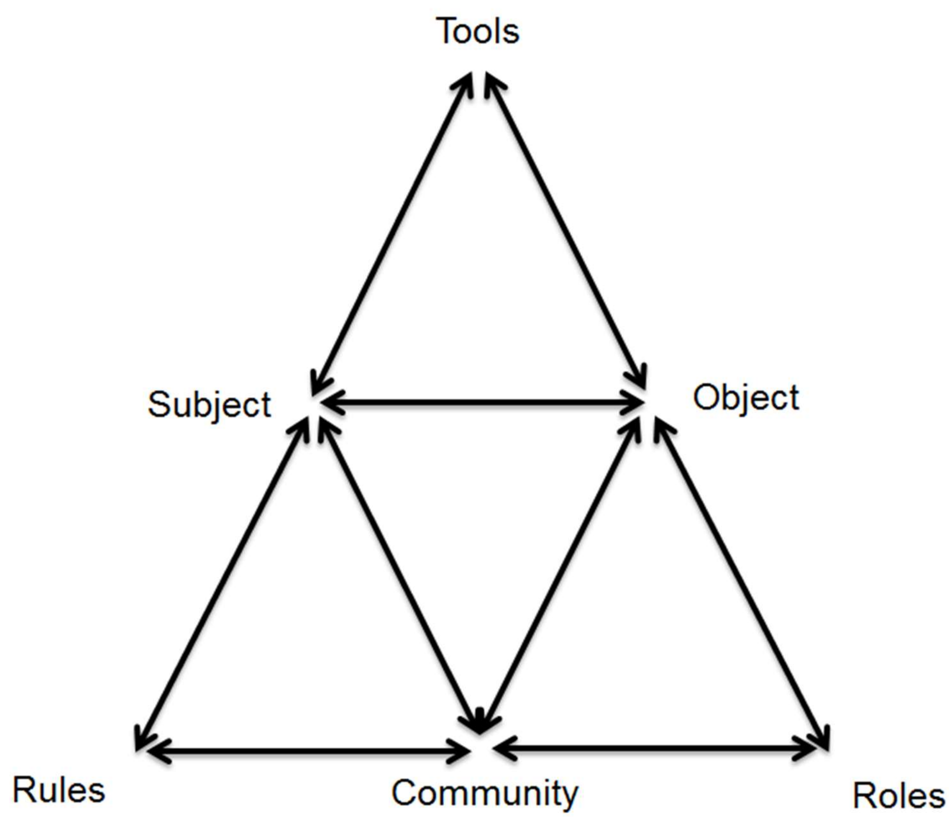


Figure 1. Activity System (Engeström, 2001).

Activity systems comprise six elements: subjects, objects, tools, rules, roles, and community (Engeström, 2001). *Subjects* are the individuals or groups of individuals engaged in an activity (Nardi, 1996). *Objects* (in the sense of objectives or goals) are "the physical or mental products subjects seek to achieve" (Nardi, 1996, p. 73). Objects motivate participants' activities and give them purpose. For example, a student engaging in a skills-based or scenario-based simulation session in this study is likely to hold the goal of learning how to perform an EFAST exam.

Tools are culturally specific artifacts (e.g., ultrasound device, lab results) that participants use to achieve a goal (Jonassen & Rohrer-Murphy, 1999). Subjects use tools to mediate their activities as they work toward achieving specific goals. For example, students engaging in a simulation-based session to learn the EFAST exam will use an ultrasound device, probe, and gel, while practicing on a standard patient (SP).

Moreover, activity systems often employ multiple individuals, so goals are not only achieved at an individual level, but also as a joint effort with others (Leontiev, 1981). Therefore, a subject's activities are further influenced by the role they play in the designated context. *Roles* are defined as the division of labor among the actors in the system (e.g., student, physician, nurse) (Jonassen & Rohrer-Murphy, 1999). Thus, analyses of activity systems should take into account the role that a participant plays. For example, Battista (2015) highlights that although two students partake in the same scenario-based simulation, they have different experiences because they are assigned different roles, such as that of the primary nurse or patient care technician. Examining the activities a participant engages in from the point of view of their designated role allows for the analysis of the nuances of participation despite the complexity and dynamic nature of scenario-based simulations.

Finally, participants are also influenced by rules of the communities they represent. *Rules* are defined as either formal or informal regulations or guidelines that subjects follow when engaging in an activity (Nardi, 1996). For example, a physician who performs a diagnostic procedure is guided by the processes of that procedure, such as conducting an ultrasound. *Communities* are the group that individuals represent, such as nurses or physicians (Nardi, 1996).

Although AT was historically established to examine how individuals develop and grow, more contemporary applications of AT emphasize its use as an analytic framework. Examples include learning in the clinical setting (de Feijter, deGrave, Dornan, Koopmans, & Scherpbier, 2011), and analyzing pedagogical practices associated with clinical rotations (Morris, 2014). In both examples, the researchers used activity theory to gain a deeper understanding of how participants engaged in rich and complex contexts.

For example, de Feijter et al. (2011) used AT to examine how fourth-year medical students learned about patient safety practices during clerkship rotations. They found that medical students' learning about patient safety was mediated through interactions with their supervisors, access to textbooks and journals, and by coming to know what resources were available to them in the hospital setting. In another example, Morris (2014) used AT to examine teaching practices employed by physicians in the clinical setting of the National Health Service to better understand the pedagogical practices that underpin medical education.

Another way AT is applied is as a framework to structure the design of complex learning environments (Jonassen & Rohrer-Murphy, 1999), or to develop computer learning environments, such as games and simulations (Mwanza, 2002). Both Mwanza, (2002) and Jonassen and Rohrer-Murphy (1999) operationalized AT by creating structured questionnaires to assist designers as they analyzed work practices in context. The questionnaires include the six components of the activity system, including subjects, objects, tools, rules, roles, and the community. Following data collection, designers then further relied on activity system analysis processes to inform the development of complex and dynamic learning environments, such as games and simulations.

More recently, AT has gained attention in the field of healthcare simulation as a way to structure participants' post-simulation reflections (Eppich & Cheng, 2015), and to support microanalysis of participants' activity in complex scenario-based simulations (Battista, 2015; Battista & Sheridan, 2014). For example, Eppich and Cheng (2015) propose the use of AT as a framework that debrief facilitators can use to organize the topics they will explore following a simulations enactment (Eppich & Cheng, 2015). They argue that AT is an ideal framework that can be used to structure post-simulation reflection for scenario-based simulations that employ multidisciplinary healthcare teams. Battista (2015) discussed how AT is also a useful theory for analyzing participation in simulations, and presents two worked examples, highlighting how AT reveals differences in participants activities. She argues that analyzing participants' activities can be useful for gaining a deeper understanding of the complexity of participants' engagement in scenario-based simulations.

In another example, Battista and Sheridan (2014) used AT to support their descriptive analysis of the clinically relevant activities participants engaged in during four different types of scenario-based simulations. They found that participants in all four scenarios engaged in three types of clinically relevant activities, including the use of tools and props, performance of structured interventions, and engagement in social interactions. Table 1 summarizes these three key activities.

Table 1

Clinically Relevant Activity Found in Scenario-Based Simulations

Activity	Definition	Examples
Tools and Props	Items that are present in the simulated setting that form the system that subjects may enact with	SPs, simulated models, ultrasound machine, probe, gel, diagnostic findings, patient simulator), diagnostic tools (e.g., stethoscope), and diagnostic findings (e.g., lab results, radiology images)
Structured Interventions	Processes or activities that participants perform during participation in a designated context. They are often governed by a set of pre-determined rules that guide the processes of how or when they are used	Diagnostic activities (e.g., auscultation, palpation), therapeutic interventions (e.g., medication administration), and patient safety practices (e.g., hand hygiene)
Social Interactions	Interactions participants have with others in the designated context, including peers, faculty, and embedded standard participants	Diagnostic questioning, education and counseling, social and emotional support, and situational management

Moreover, they used this coding scheme to further quantify the frequency of these activities, finding significant differences among the four scenarios. For example, the less complex post-partum assessment scenario required the primary nurse to engage in similar numbers of social interactions and performances of structured interventions. By comparison, the more complex fetal demise scenario required the primary nurse to focus almost exclusively on social interactions. Thus, AT was an ideal theoretical framework for supporting analysis of Research Question 1 because AT supports rich description of how participants engage within complex and dynamic contexts.

Guided Participation

In addition to using AT to structure analysis of participants' activities in simulation-based learning environments, I also drew from Rogoff's sociocultural theory of guided participation. I selected guided participation to support analysis of students' interpersonal interactions because simulations provide opportunities for participants to engage in complex social interactions (Dieckmann et al., 2007a). Similar to AT, guided participation, also a neo-Vygotskian theory, maintains that knowledge and learning are byproducts of the dynamic interactions that people engage in with other social members and the environment they participate in (Lave & Wenger, 1991; Rogoff, 1990). Although I drew from AT to identify the types of activities participants engage in, guided participation complemented my analysis of student engagement by attending to the interactions student have with faculty, peers, and embedded standard participants (ESPs).

Rogoff describes guided participation (GP) as a theoretical framework that provides a way of looking at "the processes and systems of involvement between people as they communicate and coordinate efforts while participating in a culturally valued activity" (Rogoff, 2008, p. 59). GP emphasizes the active role that novices play in their learning and development when engaged in meaningful activity with more skilled others, such as parents or teachers. According to Rogoff (1990), during participation in culturally relevant activity, children and their parents or companions work together to "(1) build bridges from children's present understanding and skills to reach new understanding and skills, and (2) arranging and structuring children's participation in activities" (Rogoff, 1990, p. 8).

GP includes attending to face-to-face and side-by-side interactions, tacit or explicit activities, as well as situations in which people work without the co-presence of another, or where access to guidance or culturally relevant tools is constrained (Rogoff, 1995). *Face-to-fa*ce interactions often include more formal instructional arrangements, such as learning in a classroom, whereas side-by-side *joint participation* includes less formal arrangements, where people work collaboratively to complete everyday tasks.

Instances of guidance may also include instances where people work independently. However, this does not mean they are working without guidance. They may be guided by the contents of a textbook, or other item that helps focus or structure their activity (Rogoff, 1990, 1995). Thus, guidance includes both verbal forms of guidance, as well as physical forms of guidance. *Verbal guidance* may include direct efforts to instruct, incidental comments, or actions that are overheard (Rogoff 1990, 1995). Verbal guidance is often limited and efficient, where people may elaborate on their efforts, or ask clarifying questions; rather than organized formal instruction (Rogoff, 1990, 1995). *Physical guidance* may include instances where one person physically supports the actions of another. For example, when learning how to perform an ultrasound, faculty may handle the ultrasound probe at the same time as the student to help them identify the proper location for obtaining an image.

Tacit forms of guidance include the activities of everyday life, and are presumed to be among the most powerful (Rogoff, 1995). Through participation in tacit lessons, people's participation in everyday life afford them with opportunities to learn about their community, and its unspoken values. On the other hand, *explicit* forms of guidance include more formal efforts to instruct, that are more often associated with formal schooling where teachers convey information to students in face-to-face interactions.

For example, Kirshner (2008) drew from GP as an analytic lens to examine how three youth activism organizations supported youths' access to learning and engaging in political activism. His findings highlight the range of diversity in how adults provided access to explicit and tacit forms of guidance for young people. For example, one of the youth organizations Kirshner (2008) observed provided youths with face-to-face workshops, which were intended to develop their activism skills. However, in the third organization, most of the activity the young people engaged in was undertaken jointly in side-by-side arrangements with adults. During joint participation, adults worked alongside youths and structured and focused their activities by sharing their own experiences, advising them about how to organize events, and facilitating role-playing. When engaging in role-play situations, adults often assumed the role of another student or a policy maker in order to help youths gain skills in recruiting. Importantly, during joint participation, youths' were not learners or naïve actors following instructions, they were full participants in the activities they were engaged in.

In another example, Vandermaas-Peeler, Way, and Umpleby (2003) highlights how mothers and their children negotiated the practice of baking cookies at home. Here, the researchers' video-recorded 36 mother-child dyads as they prepared and baked cookies. The children's ages ranged from 4 to 6. The researchers found that mothers worked jointly with children in side-by-side arrangements to focus and structure their children's attention and activities by using verbal guidance (e.g., offering tips, reading instructions if children hadn't yet learned to read), rather than making the cookies for the children. Mothers also provided physical guidance by holding the bowl while children mixed the ingredients, or guided children's choices of cooking implements. By holding the bowl, which was too heavy for children to hold alone, mothers provided a bridge for their children that allowed them to continue participating. This allowed them to extend their skills and abilities in mixing, which would have otherwise been constrained.

Central to GP are communication and active participation (Rogoff, 1990). *Participation* includes gaining access to community practices whereby people are able to take part in hands-on activities, as well as opportunities to observe and pitch in (Rogoff, 1990). *Observation* includes instances where people attend to the skillful activities of others, whether they be peers, or adults. However, observation does not mean that people are not participating or learning. On the contrary, people watch, listen, and carefully attend to the activities of the more skilled others with great concentration (Paradise & Rogoff, 2009). In addition, Paradise & Rogoff (2009) indicates that observation does not imply that speech isn't involved, rather that speech is used more efficiently, rather than for formal lessons. For example, Rogoff (1990) highlights how Mayan girls come to learn the practice of weaving through a series of complex interactions, which often begins with younger girls' observation of more skillful others weaving. Over time, girls engage in hands-on participation in weaving practices, and as girls become more skillful, adults vary their guidance until the girls are able to weave independently.

Guided participation also takes into account the resources and tools that are available to structure and focus activities. For example, Rogoff (1995) describes the types of guided participation present in the activities associated with the economic activity of selling and delivering Girl Scout cookies. Her analysis focused on examining the interpersonal arrangements among girl scouts, girl scouts and troop leaders, as well as influences from the parent organization, the Girl Scouts of America. She also attended to the resources that Girl Scouts of America made available to the troops and parents to guide and focus selling, money collection, and delivery. Girl scouts partook in the sales process with a sibling or another scout with limited guidance from parents. The scouts were guided by the use of the pre-printed order forms provided by the parent organization to record and account for their orders. During the cookie delivery phase, scouts and parents collaborated to organize and distribute the cooking orders. They relied on the order form to help them organize orders, and then again during delivery to collect the appropriate amount of money. Parents often took on a more explicit role during the delivery process by providing transportation and facilitating money handling.

Guided participation includes attending to more than just dyads; it takes into account the engagement people have with multiple others who have diverse responsibilities (Rogoff, 1990). For example, Zimmerman and McClain (2015) drew from GP to examine how family members guided the participation of other family members as they engaged in the use of scientific equipment (i.e., field guide, magnifying glass) during a nature walk. This in-depth single case study included a family comprising one parent, one grandparent, and two siblings, aged 4 and 2. The researchers video-recorded the family's activities during a 45-minute nature walk, and then they conducted micro-ethnographic analysis of the video recordings.

The researchers found that participation included substantial side-by-side analysis of mushrooms by all family members. For example, the mother often explicitly focused the older child's attention to help him identify key features of mushrooms through the use of verbal and physical forms of guidance. The mother often physically held the older child's hand in order to guide and focus his attention while using the magnifying glass. She augmented her physical guidance with verbal tips and prompts, often seeking acknowledgment from her son that he understood. In addition, the grandmother participated by holding and frequently referencing the field guide they were given to assist their identification of mushroom species. The younger sibling frequently participated by holding the field guide, or the magnifying glass, which occasionally constrained the 4-year old's access to that scientific tool.

Simulations can also be understood as providing students with access to participate in culturally relevant endeavors (Barsuk et al., 2009; Hayden et al., 2014; Issenberg et al., 2005). For example, Issenberg et al. (2005) and Barsuk et al. (2009) both highlight how simulations provide diverse healthcare professionals with access to participate in the performance of a wide range of healthcare-related activities, such as learning how to perform an ultrasound or care for a patient in crisis. In fact, simulations and SBL growth and acceptance is in large part due to the need to create learning experiences during which students gain access to opportunities to care for patients without placing actual patients in harm's way (Ziv et al., 2003).

Skills-based and scenario-based simulations provide diverse opportunities for students to partake in hands-on activities, as well as observe the skillful activities of faculty or peers. For example, during participation in scenario-based simulations, students are able to engage in caring for a patient in designated role, such as the role of primary or resource nurse, despite their novice status (Battista & Sheridan, 2013; Jeffries, 2005). In addition, participation in simulations often requires faculty to direct students to observe when they are not assigned a hands-on role (Lasater, 2007). In addition, during skills-based simulations, students are afforded access to practice a designated skill, such as performing a lumbar puncture or placing a central line. Thus, the activities students engage in during skills-based and scenario-based simulations are highly relevant to medical practice.

Moreover, participation in simulations is often viewed as being largely composed of social practice. For example, Dieckmann et al. (2007b) describes simulations as complex social endeavors in which people interact with each other, the simulator, and technical devices. Furthermore, simulations employ a wide range of learning arrangements, including independent practice (Brydges, Nair, Ma, Shanks, & Hatala, 2012), peer-peer dyads (Tolsgaard et al., 2015), faculty-led small groups (Dubrowski & MacRea, 2006), as well as student-led small groups (Bays et al., 2014). Thus, participation in simulations often involves multiple opportunities for communication with peers, faculty, and SPs, and ESPs.

Although usually not explicitly studied, numerous reports in the healthcare simulation literature describe diverse types of guidance offered to simulation participants during research interventions. They include the provision of face-to-face didactic instruction (Barsuk et al., 2012; Einspruch, Lynch, Aufderheide, Nichol & Becker, 2007), face-to-face feedback (Cook et al., 2013; Goldenberg & Iwasiw, 2005), and modeling (Cauraugh, Martin, & Martin, 1999; Walton et al., 2011).

For example, most simulation sessions reported in the literature include some form of didactic instruction that is usually delivered in advance of simulation engagement. In an example, Barsuk et al. (2012) included a didactic lecture in advance of study participants engaging in practicing the lumbar puncture structured intervention. In addition, Einspruch et al. (2007) reported using video-recorded didactic lectures in their efforts to standardize instruction related to cardio-pulmonary resuscitation (CPR).

Cook et al.'s (2013) analysis of different instructional design features of simulations revealed that 80 studies out of 289 included studies reporting that face-to-face feedback between students and faculty following the simulation was a part of the intervention. Additionally, although the primary purpose of Goldenberg and Iwasiw (2005) was to examine the influence of classroom simulations on senior nursing students' self-efficacy for health teaching, they elected to include a detailed description of the types of guidance faculty offered during student-led small group work. For example, faculty reported that they engaged in observing small groups, asking clarifying questions, correcting misconceptions, and supporting students' deliberations.

Moreover, Cauraugh et al. (1999) compared the effectiveness of expert modeling with accessing traditional literature and textbooks to support how six surgical residents learned about inguinal hernia repair with a McVay technique. They defined modeling as watching and imitating what an expert does. The researchers provided students in the control group with references to textbooks and articles about the technique, whereas students in the intervention group viewed a video in which an expert faculty member modeled the inguinal hernia repair using a McVay technique, while at the same time providing verbal guidance by describing and elaborating on his choices and strategies. Although the type of modeling Cauraugh et al. (1999)describes is more formally organized, it still provided students with access to opportunities to observe the culturally relevant activity of a hernia repair, and access to the thinking and strategies used by more knowledgeable others.

Thus, although GP has not yet been applied to examine engagement in medical simulations, its emphasis on the interpersonal relationships makes it an ideal theoretical framework to further explore how students engage. In addition, it complements activity analysis by helping organize rich description of interpersonal interactions in skills-based and scenario-based simulations.

Self-Efficacy

In order to examine the influence of simulation context on participants' self-efficacy for the EFAST exam, I drew from the social cognitive theory of self-efficacy. *Perceived self-efficacy* refers to "personal judgments of one's capabilities to organize and execute courses of action to attain designated goals" (Bandura, 1977, p.

3). Self-efficacy is a common concept that has been examined in diverse contexts, including science (Britner & Pajares, 2006), math (Pajares & Miller, 1994), writing (Zimmerman & Kitsantas, 1999), sports (Hepler & Feltz, 2012), and, more recently, simulation-based learning (e.g., Akhu-Zaheya, Gharaibeh, & Alostaz, 2013; Christian & Krumwiede, 2013).

Self-efficacy examines particular tasks, such as solving math problems, or in the case of healthcare, resuscitation using basic life support techniques. By contrast, self-efficacy does not address a person's feelings about themselves in general. Therefore, self-efficacy judgments are measured using questionnaire items that are task specific, such as the task of performing an ultrasound exam, or the processes of caring for a patient with eclampsia. Self-efficacy beliefs are mastery oriented, meaning that self-efficacy examines a person's beliefs about their individual ability to perform a task, rather than examining their performance using normative criteria (Bandura, 1986, 1997).

Moreover, self-efficacy beliefs are multidimensional, in that they can differ based upon domain. For example, people may have higher self-efficacy beliefs about their ability to engage in a task or activity, but less self-efficacy in another (Zimmerman, 2000). In healthcare, medical students may experience more self-efficacy when caring for patients in the medical-surgical setting, but less self-efficacy when caring for patients in psychiatric settings. Moreover, self-efficacy beliefs are not stable, and change over time. For example, a series of failures can lead to declines in self-efficacy (Bandura, 1997).

Self-efficacy has been shown to influence people's academic achievement and motor performance, choice of activities, persistence, as well as people's levels of anxiety, and the degree of serenity that they experience when engaging in activities (Bandura, 1997; Zimmerman, 2000). For example, Pajares and Miller (1994) used path analysis to test the predictive and mediational role self-efficacy beliefs on undergraduate students mathematical problem solving. They found that self-efficacy was more predictive of math problem solving than perceived usefulness of math, prior experience, or gender (Pajares & Miller, 1994). In another example, Hepler and Feltz (2012) examined the relationship between decision-making self-efficacy and decision making performance in baseball. The study included 76 undergraduate students (38 men, 40 women) who, following completion of a self-efficacy scale, performed 10 trials of decision making in a baseball simulator. They found that self-efficacy was a significant predictor of speed, but not accuracy. Lent, Brown and Larkin, (1986) explored the relationship of self-efficacy beliefs to educational and vocational choices in 105 undergraduate students. They found that self-efficacy contributed to students' grades, persistence, and perceived career options in scientific and technical vocations.

Self-efficacy in academic learning is said to be derived from a number of sources, including (a) enactive mastery experiences, (b) vicarious experiences, (c) social and verbal persuasion, and (d) emotional and psychological states (Bandura, 1997). Enactive mastery experiences are thought to be the most influential sources of efficacy because they support the development of the cognitive and self-regulative capabilities for effective performance (Bandura, 1997, p. 80). After completing a task, students evaluate their experience and their results, which are then used to make judgments about their competence. These judgments serve to inform a persons' self-efficacy for future participation in activities.

Self-efficacy beliefs developed through enactive mastery experiences are further mediated by non-performance factors including pre-existing self-knowledge, task difficulty, contextual factors and effort expenditure (Bandura, 1997). For example, students experience greater gains in self-efficacy from completing a newly learned task or when they have overcome a difficult task (Bandura, 1997). Additionally, students who extend greater degrees of effort to complete a task tend to have greater gains in self-efficacy than do students who complete a task that they already know how to do.

In addition to interpreting one's own actions, students also incorporate *vicarious experiences* (Bandura, 1997), which are mediated through the observation of others of a similar ability that serve to provide an opportunity for social comparison to further gauge their proficiency. For example, students participating as an observer during a simulation may compare their performance to that of their peers. From this, they make comparisons between their own outcomes and the model's outcomes. According to Schunk, Hanson, and Cox (1987), observing peers practicing is important because students own self-efficacy may be bolstered if they see someone similar to themselves achieve a task. In addition to peer-level social comparison, students also look to teachers or those with greater expertise as symbolic models (Bandura, 1997).

A third source of self-efficacy is *social and verbal persuasion*, is often considered to the least powerful source of self-efficacy, though it remains an integral component

(Bandura, 1997). Social and verbal persuasion can include expressions of faith or encouragement that are given during performance or following performance as a component of evaluative feedback. Social and verbal persuasion can be especially important when students are struggling or experiencing difficulties because it can help bolster their efforts when working through difficult tasks (Bandura, 1997). For example when learning ultrasound exams, students may struggle with obtaining high-quality images but still have reason to believe they are able to attain their goals. Persuasive comments from a trusted source (e.g., parent, teacher, coach) indicating the individual is capable, can help them persist long enough to succeed. Social and verbal support is also more effective during the serves to bolster their persistence during this early stage of learning.

To date, most research using self-efficacy measures has centered on examining the contribution that simulation-based learning environments have on students' self-efficacy with clinical skills such as health teaching, successful management of preeclampsia and eclampsia, and resuscitation. Nishisaki, Keren and Nadkarni (2007) have hypothesized that participation in simulations provides students with access to learning experiences that contain more sources of self-efficacy when compared to those in traditional classroom learning. For example, both skills-based and scenario-based simulations offer students access to opportunities to engage in practice with the support and presence of peers and faculty who provide access to vicarious and social and verbal persuasion.

For example, Christian and Krumwiede (2013) investigated the influence of participation in a simulation-based workshop on experienced obstetrics nurses' self-efficacy for managing patients with eclampsia and pre-eclampsia. Successful management requires careful attention to a number of complex variables, often requiring nurses to act quickly. They found that nurses' self-efficacy for managing pre-eclampsia and eclampsia increased from pretest to posttest.

In another example, Akhu-Zaheya, Gharaibeh, and Alostaz (2013) examined the effect of simulation-based learning on nursing students' knowledge and self-efficacy for basic life support (BLS). They assigned 52 senior nursing students to either traditional lectures with skills-based practice, or lectures with participation in a scenario-based simulations. Students who participated in the scenario-based simulations achieved higher post-test knowledge, and their self-efficacy for BLS was numerically higher than that of the lecture and skills-based practice group.

Given the increasing interest in self-efficacy in simulation-based learning, the inclusion of self-efficacy as a measure in this study, accompanied by examining the types of activities and interpersonal interactions students engage in is relevant to both simulation-based learning as well as the social-cognitive theory of self-efficacy.

Chapter Three

The purposed of this study were twofold, (a) examine how learning was supported in skills-based and scenario-based simulation learning environments used to teach the EFAST exam, and (b) examine if differences in simulation contexts influenced students' self-reports of learning, self-efficacy for EFAST, or pretest/posttest performance on the EFAST exam. My research questions were:

My research questions were:

1. How do student healthcare professionals engage in skills-based and scenario-based simulations used to prepare healthcare professionals to perform the EFAST exam?
    a. Are there between group similarities and differences in students activities?
    b. Are there between group similarities and differences in guided participation?
2. What do student healthcare professionals report that they learn from participating in skills-based and scenario-based simulations?
    a. Are there differences in what students report learning?
3. Are there between group differences in student healthcare professionals' self-efficacy for learning or performance of EFAST?

Sample

For this study, I sought a purposive sample (Maxwell, 2013) of 8-10 student healthcare professionals with at least one year of prior experience as Emergency Medical Technicians (EMT). This sample was valuable because with at least one year of clinical experience, these students:

1. Were likely to possess the pre-requisite knowledge and skills for interacting with patients independently, and conducting a trauma assessment
2. Were likely to possess the pre-requisite knowledge of anatomy and physiology that we surmised would be helpful in learning how to interpret EFAST images
3. Were unlikely to have prior experience with ultrasound
4. Were unlikely to engage in ultrasound practice during clinical rotations

I conducted two information sessions during the fall 2014 semester, and one information session during the spring 2015 semester. Because all students were a member of an on-campus emergency medical response team, information sessions were conducted during their monthly meetings. All students received a detailed description of the study and were invited to participate. Informed consent was obtained and demographic data were collected following the consent process.

Sample demographics. I recruited 10 students currently undertaking their undergraduate pre-medical studies at an urban campus in the mid-Atlantic region. Eight students started and completed the study. Two students withdrew from the study prior to the pre-test, indicating that their current school workload prevented their participation. I assigned 4 students to skills-based simulations, and 4 to scenario-based simulations.

All students reported having at least one year of clinical experience, and having no prior experience with ultrasound. All students were certified Nationally Registered Emergency Medical Technicians (NREMT), and all reported that they engaged in regular monthly practice in skills and scenario-based simulations. Students assigned to the skills-based practice group reported 1-4 years of prior clinical experience. Students assigned to scenario-based practice group reported 1-2 years of prior clinical experience. Both skills and scenario-based practice groups comprised two men and two women. Table 2 presents a summary of students' demographics.

Table 2

Participant Demographics

Participant Number	Group	Age	Sex	Ethnicity	Prior EMS Experience	Prior Ultrasound
1	Skills	21-25	M	White	3-4 Years	No
2	Skills	21-25	F	White	3-4 Years	No
3	Skills	18-20	M	Asian	3-4 Years	No
4	Skills	21-25	F	White	1-2 Years	No
5	Scenarios	21-25	F	White	1-2 Years	No
6	Scenarios	18-20	F	White	1-2 Years	No
7	Scenarios	21-25	M	White	1-2 Years	No
8	Scenarios	21-25	M	White	1-2 Years	No

Measures

Quantitative and qualitative data were included in this study. Quantitative measures included the EFAST Self-Efficacy Inventory and the Radiology Direct Observation of Procedural Skills (RAD-DOPS) performance assessment scale. Qualitative data sources included written reflection prompts.

EFAST self-efficacy inventory. Although I sought a previously developed and validated self-efficacy inventory, I was unable to locate one that suited the needs of this study. Thus, I elected to develop the EFAST Self-Efficacy Inventory using procedures outlined by Bandura (2006). The EFAST Self-Efficacy Inventory contained four sub-scales:

1. Identifying when to perform an EFAST exam that included 2 items.
2. Processes of the EFAST exam that included 10 items.
3. Interpretation of obtained images that included 8 items.
4. Integration of EFAST findings into patient care that included 3 items.

The response scale used a 0-100 response format, and written descriptions accompany the following points of scale: (10) not sure, (40) somewhat sure, (70) pretty sure, and (100) very sure.

Processes for developing the EFAST self-efficacy inventory. To develop the EFAST self-efficacy inventory, I first conducted a literature review of the related domain of ultrasound and the EFAST exam (Bandura, 2006). After reviewing common instructional strategies, and approaches used to teach EFAST to identify common topics (e.g., Castanelli, 2009; Sekiguchi, Bhagra, Gajic, & Kashani, 2013), I then reviewed literature specific to the domain of emergency medicine's use of EFAST, including emergency medicine physicians, nurses, and EMS providers (e.g., Press et al., 2013; Walcher et al., 2006).

