SIMULATION, REFLECTION, AND FEEDBACK

IN MEDICAL EDUCATION

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by

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And hereby that, in their opinion, it is worthy of acceptance.

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Dr. Joe Donaldson _____

DEDICATION

This dissertation is dedicated to my lovely husband Ozy, my beautiful daughters Anastasia and Indiana, and my family in Indonesia who always support and encourage me throughout the years. I would not have accomplished this without your unconditional love and endless encouragement.

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ABSTRACT

The purpose of this study was to examine differences between residents' perceptions of their learning after participation in a simulation, and residents' perceptions of their learning after participation in a simulation followed by a reflection and feedback session. Twelve first-year surgical residents participated in this study. The participants were randomly assigned to one of three groups (named A, B, and C) with four participants in each group. Participants in groups A and C participated in a simulation followed by a reflection and feedback session, and participants in group B participated in a simulation only. The survey was administered to all residents (n=12) prior to their participation in the simulation. A direct observation was conducted at each group's activities and discussions during the simulation sessions, and reflection and feedback sessions (for the applicable groups). Then, individual interview was conducted to each of participants after simulation session (for group B), and simulation followed by reflection and feedback session (for groups A and C) have completed. Digital video recorders were set up to capture the entire simulations, reflection and feedback sessions, and individual interviews.

Results of this study indicated that the residents in groups A, B, and C were able to articulate areas of perceived learning. They were able to associate their prior experiences with the current situation when they responded to the simulation scenario. Furthermore, all of the residents acknowledged the realism and complexity of the situation as well as the distractions that occurred while they were dealing with the patient. The realism of the simulation scenario led to the residents becoming aware of unanticipated problematic events that could occur in an actual *Code Blue* situation. In addition, because all residents in the group worked as a team, two-way communication was seen as one of an important aspect that influenced the outcome of the simulation. Even though residents in groups A, B, and C were able to identify the problems of *complexity, distractions,* and *teamwork,* as a result of the realism of the simulation scenario, the residents in groups A and C were able to identify solutions for the problems based on the feedback they received from experienced practitioners during the reflection and feedback session. The identification of the problems of *complexity, distractions,* and *teamwork* were area of perceived learning for residents in all three groups, but the solutions provided as feedback from experienced practitioners during the reflection and feedback session is an additional area of perceived learning for residents in groups A and C.

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CHAPTER 1

INTRODUCTION

Reflection has been discussed as an important aspect within the education field (Dewey, 1933, 1938; Schön, 1983, 1987). Dewey (1933) argued that even though experiences are the basis of learning, learning itself could not take place without individuals' ability to perform reflection. Reflection enables individuals to look back over the events that have occurred, to understand them, and to turn them into a learning experience (Dewey, 1933).

The concept of reflective practice introduced by Schön (1983, 1987) was based on Dewey's theories of learning. He believed that individuals would have a better understanding of their learning if they were able to look back over previous experiences and learn from them. Reflective practice has been applied in different fields, mainly within areas of education (Loughran, 1996, 2002; Pinsky et al., 1997, 1998; Sobral, 2000), nursing (Hancock, 1999; McCrindle & Christensen, 1995; Teekman, 2000; Thorpe, 2004; Tomlinson, et al., 2002), and medicine (Charlin et al., 2000; Guest et al., 2001; Norman & Brooks, 1997; Mamede & Schmidt, 2004, 2005; Sobral, 2000).

Within medical education, it is common for medical practitioners (e.g., medical students, medical residents, nurses) to learn via a theory-practice hierarchy in which they learn the theory, augmented by case problems presented and discussed in a classroom

setting, followed by practical implementation with real patients. However, theoretical knowledge that has been learned may have little relevance to real-life situations that involve complex situations and unpredictable events (Salvage, 1998). Argyris and Schön (1974) referred to this situation as a theory-practice gap. Within medical education, it is not uncommon for medical practitioners to find that what they have learned in the classroom can be different from the real-world practices being conducted. Reflective practice can be used as a strategy to bridge the gap between theory and practice in order to develop a better understanding of the medical cases.

Medical practitioners cannot only learn from theoretical cases, but they need to be exposed to hands-on experiences in real-life settings. Loughran (2002) discovered that the development of knowledge through life experiences has a positive impact in guiding students toward becoming professional practitioners who easily incorporate theory and practice. Through simulation, medical practitioners have the opportunity to engage in hands-on experience, and can practice a set of specific knowledge and skills without potentially harming patients (Kneebone, 2003; Ziv et al., 2003). Thus, simulation allows the medical practitioners to practice their skills repeatedly, and to learn from their own mistakes within a safe environment (Gaba, 2000; Kneebone, 2003). The ability to perform reflection after a simulation may encourage them to associate the theory they have learned from their previous experiences to the current situation, as well planning for future actions. However, while there is a large amount of existing literature on simulations in medical education, the literature on reflective practice following simulations is very limited. Further investigation of how reflective practice influences residents' perspectives of their learning from simulations is needed.

Background

Reflective Practice

The concept of reflective practice was popularized by Schön (1983, 1987), and it has been expanded into a variety of professional areas. Schön believed that even though experiences are the basis of learning, learning itself could not take place without one's ability to perform reflection. Schön maintained that reflection is a strategy to re-examine experiences, including learning from experiences and framing the complex problems within professional practice. Schön identified two types of reflection: reflection-*in*-action and reflection-*on*-action. Through reflection-*in*-action, the practitioners can think about what they are doing *while* they are performing an action. Schön also emphasized the importance of reflection-*on*-action, where the practitioners do retrospective reflection, including self-assessments, peer evaluations, and group discussions, to facilitate the learning process regarding the action that has already occurred.

According to Schön (1983), reflective practice is useful in teaching complex cases in which practitioners must be able to understand the relationship between the action that was employed and the results that were obtained. Given a situation in which the knowledge learned did not always match that needed to solve the current situation, Schön suggested that practitioners should learn about reflection-*in*-action and reflection-*on*-action by applying standard rules, implementing their focus of the rules from general rules to application needed for a specific case, and then developing and testing a form of understanding of their action when application that was made failed. Throughout reflection-*in*-action, practitioners can integrate their knowledge and experiences with current situations. By doing reflection-*on*-action, practitioners can learn to retain their

effective actions and to discard their ineffective actions that did not achieve desirable results. Moreover, implementing reflective practice in professional settings can help practitioners to be self-directed and self-regulated in their learning (Sobral, 2000), as well as providing effective strategies for dealing with complicated and unexpected events (Teekman, 2000; Tomlinson, 2002), which is essential for professional growth. In summary, reflective practice allows practitioners to reflect on and think through a process of their actions and to develop their own constructive learning strategy to guide their actions. Both reflection-*in*-action and reflection-*on*-action have positive impacts on developing plans and executing them within different professional settings. Furthermore, medical practitioners who constantly reflect on their professional activities and learn from them might better serve patients compared to those medical practitioners who do not perform reflection (Mamede & Schmidt, 2004). Thus, implementing reflective practice can prepare practitioners to think through what is happening, and what has happened, both during and after the activity.