Following this initial analysis, I then conducted informational interviews with an attending trauma surgeon, and three emergency medicine physicians who use ultrasound in their regular clinical practice and who regularly provide instruction related to the EFAST. During these informational interviews, I asked about the relevance of an

EFAST exam, typical approaches to teaching ultrasound, which approaches they employed, and what challenges they observed students had learning and applying EFAST to clinical practice (Bandura, 2006). From this data collection, I developed four primary themes related to EFAST. They were:

1. Identifying when an EFAST is indicated (Salen, Melanson, & Heller, 2000; L. Johnson, personal communication, October 25, 2013; S. Wood, MD, personal communication, November 20, 2013).
2. Processes of the EFAST exam, including knowing how to use the ultrasound machine, probe selection and communicating the reasons for the ultrasound to the patient, and process of the EFAST exam (American College of Emergency Physicians (ACEP) Emergency Ultrasound Guide, 2008; L. Johnson, personal communication, October 25, 2013; M. Antonis, personal communication, April 14, 2014).
3. Interpretation of normal and abnormal ultrasound images (e.g., identifying free fluid), knowing how to improve image quality, and knowing what types of common anomalies enhance or hinder interpretations (American College of Emergency Physicians (ACEP) Emergency Ultrasound Guide, 2008; L. Johnson, personal communication, October 25, 2013).
4. Integration of EFAST findings with other diagnostic findings and making diagnostic decisions, and discussing those decisions with other members of the healthcare team (L. Johnson, personal communication, October 25, 2013; S. Wood, MD, personal communication, November 20, 2013).

I then developed draft items for each sub-scale, drawing from my literature review and personal communications with subject matter experts (SME). I also developed the response scale using a 0-100 response format based on recommendations by Bandura (2006) and Pajares, Hartly, and Valiante, (2001), and placed written descriptions beside the following points of scale (10) not sure, (40) somewhat sure, (70) pretty sure, and (100) very sure.

Analysis of the self-efficacy inventory. Following development of the EFAST Self-Efficacy Inventory, I asked that two additional SMEs review the inventory and provide feedback. One SME is a Registered Diagnostic Medical Sonographer (RDMS) qualified emergency medicine physician. The second SME has extensive expertise in developing self-efficacy scales. Once I received feedback from both parties, I made changes to the items based on their recommendations. I then returned the improved inventory to the same SMEs for a final review before using the inventory. A copy of the EFAST Self-Efficacy Inventory is included in this document in Appendix I.

RAD-DOPS performance assessment checklist. The Radiology Direct Observation of Procedural Skills (RAD-DOPS) is a formative assessment scale that contains 10 items scored using a 6-point likert scale. The RAD-DOPS can be used to assess a variety of radiological procedures, such as the EFAST exam, Computed Tomography (CT), or Magnetic Resonance Imaging (MRI). The RAD-DOPS contains items to assess participants' knowledge of when to perform a radiological procedure, the steps and processes involved to do so, their interpretation of radiologic images, and communication with the patient and other health care team members. The RAD-DOPS also provides two areas for free-text comments for both the participant and rater to account for their impressions of the assessment process.

Based on discussions with physician SMEs, I classified our learners as novices for the duration of the study. Based on these same discussions, I elected to omit Items 3 and 8. I omitted Item 3 because it addressed the use of analgesia, which we determined was outside our sample populations' scope of training and practice (M. Antonis, personal communication, April 14, 2014; S. Wood, MD, personal communication, November 20, 2013). I omitted Item 8 because it examines participants' efforts to minimize exposing patients to excessive radiation. Ultrasound does not place participants at risk for radiation exposure (M. Antonis, personal communication, April 14, 2014; S. Wood, MD, personal communication, November 20, 2013).

RAD-DOPS development and validation. The construct for the RAD-DOPS was derived by the Royal College of Radiologists in the United Kingdom and is based on the general direct observation of procedural skill (DOPS) assessment form. A learner-centered, formative assessment, used to evaluate performance of procedures in the clinical setting (Bari, 2010; Naeem, 2013), the DOPS is used to assess performance of a procedure on an actual patient, and evaluates participants on the whole clinical encounter. This evaluation includes their interactions with the patient and other healthcare professionals as they perform a procedure (Bari, 2010; Naeem, 2013). The DOPS allows for teaching, supervision, and feedback.

To adapt the DOPS scale for radiology, a committee of radiological professionals was convened to review existing workplace assessment tools related to radiological procedures including CT, Fluoroscope, and Ultrasound (Bari, 2010; Naeem, 2013). They then triangulated that data with a literature review, and external reviews from other radiology program directors not participating on the committee (Bari, 2010; Naeem, 2013). They created the RAD-DOPS and pilot-tested it internally and externally. Current validity and reliability data for the RAD-DOPS is not available. A copy of the RAD-DOPS is included in Appendix G.

Written reflections. The self-reflection questionnaire included a series of five open-ended writing prompts asking participants about their initial reactions to the simulation session, what they perceived having learned from participation, how simulation supported their learning, and what their goals were. Examples of written reflection prompts included "Write down your initial reactions (positive and negative) to participating in this simulation", "What did you learn while participating in the scenario/skills lab?", and "Can you provide an example of how participation in the simulation helped you learn?" A copy of the self-reflection written reflection prompts are in Appendix E.

Materials

Exemplar skill selection. I purposely selected the Enhanced Focused Assessment using Sonography for Trauma (EFAST) diagnostic ultrasound exam as the exemplar diagnostic skill. The EFAST exam is considered the standard of care in early trauma assessment. EFAST is a reliable alternative to radiological scanning approaches such as Computed Tomography (CT), or more invasive approaches to assessing for internal bleeding, such as Deep Peritoneal Lavage (DPL) (Ma, Mateer, & Blaivas, 2008).

Therefore, EFAST also helps reduce patient exposure to dangerous levels of radiation, while minimizing the need for invasive procedures that increase the likelihood of infection.

When performed properly, EFAST is a fast, cost-effective diagnostic exam used to guide decisions about trauma care in emergency and critical care settings. The exam can be performed by physicians, nurses, and in some instances pre-hospital providers (Ma et al., 2008). The successful performance of an ultrasound involves:

- Knowing when to conduct an EFAST exam
- Knowing how to use the ultrasound device and associated probes
- Knowing how to perform the exam
- Capturing high quality images
- Interpreting obtained images
- Incorporating findings and adjusting the patient treatment plan accordingly
- Communicating that plan to others (Castanelli, 2009; Keddis et al., 2011)

Simulation lab. All skills-based and scenario-based simulations were conducted in the same, dedicated simulation center. The lab space was configured either for skills-based practice, which usually employs and an open floor plan, or as a patient bay, which is typically found in the emergency department. Appendices V and W contain diagrams of each set up. Both settings contained all of the durable medical equipment (e.g., stretcher, patient monitoring equipment) and disposable medical supplies (towels, ultrasound gel) typically available for practice and patient care.

Ultrasound device. All skills-based and scenario-based simulations used the Sonosite® M Turbo ultrasound device along with the P21x® cardiac probe.

Positive EFAST model. All skills-based and scenario-based simulations used the Kyoto FAST ER/FAN® model, which presents positive EFAST findings when scanned.

Debriefing model. I selected the "Debriefing with Good Judgment" debriefing model (Rudolph et al., 2007). My strategy in selecting this model was because it was developed for both formative and summative debriefings and can used to address individual experiences while in a group setting (Rudolph, et al., 2007). A typical debriefing using this model starts with prompts from the facilitator to first ask participants about their initial reactions and experiences in the simulations. Following this, the facilitator then walks the group through a reflection on the simulation, stopping to probe participants' experiences where clarification is desired. For example, the facilitator may ask a participant, "I seemed to me that you hesitated for a moment at this point (may or may not refer to the video recording), can you recall what you were thinking here?" Once the facilitator has explored the learners' self-reflections, they or the subject matter expert may then offer coaching to the participant.

Standard patients. All skills-based and scenario-based simulations used two SPs per session so that students could practice scanning and interpreting non-positive EFAST images on actual humans. Additionally, using SPs in lieu of only simulated models allowed me to introduce students to SPs with different types of body habitus. I worked with an SP coordinator to identify, cast, and schedule standard participants to play the role of the patient for both types of simulations. For each simulation, I made casting decisions based on the SP's body habitus (e.g., thin or obese) as a strategy to increase complexity in either simulation. For scenario-based simulations, I cast SPs with known medical acting experience consistent with the situations our scenarios portrayed. I cast the same SPs for both skills-based and scenario-based simulations for all sessions as a strategy to improve consistency in simulation implementation.

Embedded standard participants (ESP). For scenario-based simulations, I also cast two to three ESPs to enact the role of the nurse or trauma surgeon. ESPs play an important role in facilitating the scenario narrative, and also provide students with opportunities to engage other healthcare practitioners (Sanko et al., 2013). I determined the number of ESPs based on scenario complexity. I cast the same ESPs for all scenario-based simulations. All ESPs were registered nurses, and had 5-9 years' experience portraying clinical roles in scenario-based simulations. Skills-based simulations did not employ ESPs, which is consistent with standard practice in medical simulation.

Physician faculty. One physician faculty member was present at each simulation to provide instruction and guidance for study participants. All physicians were emergency medicine (EM) physicians who completed their residency training 1-9 years prior. All EM physicians received training in ultrasound during their residency training, and received additional training in ultrasound by partaking in either an ultrasound fellowship or a registered diagnostic medical sonographer (RDMS) program. All EM physicians reported having 4-12 years' experience performing the EFAST exam in the clinical setting. All physicians reported having 2-10 years' experience teaching EFAST and other ultrasound procedures in the clinical setting. All physicians reported having 2-8 years' experience teaching in skills-based and scenario-based simulation contexts.

Debriefing facilitators. One debriefing facilitator led each post-simulation debriefing session for skills-based and scenario-based simulations. All debrief facilitators:

- Reported having previously completed 1-3 structured courses in debriefing in medical simulation
- Had received prior training in implementing the designated debriefing model selected for this study, *Debriefing with Good Judgment*
- Had 5-8 years' experience facilitating debriefing sessions, and regularly facilitate debriefings sessions
- Had 4-12 years' experience teaching with simulation-based learning in both skills and scenario-based simulation settings

Research Design

For this study, I employed a mixed-methods comparative case study design using comparison as a strategy to support my goal of examining differences and similarities of skills-based and scenario-based simulations. The strategy of drawing from both quantitative and qualitative forms of data is complementary. For example, I employed multiple qualitative methods to support rich description of how students' engagement in skills-based and scenario-based simulations led to learning. I included repeated measures of students' skills-performance and self-efficacy for EFAST, which are the two most common measures employed in the simulation literature, to examine differences and similarities in students' learning and development.

Fidelity of Treatment Procedures

In order to improve consistency in study implementation fidelity, I took several steps, including providing training for physician, SPs, and ESPs; standardizing skills-based and scenario-based simulation goals and objectives; recruiting and casting similar SPs and ESPs across simulations; and monitoring implementation. Descriptions of these steps follow.

Training. All physician faculty, debriefing faculty, SPs, and ESPs underwent training prior to partaking in skills-based and scenario-based simulations. Moreover, all materials (e.g., curriculum documents, scenarios) were posted to an online portal so that the study team could access them as needed throughout the duration of the study.

Physician faculty. Prior to supporting skills-based and scenario-based simulations, all physician faculty participated in a 2-hour training session prior to the start of the study. During this session, we reviewed the research protocol and guidelines for providing instructional support, and then discussed their role during post-simulation debriefing.

Moreover, because physicians were responsible for rating students during the pre-test and post-test, they received training in how to complete the RAD-DOPS in accordance with the Royal College guidelines. Because the study was offered in the fall and the winter, faculty also partook in a brief refresher on the RAD-DOPS during which we reviewed the guidance document again. A copy of the RAD-DOPS *Guidance for Assessors* is included in Appendix H.

Debriefing faculty. All debriefing facilitators participated in a one-hour training session prior to supporting study interventions. During this session, we reviewed the research protocol and guidelines for debriefing, and discussed their roles and those of faculty during post-simulation debriefing. We also reviewed the *Group Debrief Protocol.*

SPs and ESPs. Individuals portraying the role of the patient or clinicians received copies of their designated scenario one week in advance of simulation sessions. For skills-based simulations, SPs reviewed the goals of each practice session prior to each session. For scenario-based simulations, all SPs and ESPs partook in a pre-simulation rehearsal session prior to enacting their roles. During rehearsals, SPs and ESPs engaged in readings and role-playing. The purpose of these sessions was enable SPs and ESPs to become familiar with the goals of the scenario, their characters, and the sequencing and timing of the scenario (Sanko et al., 2013).

Structured simulations and debriefing prompts. In order to provide additional structure and minimize variation in simulation and debriefing implementation, I designed the skills-based and scenario-based simulations curricula in advance, and developed the Group Debrief Protocol.

Simulation curriculum design. All skills-based and scenario-based simulations, including the pre-test and post-test scenarios, were designed in advance of implementation in order to standardize the purpose, goals, session objectives, and sequencing. Furthermore, documentation for each scenario and skills session included guidance for SPs, ESPs, and faculty enactment. Once the initial design process was completed, four SMEs (two EFAST faculty and two emergency department nurses) reviewed the skills-based and scenario-based simulations for accuracy. Following their review and subsequent revisions, I pilot tested each scenario with faculty, SPs, and ESPs prior to implantation in the study. A copy of all scenarios and skills-based practice sessions are located in Appendices J-R.

Debriefing prompts. Because the study required multiple debriefing sessions, I created the Group Debriefing Protocol, which follows the same structure of my selected debriefing model, *Debriefing with Good Judgment,* outlined by Rudolph et al. (2007). For example, to address students initial affective reactions, a key step in the Debriefing with Good Judgment approach, the written prompt includes questions such as "*you just took care of a patient who experienced injuries related to an assault, how are you feeling right now?" A*nother example of a written prompt was "*I noticed that you…*," which was used to support explorations into a student's reasoning for performing certain actions. A copy of the *Group Debrief Protocol* is located in Appendix F.

Intervention monitoring. Furthermore, I conducted an ongoing process evaluation throughout the study's implementation. To achieve this, I developed checklists for each stage of the study to help identify variances from the studies' planned procedures or content. The checklists contained multiple sections attending to implementation fidelity. They were:

- Processes for confirming each session with study participants, faculty, and SPs and ESPs
- Orienting study participants to the goals and plan for each session
- Ensuring all measures were collected for each study participant
- An accounting of staffing for each session

A free-text session to describe issues that emerged that were not accounted for in checklist sections. For example, content included in this section may descriptions of equipment or device failures and what was done to resolve the issue. Copies of the pre-test, intervention, and post-test session checklists are available in Appendices S, T and U.

I completed a checklist for each skills-based and scenario-based session. I then reviewed these checklists following each week's simulations to analyze any common themes or discrepancies. When discrepancies were identified, I composed a summary of the event and shared it with the simulation team for discussion.

Procedure.

The study was implemented in four phases. They were:

1. Recruitment and enrollment
2. Baseline assessment and orientation
3. Acquisition
4. Reassessment

Figure 2 presents a graphic representation of the study phases and their sequence.

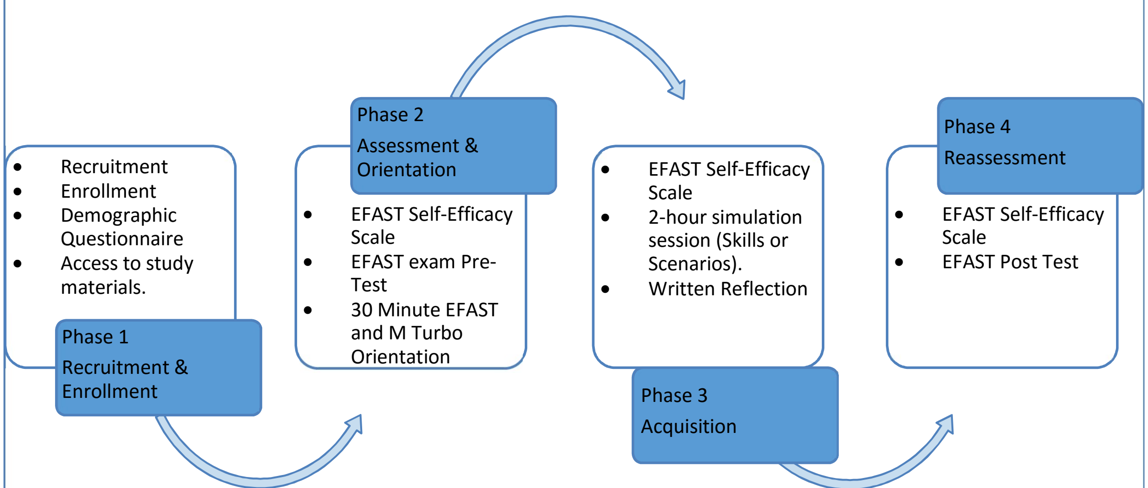


Figure 2. EFAST Simulation Study Phase Diagram.

Phase 1: Recruitment and enrollment. Following completion of the consent process, participants were assigned a unique numeric identifying code that was used to link all questionnaires, surveys, and assessments. Participants were then sent an email notification requesting they complete the demographics questionnaire via Survey Monkey. All participants also received access to an EFAST wiki created for this study. The wiki contained a series of journal articles, web links to ultrasound websites (e.g., http/:www.sonoguide.com:ems_pre-hospital.html; http://www.sonoguide.com/FAST.html), and additional ultrasound videos participants could review. Videos and articles addressed:

- Physics of ultrasound
- Operation and use of the Sonosite M-Turbo® ultrasound device and the P21x® probe
- Processes for performing an EFAST
- Integration of EFAST into patient care
- EFAST exams use in the emergent setting

Identification and selection of these resources was done collaboratively with physician SMEs. Access to this site remained available throughout out the duration of the study; however, accessing it was not mandatory.

Phase 2: Baseline assessment and EFAST orientation. Following completion of Phase 1, all study participants attended the baseline assessment and EFAST orientation session, which consisted of partaking in a 10-minute pre-test scenario, followed by a 30-minute EFAST orientation.

Pre-test. To begin, participants were first asked to complete their first EFAST self-efficacy inventory. Then, participants were given an overview of the simulation lab, which included introducing students to faculty, reviewing performance expectations, and providing an orientation to the tools that were available, such as SP and phantom models.

Following this, participants were asked to review expectations and instructions for completing the first performance assessment. Prior to beginning the pre-test assessment, participants were encouraged to ask clarifying questions, and were allowed to determine when they were ready to begin.

The pre-test scenario presented students with a patient who had sustained a traumatic injury, and was in need of an EFAST exam. For this assessment, we recruited a standardized participant with normal body habitus and known normal anatomy to portray the role of the patient. During the pre-test, participants were required to interact with two ESPs portraying the role of the patient's nurse and the attending physician. The physician faculty portrayed the role of attending physician in order to have an adequate view of the images participants acquired. All pre-test scenarios were stopped at 10 minutes. All sessions were video recorded.

Lastly, participants discussed their performance with the physician faculty, drawing from the RAD-DOPS scale to guide feedback. In accordance with the guidelines of the RAD DOPS, participants were then given ten minutes to complete the designated reflection prompts on the RAD-DOPS.

EFAST orientation. Following completion of the initial assessment, participants partook in a mandatory orientation session to receive training on the Sonosite M Turbo® ultrasound device and to learn the processes of the EFAST exam. Participants practiced on standard patients with normal body habitus and known normal abdominal anatomy.

Participants worked in small groups of one to two per instructor. One Sonosite M-Turbo® ultrasound device and P21x® cardiac probe was made available per orientation session.

During this session, physician faculty emphasized basic operations of the M Turbo ultrasound device, including turning it on and off, cleaning, general scanning principles, basic knobology (e.g., use of the gain, image enhancement controls), and reviewed the processes of the EFAST exam. All sessions were video recorded. At the end of this session, I notified participants of their assignment to either the skills-based or scenario-based simulation group.

Phase 3: Acquisition. One week following the initial assessment and orientation, participants began the acquisition phase of the study. The acquisition phase comprised two 2-hour simulation sessions that were completed one week apart. Both skills-based and scenario-based sessions required participants to:

1. Complete the EFAST self-efficacy scale and review session guidelines
2. Participate in either skills-based or scenario-based simulations
3. Compose a written reflection

Completion of the self-efficacy scale and session guidelines. Upon arrival to each practice session, participants completed their individual self-efficacy inventories in a private setting (Bandura, 2006). I then offered participants instructions to review regarding the session's goals, and participation guidelines, encouraging them to interact with the other team members. Prior to the start of the session, participants had an opportunity to ask questions. All sessions were video recorded.

Participation in skills-based or scenario-based simulations. Following the completion of the self-efficacy scale and reviewing participation guidelines, students engaged in their designated simulation activity. Below, I describe skills-based simulations, followed by scenario-based simulations.

*Skills-based simulations***.** Skills-based simulations were semi-structured, emphasizing a mastery approach, and I encouraged participants to self-direct their learning and seek help when needed. I advised participants that they could practice alone, or with another participant. There was one physician faculty member available for each skills-based simulation session. Participants were allowed to practice up to 75 minutes during each lab; however, they were advised that they could end their practice earlier if they desired. There was no penalty for ending practice early, or using all 75 minutes. The practice session was observed by the debriefing facilitator.

One M-Turbo ® and P21x® cardiac probe was provided per participant. There were two SPs available for scanning during each lab. Skills-based sessions were designed and presented to participants ranging from less-complex to more-complex (Brydges, et al., 2012). For example, I sequenced SPs from normal body habitus to obese. For the first skills-based simulation session, I cast one male and one female SP. For the second skills-based simulation session, I cast two male SPs who were either overweight or obese to provide complexity in scanning. The Kyoto FASTER® ultrasound phantom was available during each lab to present participants with an opportunity to examine positive scans. All practice sessions were video recorded.

Following skills-based practice, participants partook in one group post-simulation debriefing session. The debriefing session included the participants, a designated debriefing facilitator, and the physician faculty. I allowed up to 30 minutes per debrief session. All skills-based debriefing sessions were audio recorded.

Scenario-based simulation session workflow. Scenario-based simulations emphasized a mastery approach, and I encouraged participants to self-direct their learning and seek help when needed. During each session, participants partook in two scenario-based simulations. There was one physician faculty member available for each scenario-based simulation session. Participants were assigned to either lead or secondary prior to the beginning of the session. I tracked this to ensure that participants rotated roles in the following scenarios. I presented Scenarios 1 and 2 during the first session, and Scenarios 3 and 4 during Session 2. I allowed up to 25 minutes per scenario, but participants were advised that they could end the scenario sooner if they desired.

Scenario-based simulations were designed to be complex. They included the social roles, tools, and rules one would expect to find in the clinical setting (Battista & Sheridan, 2014; Jeffries, 2005). One Sonosite M-Turbo ® and P21x® cardiac probe was provided per scenario. Participants practiced on SPs who portrayed the patient. The Kyoto FASTER® ultrasound phantom was available during each lab to present participants with an opportunity to examine positive scans. Participants also had access to other diagnostic findings, including the patient’s vital signs, lab results, and other radiological images (e.g., X-ray).

Scenarios were presented to participants ranging from less-complex to more-complex (Jeffries, 2005; Kneebone, 2009). For example, for Session 1, I cast one male and one female SP with normal body habitus. For the second session, I cast two male SPs who were overweight and obese to add complexity in scanning. Complexity also increased during the second session, by presenting patients with added comorbidities, or who presented communication challenges (e.g., suspected alcohol intoxication). The debriefing facilitator observed each scenario.

Following each scenario, participants partook in a post-scenario debriefing session that included the participants, a designated debriefing facilitator, and the physician faculty. I allowed up to 30 minutes per debrief session. All scenario-based debriefing sessions were audio recorded.

Table 3 presents a summary of similarities and differences in skills-based and scenario-based simulation sessions.

Table 3

Summary of Similarities and Differences in Skills-Based and Scenario-Based Simulation Sessions

	Skills-Based Sessions	Scenario-Based Sessions
Participant/Faculty Ratio	1-2 participants per faculty	1-2 participants per faculty
Participants	1-2 participants No role assignments	1-2 participants Attendant in charge or secondary attendant in charge
Standard Participant Roles	4 SPs exhibiting different body habitus	4 SPs exhibiting different body habitus 1 - 2 Nurses 1 Trauma Surgeon
Faculty Roles	1 Emergency Medicine Physician	1 Emergency Medicine Physician
EFAST Model	Kyoto FAST/ER FAN® Ultrasound Examination Training Model	Kyoto FAST/ER FAN® Ultrasound Examination Training Model
Ultrasound Device	Sonosite M-Turbo® with P21x® probe	Sonosite M-Turbo® with P21x® probe

Written reflections. Following their participation in the group debriefing session, I asked participants in skills-based and scenario-based simulations to complete a written reflection. Participants completed their written reflections in a designated area away from the practice space.

Phase 4: Post testing. Seven to ten days following the finals skills-based or scenario-based simulation practice session, all eight participants partook in a post-test evaluation of their performance of the EFAST exam. This session followed the same format and process as the pre-testing session.

To begin, I asked participants to complete their first EFAST self-efficacy inventory. Then, participants then learned about the simulation lab, met faculty, reviewed performance expectations, and received an orientation to the tools that were available, such as SPs and phantom models.

Following this, participants reviewed expectations and instructions for completing the post-test assessment. Prior to beginning the assessment, I encouraged participants to ask clarifying questions and allowed them to determine when they were ready to begin.

The post-test scenario presented students with a patient who had sustained a traumatic injury, and was in need of an EFAST exam. For this assessment, we recruited a standardized participant with normal body habitus and known normal anatomy to portray the role of the patient. During the post-test, participants were required to interact with two ESPs portraying the role of the patient's nurse and the attending physician. The physician faculty portrayed the role of attending physician in order to have an adequate view of the images participants acquired. Seven of eight students completed the EFAST in the allowed time of 10 minutes. One student was allowed to continue scanning for an additional 4 minutes. All sessions were video recorded.

Lastly, participants discussed their performance with the physician faculty drawing from the RAD-DOPS scale to guide feedback. In accordance with the guidelines of the RAD-DOPS, participants were then given up to 10 minutes to complete the designated reflection prompts on the RAD-DOPS.

Chapter Four

The purposed of this study were twofold, (a) examine how learning was supported in skills-based and scenario-based simulation learning environments used to teach the EFAST exam, and (b) examine if differences in simulation contexts influenced students' self-reports of learning, self-efficacy for EFAST, or pretest/posttest performance on the EFAST exam. In the sections that follow, I discuss how students engaged skills-based and scenario-based simulations, followed by self-reports of what they learned. I end with student's self-efficacy and pretest/posttest findings.

How Students Engaged in Skills-Based and Scenario-Based Simulations

To examine how simulations engage learning, my first research question was "How do student healthcare professionals engage in skills-based and scenario-based simulations used to prepare healthcare professionals to perform the EFAST exam?" I analyzed participant engagement by drawing from activity theory and guided participation. The primary data sources for Research Question 1 were 18 video recordings of skills-based and scenario-based simulations obtained during the acquisition stage of the study.

To account for the types of activities students engaged in during both types of simulations, I categorized each student's activities, drawing from an a priori coding scheme (Battista & Sheridan, 2014). Using video analysis software, I made three coding passes per student to account for the frequency and duration of their social interactions, structured interventions, and tool and prop use. Because the second stage of analysis called for evaluation of interpersonal interactions, I made these same three passes for faculty. Video coding software generates visual time-ordered displays and frequency and duration counts for each coded category.

Additionally, during activity coding, I noted gaps in the coded timelines where students were not engaged in hands-on practice of a structured intervention. Therefore I reviewed these instances and noted that during this time, they often observed the skilled actions of others. When they observed, students focused their visual gaze towards the actions of their peer, faculty or ESP, while often simultaneously leaning closer. I entitled this activity *observation,* which is defined as an activity in which students or faculty partook when they focused their attention on the skilled activities of others. I also accounted for who the student or faculty member observed. I then reviewed the videos again and coded each student's and faculty's timelines for observation before making a second pass on all videos.

To improve accuracy of activity coding, I reviewed video clips of each student's and faculty member's coded instances (e.g., social interactions, structured interventions). I re-categorized or eliminated instances that were inaccurate. While finalizing activity analysis, I used descriptive statistics to analyze the frequency and duration of students' structured interventions.

In the sections that follow, I address how students engaged in these sessions by first providing a detailed description of the types of activities students engaged in during skills-based and scenario-based simulations. Secondly, to address student engagement drawing from guided participation (Rogoff, 1995), I first summarize and define the types of guidance and participation identified, and then provide a careful descriptive account of guided participation in the simulations.

Student activity in skills-based simulations. Skills-based simulations ranged between 41 minutes and 67 minutes. The mean length of Session 1 was (M = 53.6 minutes, SD = 13.4 minutes). Session 2 was (M = 55.7 minutes, SD = 0.4 minutes). During participation in skills-based simulations, students partook in the structured intervention of performing the EFAST exam and engaging in clinically relevant social interactions (i.e., education and counseling).

The EFAST exam included placing gel on the probe, palpating the standard patient's chest or abdomen prior to placing the probe, educating the SP about the exam, scanning, and manipulating the gain and depth controls to enhance ultrasound images (i.e., knobology). To achieve this, students used the ultrasound device, the probe, and gel to practice scanning on SPs and the ultrasound model. Students also engaged in patient safety practices, such as wearing gloves and hand washing. During all labs, gloves and other personal protective equipment were available.

During Session 1, students spent 57-76 % of their time engaged in practicing the EFAST exam (M = 34.1 minutes, SD = 7.7 minutes). Students practiced between three and four complete EFAST exams. During Session 2, students in skills-based simulations spent 41-65% of their time engaged in practicing the EFAST exam (M = 28.1 minutes, SD = 5.6 minutes). The number of EFAST exams students completed during Session 2 was diverse. For example, two of four students practiced three complete exams, one student completed four exams, and one student completed five EFAST exams.

In addition to partaking in hands-on practice, students also observed the practice activities of faculty and peers. Instances of observations occurred in all skills-based practice sessions, and all four students in the skills-based practice group engaged in observation. During Session 1, students in skills-based simulations spent 14-24 % of their time engaged in observation (M = 8.9 minutes, SD = 1.9 minutes). During Session 2, students spent 9-13% of their time engaged in observation (M = 6.4 minutes, SD = 0.8 minutes). Students primarily observed faculty and their peers performing the EFAST exam.

When students observed them, faculty modeled a component of the EFAST exam, but there were no instances where faculty modeled the full exam. Student observation of their peers occurred when one student finished scanning their SP before the other, or when students sought to use the same resource (e.g., positive ultrasound model, standard patient). Students observed their peers practicing more often than they observed faculty modeling. This disjunction likely occurred because faculty were able to obtain images more quickly than peers and because faculty modeled a single component of the EFAST exam, rather than the full exam. By comparison, when students observed their peers, they took turns completing the full EFAST exam. For example, during Practice Session 2, two students took turns scanning the SP. While they practiced, one student scanned one view on the SP, and the second student observed. When the first student finished scanning the designated view, he gave the probe to the second student who then scanned the same view. The student who had scanned first then observed as the second student scanned. The students repeated this sharing activity until they finished a complete EFAST exam. Table 4 summarizes the time students spent engaged in scanning and observation for skills-based simulations.