Simulations in Medical Education

In the past decade, medical educators have integrated simulations into the medical curriculum. Simulation provides a realistic and controlled environment for medical practitioners to practice their skills and expand their knowledge without endangering patients (Kneebone, 2003). It is also useful for both novice and expert due to the ability of simulators to deliver more realistic and complicated events under controlled circumstances. In addition to promoting patients' safety, simulations have been found to increase performance and learning outcomes, since medical practitioners can practice their skills repeatedly (Maran & Glavin, 2003). Kneebone (2003) pointed out that the use

of simulations allows training to be customized to meet the needs of individual medical practitioners. Medical practitioners can practice specific parts of a procedure, or the whole procedure, as often as necessary without concern of failure. They can learn from their own mistakes and failures, and discover safer techniques for performing medical procedure on their own. Maran and Glavin (2003) stated that simulations are not intended to replace the learning process in clinical environments involving real patients; however, it can enhance preparation of medical practitioners before they apply their knowledge and skills to real patients.

The term *fidelity* is generally used to illustrate the *reality* of experiences, including appearances and activities within simulator exercises as compared those in actual medical situations. Medical practitioners can use either low, medium, or high-fidelity simulators when practicing a procedure and technical skill. The more realistic the cases and situations that are presented during simulation, the better their connection with an ability to perform with better technical skills (Kneebone, 2003). Furthermore, the ability to receive feedback from simulators as well as from faculty or clinical facilitators while performing simulations and afterwards, increased students' self-awareness and their self-confidence (Ker, 2003; Kneebone et al., 2002), as well as enhanced their understanding in managing uneven and complicated situations (Flanagan et al., 2004), including managing situations under realistic time and other pressures (Weller, 2004).

Rationale for the Study

Medical practitioners usually acquire theory and some case-based learning in the classroom before they actually apply them with real patients. Nevertheless, what they have learned in the classroom is not always relevant to real case problems, due to more

complicated situations and unpredictable events inherent in *real* cases. For these actual situations, simulations can be used as a bridge between theories that they had learned and hands-on practice, inasmuch as the simulation provides the opportunity for practitioners to gain hands-on experience that will prepare them better before applying their knowledge and skills to real patients. Hayden and Panacek (1999) emphasized that the use of simulation provides the opportunity for medical practitioners to gain hands-on experience with simulated patients with a wide variety of cases, including common and rare diseases in the safe and controlled environment. The ability to gain exposure to hands-on experiences through simulation can enhance their preparation and clinical experiences prior to treating actual patients (Maran & Glavin, 2003). Even though learning through hands-on experience is necessary in medical education, Dewey (1933) and Schön (1983, 1987) believed that meaningful learning would not likely take place without the ability to engage in reflection. Schön (1983, 1987) emphasized that the implementation of reflective practice leads to an enhanced understanding of the case problem by allowing the practitioner to look back on prior learning, make connections with the current situation, and think deeply about a plan for future actions if he or she should ever face a similar situation. Through reflection-*in*-action, practitioners will think about what they are doing while they are engaging in the action. This process necessitates the development of knowledge and skills from their previous experience to build a new understanding and hypothesis for a specific case, and to implement the hypothesis to test it and see how it works. Schön also emphasized the importance of reflection-*on*-action in which practitioners reflect on strategies and actions that have been made, and learn from them. Hence, the focus of reflective practice is to help practitioners define a better

understanding of what they know and the reasons for their decisions, construct new understandings, and develop new strategies and plans for their future actions.

The popularity of reflective practice in recent years has spurred researchers to explore and develop a better general understanding of terminology, theoretical perspective, and implementation in different areas including education, nursing, and medicine. Despite its popularity in those areas, there have been limited adequate empirical studies about the implementation of reflective practice following medical simulations. This situation brings up questions regarding how simulations followed by reflective practice might influence residents' perspectives of learning.

Purpose of the Study

The purpose of this study was to examine differences between residents' perceptions of their learning after participation in a simulation, and residents' perceptions of their learning after participation in simulation followed by a reflection and feedback session. Specifically, I sought to examine how residents: (1) associated prior knowledge, skills and experiences with their thoughts and actions regarding the simulation; (2) how they related their thoughts and actions regarding the simulation to similar events that they may encounter in future clinical situations; and (3) if there were differences when a simulation was followed by a reflection and feedback session.

Research Questions

The research questions addressed in this study included:

1. What are surgical residents' perceptions of learning after their participation in a simulation?

2. What are surgical residents' perceptions of learning after their participation in simulation followed by a reflection and feedback session?
3. What are the differences, if any, between surgical residents' perceptions of learning when they participate in simulation only, and residents' perceptions of learning when they participate in simulation followed by a reflection and feedback session?

Assumptions

Since participants in this study were first-year surgical residents, it was assumed that participants have already learned the basic knowledge and theories within the major medical sciences, and that they have already been exposed to various case-based learning experiences (e.g., myocardial infarction). It was also assumed that participants responded to the simulation as they would in a clinical setting, despite the fact that all of simulation activities were observed and recorded via video recorder. Finally, it was assumed that participants would be honest while they engaged in the discussion, both during and after simulations, as well as when they answered several questions that were asked during the interviews.

Significance of the Study

While there have been many studies that have discussed the benefits of having simulation to augment and support residents' learning, discussions in the existing literature about how residents perceived their learning from simulation are very limited. As Dewey (1933) stated, learning from experiences is more meaningful if it is followed by reflection on previous experiences, to understand them, and to learn from them. This is more or less summed up in the question, "How could I have done this better, and how

can I do this better if I have similar cases in the future?" The ability to perform reflection may aid residents in defining a better understanding of their cases' inherent problems, as well as in making connections to what they already know, and to the reasons behind their decisions made while performing their actions. They may construct new understandings and develop new strategies for their future actions. According to the descriptive literature, the implementation of reflective practice following a simulation should help practitioners grow within the realm of professional knowledge and skills, gain a better self-awareness (Osterman, 1990; Schön, 1987), gain better self-regulation, and increase their readiness to face more complex situations in their future careers (Sobral, 2000) as compare to participate in a simulation only.

Chapter Summary

Despite the advantages of simulations in enhancing the preparedness of medical practitioners in applying their knowledge and skills to practice within a safe environment, and without potentially endangering patients, Schön (1983, 1987) suggested the importance of conducting reflective practice to enhance practitioners' understandings of the case problems they are faced within real life by being allowed to make connections between their previous experiences, their current situations, and their plans for their future actions. In this chapter, the benefits of implementation of reflective practice following a medical simulation is discussed, followed by the purpose of the study and research questions that address an exploration of how residents perceive their learning from a simulation only, how they perceive their learning from a simulation followed by a reflection and feedback session, and the differences between those perceptions.

CHAPTER 2

LITERATURE REVIEW

This chapter begins with a review of the extant literature on the Schön's conceptualization of reflective practice, followed by the use of simulations in medical education. Reflective practice is applied mainly within the areas of education (Loughran, 1996, 2002; Pinsky et al., 1997, 1998; Sobral, 2000), nursing (Hancock, 1999; McCrindle & Christensen, 1995; Teekman, 2000; Thorpe, 2004; Tomlinson, et al., 2002), and medicine (Charlin et al., 2000; Guest et al., 2001; Norman & Brooks, 1997; Mamede & Schmidt, 2004, 2005; Sobral, 2000). However, literature that might better explain the implementation of reflective practice in medical simulation is very limited. Schön (1983) suggested that the utilization of the reflective practice could serve as a learning strategy for continued learning throughout the career; therefore, a further exploration of how reflective practice influences medical residents' learning from simulation is needed.

Reflective Practice

Reflection has been proposed as an important aspect within the education field (Dewey, 1933, 1938; Schön, 1983, 1987). Dewey (1938) believed that "there is an intimate and necessary relation between the process of actual experience and education" (p.7). He argued that individuals only could learn through experience, and individuals' experiences will be characterized based upon their previous experiences. Even though experiences are the basis of learning, he claimed that learning itself could not take place without the individuals performing reflection. Dewey stated that reflection allows an

individual to look back over the events that have happened, understand them, and turn them into learning experiences.

Schön (1983) introduced the concept of reflective practice based on Dewey's learning theory. He stated:

> The practitioner allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique. He reflects on the phenomenon before him, and on the prior understandings which have been implicit in his behaviour. He carries out an experiment which serves to generate both a new understanding of the phenomenon and change in the situation (p. 68).

By looking back over prior experiences and learning from them, individuals become reflective practitioners. Reflective practitioners look at the events in everyday practice as learning experiences, and asking themselves, "How could I have done this better?" Within reflection, practitioners will have a better understanding of their learning. They can clearly identify what they have learned from the experiences; evaluate their thought, feeling, as well as the outcomes. This also influences how the practitioners plan for similar, future events.

Schön (1983) identified two types of reflection: reflection-*in*-action and reflection-*on*-action. Reflection-*in*-action refers to the reflection that occurs while conducting the action and reflection-*on*-action refers to the reflection on an action that has already occurred. In the following sections, I will discuss the importance of learning from experience through reflection-*in*-action and reflection-*on*-action.

Reflection-In-Action

Schön (1983) defined reflection-*in*-action as "the spontaneous, intuitive performance of the action of everyday life" (p. 49), in which we are not always able to clarify what exactly we know and how we know it. He acknowledged reflection-*in*-action

as a process of thinking while doing the activity, and it is an ongoing process as learning takes place. “Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is in our action” (p. 49). Osterman (1990) identified an important part of the reflective practice as expanding the ability to convey tacit knowledge to enhance professional knowledge and skills. Schön also stated that by engaging in reflection-*in*-action, practitioners become researchers in the context of specific action and practice. They are able to construct new understandings to fit a unique situation in the future.

Schön (1983) described that practitioners usually think about what they are doing while they are doing something. In this situation, they may ask themselves, “What should I have to do to solve this case? What criteria that I need to make this judgment?” While reflective practitioners are facing some complicated situation and trying to understand it, they are unconsciously doing reflection and trying to find some ways to deal with this situation. Schön (1983) emphasized that reflective practice without basic knowledge and skills that represent good practice may lead to a duplication of mistakes. In addition to coming up with solution, reflective practitioners will draw upon their previous experiences. They shaped their thought from general rules into a specific case. Then, practitioners come up with a hypothesis as a solution for a specific case and test the hypothesis. Hence, practitioners are able to construct a new understanding to fit the unique situation. In the mean time, practitioners also need to maintain openness in order to continue with adjustments that are needed (Schön, 1983).

Even though Schön (1983) believed that reflection-*in*-action is necessary for practitioners while they are performing the action, this concept has been criticized. Eraut

(1994) and Ixer (1999) argued that thoughtful reflection only happened when the individual reflects *on* the action that has already happened. Due to the time constrictions involved in the reflection process, Eraut referred this is more on the thinking process instead of deep in thought reflection. He stated, "When the time is extremely short, decisions have to be rapid and the scope for reflection is extremely limited" (p. 145). In this circumstance, he believed that reflection can be seen as a metacognitive process, in which the practitioners are aware with the case problem as well as the situation that presented, and then they will determine what the next step they want to do in dealing with this situation. This may lead to *thinner* reflection rather than *thicker* reflection (i.e., reflection-*on*-action).

Reflection-On-Action

Unlike reflection-*in*-action in which occurs while practitioners are performing the action, reflection-*on*-action takes place after the action is completed. Within reflection-*on*-action, practitioners reflect on the strategies and actions that have occurred, and learn from them. Thus, practitioners have more time to think deeply, to look at their work from different perspectives, and to analyze the activities that occurred without any concern about the necessity to provide any further immediate action. In this situation, the focus of reflective practice is to help practitioners define a better understanding of what they know and the reasons for their decisions, construct new understandings, and develop new strategies and plan for future actions if they face similar situations. Table 1 below shows the differences between reflection-*in*-action and reflection-*on*-action.

Table1

The Differences between Reflection-In-Action and Reflection-On-Action

Reflection-*In*-Action	**Reflection-*On*-Action**
It happens during the event.	- It occurred after the event has done. - It happened retrospectively.
It is spontaneous/unconscious process.	It is conscious process.
It is intuitive.	- It occurs through the analysis and interpretation about the events to develop a new perspective. - It allows identifying the strengths and weaknesses of the action.
It is often seen as the advance practitioners' practice as the combination of the knowledge, skills, and practice.	It is an active process in transforming experience into knowledge and skills that involve depth thought of practice.

Implementation of the Reflective Practice

Reflective practice is an epistemology of practice in which the practitioners do not always see their cases as bound by rules or as different examples of the same case. Reflective practitioners will see their cases or events as somewhat similar to previous cases, but possibly requiring different solutions. In addition to coming up with the solution, reflective practitioners will draw upon their previous experiences, come up with a hypothesis as a solution for a specific case, and then test the hypothesis. Thus, practitioners are able to construct a new understanding to fit the unique situation (Schön, 1983).

Argyris and Schön (1974) argued about the theory-practice gap, in which students find that what they have learned in the classroom is somewhat different from the real-world practices being conducted. For example, new physicians often find that the

symptoms of their patient will not clearly correlate with a specific disease that the physicians have learned about before. The unique case is not "in their book," so they cannot only rely on the previous knowledge to solve the problem. In this situation, Schön (1983) suggested the use of reflective practice as a strategy to bridge the gap between theory and practice. Here, practitioners need to do reflection based on their prior experience, and come up with new strategies, and then apply them to deal with the case.