Table 4

Summary of Students Activity Data for EFAST and Observation in Skills-Based Simulations

Student Activity	Session 1	Session 2
Session Length (in minutes)	*M* = 53.6 *SD* =13.4	*M* =55.7 *SD* = 0.4
EFAST (in minutes)	*M* = 34.1 *SD* = 7.7	*M* = 28.1 *SD* = 5.6
Observation (in minutes)	*M* = 8.9 *SD* = 1.9	*M* = 6.4 *SD* = 0.8
Number of EFAST Exams (Per Student)	3-4	3-5

Students' activity in scenario-based simulations. The mean length of Scenario 1 was (M = 19.1 minutes, SD = 5.5 minutes); of Scenario 2 (M = 11.1 minutes, SD = 1.6 minutes); of Scenario 3 (M = 9.1 minutes, SD = 0.7 minutes); and of Scenario 4 (M = 10.3 minutes, SD = 2.6 minutes). The activities students engaged in while participating in scenarios included the structured intervention of performing the EFAST exam, a trauma assessment, team communication, and patient safety practices (e.g., donning gowns and gloves).

The structured intervention of performing the EFAST exam included placing gel on the probe, palpating the abdomen or thorax prior to scanning, scanning, manipulating the depth and gain to enhance ultrasound images (i.e., knobology). To partake in the EFAST exam, students used the ultrasound device, gel, and the ultrasound probe, and they scanned standard patients and the EFAST model.

Scenario practice time of the EFAST exam broke down like this:

1. Scenario 1: Students spent 13-50% of their time (M = 5.6 minutes, SD = 1.9 minutes).
2. Scenario 2: Students spent 20-55% (M = 4.4 minutes, SD = 1.8 minutes).
3. Scenario 3: Students spent 15-45% (M = 2.9 minutes, SD = 1.2 minutes).
4. Scenario 4: Students spent 7-54% (M = 3.4 minutes, SD = 1.9 minutes).

Students practiced one complete EFAST exam each during the first and second scenarios. However, during the second and third scenario, two of the four students completed the EFAST exam by sharing responsibility for scanning with their peer rather than completing a full exam. Therefore, each student completed half of an EFAST exam because they scanned three of the six views. This sharing activity resulted in lower percentages of EFAST practice time for two of the four students.

In addition to the EFAST exam, students also engaged in non-EFAST-related structured interventions, including performing a trauma assessment, team communication, and patient safety practices. The structured intervention of the trauma assessment included exposing the patient, visualization, auscultation, palpation, obtaining and interpreting diagnostic findings, and patient care-related social interactions (e.g., diagnostic questioning, education and counseling, & social and emotional support). To achieve this, students engaged the SPs and embedded standard participants (ESP). They took their cues from simulated wounds and injury patterns on the SPs, SPs' utterances, and other diagnostic findings (e.g., labs, X-rays).

The structured intervention of team communication included instances of communicating situational needs, verbalizing diagnostic findings, and coordinating care with other team members (e.g., nurse, trauma surgeon). To achieve these structured interventions, students interacted with the ESPs. The structured intervention of patient safety practices included donning gloves, gowns, and hand washing. Gloves and other personal protective equipment were made available during all sessions.

Scenario practice time of non-EFAST structured interventions broke down as follows:

1. Scenario 1: Students spent 5-20% of their time (*M* = 1.6 minutes, *SD* = 0.4 minutes).

2. Scenario 2: Students spent 17-30% of their time (*M* = 2.9 minutes, *SD* = 0.7 minutes).
3. Scenario 3: Students spent 13-68% of their time (*M* = 2.9 minutes, *SD* = 1.9 minutes).
4. Scenario 4: Students spent 14 -19% of their time (*M* = 2.6 minutes, *SD* = 0.4 minutes).

Scenario-based students' engagement in observation included:

1. Scenario 1: Students spent 0-64% percent of their time (*M* = 6.9 minutes, *SD* = 6.9 minutes).
2. Scenario 2: Students spent 0-19% of their time (*M* = 0.9 minutes, *SD* = 1.1 minutes).
3. Scenario 3: Students spent 0-22% of their time (*M* = 0.9 minutes, *SD* = 0.9 minutes).
4. Scenario 4: Students spent 0-23% percent of their time (*M* = 0.9 minutes, *SD* = 1.4 minutes).

Students observed when faculty members modeled a component of the EFAST exam and when ESPs provided care for the patient. In addition, students occasionally observed each other's practice. Faculty members modeled the EFAST exam and other types of patient care activities, such as communicating with the patient. During the first scenario, one faculty member modeled the complete exam for two of the four students.

The following vignette highlights how the faculty member modeled the EFAST exam for two students during Scenario 1.

Faculty: "I'm looking at her liver right here (gestures towards the ultrasound screen, pointing to the image on the screen). That's her diaphragm right there above the liver (gestures using a side-to-side arching motion over the image on the screen). So what we're looking at right here - see this is her kidney right there (points to an image)?"

Both students: Hmm hmm."

Faculty: And then this is her liver right there. So we're looking...you guys see the kidney right there?"

Both students: "Hmm hmm."

Faculty: "Right in this space (gestures towards the image on the screen)."

Student 1: "Yeah."

Faculty: "So this is...I can see this a little bit better now...I don't see any blood there right now. So that looks pretty good to me. So the hepatorenal space is negative for fluid."

The previous vignette highlights how a faculty member modeled a scan of the hepatorenal space. The next excerpt highlights a scene during Scenario 1, when two students observed the verbal exchange between faculty and the nurse regarding pain management.

Nurse: "Did you want me to give her another dose of Morphine before she goes to CT?"

Faculty: [turning toward the patient] "What would you rate your pain as right now?"

Patient: "A six or seven."

Faculty: "Okay, we can give you a little bit more. But we'll keep a very close watch on you. Okay?"

Faculty: [turning to both students] "You always ride kind of a fine line in pain management between making your patient comfortable, and making your patient very sleepy. That's where you have to be very careful."

Students who didn't engage in observation during a scenario were either occupied with other patient care-related activities during the scenario, or participated in a scenario without a peer. Instances of observation in scenarios decreased after the first scenario because faculty engaged in fewer instances of explicitly modeling the EFAST exam; however, they continued to occasionally model social interactions with other healthcare professionals. Table 5 summarizes mean activity data for students' engagement in scenario-based simulations.

Table 5

Summary of Activity Data for EFAST, Non-EFAST Structured Interventions and Observation in Scenario-Based Simulations

Scenario	1	3	3	4
Scenario Length (in minutes)	*M* = 19.1 *SD* = 5.5	*M* = 11.1 *SD* =1.6	*M* = 9.1 *SD* =0.7	*M* = 10.3 *SD* = 2.6
EFAST Exam (in minutes)	*M* = 5.6 *SD* = 1.9	*M* = 4.4 *SD* = 1.8	*M* = 2.9 *SD* = 1.2	*M* = 3.4 *SD* = 1.9
Non EFAST (in minutes)	*M* = 1.6 *SD* = 0.4	*M* = 2.9 *SD* = 0.7	*M* = 2.9 *SD* = 1.9	*M* = 2.6 *SD* = 0.4
Observation (in minutes)	*M* = 6.9 *SD* = 6.9	*M* = 0.9 *SD* = 1.1	*M* = 0.9 *SD* = 0.9	*M* = 0.9 *SD* = 1.4
Number of EFAST Exams (per student)	1	1	.5-1	.5-1

Summary of skills-based and scenario-based activity. Differences in simulation context influenced the types of activities and tools and props students had access to. Consequently, differences in context impacted students' practice activities. For example, students assigned to skills-based simulations engaged in more total practice time of the EFAST exam. They also completed more total EFAST scans than did scenario-based students. By contrast, scenario-based students engaged in the EFAST exam as well as diverse types of structured interventions, such as conducting a trauma assessment and engaging in team communication. Although students engaged in these other activities, they still focused most of their practice time on the EFAST exam. In addition to hands-on practice, students in skills-based and scenario-based simulations also engaged in observation of others.

Moreover, students in skills-based simulations engaged in more observation of the EFAST exam than students in scenario-based simulations. Students in skills-based simulations observed the practice of the EFAST exam, whereas students in scenario-based simulations observed the diverse activities of peers, embedded standard participants, and faculty. Students assigned to skills-based simulations observed faculty and peers, whereas scenario-based students observed faculty, ESPs, and their peers. Compared to skills-based students, scenario-based students used a wider range of tools and props, which included diagnostic findings, and other healthcare professionals. Table 6 summarizes students' activities in skills-based and scenario-based simulations.

Table 6

Summary of Students Activities in Skills-Based and Scenario-Based Simulations

Theme	Category	Skills-Based Simulations		Scenario-Based Simulations	
Activities	Structured Interventions	EFAST		EFAST, Trauma assessment, Team communication, and Patient safety practices (e.g., gowning)	
	Social Interactions	Education and Counseling		Diagnostic questioning, Education and Counseling, Social and emotional support, Situational awareness	
	Tools and Props	Ultrasound device, probe, standard patient, positive ultrasound model, Diagnostic findings (EFAST images)		Ultrasound device, probe, standard patient, embedded standard participants, positive ultrasound model, diagnostic findings (e.g., EFAST images, Vital signs, lab results), gowns, gloves	
	Observation	Observation of faculty or peers		Observation of faculty, peers, or embedded standard participants	
	EFAST Exams/ Session	3-5		0.5 - 1	
Activity Duration (in minutes)		Skills Session 1 *M (SD)*	Skills Session 2 *M (SD)*	Scenario Session 1 *M (SD)*	Scenario Session 2 *M (SD)*
	Total Practice Time	**53.6 (13.4)**	**55.7 (0.4)**	30.9 (7.2)	19.5 (3.0)
	EFAST Practice	**34.1 (7.7)**	**28.1 (5.6)**	10.5 (3.38)	6.2 (3.2)
	Non-EFAST Activity	0.0 (0.0)	0.0 (0.0)	**1.1 (0.7)**	**1.5 (1.0)**
	Observation	**8.9 (1.9)**	**6.4 (0.8)**	8.2 (7.9)	2.2 (2.4)

Guided Participation in Skills-Based and Scenario-Based Simulations

To further address Research Question 1, I also examined students' engagement by drawing from guided participation (Rogoff, 1995). To identify the types of guided participation students engaged in, I selected one skills-based session from Session 1 and 2 and one scenario-based session from Sessions 1 and 2 for restorying. For scenario-based sessions I constructed descriptive narrative for both scenarios in the designated session (Ollerenshaw & Cresswell, 2002).

Once I selected my designated sessions, I viewed each video-recorded session and wrote a narrative account of the sequence of events that occurred in each session (Ollerenshaw & Cresswell, 2002). Because I was drawing from guided participation, I focused my efforts on describing the explicit and implicit interpersonal interactions that occurred between the participants and students as they engaged in the simulation. I also made sure to account for the participations social interactions, structured interventions, and use of tools and props. I then reviewed each restoryed skills-based and scenario-based session and conducted open coding searching for categories of interpersonal interactions. This process supported my decision to examine interactions between students and faculty, students and their peers, students and SPs, and students and embedded standard participants.

Secondly, in order to account for the types of guided participation present in skills-based and scenario-based simulations, I reviewed students' and faculty's time-ordered displays, which were created when I performed my activity analysis. Time ordered displays generated from video analysis result in a visual color-coded timeline of a participants coded activities. I searched for clusters of activity during which students and faculty, students and peers, and students and embedded standard participants interacted with each other. I analyzed those specific interpersonal occurrences by examining the types of activities (e.g., structure interventions) students and my designated participants (i.e., faculty, SPs, ESPs) engaged in. I then conducted open coding to identify the types of participation and guidance present. To finalize this stage of analysis, I compared these categories to the selected restoried skills-based and scenario-based sessions, searching for negative or discrepant cases.

In the following section, I carefully describe categories of guided participation I identified. I then compare the types of guided participation in skills-based and scenario-based simulations in greater detail.

Types of guidance. Guidance in skills-based and scenario-based simulations included process of structured interventions, the scenario narrative, verbal guidance, and physical guidance. Below I introduce these major themes.

Processes of structured interventions. The steps and processes of structured interventions served to guide students' engagement. For example, completing an EFAST exam required the systematic scanning of six areas of the abdomen and thorax (e.g., hepatorenal, pelvic, splenorenal, pericardial, and the right and left lung views).

Scenario narrative. The narrative of the scenario, enacted by the SP and ESPs, also focused and guided participants' activities. For example, when students encountered the SP portraying the patient, they engaged the SP by introducing themselves, followed by a line of diagnostic questioning. Simultaneously, ESPs partook in activities such as exposing the patient and assessing vital signs. The students then aggregated the information they gained from these activities to make decisions about the next steps in care.

Verbal guidance. Verbal guidance included instances of description and elaboration, questioning, and encouragement. *Description* included instances of faculty offering verbal descriptions of objects, activities, processes, and images. *Elaboration* included utterances in which faculty incorporated verbal details about objects, activities, processes, and images in order to add complexity. Description and elaboration were usually accompanied by physical guidance, modeling, or gesturing. *Questioning* included instances of students and faculty asking questions, or when faculty asked students to describe their current understanding of a process or interpretation of an image. *Encouragement* included instances of faculty giving students support or confidence when students had achieved the desired goal. Table 7 presents each theme, key terms, and sample responses for verbal guidance.

Table 7

Types of Verbal Guidance

Thematic Category	Key Characteristics or Terms	Example Responses
Description and Elaboration	"That's "her/his," "You're" "Here is"	*"That's her diaphragm right there, above the liver." "Okay, so you're just a little high up. So what you'll do is move it this way. Back and forth."*
Questioning	"Tell me" "What are" "Do you" "What do,"	*"Tell me what you see?", "What do you want to do? What are you looking at?"*
Encouragement	"Good," "Yes," "good job,"	*"Good," "Nice Job"*

Physical guidance. In addition to verbal guidance, students' attention was also focused by physical guidance, gesture, and modeling. Physical guidance included instances during which faculty and students shared the simultaneous use of a tool (e.g., ultrasound probe, M-Turbo) while performing a structured intervention (e.g., EFAST exam, trauma assessment). Faculty and students used gestures to focus each other's attention on a specific image or anatomical landmark. Faculty *modeled* how to perform structured interventions, such as the EFAST exam, or how to communicate with the patient. Physical guidance was often coupled with other forms of physical guidance and verbal guidance.

Figure 3 contains two images depicting different forms of physical guidance. Figure 3a is taken from a skills-based practice session during which a faculty member provides physical guidance by jointly holding the ultrasound probe with the student while scanning the pericardial view. The faculty member also gestures toward the screen to elaborate key characteristics of the image they have obtained. Figure 3b depicts two students observing as the faculty member models how to obtain and interpret the pelvic view of the EFAST exam. She also gestures to highlight key features of the image on the screen.

Physical Guidance with Gesture

(a) The faculty member provides physical guidance by holding the probe while scanning. He also gestures towards the ultrasound screen to highlight key features of the image they are examining.

Modeling with Gesture

(b) Faculty modeling how to scan the bladder view, while gesturing towards the ultrasound screen to highlight key features of the image she has obtained.

Figure 3. Forms of physical guidance provided in skills-based and scenario-based simulations.

Types of participation. I noted instances of joint participation and independent participation. *Joint participation* included instances of student healthcare professionals engaging in hands-on practice with the co-presence of faculty, peers, or ESPs. During that time, the joint activity included a combination of activities such as hands-on performance of structured interventions, and observation by faculty or students. For example, both images contained in Figure 1 above depict joint participation during skills-based and scenario-based simulations.

Independent participation included instances of students engaging in hands-on practice of a structured intervention, but the visual gaze, body positioning, or social interactions of faculty and peers were not directed toward the designated student. For example, during Skills Session 1, each student worked independently with an SP and ultrasound device (Figure 4). While they practiced, the faculty member divided his time among students by observing and providing guidance one student at a time. When faculty guided a student, they gave that student their full attention. Consequently, this resulted in their turning away from the second student. Figure 4 depicts both joint and independent participation during a skills-based practice session. Student 1 is scanning independently, while the faculty member and Student 2 are jointly engaged in scanning of the splenorenal view.

Figure 4. Joint and independent participation. Student 1 (left) is engaged in independent participation of the EFAST exam. Student 2 is engaged in joint participation with the faculty member. They are scanning the splenorenal space together, while interpreting the image they have obtained of the splenorenal view.

Guided participation in skills-based simulations. During skills-based simulations, students engaged in a combination of joint and independent participation. Joint and independent participation were present in all skills sessions. During Session 1, students spent 25-55% of their time engaged in independent participation (*M* = 21.9 minutes, *SD* = 9.9 minutes). Students also engaged in 37-62% of joint participation during Session 1 (*M* = 26.7 minutes, *SD* = 5.9 minutes). During Session 2, students spent

23-40% of their time engaged in independent participation (*M* = 18.5 minutes, *SD* = 3.7 minutes). Students also engaged in 23-66% of joint participation (*M* = 25.2 minutes, *SD* = 9.0 minutes) during Session 2.

Joint participation was more common than independent participation. Three of four students in Skills Session 1 engaged in more joint participation than independent participation. Three of four students in Skills Session 2 engaged in more joint participation than independent participation. When students engaged in joint participation, they did so with faculty, or with faculty and their peer. Students engaged in more joint participation with faculty than they did with a peer and faculty member. Table 8 presents a summary of joint and independent participation students engaged in during skills-based simulations.

Table 8

Mean Joint and Independent Participation in Skills-Based Simulations in Minutes

Skills-Based Simulations	Session 1 *M (SD)*	Session 2 *M (SD)*
Independent Participation	21.9 (9.9)	26.7 (5.9)
Joint Participation	18.5 (3.7)	25.2 (9.0)

Guided participation during independent practice in skills-based simulations. During independent participation, students in skills-based simulations were guided by the processes of the EFAST exam. For example, students structured their practice time by repeating the processes of the six views that make up the EFAST exam. They sequenced their practice time by performing a complete EFAST exam on the first SP, and then repeated the EFAST exam on the next SP and the ultrasound task model. This pattern resulted in students completing multiple EFAST scans during a single practice session. Students also repeated individual views of the EFAST exam during independent practice. They did this when they struggled to obtain an image, such as the pericardial view, or when the patient's body habitus was more complicated (e.g., obese). When students were unable to obtain the view they wanted, they sought help from faculty, thereby resulting in a transition to joint participation.

Guided participation during joint participation in skills-based simulations. During joint participation, students were guided by the processes and steps of the EFAST exam and by interactions with faculty and peers who provided diverse forms of physical and verbal guidance. For example, while students worked through the six views of the EFAST exam, faculty observed students practice or asked them about their progress. Following this, faculty provided verbal or physical guidance, or verbal and physical guidance simultaneously to obtain the desired image. The following vignette highlights an instance of joint participation between student and faculty from Skills Session 1.

The faculty member approaches one of the students and asks, "How are you doing?" The student remarks, "I'm fine, just trying to scan the right upper quadrant (RUQ)." After observing the student's efforts, the faculty member suggests that the student add some gel to the probe to improve his view. After adding gel, the student scans the hepatorenal view while the faculty member continues to observe. Then the *faculty approaches the ultrasound machine, makes a series of changes to the depth and gain, and then asks the student to move the probe towards the patient's head. When the student struggles to move the probe into a sufficient position, the faculty member reaches across, places his hand over the student's hand on the probe, and guides him to the location to obtain the desired image. The faculty member then verbally describes the image, and further elaborates by gesturing to organ boundaries on the screen.*

Not only did joint participation include multiple forms of guidance, it was also dynamic. For instance, students and faculty engaged in a combination of verbal and physical guidance rather than relying on a single form of guidance. Figure 5 and the following vignette highlight this complex activity.

The student depicted in Figure 5a seeks help from the faculty member to scan the pelvic view. When the faculty member approaches, he first observes the student's image and scanning technique, and then probes the student's understanding of the image he has obtained. He asks, "What are you seeing?" The student responds, "I took for granted on the guy that I could find the bladder." The faculty member then places his hand over the student's hand on the probe and the two jointly scan the pelvic view. As they scan, the faculty member and the student engage in the following verbal exchange.

Faculty: Okay, so you're just a little high up. So what you'll do is move it this way. Back and forth (the faculty member guides to movement of the probe).

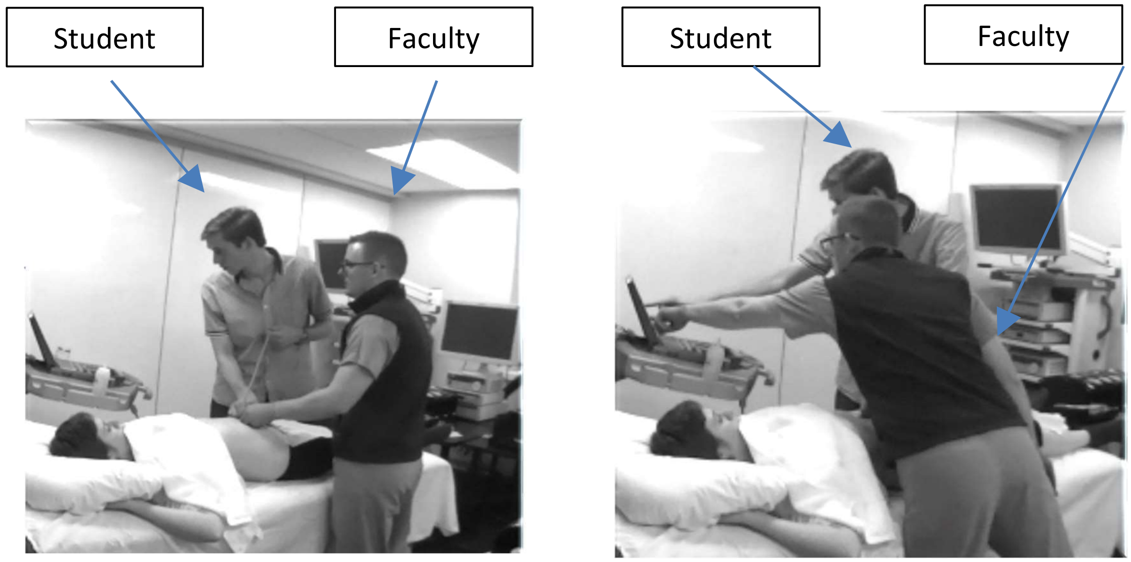
Student: Yeah.

Faculty: And if you don't see it, you can slide it down a little further, and put a little pressure on it. You see that there? (gestures towards the image on the screen)

Student: Yeah, I see that.

Following this initial activity, Figure 5b depicts the next steps following the faculty member's guidance of where to place the probe and how to manipulate it.

The faculty member returns responsibility of holding the probe to the student. They then jointly gesture toward the screen of the ultrasound device, and the student describes what he is viewing. The faculty member replies, "Yes. Good."



(a) (b)

Figure 5. Sequencing guided participation in skills-based simulation. These images depict how faculty and student work jointly to obtain a view of the bladder. Later, the faculty member returns responsibility for managing the probe to the student, and then they gesture toward the ultrasound screen to examine the image they have obtained.

In addition to participating jointly with faculty, students also engaged in joint participation with faculty and their peers. During instances of joint participation with faculty and peers, students engaged in taking turns scanning the patient or model or observing while faculty provided verbal and physical guidance. When students took turns scanning, one student scanned a single view of the EFAST exam, while the non-scanning student observed or engaged the faculty member by asking questions. Students who observed occasionally gestured toward the ultrasound screen to point out a particular image or anatomical landmark. Students occasionally engaged their peer when they were not scanning by offering verbal guidance on how to obtain an ultrasound image; however, students did not provide physical guidance. During the second session, one student indicated that she wanted to observe her peer complete a full exam rather than engage in taking turns. During this interaction, she watched her peer's performance intently, while also engaging the faculty member by asking questions.

Constraints in skills-based simulations. Students' access to faculty was occasionally constrained when they sought help. This occurred when the faculty member's attention was focused on the second student. This led to students making repeated attempts of the scan, or moving onto another view before receiving help. When faculty became available to provide help, students usually returned to the view they were struggling with. The following vignette highlights how one student's access to help was constrained.

The student working independently makes several attempts to obtain an image of the patient's bladder. She starts by placing the probe and beginning to scan. Shortly afterwards, she stops, repositions the probe, and attempts again. She repeats this pattern, and after a few attempts, she stops scanning and looks toward the faculty member. She notices his back is toward her because he is providing guidance to the second student. She pauses, but eventually returns to scanning the same location again. While she scans, her facial expression suggests she is uncertain of the image she has obtained. She eventually moves on to scanning the hepatorenal view, but looks to the faculty member four more times before catching his attention. When the faculty member becomes available, she returns to the view she was struggling with.

Although the previous vignette highlights how one student experienced constraints in accessing the faculty member, the video analysis revealed that all students in skills-based simulations experienced delays in accessing the faculty member's help. Students experienced delays in accessing faculty guidance ranged between 5 and 8 times in Session 1, and between 3 and 5 times in Session 2.

Guided participation in scenario-based simulations. During participation in scenario-based simulations, students engaged in the joint participation of caring for, diagnosing, and treating patients presenting with traumatic injuries. There were no instances of independent participation in scenario-based simulations.

As students engaged the scenario, faculty maintained co-presence by either engaging in patient care alongside the student, or by observing students' participation. For example, Figure 6a depicts how students, faculty, and embedded standard participants jointly engage in the assessment and care of a patient in Scenario 1. In this example, both student and faculty engage in visualizing the patient's thorax as they search for injuries. Meanwhile, the second student engages the patient in a line of diagnostic questioning as the nurse enacts the steps of obtaining vascular access.

Students also engaged in scenario-based simulations while faculty observed their actions. For example, Figure 6b depicts an image of a student partaking in Scenario 1 during which he and the nurse in the image are viewing the patient's blood pressure. While the student engages in the scenario with the ESP, the faculty member maintains a slight distance in the background observing the student's actions.

(a)

(b)

Figure 6. Joint participation in scenario-based simulations. Image (a) depicts two students engaged in separate activities. One student conducts an examination of the patient to identify any additional wounds, while the second student engages the patient

in a line of diagnostic questioning. Image (b) depicts the faculty member observing as the student and one of the nurses examines the patient's blood pressure.

Guidance in scenario-based simulations. Students engaging in scenario-based simulations were guided by the narrative of the scenario, the processes and steps of structured interventions (e.g., trauma assessment, the EFAST exam), and by verbal and physical guidance offered by faculty. For example, the narrative of the scenario enacted by SPs, embedded standard participants, and faculty helped students sequence the order they performed the different structured interventions (e.g., trauma assessment, EFAST exam). The following vignette illustrates an example of how the narrative structured two students' activities during scenario four.

The SP portraying the patient enters the simulated emergency department holding his left side, grimacing in pain. Witnessing this, the students quickly approach the patient, assist him to the stretcher, and begin asking questions about what happened. As the patient shares that he was stabbed, the nurse and faculty member cut his clothing off. Simultaneously, one of the nurses places the blood pressure cuff and a pulse oximetry probe on the patient and begins to obtain vital signs. While one student continues to ask the patient a series of diagnostic questioning (e.g., asking about medication use, prior medical history), the second student performs the secondary survey. As the second student finishes palpating the abdomen, she reaches for the ultrasound device, turns to the patient, and says "Sir, I'm going to do an ultrasound of your belly because I'm concerned you might have some bleeding inside."

The previous vignette highlights how the scenario narrative guided students' activities; however, it also highlights how students' activities were further guided by the process of structured interventions, such as the steps and sequence of a trauma assessment. Students in the scenario-based simulation group sequenced their structured interventions in a specific order. For example, the vignette above demonstrates how students followed the processes of a trauma assessment that eventually led to the performance of the EFAST exam.

The guidance faculty offered students shifted between transferring independence to students while observing and providing explicit forms of verbal and physical guidance (Figure 7). For example, when students required support, faculty increased their presence by moving closer to the student. They often started by asking the student, "*What do you see so far*?" Following the student's explanation, faculty then engaged in a combination of verbal and physical guidance, such as describing the image on the screen, providing physical guidance to help the student obtain the view, and gesturing toward the screen to augment their verbal description of an image. As students gained greater skill or moved onto an activity they were skilled at, faculty decreased their presence. They did this by stepping back a short distance and transferring independence back to the student.

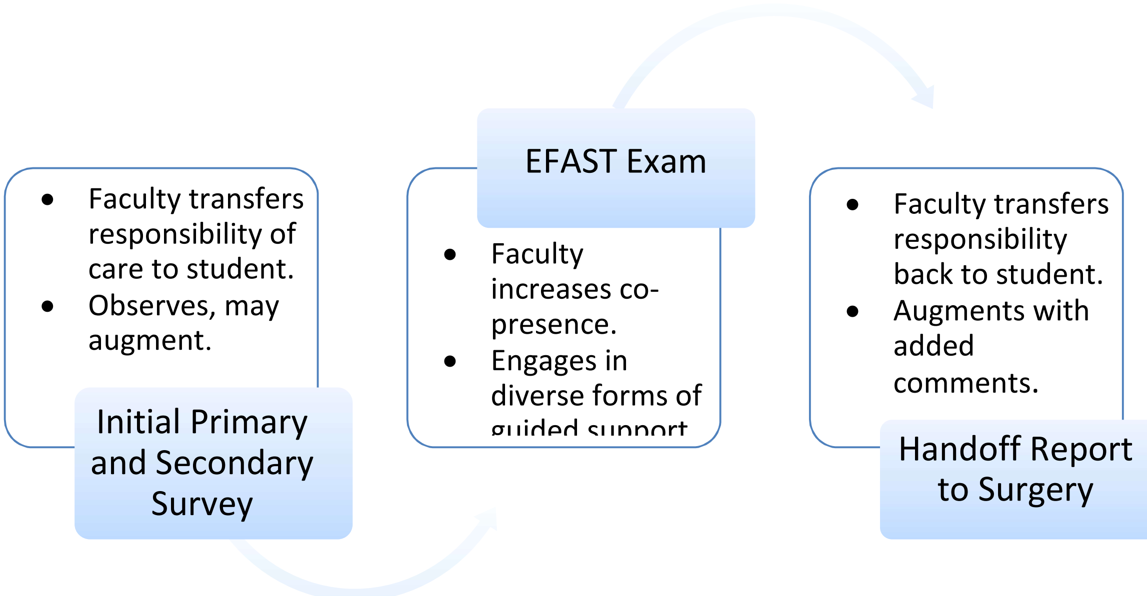


Figure 7. Dynamic faculty guidance.

Students' engagement was also augmented when faculty modeled patient care activities, such as the EFAST exam, communication with other healthcare professions, and ordering and interpreting additional diagnostics tests. Instances of faculty explicitly modeling the EFAST exam only occurred during Scenarios 1 and 2. Faculty intermittently modeled other patient care activity, such as educating and counseling the patient, and ordering and interpreting diagnostic tests and findings. For example, Figure 8 depicts the image of a student observing the faculty member as he educates the patient about what was found during his EFAST exam and what the next steps are.

Figure 8. Faculty modeling how to educate and counsel a patient about their diagnostic findings.

Constraints in scenario-based simulations. The scenarios' dynamic and complex enactment by SPs and ESPs resulted in fewer than expected opportunities for EFAST exam practice. For example, two out of four students performed half of an EFAST exam during Scenarios 3 and 4, rather than completing a full scan. They did this by taking turns scanning the different views, or when one student was in a better physical position to complete the scan (e.g., standing on the patient's right made it easier to scan the hepatorenal view). Neither faculty nor the other ESPs were aware that the students hadn't performed a complete EFAST exam. These instances occurred only during

Scenarios 3 and 4 when scenario complexity increased. It only occurred when students engaged scenarios in pairs, but did not happen when students engaged in a scenario without a practice partner.

Summary of guided participation in skills-based and scenario-based simulations. There were similarities and differences in students' guided participation in skills-based and scenario-based simulations. For example, students in both groups engaged in joint participation with faculty and their peers. However, students' roles differed. Students in skills-based simulations engaged in joint participation with faculty and their peers in expert-novice and peer-peer dyads. By comparison, students in the scenarios group were treated as full members of the healthcare team in the care of their patients despite their novice status. Additionally, students in the skills group engaged in periods of independent participation during all sessions, whereas scenarios-based students did not because faculty always maintained co-presence.

There were also similarities and differences in the types of guidance students received. For example, skills-based and scenario-based students were guided by the process of the structured interventions they engaged in, and they received similar types of verbal and physical guidance from faculty such as modeling and the use of gesture to augment verbal descriptions.

However, sources of guidance differed as well. For example, students in skills-based simulations were solely guided by the structured intervention of the EFAST exam. Meanwhile, students assigned to scenario-based simulations were guided by multiple structured interventions (e.g., EFAST exam, trauma assessment). In addition, scenarios-based students' activities received added guidance from the narrative enacted by the SPs and ESPs.

An additional difference manifested itself in how faculty sequenced their guidance. Faculty in the skills-based group split their time between both students. They began by observing and questioning, and then offered diverse types of verbal and physical guidance before moving to the second student. Meanwhile, faculty in scenarios sequenced their guidance by shifting between observation and side-by-side participation in patient care, and providing explicit guidance. When students engaged in an activity they were able to accomplish alone, faculty transferred independence to the student and observed. However, when students struggled, faculty increased their presence by moving closer to the student, providing guidance, and then reducing their presence and guidance as students' needs declined. ESPs also gave students guidance (e.g., engaging faculty in patient care-related discourse, administering medications), whereas students assigned to skills-based simulations did not receive guidance from ESPs.

Although students in both groups experienced constraints, their occurrences differed. For example, students in skills-based simulations experienced constraints in accessing faculty when they needed help because the faculty member was engaged with the other student. By contrast, students in the scenario-based group had limited chances to repeat EFAST exams because of the complexity of implementing the scenario.

Table 9 presents a summary of the types of guided participation identified in these skills-based and scenario-based simulations.

Table 9

Comparative Summary of Activities and Guided Participation in Skills-Based and Scenario-Based Simulations

Theme	Category	Skills-Based Simulations	Scenario-Based Simulations
Participation	Joint Participation	Joint participation with faculty and peers	Joint participation with faculty, peers, SPs, and ESPs
	Independent Participation	Independent participation	None
Guidance	Scenario Narrative	None	Scenario narrative
	Structured Interventions	EFAST	EFAST, Trauma assessment, Team communication, and Patient safety practices
	Verbal Guidance	Description, Elaboration, Encouragement, Questioning	Descriptions, Elaboration, Encouragement, Questioning
	Physical Guidance	Joint participation of structured interventions	Joint participation of structured interventions
	Who Provided Guidance	Faculty, peers	Faculty, ESPs (e.g., nurse, trauma surgeon)
	Constraints	Access to faculty when help was needed	Access to practicing the EFAST

What Students Reported Learning

The second research question was, "What do student health care professionals report they learn from participating in skills-based or scenario-based simulations?" First, I reviewed students' written statements about what they learned, and then I conducted open coding to generate initial categories for students' responses. After I grouped these initial codes into categories, I compared them across skills-based and scenario-based simulations. Categories included these instances:

Processes of the EFAST - Students reported learning about the structured intervention of the EFAST exam, or the use of tools that were necessary for performing the EFAST exam (e.g., ultrasound device, probe).

Interpretation of EFAST images - Students reported focusing on identifying anatomical landmarks on the body of the patient or on the screen of the ultrasound device.

Integrating diagnostic findings into patient care - Students wrote about how they sequenced the EFAST exam with other structured interventions (e.g., trauma assessment, team communication).

Team and patient communication - Students reported focusing on interpersonal interactions with other participants in the simulation, such as the nurse or other physicians.

Self-regulation - Students indicated having learned something about their own practice or performance behaviors

Table 10 presents each theme, including key terms that I used to categorize students' statements, and sample responses.

Table 10

Participant Self-Reports of Learning Categories

Category	Key Terms	Example Responses
Processes of EFAST	*Probe placement, image improvement*	*"I've learned more detail about where to place and manipulate the probe."*
Interpretation of EFAST images	*Finding structures, recognize positive & negative scans, identify images*	*"The most helpful thing I learned was how to better identify the on-screen images."*
Integrating diagnostic findings into patient care	*Steps of assessment, holistic, integration, lung sounds*	*"I improved upon integrating EFAST into a more holistic assessment."*
Team and patient communication	*Healthcare team, physicians & nurses, give report, communicate*	*"I learned how to better interact as a member of a healthcare team that includes both physicians and nurses."*
Self-regulation	*Envision, planning, think-aloud, attention, help, self-confidence*	*"I learned how to envision how I would approach the test."*

What skills-based students reported they learned. Self-reports of students in skills-based simulations included accounts about the processes of EFAST exam, interpretation of EFAST images, and self-regulation. Following the first practice session, all four students reported learning about processes of the EFAST exam. Three of four students reported learning how to interpret EFAST images. One student commented on self-regulation. She wrote, *"I learned how to envision how I would approach the test."*

Following the second skills-based practice session, students' self-reports of learning themes included processes of EFAST exam, interpretation of EFAST images, and self-regulation. Three of four students reported that they continued to learn more about process of the EFAST exam. Two of four students emphasized learning how to interpret the EFAST images they had obtained. One participant commented on self-regulation. He wrote, *"I learned how important high quality practice is, to ask for help, and to be confident in one's abilities."*

What scenario-based students reported learning. Self-reports of learning included accounts of EFAST exam processes, interpretation of EFAST images, integrating diagnostic findings into patient care, team and patient communication, and self-regulation. During the first practice session three of four students reported having learned about EFAST exam processes. All four students reported having learned how to interpret EFAST images. Two students reported having learned about self-regulation. One student reported learning about team and patient communication. One student reported learning how to integrate diagnostic findings into patient care.

Following the second scenario-based practice session, students' self-reports of learning categories included processes of EFAST exam, integration of diagnostic findings into patient care, team and patient communication, and self-regulation. Two of four students reported that they continued to learn more about processes of the EFAST exam. Two of four students emphasized learning how to integrate diagnostic findings into patient care (e.g., including EFAST images and lung sounds). One participant commented on self-regulation. He wrote, "*I learned that I have a habit of dividing my attention and asking questions but not listening to answers.*"

Summary. There were similarities and differences in what students reported having learned by participating in skills-based and scenario-based simulations. Table 11 presents a comparative summary of what skills- and scenario-based students reported learning and their frequency. Students in both groups reported learning about processes of the EFAST exam, interpretation of EFAST images, and self-regulating their practice. In addition, students in both groups also reported that they learned how to self-regulate their practice. However, scenario-based students also reported learning about team and patient communication, and how to integrate diagnostic findings into patient care.

Table 11

Comparative Summary of Categories and Frequency of Skills- and Scenario-Based Students Self-Reports of Learning

	Skills-Based Students		Scenario-Based Students	
Session	1	2	1	2
Processes of EFAST	4	3	3	2
Interpretation of EFAST images	3	2	4	0
Integrating diagnostic findings into patient care	0	0	1	2
Team and patient communication	0	0	1	0
Self-regulation	1	1	2	**1**

Students' Self-Efficacy for EFAST and Pretest/Posttest EFAST Performance.

My third research question was, "Are there between-group differences in student healthcare professionals' self-efficacy (SE) for learning or performance of the EFAST exam?" To evaluate patterns in skills- and scenario-based students' self-efficacy, I used descriptive statistics to analyze students' repeated measurements of self-efficacy for EFAST inventories, and pretest/posttest EFAST performance.

Pretest. Prior to the pretest, students in skills-based simulations rated their SE for knowing when to perform the EFAST exam as (M = 15.00, SD = 10.80), with scenario-based students rating their SE numerically higher (M = 18.75, SD = 16.50). For processes of the EFAST exam, skills-based students rated their SE as (M = 8.25, SD

=13.20), with scenario-based students rating their SE numerically higher (*M* = 10.75, *SD* = 7.27). For interpretation of images obtained, skills-based students rated their SE as (*M* = 6.56, *SD* = 9.92), and scenario-based students rated their SE numerically higher (*M* = 7.81, *SD* = 8.16). For integrating findings from EFAST exam into patient care decisions, skills-based students rated their SE as (*M* = 12.50, *SD* = 12.58), with scenario-based students rating their SE numerically lower (*M* = 10.00, *SD* = 8.16).

Practice Session 1 acquisition stage. Prior to Practice Session 1, students in skills-based simulations rated their SE for when to perform an EFAST exam as (*M* = 46.25, *SD* = 23.58), and scenario-based students rated their SE numerically lower (*M* = 55.25, *SD* = 13.00). For processes of the EFAST exam, skills-based students rated their SE as (*M* = 46.00, *SD* = 19.33), and scenario-based students rated their SE numerically higher (*M* = 54.75, *SD* = 16.10). For interpretation of images obtained, skill-based students rated their SE as (*M* = 30.32, *SD* = 13.52), and scenario-based students rated their SE numerically lower (*M* = 29.37, *SD* = 15.30). For integrating findings from an EFAST exam into patient care decisions, skills-based students rated their SE as (*M* = 43.35, *SD* = 18.64), and scenario-based students rated their SE numerically higher (*M* = 49.98, *SD* = 11.55).

Practice Session 2 of the acquisition stage. Prior to Session 2, skills-based students rated their SE for identifying when to perform an EFAST exam as (*M* = 71.25, *SD* = 14.93), and scenario-based students rated their SE numerically higher (*M* = 76.23, *SD* = 8.53). For EFAST exam processes, skills-based students rated their SE as (*M* = 68.25, *SD* = 1.50), and scenario-based students rated their SE numerically higher (*M* =

69.12, *SD* = 7.70). Skills-based students rated their SE for interpretation as (*M* = 67.81, *SD* = 4.10), and scenario-based students rated their SE numerically lower (*M* = 60.56, *SD* = 4.20). For integrating findings from an EFAST exam into patient care decisions, skills-based students rated their SE numerically higher as (*M* = 72.50, *SD* = 11.02), and scenario-based students rated their SE numerically lower (*M* = 70.83, *SD* = 8.75).

Posttest. Prior to the posttest, skills-based students rated their SE for identifying when to perform an EFAST exam as (*M* = 83.75, *SD* = 9.46), and scenario-based students rated their SE numerically higher (*M* = 85.00, *SD* = 5.77). For processes of EFAST exam, skills-based students rated their SE as (*M* = 80.25, *SD* = 4.50), and scenario-based students rated their SE numerically higher (*M* = 84.87, *SD* = 1.60). For interpretation of images obtained, skill-based students rated their SE as (*M* = 79.37, *SD* = 3.89), and scenario-based students rated their SE numerically lower (*M* = 74.84, *SD* = 5.60). For integrating findings from an EFAST exam into patient care decisions, skills-based students rated their SE as (*M* = 77.52, *SD* = 10.67), and scenario-based students rated their SE numerically higher (*M* = 86.67, *SD* = 5.4).

Table 12 presents students' mean scores and standard deviations for Sessions 1- 4. Figures 9 and 10 depict visual trends of how students' self-efficacy for EFAST exam changed throughout the study.

Table 12

Descriptive Statistics of Repeated Measures Self-Efficacy for EFAST for Skills-Based and Scenario-Based Students

		Skills-Based				Scenario-Based			
Session		1	2	3	4	1	2	3	4
Identify	*M*	15.00	46.25	71.25	83.75	18.75	55.25	76.23	85.00
	SD	10.80	23.58	14.93	9.46	16.50	13.00	8.53	5.77
Processes	*M*	8.25	46.00	68.25	80.25	10.75	54.75	69.12	84.87
	SD	13.20	19.33	1.50	4.50	7.27	16.1	7.70	1.6
Interpretation	*M*	6.56	30.32	67.81	79.37	7.81	29.37	60.56	74.84
	SD	9.92	13.52	4.10	3.89	8.16	15.3	4.20	5.6
Integration	*M*	12.5	43.35	72.5	77.52	10.00	49.98	70.83	86.67
	SD	12.58	18.64	11.02	10.67	8.16	11.55	8.75	5.4

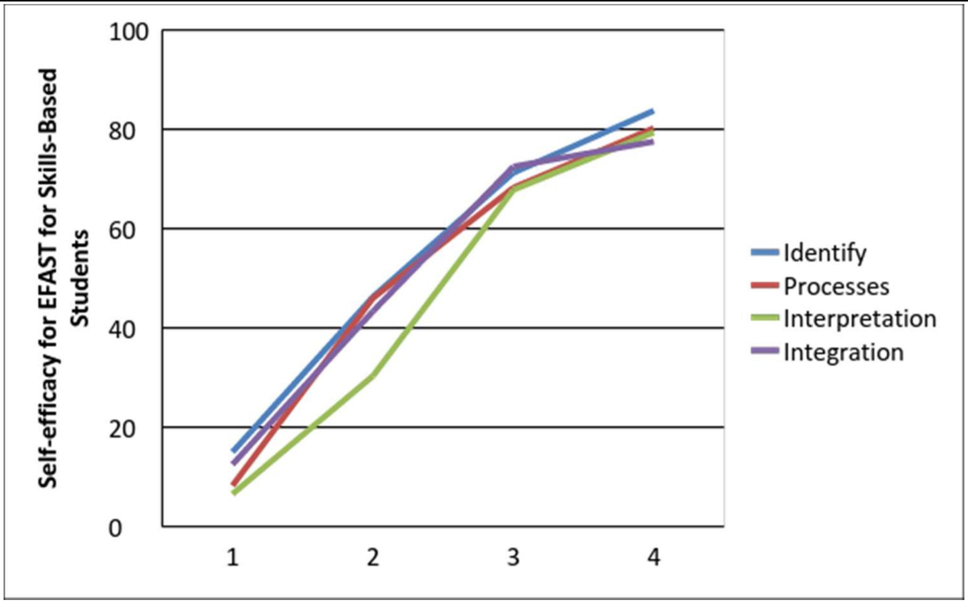


Figure 9. Plot of mean self-efficacy for EFAST sub-scales for skills-based students across four sessions.

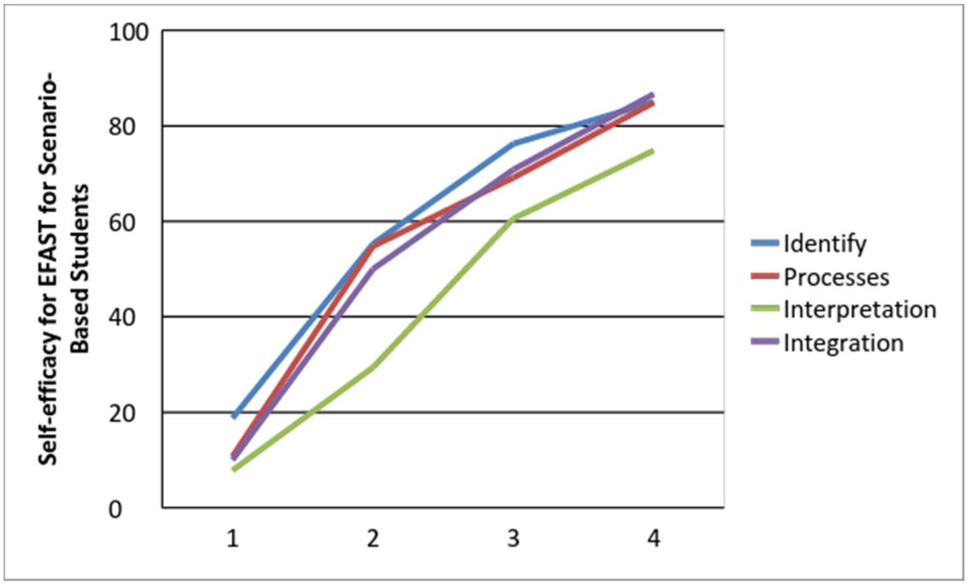


Figure 10. Plot of mean self-efficacy for EFAST sub-scales for scenario-based students across four sessions.

EFAST pretest/posttest performance. Skills-based participant pretest scores were (M = 1.71, SD = .42), and scenario-based students pretest scores were numerically similar (M = 1.71, SD = .31). Skills-based participants posttest scores were (M = 3.71, SD = .45), and scenario-based students' posttest scores were numerically lower (M = 3.42, SD = .78).

Summary. The data supports research question three, indicating that there were differences in SE for EFAST between skills-based and scenario-based groups. All students reported having increased self-efficacy scores throughout the study. Notably, prior to practice Session 2 of the acquisition stage, scenario-based students rated their SE for identifying when to perform an EFAST exam and the processes of the EFAST exam numerically higher than did skills-based simulation students. However, scenario-based students rated their SE for interpretation of EFAST images numerically lower than skills-based students. In addition, prior to Session 2, skills-based students rated their SE for integrating EFAST findings into patient care numerically higher than did scenario-based students. Prior to the posttest, skills-based students rated their SE for identifying when to perform an EFAST, the process of conducting an EFAST exam, and integrating EFAST findings into patient care numerically lower than did scenario-based students. Scenario-based students continued to rate interpretation of EFAST images numerically lower than did skills-based students. Students in skills-based and scenario-based treatment groups had similar pretest scores. Skills-based students' posttest scores were numerically higher than those of scenario-based participants.

Chapter Five

The purpose of this study were twofold: (a) to examine how learning was supported in skills- and scenario-based simulations used to teach the EFAST exam; and (b) to examine how differences in simulation contexts influenced students' self-reports of learning, self-efficacy for EFAST, and pre-/posttest performance of the performance assessment. In the sections that follow, I summarize key findings, discuss these findings in relationship to prior research, address educational implications and limitations, and close with suggestions for future research.

Summary of Key Findings

How students engaged in simulations. With respect to the first research question, the findings show similarities and differences in how students engaged in skills- and scenario-based simulation contexts. Similarities encompass what students practiced, the tools they used to practice, and guided participation. The activity analysis revealed that students in both groups partook in repeated opportunities to practice the EFAST exam. In addition, students used similar tools during their practice, including the ultrasound device, probe, and gel. Students in both groups practiced scanning standard patients and a positive EFAST model.

The analysis drawn from guided participation revealed that students in both groups gained access to hands-on practice of the EFAST, as well as opportunities to observe others performing the exam. For example, students in skills- and scenario-based simulations engaged in side-by-side participation, during which students and faculty, and students and peers worked together to scan and identify ultrasound images. In addition, during side-by-side participation in both types of simulations, faculty offered similar types of guidance (i.e., a combination of verbal and physical forms). Lastly, when faculty offered guidance, they tailored it to the needs of the individual student.

Despite these similarities, differences in students' engagement were notable. They included the types of activities students engaged in, the tools they accessed, frequency and distribution of practice, and guided participation. For example, the activity analysis showed that students in scenario-based simulations performed multiple structured interventions, such as conducting a trauma assessment and partaking in team-related activities, while also practicing the EFAST exam. Students in scenarios used a wider range of tools, which included diagnostic findings such as wound patterns, vital signs, and laboratory reports. Additionally, students assigned to scenarios engaged in sequencing the trauma assessment, the EFAST exam, and team-related interactions, whereas skills-based students did not. This resulted in scenario-based students having the added opportunity to learn how and when to integrate the EFAST exam, as well as how to interpret diagnostic findings to make decisions about the patient's future care.

Furthermore, simulation context influenced how frequently students practiced the EFAST exam. For instance, students assigned to skills-based simulations engaged in the focused and repeated practice of the EFAST, during which they completed multiple scans (defined as performance of all six views) during each simulation session. As a result, skills-based students engaged in more total practice time of the EFAST when compared to students assigned to scenarios. By comparison, students assigned to scenario-based simulations performed up to one EFAST per scenario, with repetition distributed across four sequential scenarios. Therefore, context significantly influenced students' activities, the tools to which they gained access, and the duration and frequency of their practice of the EFAST exam.

Several differences in guided participation were apparent as well. Differences included the types of guidance available, how faculty sequenced their guidance, and the types of participation in which students engaged. For example, although students in both contexts received guidance from faculty about the processes of the EFAST exam, students assigned to scenarios received guidance from additional sources, including the scenario narrative and the steps of additional structured interventions (e.g., trauma assessment, patient safety practice). These additional forms of guidance served to focus and scaffold students' activities. However, I also noted examples of when the pace of the scenario disrupted students' rhythm as they practiced, thus revealing a constraint associated with the use of scenarios.

There were also differences in the types of participation in which skills- and scenario-based students engaged. For instance, during side-by-side participation, faculty *sequenced* their guidance differently. During skills-based simulations with dyads, faculty split their time between the students such that students received guidance when faculty were available. This arrangement occasionally resulted in instances in which students' access to faculty guidance was constrained. By comparison, faculty always maintained co-presence with students during side-by-side participation. During this time, students maintained independence until they needed help, at which time, faculty stepped in, provided guidance, and then returned independence to the student.

Moreover, although students in both groups engaged in observation, there were differences in terms of whom students observed, the quantity of observation, and the activities that students observed. For example, students in skills-based simulations primarily engaged in observation of their peers, and engaged in longer periods of observation when compared to students assigned to scenarios. These differences occurred because students in skills-based simulations engaged in taking turns while scanning together. Additionally, when faculty modeled, they usually scanned a single view of the EFAST rather than all six views. This resulted in less time to observe faculty.

By contrast, scenario-based students engaged in less observation time, yet they had access to more sources of observation. Scenario-based students didn't engage in observation as frequently because they regularly assumed a role in supporting patient care. When they did observe, scenario-based students observed faculty, peers and, interestingly, ESPs. When observing faculty members and peers, students watched their performance of the EFAST as well as their care of the patient. For example, students observed faculty when they scanned the patient, when they interpreted and explained diagnostic findings to the patient, and when they gave handoff report to the trauma surgeon (enacted by an ESP). Students also observed ESPs when they engaged in an activity such as when one of the nurses administered a medication. Thus, scenario-based students observed more diverse activities. Furthermore, simulation context significantly influenced how students engaged in skills- and scenario-based simulations.

What students reported having learned. With respect to the second research question, which examined what students reported learning, the findings also show similarities and differences. For example, students in both groups reported learning about the steps and processes of the EFAST. However, students in scenario-based simulations reported learning about how to participate as a member of the healthcare team, and gained an understanding of their contribution to patient care in addition to learning about the EFAST. Thus, simulation context also influenced what students reported having learned.

Students Self-efficacy for EFAST and pretest/posttest findings. With respect to the third research question, the findings show differences in skills- and scenario-based students' self-efficacy for EFAST. For example, students assigned to scenario-based simulations consistently rated their self-efficacy lower than did skills-based students, especially for EFAST interpretation. Moreover, although both groups experienced improvements in their post-test performance of the EFAST exam, the scores of students in the skills-based simulation group were numerically higher than those of students assigned to scenario-based practice.

Implications for Theory

How simulations support learning. The quantitative and qualitative data from the activity and guided participation analysis suggests that learning was supported by these multiple sources: access to hands-on practice of clinically relevant activities (e.g., EFAST exam), repeated practice, and diverse social arrangements (e.g., joint participation, observation). These findings are consistent with a review conducted by Cook et al. (2013), who concluded that learning in simulations is likely the result of multiple factors.

In addition, the quantitative findings from the activity analysis indicate that students in both groups engaged in repeated practice of the designated exemplar skill. These findings are consistent with both Issenberg et al.'s (2005), and McGaghie et al.'s (2009) reviews, which state that simulation-based learning enables students to engage in repeated practice. Importantly, this study extends our understanding of how simulation context influences how students engage in repeated practice, and how repeated practice is distributed over more than one session.

Moreover, the qualitative findings derived from my analysis of guided participation suggest that simulations enable diverse social arrangements, such as peer-peer and student-faculty joint participation. These findings are consistent with Dieckmann et al., (2007a), Dieckmann et al. (2007b), and Kneebone (2009), who suggest that simulations involve complex social interactions.

Furthermore, this study's careful attention to the interpersonal arrangements of students and faculty reveal that when students engaged in joint participation, faculty provided a combination of verbal and physical guidance. The instances of physical and verbal guidance faculty employed are similar to those of Rogoff (1995) and Kirshner (2008), who found that during joint participation, learning was supported when more knowledgeable others structured and focused the practice of novices.

In addition, verbal and physical guidance also acted as a bridge to students' participation, allowing them to engage more fully in complex activities that were beyond their independent capability. This is constant with Rogoff (1995) and Zimmerman and McClain (2015) who found that when adults provided verbal and physical forms of guidance during joint participation, it allowed children to engage in activities beyond their independent ability. These findings are also consistent with Vygotsky's (1978) concept of the *zone of proximal development*, which Vygotsky defines as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86).

Furthermore, Rogoff (1990) and Rogoff, Paradise, Arauz, Correa-Chávez, & Angelillo (2003) indicate that guidance also serves to provide novices with access to the mature practices of more knowledgeable others during joint participation. For example, the guided participation analysis revealed that faculty members' use of verbal guidance included instances of elaboration to highlight or to describe the ways in which to obtain a scan or interpret an image. Verbal guidance was often accompanied by physical forms of guidance such as the use of gesture or modeling. During these instances, faculty often guided students as they worked jointly to obtain ultrasound images, or as they worked to interpret the images they had obtained. For example, faculty helped students improve their interpretation strategies by gesturing to the ultrasound screen to bring attention to specific characteristics of the images that were of diagnostic significance.

Apprenticeship. The findings the activity analysis and the guided participation analysis are also consistent with apprenticeship theories of learning. A central argument to this approach is that development and learning emerge through participation in culturally mediated, historically grounded, practical activity involving cultural practices and tools (Lave & Wenger, 1991; Rogoff, 1990). Apprenticeship learning emphasizes skill advancement and increased understanding for newcomers as a byproduct of interaction and participation with more knowledgeable others (Lave and Wenger, 1991). These arrangements often include a prescribed pathway that novices take as they gain skills and progress from newcomers to more knowledgeable members of their community.

For example, Issenberg et al. (2005), and McGaghie et al. (2008) indicate that an added feature and benefit of simulations are that they provide structured opportunities for novices to learn clinically relevant skills. In addition, the findings from the guided participation analysis reveal that one of the ways this may be achieved in simulations is when faculty structured students' activities. For example, the activity analysis revealed that there were instances where faculty either modeled a component of the EFAST exam or the full exam during the first simulation sessions. However, there was also evidence that faculty altered their guidance over time as students gained greater skill. For example, faculty engaged in no instances of modeling during the second simulation sessions.

Informal learning opportunities. Although the goals for each skills- and scenario-based simulation session were designed in advance of implementation, the qualitative and quantitative data from the activity and guided participation analysis suggests that there were instances when students' participation included their learning about non-EFAST topics (e.g., communication with a trauma surgeon). These instances share similarities with what Rogoff (1990) and Rogoff et al. (2003) refer to as tacit learning experiences, which includes opportunities to partake in the everyday activities of a community. For instance, the activity analysis revealed that students in scenarios were able to partake in the everyday activities of patient care, such as diagnosing and treating patients. Rogoff (1990) indicates that participation in tacit lessons allow people to learn about their community and its unspoken values. Subsequently, this may have contributed to reports from scenario-based students that they learned about the broader practice of patient care.

This informal participation also shares some similarities to what Paradise & Rogoff (2009) call "learning by observing and pitching in" (Paradise & Rogoff, 2009, p. 104). Learning by observation and pitching in involves belonging to a community, and participating in the community through watching, listening, and attending to regular ongoing daily activities (Paradise & Rogoff, 2009). By contrast, it differs from apprenticeship forms of learning, which emphasize participation in more structured activities and where progress is made through more predictable steps and processes.

For example, students' engagement in simulations varied throughout the simulation sessions, especially as they became more familiar with the rules of participating in simulation sessions. Furthermore, students shifted their roles from working jointly with faculty, to observation of faculty. At other times, students watched their peer's practice, while in other instances, peers sought opportunities to work jointly with other peers to scan and identify images.

Furthermore, one of the more interesting findings from this study suggests that students may also benefit from social interactions and observation of the skillful activity of ESPs when they perform their roles in a clinically consistent way. For example, by observing ESPs, students in scenarios may have also gained access to learn about the mature practices of nurses and the trauma surgeon when they observed their performances. Importantly, this did not mean that students weren't participating or that their learning was constrained. Rather, Rogoff et al. (2003), suggest that attending to the skilled activities of others by watching is also an important learning activity. Furthermore, Rogoff et al. (2003) indicates that when people observe an activity that they are likely to perform in the future, learning is bolstered because of their anticipation to put what they have witnessed into practice.

The influence of simulation context. The findings from this study contribute important contextual details about *how* skills- and scenario-based simulations support learning. Furthermore, the comparative findings offer important insight into how *differences* in skills- and scenario-based simulation context influenced learning, particularly with regard to the types of activities students had access to, such as repeated practice, and interactions between students and faculty. Lastly, there was evidence that suggested that these contextual differences may have influenced students SE for EFAST.

How learning in skills- and scenario-based contexts was similar. The principal similarity in learning opportunities stemmed from the fact that participants in both groups engaged in an authentic problem or task. Learning how to perform an EFAST exam and learning about the principles of ultrasound are highly relevant to medical practice. In addition, skills-based and scenario-based simulations created opportunities for participation by novice student healthcare professionals even though they had little prior experience with ultrasound.

In addition, the activity analysis indicates that students in both groups engaged in repeated practice of the designated exemplar skill. This analysis is consistent with both Issenberg et al.'s (2005), and McGaghie et al.'s (2009) reviews, both of which indicate that simulation-based learning enables students to engage in repeated practice.

Furthermore, students in both groups partook in the culturally relevant activity of the EFAST exam using some of the same culturally relevant tools, such as the ultrasound device, probe, and gel. When engaged in joint participation, faculty structured students' actions by giving regular physical and verbal guidance. Moreover, they engaged in joint participation with faculty, during which faculty structured students participation, which served as a bridge to students learning the EFAST procedure. Additionally, students were exposed to the mature scanning, interpretation, and practice strategies of faculty.

Lastly, although students gained access to practice and guidance from faculty, students in both groups experienced constraints in their practice. For example, employing one faculty member per two students in skills-based simulations resulted in all students experiencing delays in gaining access to guidance. By comparison, scenario-based students had ready access to faculty, but scenario complexity and pace resulted in some students missing opportunities to practice the EFAST. Thus, even though simulations are often viewed as reliable and predictable by many simulation experts (e.g., Jeffries, 2005; Ziv et al., 2007), simulations also present simulation stakeholders with the need to attend to how constraints may influence student participation.