Practitioners learn by thinking about the action that is happening or has happened, and allow seeing it from a different point of view to enable them to take some of specific action. The notion of reflective practice came from Dewey (1983) who believed that we are *learning by doing*. While the novice practitioner relies on what they have learned in theoretically based rules in order to make a decision, expert practitioners come up with decisions based on their previous experience. Here, learning from experience is the goal of reflective practice.

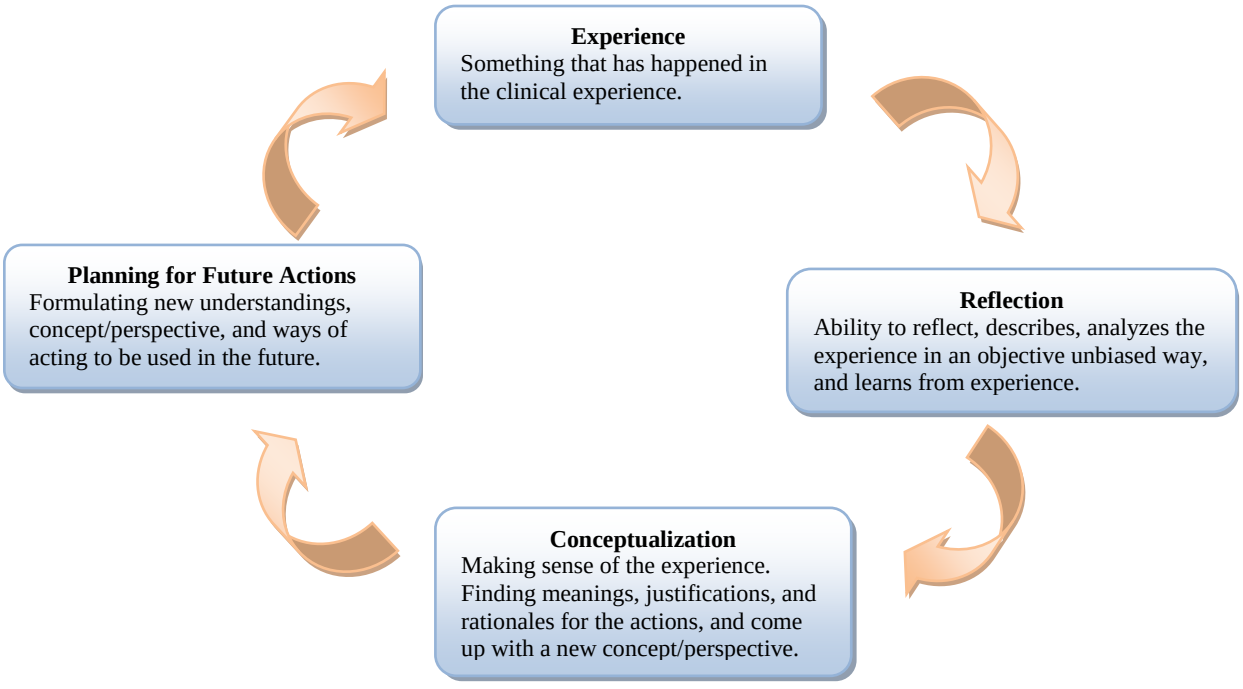

Figure 1. The Experiential Learning Cycle (adapted from Kolb, 1984).

Kolb (1984) developed an experiential learning cycle, which was formed from reflective practice (Figure 1). It consist four stages: experience, reflection, conceptualization, and planning for future actions. According to Kolb (1984), “learning is the process whereby knowledge is created through the transformation of experience” (p. 41). Even though experience is a base of learning, it does not provide the meaningful learning to develop expertise without the ability to perform reflection. While performing reflection, reflective practitioners will step back and examine their previous experiences. What was the nature of case problem? What did I do? What happened? Why did I make that decision? In the process of conceptualization, reflective practitioners find a discrepancy between what happened and what should happen, or between the plan and the action. This circumstance motivates practitioners to absorb new information and come up with new concepts and strategies; and then, practitioners use new concepts and strategies in planning their future action.

Reflective practice does not stop after only one cycle. After completing the first cycle, in the future practitioners are going to face more new experiences, and they will reflect on them in a different, and of course, composite and synthetic way. Thus, the experience itself has transformed into an application for different experiences. This can be seen as a continuous reflective cycle (Figure 2).

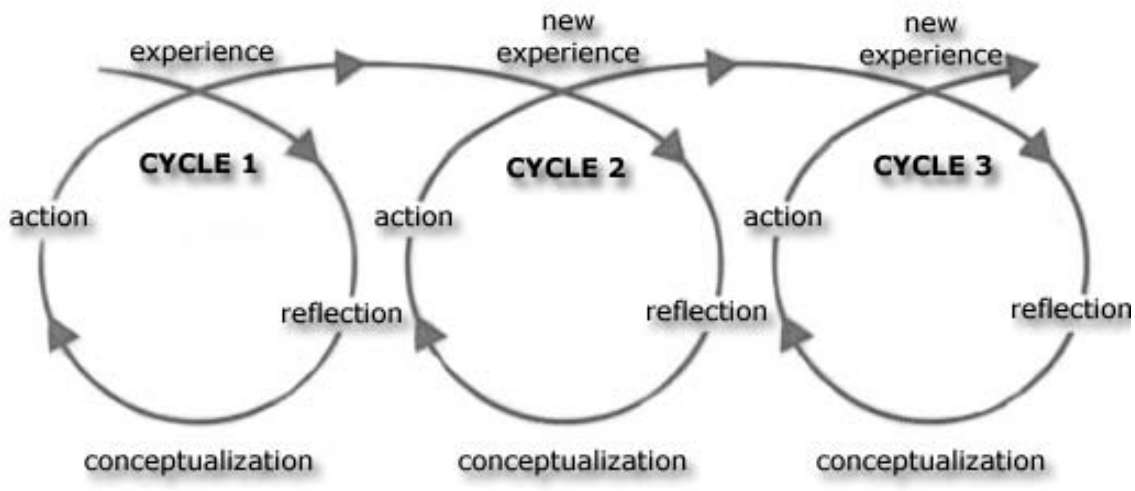

Figure 2. The Continuous Reflective Cycle.

In the medical field, novices have not yet developed the basic knowledge and skills for solving clinical cases. However, novice practitioners learn by doing the action; and the ability to perform reflection will allow them to apply better solutions when they encounter similar problems in the future. At the second reflective cycle, less effort is needed; at the same time, less learning has occurred. Once the novices become more experienced at a certain level, most new cases that they are facing are similar to previous ones. At this point, the practitioners have gained sufficient experience so that they may act automatically when solving the case problems (Mamede & Schmidt, 2005).