How learning in skills- and scenario-based simulation contexts differed. Unique to skills-based simulations is their affordance of access to intense, focused practice of the EFAST. These findings are consistent with McGaghie et al. (2006), and Reznick and MacRea (2006) who emphasize that participation in skills-based simulations affords access to focused practice of designated skills. This intense focused practice was exemplified by students' activities and their interpersonal interactions with faculty and peers. For example, by removing students' access to other activities and culturally relevant tools (e.g., caring for a patient, diagnostic findings), students and faculty were able to devote their full attention to the EFAST exam. This allowed students to perform multiple EFAST scans and obtain and interpret multiple ultrasound images during each session.

By contrast, scenarios afforded students with access to a more robust opportunity to engage in the cultural activities of healthcare practice, which is consistent with Dieckmann et al. (2007a), and Jeffries (2005) who have suggested that participation in scenarios more closely resembles the social practice of clinical experiences. This was exemplified when students assigned to scenario-based simulations, participated in solving the emergent problems that are a part of daily clinical practice, such as determining a patient's diagnosis, deciding on a course of care, and collaborating with other healthcare providers.

Students' participation in these added activities were made possible because scenarios afforded access to the types of diagnostic data that are included in day-to-day patient care, such as vital signs, lab reports, and ultrasound images. These findings are also consistent with findings from Battista & Sheridan (2014), which found that participation in scenario-based simulations affords participants access to opportunities to partake in multiple types of clinically relevant activities while using culturally relevant tools. Together with faculty and ESPs, students were able to aggregate and interpret diagnostic findings to come to a conclusion about a patient's status. Thus, scenario-based students were able to participate in diverse types of culturally valued activities that extended beyond focused practice of the EFAST.

Similarities and differences in self-efficacy for EFAST. Although not explicitly pursued during this study, the qualitative and quantitative findings from the activity and guided participation analysis also suggest that students' gains in self-efficacy were supported as they engaged in a combination of enactive mastery learning experiences, vicarious learning experiences, and as they received verbal and social support. These findings are consistent with Bandura's (1997) theory of how people's self-efficacy is developed, and are also consistent with Nishisaki et al.'s (2007) hypothesis that simulations support gains in self-efficacy.

For example, during the acquisition stage of this study, students in skills- and scenario-based simulations engaged in mastery opportunities, which Bandura (1997) indicates are the most important antecedents of self-efficacy. The activity analysis indicated that students in both groups gained access to practice the EFAST with the purpose of improving their performance, rather than being scored or rated against pre-determined performance criteria. In addition, students' access to repeated opportunities to practice the EFAST during each session may have afforded them with the opportunity to regularly reassess their skills and make judgments about their progress. According to Bandura (1977), regular access to reassess ones performance is an important factor in development of self-efficacy beliefs.

Moreover, students in both groups may have partaken in vicarious learning experiences, which Bandura (1997) indicates are also important antecedents of self-efficacy. For example, the activity analysis indicates that students in both groups observed their peers, which could have provided students with additional opportunities to compare their performance. Finally, the guided participation analysis revealed that one of the sources of verbal guidance included verbal encouragement from faculty. Therefore students SE for EFAST could have been further bolstered when faculty provide them with verbal encouragement.

However, by contrast the self-efficacy findings indicated that there were differences in skills- and scenario-based students SE for interpreting EFAST images. Specifically, students assigned to skills-based simulations reported higher SE scores for interpretation of EFAST images than students assigned to scenarios. These results may have occurred as a result of differences in the sources of self-efficacy available to students in skills- and scenario-based simulations. For example, the activity analysis indicated that skills-based students had more opportunities to practice the EFAST exam during each session when compared to scenario-based students. For skills-based students, repeated practice occurred during each session and well as was distributed over the two sessions. Thus, skills-based students may have had more opportunities to re-evaluate their EFAST performance and skills as they partook in repeated practice cycles.

Furthermore, the activity analysis indicated that students in skills-based simulations had access to more opportunities to observe their peers practicing than did scenario-based students. In addition, there were instances in both skills-based sessions where students verbally expressed a desire to observe their peers, rather than practice independently or work with faculty. According to Bandura (1997) peers access to observe each other provides students with the opportunity to compare their performance with others of a similar ability. Viewing the performance of a similar other succeed typically raises self-efficacy beliefs in the observer, because they then persuade themselves that if their peer ca do it, so can they(Bandura, 1997).

Taken together, the findings from this study suggest that simulation based learning are intermediate learning environments that allow students to partake in learning clinically relevant skills, while also learning about the cultural historical practices of healthcare. In addition, simulations may also provide students with a unique opportunity to partake in activities that are relevant to their lifetime practice of healthcare. Of note in this study were self-regulation and observation. For example, many students in this study revealed that they gained insight into their own self-regulated practice habits, while also learning about the EFAST. Though not as easily captured on a checklist or performance assessment, most social-cognitive researchers agree that students who are self-regulated are more successful in their studies and in life. Moreover, during participation in both skills- and scenario-based simulations, students had the benefit of observing a wide variety of activities conducted by peers, faculty, and ESPs. Observation of faculty provided students with the opportunity to notice what they may not have known to look for, while observing peers may have served to bolster their self-efficacy. In addition, students assigned to scenarios had the additional benefit of observing how nurses and other physicians partook in patient care, which contributed to their gaining an understanding of their role as a member of the healthcare team. Thus, not only are simulations valuable because they give vital experience of the complexity of the clinical experiences future medical professionals will encounter, but the implications of participating in simulations may be more extensive than previously thought.

Recommendations

Drawing on the findings from this study, I recommend five principles for simulation designers and educators who promote or design simulations and SBL. I present these a principles so that they may appeal to a broader variety of simulations, or participant populations.

Provide access to the tools and props that will support students' access to the cultural and historical practices of healthcare. Historically, simulation stakeholders have sought to ensure that a simulated task model is an accurate replica of the object it is intended to represent (Dieckmann et al., 2007b). Similarly, designers of scenarios also seek to create a setting that accurately represents the clinical context they are attempting to reproduce. Frequently, simulation stakeholders have attempted to model fidelity as a way to ensure that when students engage in practice, the model does not cause the learner to develop skills that may be detrimental to actual clinical practice. For example, a surgical suturing block that does not perform similarly to skin may influence the learners' perception of how skin tissue actually behaves when sutured.

However, the findings from this study suggest that students' access to culturally relevant tools and props supports more than access to an accurate model; it influences the types of clinically relevant activities they engage in. For example, students in skills- and scenario-based simulations improved their EFAST skills when they had access to a variety of SPs and models. This way, students were able to scan SPs with different types of body habitus, which we learned was important during the design phase of the curriculum. When students had access to the ultrasound device, they were able to learn about knobology, as well as proper probe orientation and depth. Furthermore, students in scenario-based simulations were able to partake in complex clinical decision-making because they had access to a wide variety of tools and artifacts that they could discover and interpret, such as a wound care patterns, patient history, vital signs, lab reports, and ultrasound images. Thus, the purpose of these tools and artifacts was not merely to make the setting more realistic, they supported students' participation in the clinically relevant activities of providing care. Moreover, students' access to culturally relevant tools and artifacts also allowed them to participate in the cultural and historical practices associated with those tools and artifacts (Rogoff, 1990), thus further inculcating them into the social practice of medicine.

Provide access to mature participation practices. One of the reasons simulations were initially accepted is because they were framed as an instructional strategy that affords students with opportunities to receive feedback from expert faculty (Issenberg et al., 2005; McGaghie et al., 2008; Ziv et al., 2007). However, findings from this study revealed that faculty did more than assess student's abilities and provide correctional feedback. Instead, students benefited greatly when they had the opportunity to partake in shared endeavors with faculty as they worked collaboratively. During this time, faculty provided a combination of verbal and physical guidance to help students improve their scanning and interpretation skills.

For example, during both skills- and scenario-based simulations faculty provided verbal and physical guidance to students, which helped them learn the processes of the EFAST exam. In skills-based simulations, faculty were able introduce students to more advanced ways of obtaining high-quality images, and how to interpret them. By comparison, in scenarios, faculty helped students integrate the EFAST exam into the process of patient care, determine which diagnostic tests would be helpful, interpret diagnostic findings, and make decisions about care trajectory. Thus, the key principle here is for designers to include opportunities for access to more mature practices rather than limiting the role of mature practitioners to the provision of corrective feedback.

Be thoughtful about how ESPs are trained and enact their roles. Sanko, Shekhter, Kyle, and Birnbach (2015) suggest that when planning, evaluating, and implementing simulations, preparation of ESPs is often overlooked when compared to the preparation of SPs. The findings from this study suggest that ESPs have multiple contributions that warrant thoughtful consideration by simulation designers and educators. For example, in this study, ESPs played a critical role in supporting the scenario narrative, which served as an important form of guidance that structured and focused students' activities. Moreover, the findings also highlighted how students in scenarios carefully observed the actions of ESPs as they portrayed the roles of the nurses or trauma surgeons.

By portraying their role in a clinically accurate way, ESPs provided students with access to the mature participation practices of nurses and other physicians during the care of trauma patients. Therefore, students gained access to an opportunity to observe how these different professionals function as members of the healthcare team, as well as gain insight into the activities members assigned these roles may assume when engaged in trauma care. This opportunity likely contributed to reports from scenario-based students on learning about their role as a member of the healthcare team. Therefore, the key principle here is that designers and educators should carefully consider how ESPs are expected to portray their roles, how ESPs are prepared and trained, and ensure that ESPs have access to the tools and props they need to carry out these expectations.

Give careful consideration as to when to integrate skills- and scenario-based simulations into curricular design. Many of the studies conducted in medical simulations report the use of a single simulation genre, such as skills-based or scenario-based simulations, which are used to teach a specific skills (e.g., Cook et al., 2011). At the same time, many of these studies highlight the importance of both the ability to perform procedural skills safely and effectively, while acknowledging the importance of learning about the social context of healthcare. However, it remains unclear whether simulation curricula used in everyday practice incorporate a single genre or are designed to incorporate both genres of simulation.

The findings from this study highlight similarities and differences in how skills- and scenario-based simulations enable student access to different opportunities. For example, skills-based simulations afford student with access to intense focused practice of a designated exemplar skill; however, at the same time, students' access to opportunities to participate in the wider range of healthcare practice was constrained. By comparison, scenario-based simulations not only supported students learning and development of our designated exemplar skill, the EFAST, but they afforded students with access to learning how and when to perform the EFAST, and how to holistically integrate it into patient care. Nevertheless, students in scenarios were constrained in terms of their access to intense focused practice of the EFAST.

Therefore, the key principle here is to carefully consider the fuller range of simulation genres when making decisions about designing simulation curricula. Without this, access to one genre in favor of another, may lead students to miss out on important opportunities.

Provide greater detail about the social arrangements of faculty and peers when reporting on simulation interventions or publishing simulation curricula. One of the challenges faced during this study was identifying the different types of instructional arrangements made available to students in both skills-based and scenario-based simulations. For example, many studies report that students engage in specific types of simulations, yet, it remains unclear how students were grouped, how available or accessible faculty were, or what types of guidance students had access to during participation. Although, I found instances where some of these details were available, they were often limited. Nevertheless, the findings from this study and others (e.g., Cook et al., 2013) suggest that learning during participation in simulations is highly complex. Without adequate descriptions of simulation designs that include details about these types of arrangements, it will be more difficult for future researchers to examine and account for the impact and influence of different combinations of learning designs.

Limitations

Although my sample size does not allow me to generalize about the prevalence of students' activities and guided participation in simulations, it did support my goal of conducting an in-depth analysis of how students engaged in skills- and scenario-based simulation contexts. In addition, I employed a newly developed self-efficacy inventory for EFAST because I was unable to locate a scale that addressed the items faculty indicated were clinically important. The scale should undergo more testing and validation, but I believe that it served the purpose of this research well.

Furthermore, three of four students assigned to skills-based simulations reported that they had between 3 and 4 years prior patient prior patient care experience. This differed from students assigned to scenario-based simulations who indicated that they had between 1 and 2 years prior patient care experiences. Although students in both groups reported being ultrasound naïve, having prior certification as EMTs, and similar age ranges, this difference occurred as a result of the challenges associated with aligning students schedules with the schedules of faculty, the simulation lab, SPs and ESPs, and the equipment and supplied I required.

Another limitation was that my goal to examine guided participation in simulations does not include an in-depth analysis of students' and faculty's social interactions. Future in-depth analysis of students' and faculty's social interactions is warranted.

Last, my strategy of examining how students engaged in different simulation contexts necessitated excluding an analysis of how students prepared to engage during simulations, as well as an analysis of the contribution post-simulation debriefing made toward learning. Future efforts should take into account the contribution of students' preparatory activities and post-simulation reflections.

Future Directions for Research and Next Steps

This study describes some of the ways in which skills- and scenario-based simulations support learning. Additionally, the findings make explicit important details about how differences in simulation context influences students' activities and the types of guidance and support they receive. However, the findings also raise several questions about simulation instructional design practices, while simultaneously shedding light on how simulations support learning; these findings warrant further investigation. Future steps:

1. As previously acknowledged, my strategy of conducting in-depth analysis called for working with a small population. Future research should include a larger sample of study participants. In addition, my selection of student healthcare professionals represents a population who are currently undergoing their undergraduate training, yet simulations are regularly used to teach healthcare professionals at every stage of their career. Therefore, examining how simulations support learning across the progressive stages of a healthcare professional's career could reveal additional detail about how professionals learn over time. Such details could provide important insight at a time when simulations are increasingly employed for post-graduate education, and to re-credential and re-certify healthcare professionals for practice.
2. Although the strategy of this study called for the comparison of students' engagement in skills- and scenario-based simulations, I urge caution in assigning more value to one simulation context over another. My strategy in selecting these two contexts was to take advantage of the benefits of using comparison to make explicit how learning is supported in the two most commonly applied types of simulations. I do, however, encourage researchers and instructional designers to consider simulations as one of the many learning activities healthcare professionals engage in. To this end, another step should include examining how participation in different simulation contexts impacts student practice in the clinical setting, the classroom, and the other learning experiences that health professional students engage in (e.g., journal club, grand rounds). This may yield

important information about how simulations can be integrated more effectively into curricula for health professionals.

3. This work offers new ways of thinking about and describing instructional design choices, implementation practices, and instructional arrangements. For example, in this study, we made faculty available to students during their participation; however, many different types of instructional arrangements are currently employed. Future efforts should include the study of different types of instructional design practices to further advance our understanding of how to best design and implement simulation-based learning.

Appendix A

Georgetown University IRB Approval Letter

10/9/2014 https://eric.georgetown.edu/eric/Doc/0/SS1FP2QFJHAKV62PI6LJMQRU14/fromString.html

GEORGETOWN UNIVERSITY

Georgetown University Institutional Review Board

Date:	10/9/2014
To:	Alexis Battista
From:	Bertram Doyle Institutional Review Board
IRB #:	2014-0867
Title:	A Comparative Analysis of Skills Based and Scenario Based Simulations Using EFAST as an Exemplar Skill
Annual Approval Date:	9/12/2014
Expiration Date:	9/11/2015
Action:	Initial Review - Expedited

Attachments being reviewed: 10 documents were reviewed as part of this submission:

Document	Version
EFAST & Ultrasound Study Group Debreifing Prompts.docx	0.01
Simulation Participant Written Self Reflection Questionnaire.docx	0.01
EFAST & Ultrasound Study Video Recorded Simulation Characteristics.docx	0.01
Simulation and EFAST IRB of Record Determination Form.doc	0.01
EFAST and Recruitment Script.doc	0.01
Simulation and EFAST Educational_Research_ICF_Consent Form V3.doc	0.03
E-FAST POC Ultrasound Self-Efficacy Scale V4.docx	0.01
Ultrasound & Simulation Research Study Protocol V4.docx	0.01
Direct Observation of Procedural Skills.pdf	0.01
Demographics Questionaire for GERMS Population.pdf	0.01

Stamped Documents:

Document	Version
Simulation and EFAST Educational_Research_ICF_Consent Form V3.doc.pdf	0.01
EFAST and Recruitment Script.doc.pdf	0.01

The above-referenced protocol and consent form were approved through Expedited review by Dr. Robert Bies, IRB Chair or designee, on 10/9/2014. The IRB has determined that the research involves

https://eric.georgetown.edu/eric/Doc/0/SS1FP2QFJHAKV62PI6LJMQRU14/fromString.html 1/2 no greater than minimal risk and falls under the following expedited review categories:

Category 6. Collection of data from voice, video, digital, or image recordings made for research purposes.

Category 7. Research on:
(a) individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior), **OR**
(b) research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

This is to inform you that you may commence your project. Please note that this approval is granted through 9/11/2015.

This study will automatically become inactive when its approval expires on 9/11/2015 *unless* a continuing review submission is approved by the IRB before that date. The IRB requires that you submit an application for annual renewal at the end of each approval period and/or at study completion. It is the principal investigator's responsibility to submit the annual renewal application at least one month before the expiration date.

Any investigator whose project is externally funded must submit the applicable sponsor grant or contract for review and approval by the appropriate sponsored research office of the recipient institution (GU or MHRI). The project cannot proceed without the approval of the sponsored research office.

** If promotional advertisements will be used for patient recruitment, they must be submitted for IRB review and approval prior to their use.

** Any incentives for participation in research are subject to IRB review and approval as well.

Please remember to:

1. Seek and obtain prior approval for any modifications to the approved protocol.
2. Promptly report any unexpected or otherwise significant adverse effects encountered in the course of this study to the IRB within seven (7) calendar days. This includes information obtained from sources outside GU or MHRI that reveals previously unknown risks from the procedures, drugs, or devices used in this study.

Georgetown University IRB
Medical-Dental Building, SW104
3900 Reservoir Road NW
Washington, DC 20057
(202)687-1506 *telephone*
(202)687-4847 *facsimile*

Appendix B

George Mason University IRB Approval Letter

GEORGE MASON UNIVERSITY

Office of Research Integrity and Assurance

Research Hall, 4400 Univeristy Drive, MS 6D5, Fairfax, Virginia 22030
Phone: 703-993-5445; Fax: 703-993-9590

DATE:	October 14, 2014
TO:	Anastasia Kistantas, Ph.D
FROM:	George Mason University IRB
Project Title:	[668298-1] A Comparative Analysis of Skills Based and Scenario Based Simulations Using EFAST as an Exemplar Skill
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	October 14, 2014
EXPIRATION DATE:	October 13, 2015
REVIEW TYPE:	Expedited Review
REVIEW TYPE:	Expedited review categories 6, 7

Thank you for your submission of New Project materials for this project. The George Mason University IRB has APPROVED your submission. This submission has received Expedited Review based on applicable federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by the IRB prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to the Office of Research Integrity & Assurance (ORIA). Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed (if applicable).

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to the ORIA.

The anniversary date of this study is October 13, 2015. This project requires continuing review by this committee on an annual basis. You may not collect date beyond this date without prior IRB approval. A continuing review form must be completed and submitted to the ORIA at least 30 days prior to the

- 1 -

anniversary date or upon completion of this project. Prior to the anniversary date, the ORIA will send you a reminder regarding continuing review procedures.

Please note that all research records must be retained for a minimum of five years, or as described in your submission, after the completion of the project.

If you have any questions, please contact Bess Dieffenbach at 703-993-4121 or edieffen@gmu.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB's records.

Appendix C

Georgetown University Informed Consent Form

IRB # __2014-0867___
Title:_A Comparative Analysis of Skills Based and Scenario Based Simulations Using EFAST as an Exemplar Skill_
Page **1** of **8**

Georgetown University
Consent to Participate in Research Study

STUDY TITLE: **A Comparative Analysis of Skills Based and Scenario Based Simulations Using EFAST as an Exemplar Skill**

PRINCIPAL INVESTIGATOR: Alexis Battista **TELEPHONE:** (703-801-9811)

ADVISOR: Michael Antonis, MD

SPONSOR: None

INTRODUCTION

You are invited to consider participating in this research study. Please take as much time as you need to make your decision. Feel free to discuss your decision with whomever you want, but remember that ***the decision to participate, or not to participate, is yours***. If you decide that you want to participate, please sign and date where indicated at the end of this form.

If you have any questions, you should ask the researcher who explains this study to you.

BACKGROUND AND PURPOSE

Background:
The purpose of this study is to conduct a comparative analysis of learning processes and what is learned through participation in skills-based and scenario-based simulation environments using the Enhanced Focused Assessment using Sonography in Trauma (E-Fast) exam as an exemplar skill. While both simulation types are widely used, prior research has failed to disaggregate these unique learning environments; thus, little is currently known about how each setting contributes to learning.

Purpose:
This study is being done in order to help us learn more about how skills-based and scenario-based simulations support the learning process. We are also interested in learning if there are differences in what is learned between the two different environments. The purpose of this study is to conduct a comparative analysis of learning processes and what is learned through participation in skills-based and scenario-based simulation environments.

Name of IRB: Georgetown University Institutional Review Board
Approval Date: October 9, 2014
Expiration Date: September 11, 2015

Study Plan

You are being asked to take part in this study because you are a pre-hospital provider who has approximately one year of clinical practice. About 12-14 subjects will take part in this study at Georgetown University.

If you decide to participate in this study, you will be asked to:

1. Complete a demographics survey that evaluates your current knowledge about ultrasound and what your experiences have been so far with simulation based learning environments.

2. Complete a questionnaire asking about how confident you are in performing the EFAST ultrasound exam. You will be asked to complete this each time you come for a simulation training session. You will complete this questionnaire four times.

3. You will be asked to perform and interpret an EFAST ultrasound exam before and after you participate in the training sessions.

4. Attend two sessions to practice the EFAST ultrasound exam. You will be asked to practice performing an EFAST ultrasound. You will be provided with the tools necessary to learn EFAST which includes suggested readings, videos, and hands on participation in simulation.

5. During each session, you will work with a physician instructor who is an expert in performing and teaching the EFAST exam. They will provide you with instruction, model how to perform the EFAST assessment, and offer you guidance and feedback during your practice.

6. Complete a written reflection about your practice. You will be asked to do this after each of your practice sessions.

7. Participate in a post-event debriefing. During the debriefing sessions, we will ask you to reflect on your practice experiences, how you felt about your performance and what your goals were during practice. These sessions will be headed by faculty who have expertise in running debriefing sessions. Your instructors will also be available to offer you coaching and guidance for future practice.

Time Commitment:

We think you will be in the study for approximately six hours forty-five minutes if you attend all four sessions.

1. The first simulation session will last about 90 minutes.
2. The subsequent two simulation sessions will last about 2 hours – 2 hours 15 minutes each.
3. The final simulation session will last about 45 minutes.

You can stop participating at any time. However, if you decide to stop participating in the study, we encourage you to talk to the researcher first.

Video and Audio Recording

We will video record each simulation session and audio record each debriefing session. Your face is likely to be visible in the videos and your name may be recorded if you use it during participation in the simulation or debriefing.

Video and audio recordings will be used for the following reasons and times:

1) During the post-event debriefing to guide your reflections - We will only use your videos during your post-event debriefing for your performance. We will not show your video to another group, nor will we show another groups video to you. These video and audio recordings will not be shared with your EMS agency.

2) As part of our data analysis

To participate in this study you must be willing to be video and audio taped.

Future Use of Video and Audio Recordings

Short 45-90 second video clips may be selected for presentation at professional conferences or for the purpose of education and training. If we choose a video to share for presentation we will only show a video clip not the full video. Video clips are usually less than 90 seconds long. We will de-identify these video clips by censoring out your face, uses of your name, or any other ways you could be identified (such as a patch on your shirt from your EMS organization).

Because we are video-recording simulation and audio-recording debriefing sessions, we will create a data repository where we will store the video and audio data for future use. Your audio or video-recorded data may become eligible for use for future analysis involving video analysis. If your video or audio data is identified for future use we will only share as much video or audio data as is necessary.

You have the option to not have video and audio recordings used for future research, educational purposes or for presentation at conferences. If this is the case, please indicate so on the last page of this consent form.

RISKS

It is possible, but unlikely, that this study could cause embarrassment for you during practice, or with your volunteer EMS organization if others learn of your responses, or you have a strong emotional reaction to practicing the EFAST in a simulation.

For example, based on prior experiences, some participants may experience embarrassment at their performance, or frustration while learning the EFAST exam. We will try to reduce this risk by taking the following steps:

- Both skills-based and scenario-based simulations will be conducted using a mastery learning approach. This means that you will be provided the instructional support, materials, and time you need to achieve your learning goals.
- We have included the use of written self-reflections as a way to provide you with an opportunity to reflect on your experiences privately.
- During your debriefing session a specially trained facilitators who are experienced in creating a setting that should help you feel comfortable reflecting on your practice.
- All instructors will be required to complete a training session where they will learn how to provide feedback.
- All inviestigators will observe participants for any adverse events or reactions during simulation practice.
- We will also monitor participants during the debriefing session for adverse reactions.
- We will report any adverse events to the IRB as required.

It is possible, but unlikely, that this study could cause embarrassment for you with your volunteer EMS organization learned of your participation. We will try to reduce this risk by taking the following steps:

- Your EMS agency will not be made aware of your participation in the study.
- We will not share any performance data or data collected about you with your EMS agency.
- We will not share any video or audio-recordings with your EMS agency.

It is possible, but unlikely, that this study could cause embarrassment for you if video of your participation is lost or accidentally revealed to someone other than study investigators. We will try to reduce this risk by taking the following steps:

1. To protect your privacy we will only use these videos during the post-event debriefing for your performance.
2. We will not show your video to another group, nor will we show another groups video to you.
3. During data analysis, videos will be stored on an encrypted computer or transported on an encrypted USB drive that requires a complex pass-phrase.
4. The USB drives will be transported in a locked container.
5. When your data is not being analyzed, we will store it in a locked safe in the researcher's office.
6. We will limit access to these video and audio data to the study team only.
7. If your video or audio is discovered for analysis for another research project we will only share the necessary video. If possible, we will de-identify the data by censoring your face and name before sharing the data.

8. If your video or audio is selected for presentation, we will only use a video clip, not the full video. We will de-identify the video and/or audio data by censoring your face and name prior to presenting the data.

Benefits

If you agree to take part in this study, there will be no direct benefit to you. However, information gathered in this study may help medical educators and those using simulations for health professional education make more informed decisions about how and when to best use simulation.

Confidentiality

Every effort will be made to keep any information collected about you confidential. However, it is impossible to guarantee absolute confidentiality.

In order to keep information about you safe, we will take the following steps to protect data:

1. For demographic data - you will be asked to complete this only after agreeing to participate. This data will de-identified by assigning you a unique numeric identifier that you will use. Only the PI and the study advisor will have access to the key. The key linking your name to your unique identifier will be stored on an encrypted laptop. The encrypted laptop will be stored in a locked safe.

2. For your written self-reflection responses -This data will de-identified by assigning you a unique numeric identifier that you will use. Only the PI and the study advisor will have access to the key. The key linking your name to your unique identifier will be stored on an encrypted laptop. The encrypted laptop will be stored in a locked safe. When the forms containing your responses are transported from the research location to the researcher s office, the data will be carried in a locked container.

3. For your self-efficacy self-assessments – This data will de-identified by assigning you a unique numeric identifier that you will use. Only the PI and the study advisor will have access to the key. The key linking your name to your unique identifier will be stored on an encrypted laptop. The encrypted laptop will be stored in a locked safe. When the forms containing your responses are transported from the research location to the researcher s office, the data will be carried in a locked container.

4. For video and audio recordings - To protect your privacy we will only use these videos during the post-event debriefing for your performance. We will not show your video to another group, nor will we show another groups video to you. During data analysis, videos will be stored on an encrypted computer or transported on an encrypted USB drive that requires a complex pass-phrase. The USB drives will be transported in a locked container (pelican case). When your data is not being analyzed, we will store it in a locked safe in the researchers office. We will limit access to these videos to the study team only. These video-recordings will not be shared with your EMS agency.

5. Your EMS program director will not be made aware of your participation in the study.

6. All information from this study will be kept in a locked file cabinet, available only to the primary investigator or the study team.

7. Data will be kept for five years. At the end of this period paper data will be shredded in accordance with Georgetown University policy.

8. Video and audio data will be stored for five years. At the end of this period Laptops and USB storage devices containing video and audio data will be successively wiped, drilled, or destroyed using an appropriate hard drive shredder.

9. Your name or other identifiable information will not be included in the publication or presentation that results research project. Please note that, even if your name is not used in publication, the researcher the research team will still be able to connect you to the information gathered about you in this study.

10. **The Georgetown University IRB is allowed to access your study records if there is any need to review the data for any reason.**

Payment

You will receive a $10.00 gift card to Starbucks at the end of each of the two training sessions and at the end following completion of your post-test.

Policies and Procedures for Research-Related Injury

During the intervention sessions all instructors and debriefing facilitators will monitor participants for adverse reactions such as embarrassment during practice and post-practice debriefing. In the event that you feel you need to stop or slow your practice session you may request to do so at any time. We will offer you an opportunity to discuss your concerns with one of the debreifing faciliators and the instructor, which ever you are most comfortable with.

Researchers will make every effort to prevent study-related injuries and illnesses. If you are injured or become ill while you are in the study, you will receive emergency medical care. The costs of this care will be charged to you or to your health insurer. No funds have been made available by Georgetown University or its affiliates, the District of Columbia, or the Federal government to compensate you for a study-related injury or illness.

The PI will report any adverse events to the IRB as required.

Your Rights As A Research Participant

Participation in this study is voluntary at all times. You can choose not to participate at all or to leave the study at any point. If you decide not to participate or to leave the study, there will be no effect on your relationship with the researchers or any other negative consequences.

If you decide that you no longer want to take part in the study, you are encouraged to inform the researcher of your decision. The information already obtained through your participation will be included in the data analysis and final report for this study.

Questions or concerns?

If you have questions about the study, you may contact Alexis Battista at (703) 801-9811 or alexis.battista@gmail.com. You may also contact the researcher's faculty advisor, Mike Antonis at Michael.antonis@medstar.net.

Please call the Georgetown University IRB Office at **202-687-1506** (8:30am to 5:00pm, Monday to Friday) if you have any questions about your rights as a research participant.

STATEMENT OF PERSON OBTAINING INFORMED CONSENT

I have fully explained this study to the participant. I have discussed the study's purpose and procedures, the possible risks and benefits, and that participation is completely voluntary.
I have invited the participant to ask questions and I have given complete answers to all of the participant's questions.

________________________________ ____________________

Signature of Person Obtaining Informed Consent Date

____

Printed Name of Person Obtaining Informed Consent

CONSENT OF PARTICIPANT

I understand all of the information in this Informed Consent Form.

I have gotten complete answers for all of my questions.

I freely and voluntarily agree to participate in this study.

I understand that I will be videotaped and audio-recorded as a part of this study.

VIDEO AND AUDIO CONSIDERATIONS:

Please indicate whether you agree to allow videotaped recordings and audio recordings to be made available for conference presentations and/or education and training.

☐ **YES** *(If you change your mind about this at any point, please let the researcher know)*
☐ **NO**

Please indicate whether you agree to allow videotaped recordings and audio recordings to be made available for the data repository.

☐ **YES** *(If you change your mind about this at any point, please let the researcher know)*
☐ **NO**

________________________________ ____________________

Participant Signature Date

____

Printed Name of Participant

Once you sign this form, you will receive a copy of it to keep, and the researcher will keep another copy in your research record.

Appendix D

Participant Demographics Survey

Simulation Research Project Demographics Questionaire

Questions related to your previous and current experiences providing patien...

***1. How long have you been providing patient care, either for GERMS or another volunteer or professional organization?**

- Less than one year
- 1-2 years
- 3-4 years
- 5-6 years
- More than 7 years

***2. How long have you been volunteering for the GERMS program?**

- This is my first year
- 1-2 years
- 3-4 Years
- 5 or More Years

3. Please describe why you joined GERMS?

Questions about your experiences with simulation-based learning during GERM...

The purpose of this page is to help us learn more about the types of simulation based training you may have encountered during your GERMS training.

***4. Thinking about your GERMS training, how often do you participate in skills-based simulation activities(i.e. where you learned the processes or steps of a specific procedure such as placing an splint, oral airway or an IV)?**

- a great deal
- a lot
- a moderate amount
- a little
- none at all

Simulation Research Project Demographics Questionaire

***5. Thinking about your GERMS training, how often do you participate in scenario-based simulations (i.e., where you played a role, possibly with others, and interacted with a patient simulator or actor to identify a clinical problem and decided on treatment)?**

- a great deal
- a lot
- a moderate amount
- a little
- none at all

Questions about your other experiences with simulation-based learning envir...

***6. Have you ever participated in simulation based training other than your GERMS training (for example during an EMT certification program, or lifeguard training)?**

- Yes
- No

Questions about previous simulation based training experiences.

We are interested in learning more about any other simulation based training experiences you have had other than your GERMS training.

***7. Thinking about your other simulation-based training experiences, how often have you participated in skills-based simulation activities(i.e. where you learned the processes or steps of a specific procedure such as placing an splint, oral airway or and IV)?**

- a great deal
- a lot
- a moderate amount
- a little
- none at all

Simulation Research Project Demographics Questionaire

***8. Thinking about your other simulation based training experiences, how often have you participated in scenario-based simulations (i.e., where you played a role, possibly with others, and interacted with a patient simulator or actor to identify a clinical problem and decided on treatment)?**

- a great deal
- a lot
- a moderate amount
- a little
- none at all

Previous Ultrasound Training

We are interested in learning if you have ever received either formal or informal instruction in the use of ultrasound for patient care.

***9. Have you received any previous training or education in the use of ultrasound for patient care?**

- Yes
- No

Other (please specify)

Questions about your previous training in ultrasound

***10. Thinking about the ultrasound training you received, what body regions did your training emphasize (please select all that apply)?**

- Neck
- Thorax
- Cardiac
- Breast
- Abdomen
- Pelvis
- Extremity
- None of these

Other (please specify)

Simulation Research Project Demographics Questionaire

***11. Thinking about the ultrasound training you received, what types of exams did your training emphasize (please select all that apply)?**

- [ ] FAST
- [ ] Cardiogenic Shock
- [ ] Line Placement
- [ ] Anesthesia Related Procedures
- [ ] None of these

Other (please specify)

***12. Thinking about your previous ultrasound training, how much training have you received in point-of-care ultrasound?**

- A great deal of training
- A lot of training
- A moderate amount of training
- A little training
- Not any training at all

Other (please specify)

Participant Demographics

***13. Are you male or female?**

- Male
- Female

***14. Which category below includes your age?**

- 17 or younger
- 18-20
- 21-29
- 30-39
- 40-49
- 50-59
- 60 or older

Simulation Research Project Demographics Questionaire

***15. Are you White, Black or African-American, American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific islander, or some other race?**

- White
- Black or African-American
- American Indian or Alaskan Native
- Asian
- Native Hawaiian or other Pacific Islander
- From multiple races

Some other race (please specify)

***16. Which of the following categories best describes your current undergraduate status?**

- Freshman
- Sophomore
- Junior
- Senior

Other (please specify)

Appendix E

Participant Written Self-Reflection Questionnaire

Simulation Participant Written Self-Reflection Questionnaire

Thank you for agreeing to participate in these simulation based sessions, we greatly appreciate your time and feedback. This self-reflection questionnaire is intended to help both you and us gain a better understanding of your experiences – both what you learned, and how you feel participating in these simulations helped you learn. Your answers will be kept strictly confidential. This information will also be useful in guiding the debriefing session that will follow these simulations.

We invite you to reflect back on what was most memorable about the simulation experience we have just had. Below, you will find a series of writing prompts to help guide your reflections and thinking. Describe in your words what it was like for you to participate in the simulation.

1. Write down your initial reactions (both positive and negative) to participating in this simulation.

2. You just treated a patient with _____________ (insert chief complaint here), how are you feeling right now?

3. Describe what you learned while participating in scenario/skills lab?

4. Can you provide an example of how participation in this (skills/Scenario) based simulation helped you learn?

5. Did you have any goals in mind before you participated in this (skills/scenario) based simulation session? If yes, please describe what they were?

Appendix F

Debriefing with Good Judgement Debriefing Guide

Debriefing with Good Judgment Debriefing Guide Question/Reflection Prompts

Reaction Phase
"So, you just took care of a pt with……., how do you feel?"
"You just took care of a patient who had……., How are you feeling right now?"

After the Reaction Phase
"What portions of the simulation do you feel are most important to discuss?" *This will help frame the debriefing discussion.*

Preview/Permission to Discuss:
I want to talk about…

Advocacy/Observation: *(use clear examples, for example, wrong drug dosage, missed assessment)*

- I saw
- I noticed
- I heard

Point of View/Concern Appreciation: *(my perspective/frame)*

- I think
- What I was thinking was…
- I'm concerned (concern is not participant's action, concern is the effect on the patient)
- I was happy to see
- I was confused when
- I was surprised that

Inquiry: *(ask about their perspective, how they saw the situation)*

- I wonder
- I'm curious: how were you seeing the situation at that time
- What you were thinking when you made that decision
- Help me understand what your perspective was about that/at that time
- If you can talk to me a bit about that
- If you could tell me how you got to that point/decision

Appendix G

Radiology Direct Observation of Procedural Skills (RAD-Dops)

RANZCR
Radiology Direct Observation of Procedural Skills (RAD-Dops)

Trainee's Name (First, Last) ☐ Student Identification Number ☐ Date of assessment (DD/MM/YY) ☐☐/☐☐/☐☐

Year of specialty training: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Other

Clinical setting: ☐ Ultrasound ☐ Computed Tomography ☐ Paediatric Imaging
☐ Magnetic Resonance Imaging ☐ Interventional Radiology ☐ Breast Imaging
☐ Fluoroscopy ☐ Other (please specify below):

Assessor's name (First, Last, Title, Position): ☐

Procedure name: ☐

Number of times this procedure previously preformed by trainee: ☐ 0 ☐ 1-4 ☐ 5-10 ☐ >10

Difficulty of procedure: ☐ Low ☐ Medium ☐ High

DOPS Rating Scale	Below expectation for stage of training	Borderline for stage of training	Meets expectation for stage of training	Above expectation for stage of training	Well above expectation for stage of training	Unable to comment
1. Demonstrates knowledge of indications, relevant anatomy and technique	☐	☐	☐	☐	☐	☐
2. Explains procedure/risks to patient, obtains/confirms informed consent where appropriate	☐	☐	☐	☐	☐	☐
3. Uses appropriate analgesia or safe sedation/drugs	☐	☐	☐	☐	☐	☐
4. Usage of equipment	☐	☐	☐	☐	☐	☐
5. Aseptic technique	☐	☐	☐	☐	☐	☐
6. Technical ability	☐	☐	☐	☐	☐	☐
7. Seeks help if appropriate	☐	☐	☐	☐	☐	☐
8. Minimises use of ionising radiation for procedures involving x-rays	☐	☐	☐	☐	☐	☐
9. Communication skills with patient/staff	☐	☐	☐	☐	☐	☐
10. Quality of report of procedure	☐	☐	☐	☐	☐	☐

Trainee's comment

Assessor's comments: if you have noticed anything especially good or needing further development please note it here:

To be completed by assessor

As the assessor, how long did this process take? ☐ <10 mins ☐ 10-20 mins ☐ 20-30 mins ☐ >30 mins

Assessor satisfaction with Radiology DOPS documentation and process as a method of assessing trainees:

LOW ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 HIGH

Assessor's comments on Radiology DOPS documentation and process

To be completed by trainee

Trainee satisfaction with Radiology DOPS documentation and process as a method of assessing trainees:

LOW ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 HIGH

Trainee's comments on Radiology DOPs documentation and process

Signature of Trainee

____

Signature of Assessor

____

Descriptors of competencies demonstrated during Rad-DOPS:

Demonstrates knowledge of indications, relevant anatomy and technique	Does the trainee know the relevant indications, anatomical landmarks, and techniques relevant to the procedure?
Explains procedure/risks to patient, obtains informed consent where appropriate	Is there a clear explanation of the proposed procedure to the patient, with the patient given an opportunity to ask questions? Where informed consent is sought, is this documented appropriately?
Uses appropriate analgesia or safe sedation	Does the trainee use adequate amounts of appropriate drugs to minimise patient discomfort? Is this titrated where appropriate?
Demonstrates knowledge of equipment and uses equipment appropriately	Does the trainee demonstrate knowledge of the radiology equipment with appropriate tool/ probe selection and utilisation? Does he/she optimise equipment parameters for individual examinations?
Aseptic technique	The cleansing of hands and, where relevant, equipment before and after every physical patient episode is mandatory.
Technical ability	Most pertinent to practical applications such as ultrasound, interventions and screening. Is there satisfactory hand/eye co-ordination?
Seeks help if appropriate	Does the trainee recognise his/her limitations and request assistance when appropriate?
Minimises use of ionising radiation as needed	Where the procedure involves ionising radiation.
Communication skills with patient/staff	Is the trainee polite, and exhibits a sense of self within a team structure? Is he / she able to convey understanding to others?
Quality of report of procedure	Does the report have a clear, concise, clinically appropriate and lucid appearance, within the context of other available clinicoradiological information?
Judgement /insight	For example, the trainee stops the procedure if unforeseen complications are encountered.

(modified with permission from the Royal College of Radiologists, United Kingdom)

Appendix H

Rad-DOPS Guidance for Assessors

Pilot Study on Workplace-Based Assessment
Clinical Radiology

The Royal College of Radiologists

Rad-DOPS Guidance for Assessors

The Radiology Directly Observation of Procedural Skills (DOPS) focuses on the core skills that trainees require when undertaking a clinical practical procedure. The DOPS is a focused observation or "snapshot" of a trainee undertaking a practical procedure. Not all elements need be assessed on each occasion. You may explore a trainee's related knowledge where you feel appropriate.

Instructions:

1. Please ensure that the patient is aware that the Rad-DOPS is being carried out.
2. You should directly observe the trainee performing the procedure to be assessed in a normal environment and explore knowledge where appropriate.
3. Please score the trainee on the scale shown. Please note that your scoring should reflect the performance of the trainee against that which you would reasonably expect at their stage/year of training and level of experience.
4. Your professional registration number is needed for this study to allow us to determine the number of different assessors used – it will not be used to identify assessors by name.
5. Please give feedback to the trainee after the assessment - especially where deficiencies have been identified.
6. After fully completing a form, give it to trainee. It is their responsibility to photocopy this, keep one copy for their records if they wish and return the original to their Local Study Coordinator.

Descriptors of competencies demonstrated during Rad-DOPS:

Demonstrates understanding of indications, relevant anatomy and technique	Does the trainee know the relevant indications, anatomical landmarks, and techniques relevant to the procedure?
Explains procedure/risks to patient, obtains informed consent where appropriate	Is there a clear explanation of the proposed procedure to the patient, with the patient given an opportunity to ask questions? Where informed consent is sought, is this documented appropriately?
Uses appropriate analgesia or safe sedation	Does the trainee use adequate amounts of appropriate drugs to minimise patient discomfort? Is this titrated where appropriate?
Usage of Equipment	Does the trainee show an understanding on the radiology equipment with appropriate tool/ probe selection and utilisation? Does he/she optimise equipment parameters for individual examinations?
Aseptic technique	The cleansing of hands and, where relevant, equipment before and after every physical patient episode is mandatory.
Technical ability	Most pertinent to practical applications such as ultrasound and screening. Is there satisfactory hand/eye co-ordination?
Seeks help if appropriate	Does the trainee recognise his/her limitations and request assistance when appropriate?
Minimises use of ionising radiation for procedures involving x-rays	Where the procedure involves ionising radiation.
Communication skills with patient/staff	Is the trainee polite, and exhibits a sense of self within a team structure? Is he/she able to convey understanding to others?
Quality of report of procedure	Does the report have a clear, concise, clinically appropriate and lucid appearance, within the context of other available clinico-radiological information?
Judgement/insight	For example, the trainee stops the procedure if unforeseen complications are encountered.

For further information please contact: cilla_heath@rcr.ac.uk

RCR Rad-DOPS Guidance for Assessors.doc 1/1

Appendix I

EFAST Self-Efficacy Inventory

EFAST Self-Efficacy Inventory

This questionnaire is designed to help us gain a better understanding of the types of difficulties health care professionals may encounter when learning the EFAST point-of-care ultrasound. The attached form lists different activities associated with performing the EFAST point-of-care ultrasound.

In the column **Confidence,** rate your confidence as of now. Rate your degree of confidence by recording a number from 0 to 100 using the scale given below. Your answers will be kept strictly confidential and will not be identified by name.

0	10	20	30	40	50	60	70	80	90	100
	Not Sure			Somewhat Sure			Pretty Sure		Very Sure	

Self-Efficacy related to determination of when a point-of-care ultrasound is indicated in daily patient care:

I feel confident I can:	**My Confidence Level Now**
Identify when a point-of-care ultrasound is indicated.	
Identify when using point-of-care ultrasound can enhance my clinical decision making process.	

Self-Efficacy in the processes of performing point-of-care EFAST ultrasounds in the clinical setting:

I feel confident I can:	**My Confidence Level Now**
Obtain all of the necessary equipment and supplies needed prior to beginning a bedside US exam.	
Clean and prepare the machine prior to use	
Select the correct transducer for completing an EFAST exam	
Accurately describe the reason I need to perform the ultrasound exam to a patient and how it may affect their future care.	
Coach the patient to obtain and maintain proper positioning for the procedure.	
Thoracic	
Obtain diagnostic quality views of the right and left anterior lungs.	
Right Upper Quadrant (RUQ)	
Obtain diagnostic quality right kidney longitudinal view	
Obtain diagnostic quality right lobe of liver long axis view	
Left Upper Quadrant (LUQ)	
Obtain a diagnostic quality image of the spleen-long axis view	
Pelvis	
Obtain a diagnostic quality of the urinary bladder – transverse view	

Self-Efficacy in the processes of interpreting the images obtained in your point-of-care EFAST ultrasounds in the clinical setting:

I feel confident I can:	**My Confidence Level Now**
Determine which types of patients or medical conditions may confound my findings.	
Take steps to improve the quality of the images I am observing	
Identify anatomical images in B-Mode	
Manipulate the gain to enhance my findings	
Understand how common artifacts can distort my findings.	
Understand how common artifacts enhance my findings.	
Identify free fluid in the abdomen using B Mode	
Identify a sliding lung sign.	

Self-Efficacy related to determining future management of the patient.

I feel confident I can:	**My Confidence Level Now**
Integrate my findings with other clinical findings to form a diagnosis.	
Make decisions about the next best steps in my patient's clinical course based on my interpretations of the images in the clinical scenario..	
Understand how my assessment and the decisions I make about patient care impact the care given to my patient in the emergency department.	

Appendix J

EFAST Ultrasound Pre-Test Scenario

<table>
<tr><th colspan="2">EFAST Ultrasound Pre-Test Scenario</th></tr>
<tr><th colspan="2">Faculty Version</th></tr>
<tr><td>Ultrasound Concepts
Knobology
Incorporating the EFAST into a Trauma Assessment
Processes of EFAST Exam
Interpreting 2D Ultrasound Images</td><td>Secondary Concepts
Interpretation of Physical Assessment Findings
Interpretation of Vital Signs
Team Communication</td></tr>
<tr><td colspan="2">Scenario Overview

Patient Name: John Hunter

Date of Birth: February, 5 [Year consistent with casting]

While participating in ED clinical, the participant will be asked to perform an EFAST exam on a patient who arrived in the ED approximately 45 minutes ago after sustaining blunt force trauma to the abdomen. The patient reports that he was pushed to the ground and then kicked several times in the abdomen while still on the ground. The patient was transported to the ED by EMS in stable condition. Upon arrival in the ED, the patient remained stable, and the first EFAST was negative. He is currently being monitored and has 1 large bore IV established. Normal Saline is running at 100cc/hour, and he received 4mg of Morphine shortly after arrival. However, while the patient remains stable, he continues to complain of abdominal pain. Currently, the plan is to perform serial EFAST scans.</td></tr>
<tr><th colspan="2">Learning Objectives</th></tr>
</table>

Psychomotor Skills Perform an EFAST exam Utilize the M Turbo Ultrasound device	**Cognitive Skills** Interpret physical exam findings & vital signs Interpret EFAST findings
	Communication Establish rapport with the patient Ask relevant diagnostic questions (e.g., HPI, PMH) Provide education and counseling support to the patient (i.e., findings, next steps in care/treatment) Interact with other members of the healthcare team
Simulation Time: 10 minutes	Debriefing Time: 10 minutes

Orientation to Simulation Setting

Study participants will work individually during this experience.

In this scenario, participants will determine how and when to provide patient care, including the ordering of any tests, and performance of assessments. Participants will be asked to take their cues from the role players they interact with and to treat this as if it were an actual clinical experience. Things such as vital signs will be available on the patient monitor in the room, and the patient's nurse is also present and will answer questions and interact as needed. They will have access to the Sonosite M Turbo device.

For Physician Faculty:
As faculty, you will be playing the role of attending ED physician. In this pre-test scenario, participants are being assessed on their early understanding of the EFAST exam. Prior to this assessment, they will have had access to the participant Wiki and may have reviewed the materials on the site. We do not expect them to have prior experience performing the EFAST. This step serves to 1) establish a range of understanding of the performance that participants start with and 2) ideally, should provide participants with a baseline of their skills.

For this step please:

1. Encourage the participant to perform the EFAST, but minimize the support you offer (they will be advised of this as well). If they are discouraged, you can offer them encouragement (i.e., do your best). The SP will be patient and understanding.
2. It is important that you participate in your role in order to support the scenario's narrative – please keep the patient's presence in mind – speak to the SP as if they were an actual patient. Discuss issues that are relevant to care now and in the future.
3. If a participant wishes to end the pre-test prior to finishing the whole exam, please allow him or her to do so and say thank you.

Standard Patients:
As standard patients, you will be playing the role of the patient. In this pre-test scenario, participants will be assessed on their early understanding of the EFAST exam. Prior to this assessment, they will have had access to the participant Wiki and, ideally, should have reviewed the materials on the site. We do not expect them to have prior experience performing the EFAST as they are novices. This step serves to 1) establish an of understanding of the performance that participants start with and 2) ideally, should provide participants with a baseline of their skills that should help them establish a self-improvement plan.

It is important that you participate in your role in order to support the scenario's narrative – please – interact and speak with the faculty role players and the participant as if you were an actual patient. Your condition is not life threatening and patience with the participant at this stage of learning is important.

Scenario Context Questionnaire

Questions about the setting	Free Text Response
What are the typical physical tools (e.g., stethoscope, ultrasound device) that you expect would be needed or found in this type of scenario?	Sonosite M turbo Stretcher Stethoscope Pt. Vital signs monitor (simulated version) Oxygen mask NRB Tank IV supplies/cart (for nurse confederate x 2 with reservoir) Sp02 Probe BP Cuff . EKG leads
What props would further support the clinical situation (e.g., standard patient with moulage on the [location], human patient simulator)?	Moulage consistent with blunt trauma Standard Patient – male of average height and build. Non-obese.
What patient safety equipment should be available for the scenario?	Gloves Alcohol gel
What are the diagnostic findings that participants would needed to support their diagnostic decision making?	History consistent with penetrating trauma Physical findings consistent with penetrating trauma. Vital signs consistent Urine Dip
What diagnostic activities (e.g., auscultate, palpation) would normally be used in this type of scenario?	Visualization Auscultation Palpation Ultrasound Exam Diagnostic Questioning
What types of therapies (e.g., fluid bolus, medication administration) are typically offered in this type of scenario?	IV IV Fluids Morphine Dressing for abrasions

Questions about Roles and Rules	Free Text Response
What rules would normally guide or govern participants care or activities in this scenario?	**Assessment Guidelines**: Trauma Assessment EFAST Hospital response/trauma response protocol
Who is typically present during a scenario such as this? What role do they play during the event?	1 ED nurse 1 ED Physician 1 Student

Participant Hand Off

In this pre-test, you are rotating through the emergency department (ED), where you are participating in a clinical rotation. You will be asked to perform an EFAST exam on an established patient in the ED to the best of your ability. We understand that you have limited experience with EFAST. The purpose of this pre-test is to establish a baseline understanding of your skills in performing and EFAST exam so we can compare them with your post-test performance to measure your progress. We strongly encourage you to view this as an opportunity to begin to develop an understanding of your skills and where you want to focus your practice time in future sessions.

During this scenario, you will interact with other role players whom you would normally expect to find if you were in the ED, such as other physicians, nurses, and techs. You will find many of the typical tools and items you would normally find and need to care for patients. We encourage you to make use of these tools and items to help you. Please take your cues from the patients, patient monitors, ultrasound device, and other role players. We encourage you to imagine as if this were the actual ED and to treat the situation as if it were an actual clinical experience.

You will have up to 10 minutes to complete your EFAST exam. You may end it sooner if you desire or if you finish early. There is no penalty for finishing early or at 15 minutes.

Following the scenario you will have an opportunity to review your performance with the physician faculty.

What questions do you have?

When you are ready to start the scenario, please enter the simulation space.

PATIENT CARE SIMULATION			
Time	Manikin Settings and Changes	Patient Responses/Cues	Ideal Participant Actions
At Arrival – Prior to this Exam	Patient alert & oriented with no obvious abrasions or wounds noted to the abdomen. No external bleeding noted. Presenting Vitals: Pulse: 116 BP: 140/84 Respirations: 18 SP02: 99% RA Urine Dip: Negative Labs: All within normal limits	Cooperative, but experiencing pain and discomfort. Complaining of generalized diffuse abdominal pain (7-8/10) throughout the abdomen. When they palpate your abdomen, the patient grimaces. There is no one place that hurts the most. No rebound tenderness	Initial Treatment/Care Provided: H&PE – No obvious injuries/trauma noted. EFAST – Negative Findings Urine Dip – Negative Labs: All within normal limits
0-10 min 	Patient alert & oriented with abrasions noted on the left hand and elbow. However, no obvious trauma to the abdomen. No external bleeding noted. Current Vitals: Pulse: 90 BP: 136/84 Respirations: 16 SP02: 99% RA Urine Dip – Negative Labs – Within Normal Limits	In pain, cooperative, patient with the participant. Grimaces with palpation over the abdominal area. No rebound tenderness *Note for standard patients – this is an early pre-test scenario and we expect the assessment to take longer than it would in the clinical setting. They will have had access to videos and some readings, but they most likely haven't ever done this on actual patients. This step is critical to determining	Performs assessment – focused assessment. Reviews/analyzes initial set of vital signs Communication with the patient (introduction, diagnostic questions, education and counseling) Performs EFAST. Interprets findings and shares them with physician.

		their baseline knowledge and to help them begin to establish a self-improvement plan.	

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Appendix K

M-Turbo and EFAST Orientation

<table>
<tr><th colspan="2"><h1>M-Turbo & EFAST Orientation</h1></th></tr>
<tr><th colspan="2">Faculty Version</th></tr>
<tr><td>Ultrasound Concepts

Introduction to knobology
Introduction to the EFAST Exam
Introduction to interpretation of ultrasound images</td><td>Secondary Concepts</td></tr>
<tr><td colspan="2">Session Overview

00:00 - 00:05 Arrival and Welcome
00:05 - 00:10 Complete Self Efficacy Inventory
00:10 - 00:15 Lab Orientation & Expectations
00:15 - 00:25 EFAST Pretest (see pretest scenario for details)
00:25 - 00:30 Review Performance with Faculty
00:30 - 00:60 EFAST Orientation
00:60 - 00:65 Group Assignment</td></tr>
<tr><th colspan="2">Learning Objectives</th></tr>
</table>

<table>
<tr><td>Psychomotor Skills

EFAST exam
Use of the M-Turbo ultrasound device
Probe orientation, placement, and depth</td><td>Cognitive Skills

Interpret EFAST findings</td></tr>
<tr><td>Affective & Self-Regulatory</td><td>Communication

Interact and communicate with faculty, standardized participants, and your peers during the practice session.</td></tr>
<tr><td>Practice Time: Up to 30 minutes</td><td>Debriefing Time: 0 minutes</td></tr>
<tr><td colspan="2">Lab Set Up and Session Details:

In this skills lab, participants will begin by taking the EFAST pretest. Once all participants have completed the pretest, they will then partake in up to 30 minutes of practice emphasizing the Sonosite M Turbo® device, the P21X® cardiac probe, and the process of the EFAST exam. Participants and faculty will have access to 1 standard patient (SP). The SP will be of normal body habitus and present with a negative EFAST exam. You will have access to the necessary tools and artifacts.

They are:

Sonosite M Turbo® device
P21X® cardiac probe
Ultrasound gel
Towels
Patient stretcher
Body markers
Gloves
Alcohol gel
Additionally, the lab is also equipped with:
White boards
Whiteboard markers
Two wide screen televisions with internet access</td></tr>
</table>

Expectations for Participation:

1. During the orientation, you may provide students with as much guidance as they need.
2. If you notice that the students are struggling, or are not engaged this may indicate that they need support or guidance. If you are uncertain, please ask them if they need support or guidance. At this stage, they may not always know when they need help, or know to seek it.
3. If a participant asks a question that seems unrelated to the practice session, try to ascertain more about why they asked the question. For example, you could respond by asking "help me understand why you're asking so I can better tailor my answer?" 4. The issue is important to them and using inquiry to gain a deeper understanding of their thinking will provide you with more evidence of their thought processes.
5. Should you wish to interact with the standard participant as if he or she were a patient, please inform the SP ahead of time.

Participant Hand-Off Script

For this practice session, the goals are to focus on learning about the Sonosite M Turbo® ultrasound device, the P21X® cardiac probe, and performing the EFAST exam. Goals for this session are:

Psychomotor Skills	**Cognitive Skills**
EFAST exam Use of the M-Turbo ultrasound device Probe orientation, placement, and depth	Interpret EFAST findings
Affective & Self-Regulatory	**Communication:** Interact and communicate with faculty, standardized participants, and your peers during the practice session.

You will be supported by a physician educator during this session who will guide and support you throughout the session. If you need their help, please ask them for support.

You will have up to 30 minutes to practice. The purpose of the skills practice portion of this session is educational, you will not be graded or assessed during the orientation. During the session you will have access to the:

- Sonosite M Turbo® device
- P21X® cardiac probe
- Ultrasound gel
- Towels
- Patient stretcher
- Body markers
- Gloves
- Alcohol gel

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Appendix L

EFAST Ultrasound Skills Session 1

<table>
<tr><td colspan="2"><h1>EFAST Ultrasound Skills Session 1</h1></td></tr>
<tr><td colspan="2">Faculty Version</td></tr>
<tr><td>Ultrasound Concepts

Knobology
Processes of EFAST Exam
Interpreting 2D ultrasound images</td><td>Secondary Concepts</td></tr>
<tr><td colspan="2">Skills Session Overview

00:00 - 00:05 Arrival and Welcome
00:05 - 00:10 Complete Self - Efficacy Inventory
00:10 - 00:15 Lab Orientation & Expectations
00:15 - 01:30 EFAST Practice
01:40 - 02:10 Guided Debriefing
01:30 - 01:40 Written Reflection</td></tr>
<tr><td colspan="2">Learning Objectives</td></tr>
</table>

Psychomotor Skills	**Cognitive Skills**
EFAST exam Use of the M-Turbo ultrasound device, including gain and depth Probe orientation, placement, and depth	Interpret EFAST findings Apply strategies to improve capture and image quality.
Affective & Self-Regulatory Reflect on your performance to identify and discuss your experiences related to learning the EFAST exam.	**Communication:** Interact and communicate with faculty, standardized participants, and your peers during the practice session.
Practice Time: Up to 75 minutes	Debrief Time: Up to 30 minutes

Lab Set Up and Session Details:
In this skills-based session, participants and faculty will participate in up to 75 minutes of practice emphasizing the EFAST exam. Participants and faculty will have access to two standard patients to facilitate practice with scanning negative EFAST scans. Both SPs for this session will present with normal anatomy and will not present participants with significant complications, such as obesity. The Kyoto FAST/ER FAN model will also be available to facilitate scanning of positive EFAST scans. You will have access to the necessary tools and artifacts. They are:

Sonosite M Turbo® device
P21X® cardiac probe
Ultrasound gel
Towels
Patient stretcher
Body markers
Gloves
Alcohol gel

Additionally, the lab is also equipped with:
White boards
Whiteboard markers
Two wide screen televisions with internet access

Expectations for Participation:

1. During the orientation, you may provide students with as much guidance as they need.
2. If you notice that the students are struggling, or are not engaged, this may indicate that they need support or guidance. If you are uncertain, please ask them if they need support or guidance. At this stage, they may not always know when they need help, or know to seek it.
3. Participants are allowed to work with their peer or independently. They also may determine when to end their practice.
4. If a participant asks a question that seems unrelated to the practice session, try to ascertain more about why they asked the question. For example, you could respond by asking, "Help me understand why you're asking so I can better tailor my answer?" The issue is important to them and using inquiry to gain a deeper understanding of their thinking will provide you with more evidence of their thought processes.
5. Should you wish to interact with the standard participant as if he or she were a patient, please inform the SP ahead of time.

Participant Details

For this practice session, you will focus your practice on performing the EFAST exam. Goals for this session are:

Psychomotor Skills	**Cognitive Skills**
EFAST exam Use of the M-Turbo ultrasound device, including gain and depth Probe orientation, placement, and depth	Interpret EFAST findings Apply strategies to improve capture and image quality
Affective & Self-Regulatory	**Communication**
Reflect on your performance to identify and discuss your experiences related to learning the EFAST exam	Interact and communicate with faculty, standardized participants, and your peers during the practice session

Participant Expectations:

During this session, you will be supported by a physician educator who will guide and support as you throughout the session. If you need help, please ask for support. If you wish to work independently you may also do so.

You will have up to 75 minutes to practice. You may end your practice sooner if you desire. There is no penalty for finishing early or at 75 minutes. The purpose of this skills practice is educational; you will not be graded or assessed during this session. During the session, you will have access to the:

- Sonosite M Turbo® device
- P21X® cardiac probe
- Ultrasound gel
- Towels
- Patient stretcher
- Body markers
- Gloves
- Alcohol gel

Debriefing Expectations:
Following the practice session, you will partake in a debriefing session. The purpose of the debriefing session is to enable you to learn by reflecting on your performance and experiences. In addition to you, your practice partner, and the faculty member will also participate.