Implementation of reflective practice has some strengths and weaknesses. A benefit of reflective practice is that it will provide the positive effect of professional growth within the realm of knowledge and skills, better self-awareness, and a greater ability to extend the understanding about a given case problem that confronts the practitioner (Osterman, 1990; Schön, 1987). On the other hand, the drawback of reflective practice is that it is time-consuming, and it may cause personal sensitivity

issues, due to the questions asked that require practitioners to share their beliefs, understandings, and feelings about their experiences (Rose, 1992).

The wave of reflective practice was brought to the profession following Schön's learning theory (1983, 1987); and it can be implemented in many different areas including nursing and medicine. Studies examining the use of reflective practice in nursing and medicine will be discussed in the following section.

Reflective Practice in Nursing

In the last few decades, nursing educators struggled to encourage nursing students to think critically about their experiences, relate them to current situations, and develop strategies for future actions; so, that they could explain what they did and why they did it in a certain way. In addition to handle this situation, nursing educators utilized reflective practice journals to encourage critical thinking among nursing students in both the classroom and in practical settings (Hancock, 1999; Thorpe, 2004). With reflective practice journals, nursing students' thoughts are transferred onto paper, and this provides a permanent record that may be used in the future (Hancock, 1999). Furthermore, reflective practice journals also provide some advantages for nursing educators, allowing them to provide more constructive feedback through writing, since some students may need individual feedback that is specific, private, and constructive (Thorpe, 2004). From these studies, it is important to note that the strategy of reflective practice journaling can enhance nursing students' critical thinking skills, as well as encourage them to become active learners.

Schön (1987) showed that reflective practice also could be applied to pediatric nursing education. Family-centered care became an important aspect, especially in crisis

pediatric care, due to the impact of a child's sickness on family members (Tomlinson, et al., 2002). It is a challenge for nurses in the pediatric intensive care unit (PICU) to focus on the needs of the ill child, which requires high attention, and at the same time to communicate and determine the family's needs, as well as the roles of family members in supporting the child's needs. Schön (1987) indicated that the implementation of reflective practice can help practitioners, including nurses, learn how to deal with complicated cases. In their study, Tomlinson et al. (2002) used reflective practice in nursing education to improve strategies used for family care. The results showed that implementing reflective practice in pediatric nursing education enhanced nurses' skills in working with patients' families.

Teekman (2000) conducted interviews with ten registered nurses in order to explore reflective thinking within practical nursing. The findings showed that in a complicated situation, it was necessary for nurses to engage in reflection. Teekman identified three consecutive levels of reflection, including reflective thinking-for-action, reflective thinking-for-evaluation, and reflective thinking-for-critical-inquiry. Reflective thinking-for-action required the nurses to focus on the nature of the situation, and to make decisions from among different options that they considered the most appropriate choices. Reflective thinking-for-evaluation only occurred after reflection-for-action, and it was focused on analyzing and clarifying the experiences and assumptions in order to evaluate the events. Finally, reflective thinking-for-critical-inquiry occurred only after reflective thinking-for-evaluation, and functioned to suggest the nurse's critical inquiry level when analyzing situations. The results of this study demonstrated that all participants (ten registered nurses) had engaged in reflective thinking in order to perform

optimally when handling specific situations, as well as when planning their future actions.

Reflective Practice in Medicine

It is generally assumed that good physicians will do some research to come up with a hypothesis based on a patient's complaints and the symptoms they display. Then, physicians will reflect on what their decision was in providing treatment to the patient. Thus, physicians can use this experience as a possible deductive hypothesis if they face similar cases in the future (Guest et al., 2001; Mamede & Schmidt, 2004). Guest et al. (2001) claimed that reflection on practice and an ability to learn from experience were requirements for maintaining expertise in the medical field. Physicians are not expected to engage in reflective practice when they are dealing with the common diseases and procedures. In those cases, the physicians' reasoning comes automatically, based on previous experiences with patients having similar conditions (Charlin et al., 2000; Norman & Brooks, 1997).

In order to examine the structure of reflective practice in medicine, Mamede and Schmidt (2004, 2005) surveyed 202 physicians in Brazil. They developed a five-factor model to define reflective practice: (a) deliberate induction, in which physicians reflect upon an unfamiliar problem; (b) deliberate deduction, in which physician deduce a number of possible hypotheses from their previous experiences; (c) testing, which involves the evaluation of the problem being explored; (d) openness for reflection, in which physicians are willing to engage in constructive activities when faced with an unfamiliar situation; and (e) meta-reasoning, in which physicians are able to think critically regarding their own decisions. Each factor in this model is unique, and it occurs

either during or following the actions. The results of this study showed evidence of reflective practice when physicians dealt with complex problems. However, the study confirmed that not all physicians engaged in reflective practice when facing complex problems. Unfortunately, this study did not explain why some physicians apparently were not engaged in reflective practice when they were facing complicated problems. Mamede and Schmidt (2004) also discovered that physicians who constantly reflect on their professional activities and learn from them might serve patients better than those who did not perform the reflection.

In order to assess students' self-reflections during learning, Sobral (2000) surveyed 103 medical students using a seven-point Likert scale to investigate students' opinions about their learning experiences in the medical program. The results indicated that students' perspective of quality of learning improved as students attempted to do reflection. Furthermore, Sobral also pointed out that a greater effort put into reflection is associated with a positive learning experience and that reflection in learning is related to the readiness of self-directed and self-regulated learners.

Mamede and Schmidt (2005) conducted a study on the reflective practice in medicine. They found that reflective practice tended to decrease with experience as practitioners moved from novices to experts. The propensity for reflection is also related to the physician's age and level of medical experience. Most physicians decrease their reflective practice as a function of the number of years they are in practice. Similarly, Eva (2002) identified that analytical reasoning decreases synchronously with the increase of experience. Furthermore, Mamede and Schmidt (2005) also discovered that the place where a physician works influences his or her ability to engage in reflection. For

example, physicians who cited a hospital as their main workplace showed more acts of reflection as compared to physicians who mainly worked in local primary health care settings. Mamede and Schmidt (2005) concluded that the working environment, such as a hospital that has better facilities would positively influence physicians to do reflective practice, compared to a primary health care clinic, which has limited facilities. Moreover, the greater variety of cases that they face in the hospital, the greater the ability of physicians to engage in reflective practice as compared to those in the primary health clinics.

Reflective Practice in Simulation

Schön (1983, 1987) indicated that reflective practice could be used to enhance practitioners' learning while they developed their knowledge of their practice and considered what they were learning from their practice. In medical education, the use of simulations has become popular in supporting medical students and residents when practicing specific skills in a safe environment (Kneebone, 2003). Moreover, simulation provides opportunities to medical practitioners to practice their skills repeatedly in a risk-free environment as often as necessary without causing any harm to patients (Kneebone, 2003; Ziv et al., 2003). As Dewey (1933) stated, learning itself could not take place without engaging in reflection, so medical practitioners (e.g., medical students, medical residents, nurses) also need to engage in the reflection that will allow them to look back over the events that have happened, understand them, and turn them into learning experiences. In order to learn from simulation, medical practitioners need to reflect on and make a connection between the theory they have learned, their previous experience, their current situation, and their planning for future events.