The session will be run by a trained facilitator. The facilitator's role is twofold. Facilitators help establish a safe learning environment, and will encourage you to actively reflect on your experiences.

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Appendix M

EFAST Ultrasound Skills Session 2

<table>
<tr><th colspan="2">EFAST Ultrasound Skills Session 2</th></tr>
<tr><th colspan="2">Faculty Version</th></tr>
<tr><td>Ultrasound Concepts

Knobology
Processes of EFAST Exam
Interpreting 2D ultrasound images</td><td>Secondary Concepts

Scanning patients with complex body habitus.</td></tr>
<tr><td colspan="2">Skills Session Overview

00:00 - 00:05 Arrival and Welcome
00:05 - 00:10 Complete Self Efficacy Inventory
00:10 - 00:15 Lab Orientation & Expectations
00:15 - 01:30 EFAST Practice
01:40 - 02:10 Guided Debriefing
01:30 - 01:40 Written Reflection</td></tr>
<tr><th colspan="2">Learning Objectives</th></tr>
</table>

Psychomotor Skills	**Cognitive Skills**
EFAST exam Use of the M-Turbo ultrasound device, including gain and depth Probe orientation, placement, and depth	Interpret EFAST findings Apply strategies to improve capture and image quality on patients with difficult body habitus.
Affective & Self-Regulatory	**Communication**
Reflect on your performance to identify and discuss your experiences related to learning the EFAST exam.	Interact and communicate with faculty, standardized participants, and your peers during the practice session.
Practice Time: Up to 75 minutes	Debrief Time: Up to 30 minutes

Lab Set Up and Session Details:

In this skills-based session, participants and faculty will participate in up to 75 minutes of practice emphasizing the EFAST exam. Participants and faculty will have access to two standard patients (SP) to facilitate practice with scanning negative EFAST scans. Both SPs for this session will present with a more complex body habitus. The Kyoto FAST/ER FAN model will also be available to facilitate scanning of positive EFAST scans. You will have access to the necessary tools and artifacts. They are:

Sonosite M Turbo® device
P21X® cardiac probe
Ultrasound gel
Towels
Patient stretcher
Body markers
Gloves
Alcohol gel

Additionally, the lab is also equipped with:
White boards
Whiteboard markers
Two wide screen televisions with internet access

Expectations for Participation:

1. During the orientation, you may provide students with as much guidance as they need.
2. If you sense that the students are struggling, or are not engaged, this may indicate that they need support or guidance. If you are uncertain, please ask them if they need support or guidance. At this stage, they may not always know when they need help, or know to seek it.
3. Participants are allowed to work with their peer or independently. They also may determine when to end their practice.
4. If a participant asks a question that seems unrelated to the practice session, try to ascertain more about why they asked the question. For example, you could respond by asking "Help me understand why you're asking so I can better tailor my answer?" The issue is important to them and using inquiry to gain a deeper understanding of their thinking will provide you with more evidence of their thought processes.
5. Should you wish to interact with the standard participant as if he or she were a patient, please inform the SP ahead of time.

Participant Details

For this practice session, you will focus your practice on performing the EFAST exam. Goals for this session are:

Psychomotor Skills	**Cognitive Skills**
EFAST exam Use of the M-Turbo ultrasound device, including gain and depth Probe orientation, placement, and depth	Interpret EFAST findings Apply strategies to improve capture and image quality on patients with difficult body habitus.
Affective & Self-Regulatory	**Communication**
Reflect on your performance to identify and discuss your experiences related to learning the EFAST exam.	Interact and communicate with faculty, standardized participants, and your peers during the practice session.

Participant Expectations:

During this session, you will be supported by a physician educator who will guide and support as you throughout the session. If you need help, please ask for support. If you wish to work independently you may also do so.

You will have up to 75 minutes to practice. You may end your practice sooner if you desire. There is no penalty for finishing early or at 75 minutes. The purpose of this skills practice is educational; you will not be graded or assessed during this session. During the session you will have access to the:

- Sonosite M Turbo® device
- P21X® cardiac probe
- Ultrasound gel
- Towels
- Patient stretcher
- Body markers
- Gloves
- Alcohol gel

Debriefing Expectations:

Following the practice session, you will partake in a debriefing session. The purpose of the debriefing session is to enable you to learn by reflecting on your practice. In addition to you, your practice partner, and the faculty member will also participate.

The session will be run by a trained facilitator. The facilitator's role is twofold. Facilitators help establish a safe learning environment, and will encourage you to actively reflect on your experiences.

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Appendix N

EFAST Ultrasound Scenario 1

EFAST Ultrasound Scenario 1	
Faculty Version	
Ultrasound Concepts Knobology Indications for EFAST Incorporating the EFAST into a Trauma Assessment Processes of EFAST Exam Interpreting 2D ultrasound images Patient Disposition	**Secondary Concepts** Interpretation of physical assessment findings Interpretation of vital signs
Patient Name: Michael/Michelle DeMoro **Date of Birth: October 11, [Age range 18-28]** This scenario is set in the ED where 2 EMT participants are participating in clinical rotations to learn EFAST. The scenario starts with the ED physician and the two participants discussing expectations for their performance during rotation. As this conversation comes to a close one of the ED nurse will alert them to a patient who will needs to be seen following a ground level fall at a construction site. The participants and faculty are presented with a (20's)-year old male/female who arrives in the ED assisted by fellow co-workers after falling at a construction site on campus. He/she sustained a ground level fall as he/she tripped and fell onto a sharp object that penetrated his/her RLQ. He/she is alert and oriented, speaking in full sentences at arrival and his vital signs are stable. There is an obvious puncture wound noted on exam but with minimal external bleeding noted.	

Learning Objectives

Psychomotor Skills Perform an EFAST exam Utilize the M Turbo Ultrasound device	**Cognitive Skills** Determine when to perform and EFAST exam Interpret physical exam findings & vital signs Interpret EFAST findings Determine a plan of care for the patient based on your assessment findings
Affective & Self-Regulatory Reflect on your performance to identify and discuss your experiences related to caring for a patient with penetrating trauma	**Communication** Establish rapport with the patient Ask relevant diagnostic questions (e.g., history of present illness, medical history) Provide education and counseling support to the patient Interact and communicate with members of the patient care team
Simulation Time: Up to 25 minutes	Debriefing Time: Up to 25 minutes

Orientation to Simulation Setting This scenario takes place in the emergency department. There will be at least 1-2 other participants playing clinical roles (e.g., nurses, trauma surgeon) in the scenario. Study participants will work in pairs of two.
Expectations for Participation In this scenario, participants will determine how and when to provide patient care, including requesting and performing assessments. Participants will be asked to take their cues from the role players they interact with and to treat this as if it were an actual clinical experience. Things such as vital signs will be available on the patient monitor in the room. You will have access to the needed artifacts such as labs, vital signs and materials you typically use to provide care in this circumstance. As faculty, you will be playing the role of attending ED physician, nurses, or other ED staff. In these early scenarios, participants will require your support in performing the EFAST. Please support them as much as they need. The types of support that might be needed include: 1. For the first scenario, you will likely need to model the procedure for them completely before they do so or as they do so. As they improve, they will likely ask for less help, this is normal. 2. It is important that you participate in your role in order to support the scenario narrative – please keep the patient's presence in mind – speak to the SP as if they were an actual patient. Discuss issues that are relevant to care now and in the future with the patient and the participant. If the SP asks a question, address them as you would a patient. 3. You will need to observe participants for signs that they wish to practice without you. If you suspect this, you can remain. 4. If you sense they are struggling, or are not engaged this is an important time to offer support, as they will not always know when they need help, or know to seek it. 5. Providing verbal of physical guidance such as encouragement (e.g., "good") or affirm their correct actions. This is an important feedback strategy that helps them self-regulate in the future. 6. If a participant asks a question that seems unrelated to the scenario, seek to learn more about why they asked. For example, you could respond by asking, "help me understand why you're asking so I can better tailor my answer?" The issue is important to them and using inquiry to gain a deeper understanding of their thinking will provide you with more evidence of their thought processes.

Scenario Context Questionnaire

Questions about the setting	Free Text Response
What are the typical physical tools (e.g., stethoscope, ultrasound device) that you expect would be needed or found in this type of scenario?	Sonosite M turbo (2) Stretcher /Bed Stethoscope Pt. Vital signs monitor (simulated version) Oxygen mask NRB Tank IV supplies/cart (for nurse confederate x 2 with reservoir) Sp02 Probe BP Cuff Trauma scissors EKG leads Foley Urinal Ultrasound Gel
What props would further support the clinical situation (e.g., standard patient with moulage, human patient simulator)?	Moulage consistent with penetrating trauma Clothing with blood (disposable) Mountain dew (as urine) Standard patient
What patient safety equipment should be available for the scenario?	Yellow gowns Gloves Alcohol gel Masks Hats Booties
What are the diagnostic findings that participants need to make or confirm a diagnosis in this scenario?	History consistent with penetrating trauma Physical findings consistent with penetrating trauma Ultrasound images Vital signs consistent Urine dip
What diagnostic activities (e.g., auscultate, palpation) would normally be used in this type of scenario?	Visualization Auscultation Palpation Ultrasound exam Diagnostic questioning

What types of therapies (e.g., fluid bolus, medication administration) would typically be offered in this type of scenario?	Oxygen Fluids Bandages (4X4 with tape) Morphine

Questions about Roles and Rules	Free Text Response
What rules would normally guide or govern care or behavior in this scenario?	**Assessment Guidelines**: Trauma Assessment – Primary and Secondary EFAST **Therapeutic Guidelines**: Hypovolemia therapy Penetrating would care
Who is typically present during a scenario such as this, and what role do they play during the event?	1 ED physician 1-2 ED Nurses 2 students 1-2 Trauma physicians

Participant Hand-Off Script

The next two scenarios are set in the ED where you are both participating in clinical rotations to learn EFAST. You will be paired with a physician educator who will provide you with instruction and support as you learn the EFAST exam. If you need their help, please ask them for support. If you wish to work independently, you may also do so.

During this scenario, you will interact with other role players that you would normally expect to find if you were in the ED such as other physicians, nurses and techs. You will find many of the typical tools and items you would normally find and need to care for patients. We encourage you to make use of these tools and items to help you. Please take your cues from the patients, patient monitors, ultrasound device, and other role players you interact with. We encourage you to imagine as if this were the actual ED and to treat the situation as if it were an actual clinical experience.

You will have up to 25 minutes to complete this scenario. You may end it sooner if you desire. There is no penalty for finishing early or at 25 minutes. The purpose of this scenario is educational. Following the scenario, you will complete a post-simulation written reflection and then participate in a guided debriefing with the members of the patient care team. Debriefing is an important part of simulation where you will have the opportunity to reflect on your practice in a safe setting. During the debriefing session, we will discuss how you felt about your simulation experience and review the care and exams you performed. Faculty will offer coaching advice that you can use in future performances.

What questions do you have?

When you are ready to start the scenario, please enter the simulation space.

PATIENT CARE SIMULATION			
Time	**Manikin Settings and Changes**	**Patient Responses/Cues**	**Ideal Participant Actions**
0-3 min **Hand -Off**	Participants and physician meet to discuss expectations and goals for the clinical rotation. ED nurse begins assisting the patient back from triage. When participants are ready, the ED nurse comes and gets the physician and participants: Report - I have a patient I need you to come see. He is a 20(something – SP casting dependent) I just brought back from triage – he sustained a ground level fall when he tripped at a construction site and fell onto a sharp object. She has an obvious puncture wound in the RLQ with minor bleeding. She is alert and oriented and vitals are stable, but I'm just getting him settled.		
3-5 min **Hand -Off**	Patient alert & oriented with obvious wound to the RLQ of the abdomen. Bleeding minimal, but obvious wound found. **Vitals:** Pulse: 110 BP: 134/78 Respirations: 18 SP02: 99% RA	In pain but cooperative. Grimaces with movement. *.	Works with physician to initiates/perform assessment – primary and then focused assessment. Reviews/analyzes initial set of vital signs Communication with the patient (introduction, diagnostic questions, education and counseling)
5-20 min	Unchanged **Vitals:** Pulse: 98 BP: 130/76 Respirations: 16 SP02: 99% RA	Unchanged	Works with physician as needed to perform EFAST. Reviews/analyzes vital signs Continues communication with the patient (introduction,

			diagnostic questions, education and counseling)
20-25 min 	Unchanged **Vitals:** Pulse: 86 BP: 124/72 Respirations: 14 SP02: 99% RA	Relaxes some with less movement, or pain medication administration, but remains cooperative.	Interprets EFAST findings, vital signs and physical findings. Reviews/analyzes vital signs Communication with the patient (introduction, diagnostic questions, education and counseling) Considers patient disposition options.

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Admission Labs for Scenario 1

Patient: Michael/Michelle DeMoro
CBC WBC 8.4 HGB 9.8 HCT 31.0 PLT 305
BMP NA 135 K+ 4.0 Cl 100 HCO3 19 BUN 16 Cr 0.8 Glu 99
Coagulation Profile PT 10.0 PTT 21.0 INR 1.0
Blood Alcohol Pending
Urine Drug Screen Pending
Type and Cross Match Pending

Standard Participant Details

Scenario Goals:
This is a teaching scenario and we expect the assessment to take longer than it would in the clinical setting. This is the first time participants will be performing the EFAST. Your role is critical to helping participants learn how to perform the EFAST and to interpret their findings, along with other findings from their interview and physical exam with you. We have allowed 25 minutes for this scenario so that there is ample time for guided instruction and practice.

History of Present Illness:
You were working at a construction site (alternative – walking by a construction site) on the Georgetown campus when you tripped and fell onto a piece of rebar that penetrated your abdomen. You think it did not go too deep because you caught yourself and rolled off it quickly. You were so close to the ED your co-workers helped you up and brought you over immediately.

Pertinent Medical History:
You do not have any previous medical issues and rarely need to seek medical care. Only on occasion when you are sick or have an injury.

Affect and Behavioral Expectations:

When you first arrive in the ED the ED Nurse will bring you back from triage. You are able to move around and assist as she gets you into a patient gown, but it is painful to do so and the more you move around the more it hurts. As you settle onto the stretcher, you can relax some. When they palpate around the area where your wound will be you should grimace as if you are in pain. You do not have rebound tenderness.

Since our participants are new to this skill, we encourage you to be cooperative and patient. The exam is likely take longer than usual at this stage and participants will likely receive support, modeling and guidance from faculty and their fellow participants.

Questions or Inquiry to Make during the Scenario:

As the participants perform their assessment, we encourage you to ask questions about what they are finding on the ultrasound. For example, "what does that mean?"; "Is that good?" Since this is the first time these participants are conducting an EFAST you can expect the physician faculty to do some or most of this. This is an important learning experience, as participants will learn through observing and listening to all of the interactions that occur.

Appendix O

EFAST Ultrasound Scenario 2

<table>
<tr><th colspan="2">EFAST Ultrasound Scenario 2</th></tr>
<tr><th colspan="2">Faculty Version</th></tr>
<tr><td>Ultrasound Concepts

Knobology
Indications for EFAST
Incorporating the EFAST into a Trauma Assessment
Processes of EFAST Exam
Interpreting 2D ultrasound images
Patient Disposition</td><td>Secondary Concepts

Interpretation of physical assessment findings
Interpretation of vital signs</td></tr>
<tr><td colspan="2">Scenario Overview

Patient Name: Daniel Owen

Date of Birth: March 5, 1954

While participating in ED clinical to learn EFAST, participants and faculty are presented with a 60-70 year old male who arrived in the ED following a bicycle accident where he ran into a telephone pole while traveling downhill He was wearing a helmet. Upon arrival the patient is awake but somewhat confused. However, his vital signs were stable and his first EFAST was negative approximately 30 minutes ago. He has however experienced a decline in his blood pressure and his pulse rate is rising. The ED nurse alerts you and requests you see the patient again. Head, neck, and pulmonary and cardiovascular exams are unremarkable. The abdominal exam is soft, with diffuse tenderness, and he has some bruising noted across his abdomen at the diaphragm level. Extremity exam reveals multiple deep abrasions and contusions.</td></tr>
<tr><th colspan="2">Learning Objectives</th></tr>
</table>

Psychomotor Skills Perform an EFAST exam Utilize the M Turbo Ultrasound device	**Cognitive Skills** Determine when to perform and EFAST exam Interpret physical exam findings & vital signs Interpret EFAST findings Determine a plan of care for the patient based on your assessment findings
Affective & Self-Regulatory Reflect on your performance to identify and discuss your experiences related to caring for a patient with penetrating trauma	**Communication** Establish rapport with the patient Ask relevant diagnostic questions (e.g., history of present illness, medical history) Provide education and counseling support to the patient
Simulation Time: Up to 25 minutes	Debriefing Time: Up to 30 minutes

Orientation to Simulation Setting
This scenario takes place in the emergency department where the participant has arrived for a rotation in the ED to learn EFAST. The participant will be paired with a physician faculty member playing the role of ED attending orientating the participant to EFAST. There will be at least 1-2 other confederates (e.g., nurses, ED tech) playing clinical roles in the scenario. Study participants will work in pairs of two.
Expectations for Participation In this scenario, participants will determine how and when to provide patient care, including the ordering of any tests, and performance of assessments. Participants will be asked to take their cues from the role players they interact with and to treat this as if it were an actual clinical experience. Things such as vital signs will be available on the patient monitor in the room. You will have access to the needed artifacts such as labs, vital signs and materials you typically use to provide care in this circumstance. As faculty, you will be playing the role of attending ED physician, nurses, or other ED staff. In these early scenarios, participants will require your support in performing the EFAST. Please support them as much as they need. The types of support that might be needed include: 1. For the first scenarios, you will likely need to model the procedure for them completely before they do so or as they do so. As they improve, they will likely ask for less help, this is normal. 2. It is important that you participate in your role in order to support the scenario's narrative – please keep the patient's presence in mind – speak to the SP as if they were an actual patient. Discuss issues that are relevant to care now and in the future with the patient and the participant. If the SP asks a question, address them as you would a patient. 3. You will need to observe participants for signs that they wish to practice without you. 4. If you sense they are struggling, or are not engaged this is an important time to offer support, as they will not always know when they need help, or know to seek it. 5. Providing verbal of physical guidance such as encouragement (e.g., "good") or affirm their correct actions. This is an important feedback strategy that helps them self-regulate in the future. 6. If a participant asks a question that seems unrelated to the scenario, seek to learn more about why they asked. For example, you could respond by asking, "help me understand why you're asking so I can better tailor my answer?" The issue is important to them and using inquiry to gain a deeper understanding of their thinking will provide you with more evidence of their thought processes.

Scenario Context Questionnaire

Questions about the Setting	Free Text Response
What are the typical physical tools (e.g., stethoscope, ultrasound device) that you expect would be needed or found in this type of scenario?	Sonosite M turbo (2) Stretcher /Bed Stethoscope Pt. Vital signs monitor (simulated version) Oxygen mask NRB Tank IV supplies/cart (for nurse confederate x 2 with reservoir) Sp02 Probe BP Cuff . Trauma scissors . EKG leads . Foley . Urinal . Ultrasound gel
What props would further support the clinical situation (e.g., standard patient with moulage, human patient simulator)?	Moulage consistent with penetrating trauma Clothing with blood (disposable) Mountain dew (as urine) Standard patient
What personal patient safety equipment should be available for the scenario?	Yellow gowns Gloves Alcohol gel Masks Hats Booties
What are the diagnostic findings that would be needed to support participants as they make or confirm a diagnosis in this scenario?	History consistent with penetrating trauma Physical findings consistent with penetrating trauma. Ultrasound images Vital signs consistent Urine Dip
What diagnostic activities (e.g., auscultate, palpation) would normally be used in this type of scenario?	Visualization Auscultation Palpation Ultrasound exam Diagnostic questioning

What types of therapies (e.g., fluid challenge, medication administration) would typically be offered in this type of scenario?	Oxygen Fluids Bandages (4X4 with tape)
Questions about Roles and Rules	**Free Text Response**
What rules would normally guide or govern care or behavior in this scenario?	**Assessment Guidelines**: Trauma Assessment – Primary and Secondary EFAST **Therapeutic Guidelines**: Hypovolemia therapy
Who is typically present during a scenario such as this, and what role do they play during the event?	1 ED physician 1-2 ED Nurses 2 students 1-2 Trauma physicians

Participant Hand-Off Script

During this scenario, you are in the ED where you are both participating in clinical rotations to learn EFAST. You will be paired with a physician educator who will provide you with instruction and support as you learn the EFAST exam. If you need their help, please ask them for support. If you wish to work independently, you may also do so.

During this scenario, you will interact with other role players that you would normally expect to find if you were in the ED such as other physicians, nurses and techs. You will find many of the typical tools and items you would normally find and need to care for patients. We encourage you to make use of these tools and items to help you. Please take your cues from the patients, patient monitors, ultrasound device, and other role players you interact with. We encourage you to imagine as if this were the actual ED and to treat the situation as if it were an actual clinical experience.

You will have up to 25 minutes to complete this scenario. You may end it sooner if you desire. There is no penalty for finishing early or at 25 minutes. The purpose of this scenario is educational. Following the scenario, you will complete a post-simulation written reflection and then participate in a guided debriefing with the members of the patient care team. Debriefing is an important part of simulation where you will have the opportunity to reflect on your practice in a safe setting. During the debriefing session, we will discuss how you felt about your simulation experience and review the care and exams you performed. Faculty will offer coaching advice that you can use in future performances.

What questions do you have? When you are ready to start the scenario, please enter the simulation space.

PATIENT CARE SIMULATION			
Time	**Manikin Settings and Changes**	**Patient Responses/Cues**	**Ideal Participant Actions**
0-5 min Hand - Off 	**Vitals:** Pulse: 122 BP: 90/54 Respirations: 18 Temp: 37 C SP02: 96% RA	Confused but cooperative. Grimaces with palpation to abdomen. *Note for standard patients – this is a teaching scenario and we expect the assessment to take longer than it would in the clinical setting. This is the first time participants will be performing the EFAST. We have allowed 25 minutes for this scenario so that there is ample time for guided instruction and practice.	Works with physician to initiates/perform assessment – primary and then focused assessment. Reviews/analyzes initial set of vital signs Communication with the patient (introduction, diagnostic questions, education and counseling).
5-10 min 	Unchanged **Vitals:** Pulse: 122 BP: 88/50 Respirations: 18 Temp: 37 C SP02: 96% RA	Unchanged *Nurses provide care for the patient, including beginning IV fluids and engage with the rest of the team as you would normally in the clinical setting.	Works with physician as needed to perform EFAST. Reviews/analyzes vital signs Continues communication with the patient (introduction, diagnostic questions, education and counseling)
10-25 min	Unchanged **Vitals:**	Remains slightly confused but cooperative.	Interprets EFAST findings (fluid noted in Morison’s pouch), vital

	Pulse: 116 BP: 92/60 Respirations: 16 SP02: 99% RA	Nurses provide care for the patient, including beginning IV fluids and engage with the rest of the team as you would normally in the clinical setting. UA – revealed hematuria	signs and physical findings. Reviews/analyzes vital signs Communication with the patient (introduction, diagnostic questions, education and counseling) Considers patient disposition options.

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Admission Labs for Scenario 2

Patient Name: Daniel Owen
CBC WBC 3.2 HGB 11.2 HCT 37.6 PLT 140
BMP NA 134 K+ 3.7 Cl 108 HCO3 19 BUN 8 Cr 0.4 Glu 74
Coagulation Profile PT 10.0 PTT 28.7 INR 0.9
Blood Alcohol Negative
Urine Drug Screen Negative
Type and Cross Match 0 Negative
Urinalysis Spec grav- 1.020 Leuk est-negative Nitrite-negative Blood-2+ Protein-negative Glucose-negative Ketones-negative WBC-1.0 RBC 25-50 Bacteria-none

Repeat Labs Scenario 2

Patient Name: Daniel Owen
CBC WBC 3.2 HGB 10.3 HCT 34.0 PLT 153

Standard Patient Details

Scenario Goals:
This is a teaching scenario and we expect the assessment to take longer than it would in the clinical setting. This is the first time participants will be performing the EFAST. Your role is critical to helping participants learn how to perform the EFAST and to interpret their findings, along with other findings from their interview and physical exam with you. We have allowed 25 minutes for this scenario so that there is ample time for guided instruction and practice.

History of Present Illness:
You were brought to the ED following a bicycle accident where you ran into a telephone pole while traveling downhill. You were wearing your helmet, but did not lose consciousness, but you are somewhat confused.

Pertinent Medical History:
You have been in the ED for about 30 minutes and you have already received some initial care, will have 2 IV's in place and be dressed in a patient gown. There was an initial ultrasound performed and at this stage of the encounter, your blood pressure will start to fall.

Affect and Behavioral Expectations:
You feel cold, still confused – but not agitated.

Since our participants are new to this skill, we encourage you to be cooperative and patient. The exam is likely take longer than usual at this stage and participants will likely receive support, modeling and guidance from faculty and their fellow participants.

Questions or Inquiry to Make during the Scenario:
As the participants perform their assessment, we encourage you to ask questions about what they are finding on the ultrasound. For example, "what does that mean?"; "Is that good?"

Appendix P

EFAST Ultrasound Scenario 3

<table>
<tr><th colspan="2">EFAST Ultrasound Scenario 3</th></tr>
<tr><th colspan="2">Faculty Version</th></tr>
<tr><td>Ultrasound Concepts

Knobology
Indications for EFAST
Incorporating the EFAST into a Trauma Assessment
Processes of EFAST Exam
Interpreting 2D ultrasound images
Patient Disposition</td><td>Secondary Concepts

Interpretation of physical assessment findings
Interpretation of vital signs</td></tr>
<tr><td colspan="2">Patient Name: Tony Weeks

Date of Birth: May 21, [Year dependent on Casting]

This scenario is set in the ED where 2 EMT participants are participating in ED rotations and are currently located in triage with one of the nurses. The scenario starts with the ED nurse and participants greeting each other. A male in his early 60's will enter, holding his right side and grimacing in pain. He appears to be in a lot of pain and indicates that he fell on the stairs about 2 hours ago, falling on his right side. He denies any head injury or loss of consciousness and thinks he just missed a step. The pain in his right side has been getting worse. He is alert and oriented, able to walk, speaking in normal sentences. The patient has some abrasions and bruising to the right lateral chest. This patient will present with a positive FAST.</td></tr>
</table>

Learning Objectives

Psychomotor Skills	**Cognitive Skills**
Perform an EFAST exam Utilize the M Turbo Ultrasound device	Determine when to perform and EFAST exam Interpret physical exam findings & vital signs Interpret EFAST findings Determine a plan of care for the patient based on your assessment findings
Affective & Self-Regulatory Reflect on your performance to identify and discuss your experiences related to caring for a patient with penetrating trauma.	**Communication** Establish rapport with the patient Ask relevant diagnostic questions (e.g., history of present illness, medical history) Provides education and counseling support to the patient Interact and communicate with members of the patient care team
Simulation Time: Up to 25 minutes	Debriefing Time: Up to 30 minutes

Orientation to Simulation Setting

This scenario takes place in the emergency department. There will be at least 1-2 other standardized participants (e.g., nurses, ED tech) playing clinical roles in the scenario. Study participants will work in pairs of two.

Expectations for Participation

In this scenario, participants will determine how and when to provide patient care, including requesting and performing assessments. Participants will be asked to take their cues from the role players they interact with and to treat this as if it were an actual clinical experience. Things such as vital signs will be available on the patient monitor in the room. You will have access to the needed tools and artifacts such as lab results, vital signs, and the other materials you typically use to provide care in this circumstance.

As faculty, you will be playing the role of attending ED physician, nurses, or other ED staff. In these early scenarios, participants will require your support in performing the EFAST. Please support them as much as they need. The types of support that might be needed include:

For the third and fourth scenarios, the participants are likely to want to take on the care themselves, asking for your help and guidance as they go along. This is completely normal and should be allowed. They will likely ask for your help in identifying various views, or asking what should be ordered – this is also normal, so please answer their questions and provide support as needed.
It is important that you participate in your role in order to support the scenario's narrative – please keep the patient's presence in mind – speak to the SP as if they were an actual patient. Discuss issues that are relevant to care now and in the future with the patient and the participant. If the SP asks a question, address them as you would a patient.
You will need to observe participants for signs that they wish to practice with or without you.
If you believe they are struggling, or are not engaged, this is an important time to offer support, as they will not always know when they need help, or know to seek it.
I encourage you to provide verbal support (e.g., encouragement, affirm their findings) or physical guidance (e.g., with the P21 probe). These are important instructional strategies that will help participants learn how to self-regulate their actions.
If a participant asks a question that seems unrelated to the scenario, seek to learn more about why they asked. For example, you could respond by asking, "help me understand why you're asking so I can better tailor my answer?" The issue is important to them and using inquiry to gain a deeper understanding of their thinking will provide you with more evidence of their thought processes.

Scenario Context Questionnaire

Questions about the Setting	Free Text Response
What are the typical physical tools (e.g., stethoscope, ultrasound device) that you expect would be needed or found in this type of scenario?	Sonosite M turbo (2) Stretcher /Bed Stethoscope Pt. Vital signs monitor (simulated version) Oxygen mask NRB Tank IV supplies/cart (for nurse confederate x 2 with reservoir) Sp02 Probe BP Cuff . Trauma scissors . EKG leads . Foley . Urinal . Ultrasound gel
What props would further support the clinical situation (e.g., standard patient with moulage, human patient simulator)?	Moulage consistent with blunt trauma – abrasions (minor) with bruising. Clothing that is disposable Standard patient
What patient safety equipment should be available for the scenario?	Yellow gowns Gloves Alcohol gel Masks Hats Booties
What are the diagnostic findings that would be needed to support participants as participants make or confirm a diagnosis in this scenario?	History consistent with blunt trauma Physical findings consistent with penetrating trauma Ultrasound images Vital signs consistent Urine dip Labs Chest X-ray
What diagnostic activities (e.g., auscultate, palpation) would normally be used in this type of scenario?	Visualization Auscultation Palpation Ultrasound exam

	Diagnostic questioning
What types of therapies (e.g., fluid bolus, medications administration) would typically be offered in this type of scenario?	Oxygen Fluids Bandages (4X4 with tape) Morphine

Questions about Roles and Rules	Free Text Response
What rules would normally guide or govern care or behavior in this scenario?	**Assessment Guidelines**: Trauma Assessment – Primary and Secondary EFAST **Therapeutic Guidelines**: Hypovolemia therapy Penetrating would care
Who is typically present during a scenario such as this, and what role do they play during the event?	1 ED physician 1-2 ED Nurses 2 students 1-2 Trauma physicians

Participant Hand-Off Script

The next two scenarios are set in the ED where you are both participating in clinical rotations to learn EFAST. You will be paired with a physician educator who will provide you with instruction and support as you learn the EFAST exam. If you need their help, please ask them for support. If you wish to work independently you may also do so.