Based on theory of reflective practice, it is necessary for professional medical practitioners to be exposed to hands-on experience in real-life settings as well as learning from theoretical cases. Unexpected events that occur during simulation can generate anything from reflection-*in*-action to learning-in-action, and when the events are over, practitioners may think back on what has happened (reflection-*on*-action), relating to their previous experiences, and considering how this may affect their future practices. Even though the implementation of reflective practice may give some benefits to medical education, empirical studies about reflective practice used specifically as part of simulation is very limited in any appreciable quantity. The focus of the present study was on an examination of how reflective practice can be used as a strategy to enhance residents' learning through medical simulation practices.

Simulation

History of Simulation

According to the Webster dictionary (1999), the definition of simulation is "the imitative representation of the functioning of one system or process by means of the functioning of another" (p.1094). The history of simulation started a few centuries ago, initiated by military simulations. Military simulations that are also known as war games are simulation that focused on decision-making and strategy development that is implemented in the situation without the needs for actual warfare (Vincenzi, Wise, Mouloua, & Hancock, 2008). During the 17th century, the Prussian military used chess and toy soldiers to develop theories and military tactics into the war games (Allen, 1987). In 1880s, a war game known as *Kriegsspiel* offered more realistic warfare. It used maps, different shapes and color to differentiate with the opponent, and had complex rules for

movements and warfare. Currently, military simulations are widely implemented and recognized to be effective to develop warfare tactics and strategies to prepare the soldiers while they are facing the actual warfare (Vincenzi, et al., 2008).

In addition to military simulations, in early 1910s, Wright Brothers introduced flight simulator to control the flight while seated on the top of a barrel equipped with short "wings" that mounted and moved manually to represent the simulation of disturbance (Vincenzi, et al., 2008). In 1929, Edward Link developed *link trainer*, which is a flight simulator with a cockpit that designed to demonstrate the ability to control movement. At this time, the use of modern flight simulation is commonly used in the U.S Air Force, government (e.g., NASA), as well as in the industry (Vincenzi, et al., 2008).

Simulations are present in many different areas. Besides the use of military simulations and flight simulations that are discussed in the earlier paragraphs, simulations have been expanded in the medical education as well. Studies examining the use of simulations to support medical education will be discussed in the following section.

Simulation in Medical Education

The introduction of technology into the education is one of the most successful factors in the transformation of educational systems (Harden & Hart, 2002; Issenberg, Pringle, Harden, Khogah, & Gordon, 2003). The use of technology is widely applied in different educational settings, including medical education. Currently, medical education strives to keep pace with the escalation of medical knowledge, as well as with advances in medical technology. One way to enhance learning performance is the use of simulations. Advances in technologies have allowed the creation of sophisticated and more realistic simulations (Issenberg et al., 1999; Rosenthal et al., 2008; Schwid, Rooke,

Michalowski, & Ross, 2001; Vozenilek, Huff, Reznek, & Gordon, 2004). According to Hayden and Panacek (1999), the use of simulations in medical education provides practitioners with experiences with "patients" having both common and rare medical conditions in a safe and controlled environment. Moreover, simulations of complicated medical cases also allow medical practitioners to practice and perform *high-risk* tasks without putting real patients at risk (Kneebone, 2003).

The purpose of medical training is to prepare the medical students and residents to work as real physicians. Medical students and residents need to learn various skills from simple sets of procedures such as inserting a catheter, to highly complicated ones such as managing patients in emergency cases. It is a challenge for medical educators to offer an effective learning environment without risking the patient's health. The use of simulators offers a safe and effective learning environment to meet some needs in medical education (Kneebone, 2003).

Medical residents eventually practice their knowledge and skills by treating actual patients as part of their training. In doing so, they are responsible for providing the best possible care for the patients, while ensuring the patients' safety (Ziv, Wolpe, Small, & Glick, 2003). However, the involvement of actual patients in medical training raises various ethical concerns, because as future physicians, they may make mistakes while treating actual patients, despite being closely supervised by their attending physicians. Furthermore, it is not uncommon for residents to experience some anxiety while performing a medical procedure that they just learned. This anxiety sometimes affects their ability to multitask, such as to monitor multiple aspects of the patient's condition and make appropriate adjustments to the procedure in response to developments in the

patient's condition. Such cognitive overload can result in the residents defaulting to basic procedures and following them rigidly regardless of whether or not the procedure are the most appropriate for the patient's current condition (Dreyfus & Dreyfus, 1986). Therefore, the concept of *learning by doing* with a real patient has become less acceptable in medical education, especially when it involves invasive procedures and *high-risk* cases (Vozenilek et al., 2004). In addition, it can be difficult to teach some procedures that are rarely performed in clinical practice, thereby limiting opportunities to "see and do" such procedures (Hayden & Panacek, 1999).

The challenges and limitations in medical education described above have prompted medical educators to find alternative solutions to teaching medical knowledge and skills (Maran & Glavin, 2003; Ziv et al., 2003). Simulation is one of these solutions. It allows medical practitioners to gain some experience with a wide variety of cases, including common and rare diseases, as well as the ability to practice commonly and rarely performed medical procedures and *high-risk* actions without putting the patients at risk. Simulation is not intended to replace a learning process within the clinical environment, but rather to enhance preparation and experience to improve the quality of patient care (Maran & Glavin, 2003). According to Ziv et al. (2003), the use of simulations "can convey a critical educational and ethical message to all stakeholders in health care: patients are to be protected whenever possible, and they are not commodities to be used as conveniences of training" (p.784). Therefore, the use of simulation in medical education also eases ethical dilemmas regarding quality care and patient safety.

The treatment or management of certain medical cases sometimes requires the coordination of health-care professionals from multiple health disciplines. Simulations

offer the opportunity for residents from different fields or specialties (e.g., internists, surgeons, anesthesiologists, etc.), and other clinical practitioners to work together as a team in which they can exchange information that is relevant to the cases and learn together. By working together on a case as a team, they have the opportunity to practice not only their own particular clinical skills, but also their interpersonal and communication skills (Good, 2003).

In summary, the benefits of using simulations in medical education included the ability of medical practitioners to practice skills repeatedly in a risk-free environment without causing any harm to their patients, as well as the ability to practice clinical skills for uncommon cases (Issenberg et al., 1999; Schwid et al., 2001; Vozenilek et al., 2004). In addition to these benefits, Kneebone (2003) pointed out that simulations allow the training to be adjusted to meet the practitioners learning needs. They can practice specific parts or the whole procedure as often as necessary without concern about the failure. In fact, thanks to the risk-free environment, through reflection, they can learn from their own mistakes and failures, and they can discover better techniques for performing given medical cases and procedures in the future. Furthermore, the ability of simulators to provide immediate feedback makes them suitable for trainees to engage in the learning process both collaboratively and individually.

Classification of Simulations

In discussions regarding simulations, the term “fidelity” is used to describe the reality of experiences, including the appearance and behavior of simulators as compared to a real situation. In the following section, I will describe classifications of simulations based on their levels of fidelity.

Low-fidelity simulations. Low-fidelity simulations or model-based simulations usually use materials that are less similar to real ones. An example of a low-fidelity simulation would be a partial mannequin that is used to practice simple physical maneuvers or simple procedures, such as urinary catheterization, venepuncture, intravenous infusion, and wound closure (Kneebone & ApSimon, 2001). However, these simple models have some limitations. Some models simulate only certain body parts. Moreover, inanimate models are not able to provide immediate feedback, which is very important in learning medical skills.

Medium-fidelity simulations. Medium-fidelity simulations offer a situation that is somewhat similar to a real one. An example of medium-fidelity simulation would be a computer-based simulation that is employed to create problem-based learning about cardiac disease, lung disease, etc. A computer-based system not only simulates the case environment, but also allows learners to interact with the system through interface devices such as the keyboard, mouse, and touch-screen. This type of simulation system allows independent learning in which learners can interact with the system, and the system provides feedback during and after the interaction (Maran & Glavin, 2003). For instance, students or residents can be presented with a computer-based simulation about an acute cardiac disease problem in which they need to make case-management decisions. They can order several physical examinations and laboratory tests, and provide diagnosis and treatments, whereupon the system will provide the results immediately. This computer system can also give some comments as students or residents engage the simulation and will provide feedback at the end of the simulation.

Advances in computer technology have also allowed engineers to create virtual reality (VR) systems that are embedded into a computer-based simulation model, which enables learners to operate within a *three-dimensional* virtual environment. The main purpose of VR is to present a virtual environment that mimics the natural setting. VR simulators convey a *real* presentation that replicates a clinical setting for procedures such as laparoscopic surgery, bronchoscopy, etc (Ziv et al., 2003). For instance, when residents learn about laparoscopic surgery procedures, VR simulators offer the three-dimensional images that replicate specific laparoscopic instruments, as well as an environment that is very similar to the real one. The users are able to navigate through the VR simulator and to interact with the environment by using their skills. The ability of VR simulators to provide *haptic* (physical sensation of interaction within the environment) feedback creates the illusion of physical contact with the environment (Kneebone, 2003; Sze´kely & Satava, 1999).

High-fidelity simulations. High-fidelity simulations utilize realistic materials and accurately mimic the "real world" task. These simulations often combine full-size mannequins and computer-driven systems. The high-fidelity patient simulators allow learners to manage complicated and high-risk clinical situations in a *real-life* setting (Ziv et al., 2003). The degree of realism provided by the technology-based simulation also allows students to learn the handling of complex and ill-structured medical problems. The MedSim [1], SimMan[2], and METI Simulator[3] are examples of commercial high-fidelity simulators. These simulators allow the learner to interact with a virtual *patient* in a clinical environment. The physical signs, such as pulses palpable over the carotid arteries

[1] http://www.medsim.com/
[2] http://www.laerdal.com/document.asp?docid=1022609
[3] http://www.meti.com/index.html

and lung sounds audible over appropriate areas of the chest using a stethoscope, can create the impression of interaction with a real patient. With the ability to provide immediate feedback, high-fidelity simulators have demonstrated effectiveness in promoting specific skills among medical students, residents, nurses, and other clinical practitioners (Issenberg et al., 1999) as well as generalizing simulation into patient-care settings (Seymour et al., 2002).

Standardized Patients

Standardized patients are commonly used in the medical education while students or residents are performing the simulations. Barrows (1993) defined standardized patient as an individual who had been trained to portray the role of a patient or a patient's family member (e.g., wife, husband, daughter, etc.) to allow students and residents to practice their clinical and communication skills while they were dealing with a patient or a patient's family. Unlike real patients or family members, the standardized patients can be available anytime; and the use of standardized patients can be adjusted based on the students or residents' needs. For example, students can practice the interview skills by asking some questions to a standardized patient about the symptoms of the disease as well as a case history. In this situation, a standardized patient would respond to the questions asked and acts like a real patient. Furthermore, standardized patients can be also acted as family members during the simulation in which the residents need to learn how to deal with them while they should focus in handling the patient at the same time.

Implementation of Simulation in Medical Education

There is some evidence showed that simulated experience can improve the performance of medical students and residents in clinical practice (Kneebone, 2003;

Munz et al., 2004; Schwid et al., 2001; Schijven et al., 2005). Low, medium, and high-fidelity simulators can be useful in developing proper procedures for technical skills, especially in the medical field. The more real-life the clinical cases and situations that are referenced to create a virtual environment, the better their association with the ability to perform with better technical skills (Kneebone, 2003). Ker (2003) conducted a study to evaluate the feasibility of second- and third-year medical students' skills in performing an intimate (private human body, such as breast, rectal, and urogenital) examination via simulation. Learning the necessary professional skills in conducting intimate examinations is somewhat different from conducting any other examination, because of ethical and cultural perspectives that may influence the relationship between patients and physicians. In this study, medical students performed breast examinations on a standardized patient who wore a strap-on breast. As future physicians, students learned how to communicate with the *patient*, and asked for *her* consent to perform the examination before initiating the actual examination. After simulation had completed, students received immediate feedback from the faculty facilitator. Both the students and the faculty facilitator identified strengths and weaknesses in the examination process. In addition, students shared their experiences, raised some questions and issues regarding what they felt while performing the examinations, as well as discussing their competence and confidence. The finding showed that intimate examination followed by immediate feedback in these simulation sessions increased students' self-awareness of their learning needs, and also boosted their confidence.

Kneebone et al. (2002) conducted observations on and interviews with fifty-one medical students. By using plastic models (e.g., partial mannequin) that connected to the

standardized patient, students practiced their technical and communication skills in clinical-case scenario. Students were asked to perform urinary catheterization and wound closure to the simulated patient, and all the processes were observed and recorded. Students had received immediate feedback from faculty facilitators and the simulated patient before they received the individual feedback that followed the simulation session. The results showed the benefit of simulation for integrating technical and communication skills among medical students. Even though several students discovered some difficulties in integrating their technical and communication skills at the same time, they received some benefit from this simulation session, especially the ability to receive immediate feedback from faculty facilitator and the simulated patient as well as individual feedback from video recorders after the simulation completed.