During this scenario you will interact with other role players that you would normally expect to find if you were in the ED such as other physicians, nurses and techs. You will find many of the typical tools and items you would normally find and need to care for patients. We encourage you to make use of these tools and items to help you. Please take your cues from the patients, patient monitors, ultrasound device, and other role players you interact with. We encourage you to imagine as if this were the actual ED and to treat the situation as if it were an actual clinical experience.

You will have up to 25 minutes to complete this scenario. You may end it sooner if you desire. There is no penalty for finishing early or at 25 minutes. The purpose of this scenario is educational. Following the scenario you will complete a post-simulation written reflection and then participate in a guided debriefing with the members of the patient care team. Debriefing is an important part of simulation where you will have the opportunity to reflect on your practice in a safe setting. During the debriefing session we will discuss how you felt about your simulation experience and review the care and exams you performed. Faculty will offer coaching advice that you can use in future performances.

What questions do you have?

When you are ready to start the scenario please enter the simulation space.

PATIENT CARE SIMULATION

Time	Manikin Settings and Changes	Patient Responses/Cues	Ideal Participant Actions
0-3 min Hand - Off	Participants and triage nurse meet and discuss expectations and goals for the clinical rotation. Towards the end of this conversation the patient will enter. Patient enters triage unassisted - he arrived at the ED by cab. Participants can make a determination to assess the patient in triage or take him to the back.		
3-5 min Triage	Patient alert & oriented and in 6/10 pain. He has a minor abrasion and some bruising to the right lateral chest. ***Set Monitor for "off" until the patient is attached to the leads and cuff/probe.** **Vitals:** Pulse: 114 BP: 112/72 Respirations: 24 SP02: 95% RA	In pain, cooperative – uncomfortable with movement. Breathing rate is elevated some. Pain and tenderness to the right lateral chest with palpation. Some mild (3/10) abdominal pain. PMH: A-Fib ("irregular heartbeat") Medications: Coumadin	Participants should conduct their initial assessment. Reviews/analyzes initial set of vital signs Communication with the patient (introduction, diagnostic questions, education and counseling) Take the patient back to the ED and continue to assist the patient. ED physician will engage the scenario when requested.
5-25 min ED Setting	Unchanged **Vitals:** Pulse: BP: Respirations: SP02: 97% RA	Unchanged	Works with physician as needed to perform EFAST. Reviews/analyzes vital signs Continues communication with the patient (introduction, diagnostic questions, education and counseling)

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Admission Labs for Scenario 3

Patient Name: Tony Weeks
CBC WBC 8.4 HGB 9.8 HCT 31.0 PLT 305
BMP NA 135 K+ 4.0 Cl 100 HCO3 19 BUN 16 Cr 0.8 Glu 99
Coagulation Profile PT 25.8 PTT 75.0 INR 2.6
Blood Alcohol Pending
Urine Drug Screen Pending
Urinalysis Pending
Type and Cross Match Pending

Standard Participant Details

Scenario Expectations and Goals:
This is the third scenario in a series of four where participants are learning how to identify when to perform an EFAST exam, and learning how to do so. At this stage, we expect the participants to be improving in their ability to do the EFAST, though we still anticipate that they may still take longer to do the exam, or they may still require an opportunity to repeat their exam steps. We are expecting this and consider it a normal step in their learning processes.

History of Present Illness:
You will enter the ED triage area holding your right side and grimacing with some in pain (6/10 now). When asked you share that you fell when you were running up the stairs to a meeting about 2 hours ago, falling on your right side. You didn't hit your head, or lose consciousness, & you just missed a step and fell because you were in a hurry and late for a meeting. The pain in your right side has been getting increasingly worse since it happened. You are alert and oriented, able to walk and can speak in normal sentences, though you have trouble catching your breath if you try to move around a lot – and you are afraid to take any deep breaths because your pain increases to a 12/10 if you try (because you've fractured several ribs and have a pneumothorax). You will have some minor abrasions and bruising to your right lateral chest.

Pertinent Medical History:

History - Atrial Fibrillation
Medications - Coumadin (blood thinner)
Allergies – None Known
Previous Surgical History – None
Last Meal – About 2.5 hours ago with a glass of wine

Affect and Behavioral Expectations:

When you first arrive in the ED the ED Nurse and participants will greet you in triage and do an initial assessment there before taking you back to the ED. You are in pain so when you move around a lot of grimacing and expressions of pain are expected. Also, when they palpate over your bruising and wounds the pain will be greater 8-9/10. You also have some minor diffuse pain all around your abdomen (3/10) – when they palpate your abdomen you can complain of some discomfort as they do. You are finding it harder to breath and you can't "catch your breath".

The participants will be working with the physician instructor so they will likely receive support, modeling and guidance from faculty and their fellow participants.

APPENDIX Q

EFAST Ultrasound Scenario 4

<table>
<tr><th colspan="2">EFAST Ultrasound Scenario 4</th></tr>
<tr><th colspan="2">Faculty Version</th></tr>
<tr><td>Ultrasound Concepts

Knobology
Indications for EFAST
Incorporating the EFAST into a Trauma Assessment
Processes of EFAST Exam
Interpreting 2D ultrasound images
Patient Disposition</td><td>Secondary Concepts

Interpretation of physical assessment findings
Interpretation of vital signs</td></tr>
<tr><td colspan="2">Scenario Overview

Patient Name: Dave Allen

Date of Birth: March 5, 19[xx – Depends on Casting]

While participating in ED clinical to learn EFAST, participants and faculty are presented with a [SP age] year old male who arrives in ED triage following an altercation at a bar where he was stabbed in the epigastrium with a steak knife. The patient presents himself to the ED. The patient is awake and alert, but somewhat confused and admits to having had a several glasses of beer. He complains of pain at the injury site, and an obvious stab wound is noted under the left ribs is noted with minor external bleeding. His vital signs are stable - Pulse 98, BP 114/70, Respirations 20, Sat 98% temp 36.2C. This patient will present with a positive EFAST in the RUQ.</td></tr>
</table>

Learning Objectives

Psychomotor Skills	Cognitive Skills
Perform an EFAST exam Utilize the M Turbo Ultrasound device	Determine when to perform and EFAST exam Interpret physical exam findings & vital signs Interpret EFAST findings Determine a plan of care for the patient based on your assessment findings
Affective & Self-Regulatory	**Communication**
Reflect on your performance to identify and discuss your experiences related to caring for a patient with penetrating trauma Develop a personal plan for improvement in future practice session(s)	Establish rapport with the patient Ask relevant diagnostic questions (e.g., history of present illness, medical history) Provide education and counseling support to the patient
Simulation Time: Up to 25 minutes	Debriefing Time: Up to 30 minutes

Orientation to Simulation Setting
This scenario takes place in the emergency department where the participant has arrived for a rotation in the ED to learn EFAST. The participant will work with a physician faculty member playing the role of ED attending. There will be at least 1-2 other standard participants (e.g., nurses, ED tech), in addition to the patient. Study participants will work in pairs or alone.
Expectations for Faculty Participants
In this scenario, participants will determine how and when to provide patient care, including the ordering of any tests and performance of assessments. Participants will be asked to take their cues from the role players they interact with and to treat this as if it were an actual clinical experience. Things such as vital signs will be available on the patient monitor in the room. Participants will also have access to appropriate artifacts such as lab results and vital signs. As faculty, you will be playing the role of attending ED physician, nurses, or other ED staff. In these early scenarios, participants will require your support in performing the EFAST; however, as they progress they will gain increasing independence. Please

support them as much as they need. The types of support that might be needed include:

1. For the first scenarios, you will likely need to model the procedure for them completely before they do so or as they do so. As they improve, they will likely ask for less help, this is normal.
2. It is important that you participate in your role in order to support the scenario's narrative – please keep the patient's presence in mind – speak to the SP as if they were an actual patient. Discuss issues that are relevant to care now and in the future with the patient and the participant. If the SP asks a question, address them as you would a patient.
3. You will need to observe participants for signs that they wish to practice without you. It is important to allow them to have autonomy while practicing. They will likely continue to seek your help and guidance.
4. If you sense participants are struggling, or are not engaged this is an important time to offer support, as they will not always know when they need help, or know to seek it.
5. Providing verbal of physical guidance such as encouragement (i.e. "good") or affirm their correct actions. This is an important feedback strategy that helps them self-regulate in the future.
6. If a participant asks a question that seems unrelated to the scenario, seek to learn more about why they asked. For example, you could respond by asking, "help me understand why you're asking so I can better tailor my answer?" The issue is important to them and using inquiry to gain a deeper understanding of their thinking will provide you with more evidence of their thought processes.

Scenario Context Questionnaire

Questions about the Setting	Free Text Response
What are the typical physical tools (e.g., stethoscope, ultrasound device) that you expect would be needed or found in this type of scenario?	Sonosite M turbo (2) Stretcher /Bed Stethoscope Pt. Vital signs monitor (simulated version) Oxygen mask NRB Tank IV supplies/cart Sp02 Probe BP Cuff Trauma scissors EKG leads Foley Urinal Ultrasound gel
What props would further support the clinical situation (e.g., standard patient with moulage, human patient simulator)?	Moulage consistent with penetrating trauma Clothing with blood (disposable) Mountain dew (as urine) Standard patient
What personal patient safety equipment should be available for the scenario?	Yellow gowns Gloves Alcohol gel Masks Hats Booties
What are the diagnostic findings that would be needed to support participants as they make or confirm a diagnosis in this scenario?	History consistent with penetrating trauma Physical findings consistent with penetrating trauma. Ultrasound images Vital signs consistent Urine dip
What diagnostic activities (e.g., auscultate, palpation) would normally be used in this type of scenario?	Visualization Auscultation Palpation Ultrasound exam Diagnostic questioning
What types of therapies (e.g., fluid challenge, medications) would typically be offered in this type of scenario?	Oxygen Fluids Bandages (4X4 with tape)

Question about Roles and Rules	**Free Text Response**
What rules would normally guide or govern care or behavior in this scenario?	**Assessment Guidelines**: Trauma Assessment – Primary and Secondary EFAST **Therapeutic Guidelines**: Hypovolemia therapy
Who is typically present during a scenario such as this, and what role do they play during the event?	1 ED physician 1-2 ED Nurses 2 students 1-2 Trauma physicians

Participant Hand-Off Script

During this scenario, you are in the ED where you are participating in clinical rotations to learn EFAST. You will be paired with a physician educator who will provide you with instruction and support as you learn the EFAST exam. If you need their help, please ask them for support. If you wish to work independently, you may do so.

During this scenario, you will interact with other role players that you would normally expect to find if you were in the ED such as other physicians, nurses and techs. You will find many of the typical tools and items you would normally find and need to care for patients. We encourage you to make use of these tools and items to help you. Please take your cues from the patients, patient monitors, ultrasound device, and other role players you interact with. We encourage you to imagine as if this were the actual ED and to treat the situation as if it were an actual clinical experience.

You will have up to 25 minutes to complete this scenario. You may end it sooner if you desire. There is no penalty for finishing early or at 25 minutes. The purpose of this scenario is educational. Following the scenario, you will participate in a guided debriefing, and then complete a post-simulation written reflection. Debriefing is an important part of simulation where you will have the opportunity to reflect on your practice. During the debriefing, we will discuss how you felt about your simulation experience and review the care and exams you performed. Faculty will offer coaching advice that you can use in future performances.

What questions do you have?

When you are ready to start the scenario, please enter the simulation space.

PATIENT CARE SIMULATION

Time	Manikin Settings and Changes	Patient Responses/Cues	Ideal Participant Actions
0-3 min Hand – Off & Planning – Awaiting patient arrival.	**N/A**	**N/A**	Works with physician and other team members to plan and prepare for receiving and caring for the patient. Communication with the patient care team and planning.
3-6 min EMS Hand-Off	The nurse brings the patient back from triage (entering through M3417) and begins to assess the patient. Upon noticing the blood on the patient's shirt, the nurse calls to the physician and participants to join her in caring for the patient. **Vitals:** Pulse: 92 BP: 110/70 Respirations: 22 Temp: 36.2 C SP02: 98% RA ETOH suspected	The patient is awake and alert, but is slurring his words, and is slightly confused – but cooperative – almost "overly friendly." The patient should express 5/10 pain with movement and palpation– especially around the area of the wound. The patient reports some minor pain around the abdomen in general (2/10) with palpation. There is no rebound tenderness.	Assists in undressing the patient in order to facilitate a physician exam. Conducts a rapid trauma assessment Reviews early vital signs Communication with the patient (introduction, diagnostic questions, education and counseling)

6-25 min 	Unchanged	The patient's status remains unchanged – but the patient should continue to talk and make approximately 2 attempts to get up and leave – politely. Nurses provide care for the patient, including beginning IV fluids and engage with the rest of the team as you would normally in the clinical setting.	Conducts and interprets EFAST findings (fluid noted in splenorenal view), vital signs and physical findings. Re-analyzes vital signs Continues communication with the patient and other health care providers throughout the scenario. Considers patient disposition options.

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Belinda Hermosura, RN, BSN, MSN, CHSE

Admission Labs for Scenario 4

Patient Name: Dave Allen
CBC WBC 3.2 HGB 11.2 HCT 37.6 PLT 140
BMP NA 134 K+ 3.7 Cl 108 HCO3 19 BUN 8 Cr 0.4 Glu 74
Coagulation Profile PT 10.0 PTT 28.7 INR 0.9
Blood Alcohol **2.4**
Urine Drug Screen Pending
Type and Cross Match 0 Negative
Urinalysis Pending

Standard Participant Details

Scenario Goals:
This is a teaching scenario. This is the fourth time participants will be performing the EFAST. Your role is critical to helping participants learn how to perform the EFAST and to interpret their findings, along with other findings from their interview and physical exam with you. We have allowed 25 minutes for this scenario so that there is ample time for guided instruction and practice.

History of Present Illness:
Prior to coming to the ED you were a bar watching a football game (or Hockey depending on what day of the week it is and what is normally on). You consumed several beers over the course of a couple of hours. During the game, you made a comment about a bad call and the man sitting near strongly disagreed with you – and a fight followed. The other bar patron eventually grabbed a steak knife and stabbed you once that you can remember. The bar bouncers threw you both out without realizing you had been stabbed. You realized you were bleeding and took a cab to the ED since you did not think it was serious – maybe you just need a few stiches.

This scenario starts with you entering the ED with you holding your hand over your wound site with some obvious bleeding noted.

You deny any loss of consciousness or head injury – you were able to block most of his efforts to punch you.

Pertinent Medical History:

Medical history – none
Medications – Tylenol or Advil as needed.
Allergies – none known

Affect and Behavioral Expectations:
At Arrival:
You are awake and alert, though a little slow to respond and slurring your words. You are cooperative - almost "overly friendly." You should express 5/10 pain with movement (bending, sitting or when being laid down), and with palpation around the area of the wound. You also have some minor pain all around the abdomen (2/10) with palpation. You have no rebound tenderness.

As the Scenario Progresses:
You remain awake, alert, and continue to be a little slow in responses and slurring your words. You remain cooperative and friendly, making 1-2 attempts to get up and leave – indicating that this probably isn't all that big of a deal.

Questions or Inquiry to Make during the Scenario:

As the participants perform their assessment, we encourage you to ask questions about what they are finding on the ultrasound. For example,
“What does that mean?” or “Is that good?”

Appendix R

EFAST Ultrasound Post-Test Scenario

<table>
<tr><th colspan="2">EFAST Ultrasound Post-Test Scenario</th></tr>
<tr><th colspan="2">Faculty Version</th></tr>
<tr><td>Ultrasound Concepts

Knobology
Incorporating the EFAST into a Trauma Assessment
Processes of EFAST Exam
Interpreting 2D ultrasound images</td><td>Secondary Concepts

Interpretation of physical assessment findings
Interpretation of vital signs</td></tr>
<tr><td colspan="2">Scenario Overview

Patient Name: Dale Whitaker

Date of Birth: February, 5 [Insert Year Depending on Casting]

While participating in ED clinical, the participant will be asked to perform an EFAST exam on a patient who arrived in the ED approximately 45 minutes ago after sustaining blunt trauma to his abdomen where he was sandwich tackled while playing rugby. The patient reported 7-8/10 pain, but was stable and the first EFAST at ED arrival was negative. He is currently being monitored and has 2 IVs established, with normal saline running @ 100cc/hour. He received 6MG of morphine approximately 20 minutes ago. He is stable but continues to complain of diffuse 5/10 abdominal pain, without rebound tenderness. The plan is to conduct a series of repeat ultrasounds.</td></tr>
</table>

Learning Objective

Psychomotor Skills	Cognitive Skills
Perform an EFAST exam Utilize the M Turbo Ultrasound device	Interpret physical exam findings & vital signs Interpret EFAST findings
	Communication Establish rapport with the patient Ask relevant diagnostic questions (e.g., history of present illness, medical history) Provide education and counseling support to the patient.
Simulation Time: 10 minutes	Debriefing Time: 10 minutes

Orientation to Simulation Setting

Study participants will work individually during this experience.

Expectations for Participation

In this scenario, participants will determine how and when to provide patient care, including the ordering of any tests, and performance of assessments, including an EFAST. Participants will be asked to take their cues from the role players they interact with (e.g., patient, nurse, physician), and to treat this as if it were an actual clinical experience. Things such as vital signs will be available on the patient monitor in the room, and the patient's nurse is available. They will use the Sonosite M Turbo ultrasound device.

For Physician Faculty:
As faculty, you will be playing the role of attending ED physician. In this post-test, you will be evaluating participants as they perform an EFAST exam. Prior to this assessment, participants will have completed the pretest, the initial M Turbo/EFAST Skills Orientation, followed by two EFAST practice sessions. This step serves to, 1) establish an understanding of where the participants are at this point following their skills and scenario simulation session, and 2) provide participants with a new baseline of their skills.

For this step, please:

1. Encourage the participant to perform the EFAST independently and offer limited teaching points or assistance (they will be advised of this as well). If they are discouraged, you can offer them encouragement (i.e., "do your best"), and guided support if they appear to continue to struggle). The SP will be patient and understanding.
2. It is important that you participate in your role in order to support the scenario's narrative – please keep the patient's presence in mind – speak to the SP as if they were an actual patient. Discuss issues that are relevant to care now and in the future.

Standard Patients:
As standard patients, you will be playing the role of the patient. In this post-test, participants will be assessed on their current ability to perform an EFAST exam. Prior to this assessment, they will have completed the pretest, the initial M Turbo/EFAST Skills Orientation, followed by two EFAST practice sessions. This step serves to a) establish an understanding of where the participants are at this point following their skills and scenario simulation session, and b) ideally, provide participants with a new baseline of their skills.

It is important that you participate in your role in order to support the scenario's narrative – please – interact and speak with the faculty role players and the participant as if you were an actual patient. Your condition is not life threatening.	
Questions about the Setting	**Free Text Response**
What are the typical physical tools (e.g., stethoscope, ultrasound device) that participants would be need in this type of scenario?	Sonosite M turbo Stretcher Stethoscope Pt. Vital signs monitor (simulated version) IV supplies/cart (for nurse confederate x 1) Sp02 Probe BP Cuff EKG leads
What props would further support the clinical situation (e.g., standard patient with moulage injuries, human patient simulator)?	Standard Patient Casting – Male of average height/build/weight. Prefer non-obese– consistent with pre-test standard patient. Entry narrative and mechanism of injury can be adapted in standard patient cast is not age appropriate for playing rugby.
What patient safety equipment should be available for the scenario?	Gloves Alcohol gel
What are the diagnostic findings that are needed to support participants as they make or confirm a diagnosis in this scenario?	History consistent with blunt trauma Vital signs consistent with a stable patient, experiencing some continued pain. Normal lab results Normal urine dip
What diagnostic activities (e.g. auscultate, palpation) would normally be employed in this type of scenario?	Visualization Auscultation Palpation Ultrasound Exam Diagnostic Questioning
What types of therapies (e.g., fluid challenge, medications administration) are typically offered in this type of scenario?	At least 1 IV with 1L of NS hanging @ TKO Morphine

Questions about Roles and Rules	**Free Text Response**
What rules would normally guide or govern care or behavior in this scenario?	**Assessment Guidelines**: Trauma Assessment – Primary and Secondary EFAST

Who is typically present during a scenario such as this, and what role do they play during the event?	1 Patient 1 ED nurse 1 ED Physician 1 EMT participant

Participant Hand Off:

In this scenario you are rotating through the emergency department (ED), where you are participating in a clinical rotation. You will be asked to perform an EFAST exam on an established patient in the ED to the best of your ability. We strongly encourage you to view this as an opportunity to continue to develop an understanding of your skills.

During this scenario, you will interact with other role players whom you would normally expect to find if you were in the ED, such as other physicians, nurses, and techs. You will find many of the typical tools and items you would normally find and need to care for patients. We encourage you to make use of these tools and items to help you. Please take your cues from the patients, patient monitors, ultrasound device, and other role players. We encourage you to imagine as if this were the actual ED and to treat the situation as if it were an actual clinical experience.

You will have up to 10 minutes to complete your EFAST exam. You may end it sooner if you desire or if you finish early. There is no penalty for finishing early or at 15 minutes.

Following the scenario, you will have an opportunity to review your performance with the physician faculty.

What questions do you have?

When you are ready to start the scenario, please enter the simulation space.

PATIENT CARE SIMULATION

Time	Manikin Settings and Changes	Patient Responses/Cues	Ideal Participant Actions
At Arrival – Prior to this Exam	Patient alert & oriented with no obvious abrasions or wounds noted to the abdomen. No external bleeding noted. Presenting Vitals: Pulse: 116 BP: 140/84 Respirations: 18 SP02: 99% RA Urine Dip: Negative Labs: All within normal limits	Cooperative, but experiencing pain and discomfort. Complaining of generalized diffuse abdominal pain (7-8/10) throughout the abdomen. When they palpate your abdomen, the patient grimaces. There is no one place that hurts the most. No rebound tenderness	Initial Treatment/Care Provided: H&PE – No obvious injuries/trauma noted. EFAST – Negative Findings Urine Dip – Negative Labs: All within normal limits
0-10 min Hand - Off 	Patient alert & oriented with no obvious abrasions or wounds noted to the abdomen. No external bleeding noted. Current Vitals: Pulse: 92 BP: 136/84 Respirations: 16 SP02: 99% RA Labs/Urine Dip: Negative	Cooperative, but experiencing pain and discomfort. Complaining of generalized diffuse abdominal pain (5/10) throughout the abdomen. When they palpate your abdomen, the patient grimaces. There is no one place that hurts the most. No rebound tenderness	Communication with the patient (introduction, diagnostic questions, education and counseling) Performs assessment –focused assessment. Reviews/analyzes initial set of vital signs Performs EFAST. Interprets findings and shares them with the patient and attending physician. Makes recommendation for next steps of care & explains to the patient.

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APPENDIX S

EFAST Pre-Test Session Implementation Checklist

EFAST Pre-Testing Session Checklist

Item	Completed/Initials		Notes:
1. Confirm date and time with participant(s). Record date in notes section.	Yes O	No O	
2. Send calendar invitations to all faculty, SP's & participants (record numeric ID in notes section).	Yes O	No O	
3. Ensure multiple copies of EFAST self-efficacy scale are available.	Yes O	No O	
4. Ensure multiple copies of RAD DOPS are available for faculty.	Yes O	No O	
5. Welcome participants and request participants to complete the EFAST SE Scale – in privacy.	Yes O	No O	
6. Orient to lab	Yes O	No O	
7. Review lab goals and instructions with participants.	Yes O	No O	
8. Offer participants an opportunity to ask questions.	Yes O	No O	
9. Complete Pre-Test	Yes O	No O	
10. Offer participants an opportunity to review their pre-test score with faculty.	Yes O	No O	
11. Completed M Turbo Session. Include numeric ID and time in session in notes section.	Yes O	No O	
12. Assign participants to intervention groups.	Yes O	No O	

Appendix T

EFAST Intervention Session Implementation Checklist

EFAST Intervention Session Checklist

Item	Completed/Initials		Notes:
1. Confirm date and time with participant(s). Record date in notes section.	Yes O	No O	
2. Send calendar invitations to all faculty, SP's & participants (record numeric ID in notes section).	Yes O	No O	
3. Ensure multiple copies of EFAST self-efficacy scale are available.	Yes O	No O	
4. Ensure Learning Objectives/Cases are posted at least 1 week in advance for faculty.	Yes O	No O	
5. Greet participants and request they complete the EFAST SE Scale – in privacy.	Yes O	No O	
6. Orient to the lab, review lab goals and instructions with participants.	Yes O	No O	
7. Offer participants an opportunity to ask questions & orient to intervention session if first time.	Yes O	No O	
8. Determine lead roles (if scenarios)	Yes O	No O	
9. Give participants Gift Cards at the conclusion of the session.	Yes O	No O	

Intervention Session Details

Role	Numeric ID
Instructional Faculty	
Debriefing Faculty	
Session Observer	
Participant 1	
Participant 2	

Session Notes

(Please include any incidences of equipment failure, technological issues or instances where SP's potentially worked outside their boundaries.

Appendix U

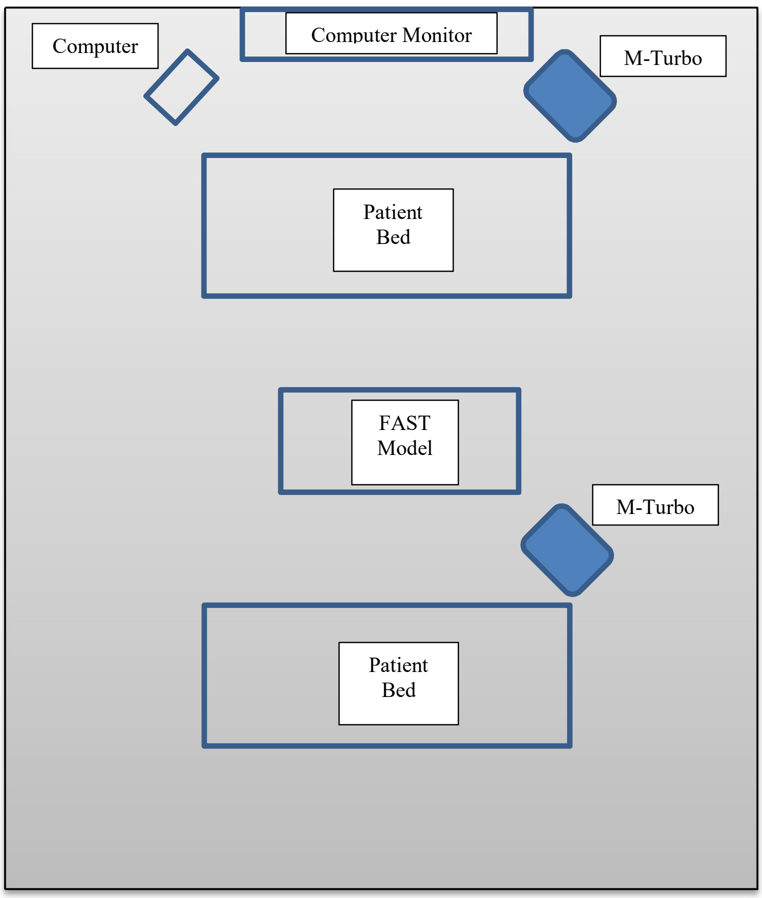
EFAST Post-Test Session Implementation Checklist

EFAST Post-Testing Session Checklist

Item	Completed/Initials		Notes:
1. Confirm date and time with participant(s). Record date in notes section.	Yes O	No O	
2. Send calendar invitations to all faculty, SP's & participants (record numeric ID in notes section).	Yes O	No O	
3. Ensure multiple copies of EFAST self-efficacy scale are available.	Yes O	No O	
4. Ensure multiple copies of RAD DOPS are available for faculty.	Yes O	No O	
5. Welcome participants and ask participants to complete the EFAST SE Scale – in privacy.	Yes O	No O	
6. Orient to the lab.	Yes O	No O	
7. Review lab goals and instructions with participants.	Yes O	No O	
8. Offer participants an opportunity to ask questions.	Yes O	No O	
9. Complete Post-Test	Yes O	No O	
10. Offer participants an opportunity to review their post-test score with faculty.	Yes O	No O	
11. Completed M Turbo Session. Include numeric ID and time in session in notes section.	Yes O	No O	
12. Give participants gift card at the end of the session.	Yes O	No O	

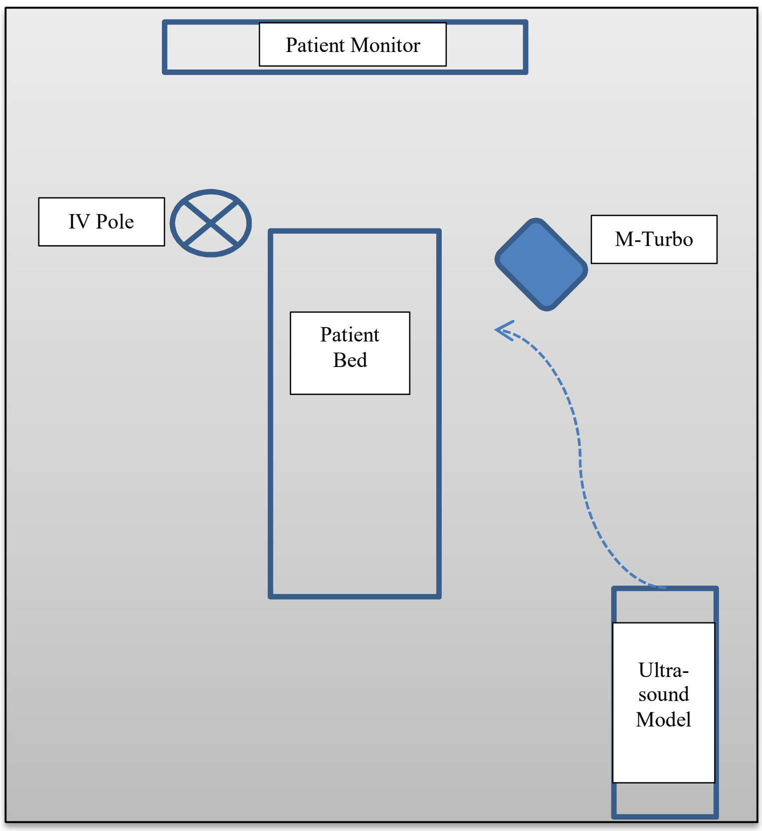
Appendix V

EFAST Skills-Based Simulation Lab Layout



Appendix W

EFAST Scenario-Based Simulation Lab Layout



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Biography

Alexis Battista graduated from Goochland High School, Goochland, Virginia, in 1990. She was employed as an emergency medical technician and as a Paramedic in Richmond, Virginia, and Lewiston, Idaho for nine years. She received her Bachelor of Science from George Washington University in 2000, and her Master's in Business Administration in 2002. She began working with healthcare simulation in 2002, and was employed at Northern Virginia Community College, Fairfax County Fire and Rescue, and MedStar Washington Hospital Center, where she worked with all three organizations to develop and advance healthcare simulation.