Flanagan et al. (2004) conducted a study on the use of high-fidelity simulators to promote patients' safety during emergency scenarios. A full-size mannequin with the ability to talk and move; and a fully integrated cardiovascular, respiratory, and nervous system, was used in this study. Vital signs were monitored on a computer screen, from which the instructor *drove* the scenario. The mannequin gave *responses* to different kinds of drugs administered through an intravenous line. The mannequin could be programmed for more than forty different case scenarios, such as myocardial infarction, cardiac arrest, etc. Two hundred ninety-nine participants participated in the simulation. Participants worked in groups to solve an emergency case during a period of approximately 30 minutes, and all of their activities were recorded using a video recorder. Comprehensive video-assisted feedback was provided immediately after the simulation training. The participants watched the video of their procedures and critiqued their own performances

with the assistance of a clinical facilitator. The findings of this study showed that providing immediate feedback after simulation sessions raised awareness and enhanced understanding of how to manage a patient during an emergency. Furthermore, participants expressed a high level of satisfaction with the results of simulation session. Flanagan et al. (2004) concluded that even though the entire learning process as provided via the simulation was valuable, the use of simulators also taught implicit skills that would have been difficult to teach outright or verbally such as learning how to manage teamwork, provide quick and correct decision-making, communicate among team members, manage stress, prioritize tasks, etc.

Simulation-based education enables learners to translate theory into practice. Learning occurs when the learners engage in the hands-on experience as they need to do specific tasks. Weller et al. (2004) performed an empirical study with seventy-one medical students, who participated in the simulation of medical emergency cases. The simulation used a full-size mannequin that was connected to a computer to provide input for patient monitoring devices. The mannequin was capable of mimicking real patient responses, such as speech, chest movements, heart sounds, breathing sounds, etc. The mannequin was also capable of giving responses to airway interventions as well as drug administrations. Participants first familiarized themselves with the simulator and the environment, and then they participated in simulation based on the scenario that had been set up. The results of this study showed that participants' performances improved significantly after they had been exposed to simulation, including their ability to apply their knowledge and skills in a clinical context, provide diagnosis and treatment procedures, and work effectively within a team. Participants valued the hands-on

experience in practicing clinical skills. They discovered just how difficult to manage the case would have been in real life, rather than just discussing the case on paper. Even though most of the participants felt a great deal of pressure while engaging in the simulation, they agreed that learning through simulation sessions brought positive impacts, especially the ability to gain first-hand experience under realistic performance pressure.

CHAPTER 3

RESEARCH METHODS

The purpose of the present study was to examine differences between residents' perceptions of their learning after participation in a simulation, and residents' perception of their learning after participation in simulation followed by a reflection and feedback session. Specifically, I sought to examine how residents: (1) associated prior knowledge, skills and experiences with their thoughts and actions regarding the simulation; (2) how they related their thoughts and actions regarding the simulation to similar events that they may encounter in future clinical situations; and (3) if there were differences occurred when a simulation was followed by a reflection and feedback session.

The three research questions were as follows:

1. What are surgical residents' perceptions of learning after their participation in a simulation?
2. What are surgical residents' perceptions of learning after their participation in simulation followed by a reflection and feedback session?
3. What are the differences, if any, between surgical residents' perceptions of learning when they participate in simulation only, and residents' perceptions of learning when they participate in simulation followed by a reflection and feedback session?

In the following sections, I will describe the research design and methods used in this study by including details about the following five areas: (1) research design and rationale; (2) participants and setting for the study; (3) pilot study; (4) data collection

strategies; and (5) data analysis. The chapter concludes with a discussion of credibility and limitations of the study.

Research Design and Rationale

The nature of a research study determines the selection of research method (Creswell, 2005; Merriam, 1998; Patton, 2002). According to Creswell (2005), qualitative inquiry is particularly appropriate when conducting a study that "relies on the views of participants, asks broad, general questions, collects data consisting largely of words (or text) from participants, describes and analyzes these words for themes, and conducts the inquiry in a subjective, biased manner" (p. 39). He also stated that a qualitative study can be used to answer research questions involving who, what, why and how, as well as when the study required depth understanding of a phenomenon or exploration of a specific event.

Creswell (2005) defined two types of case studies: single case and multiple cases. Within a single case study, the researcher only focused on one case; and within multiple case studies, more than one case will be investigated. Yin (2003) suggested that case studies can be used as a research method when "how or why questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context" (p. 1). Merriam (1998) described the advantages of a case study method in educational settings as allowing researchers to examine and understand the situation that applies in the study, including the ability to capture participants' perceptions of their learning experiences. Since the focus of this study was on residents' perceptions of their learning, the use of case study method was appropriate. In order to make a comparison between residents' perceptions

of learning after participation in a simulation only and residents' perceptions of learning in a simulation followed by a reflection and feedback session, a multiple case study method was employed. Stake (1995) described multiple case studies as those in which more than one case are collected, described, and compared to provide new insight. According to Herriott and Firestone (1983), a multiple case study method is considered a more compelling and robust method than a single case study. Yin (2003) maintained that multiple case studies enable comparison between cases, and therefore the results can provide an explanation for phenomena whereas the results of a single case study method are primarily descriptive. Yin (2003) recommended six types of sources for data collection in case study method including documents, archival records, interviews, direct observation, participant-observation, and physical artifacts. In this study, four of the six types of data were collected, including: interviews, direct observation, participant-observation, and physical artifacts (simulation materials and video recordings).

Participants and Setting for the Study

Participants

Twelve first-year surgical residents at a research public university in the Midwestern United States participated in a simulation in which a high-fidelity medical simulator was used. The participants were residents who were already scheduled to participate in a simulation on a specified date. The participants were randomly assigned to one of three groups (named A, B, and C) with four participants in each group. Participants in groups A and C participated in a simulation followed by a reflection and feedback session, and participants in group B participated in a simulation only. The same

simulation scenario (see Appendix B) was used with all three groups. Participants were asked to sign a consent form to confirm their agreement to participate in the study (see Appendix A).

Setting

A simulation was conducted at the Simulation Center of the university during the month of June in 2009. A high-fidelity simulator that is supported by a full-size mannequin and wireless computer software (Gaumard Human Patient Simulator) was used in this study. The simulation room was arranged in a setting that was similar to a real patient room. The Gaumard Simulator can be programmed to simulate various emergency cases such as myocardial infarction and anaphylaxis reaction. It can talk and generates observable vital signs such as chest movement with respiration, audible heart and breath sounds, palpable pulses, etc. There were two Intensive Care Unit (ICU) nurses who acted as nurses, a standardized patient who acted as a patient's family member, and a standardized patient who acted as another patient in the room. The digital video recorders were set up to capture the entire simulation for all three groups. For the purpose of this study, the simulated event was a post-operative myocardial infarction.

Pilot Study

During the same month, but prior to the main dissertation study, a pilot study with six surgical residents (at the end of their first year) was conducted at the Simulation Center for the following purposes: (a) to test the simulation scenario and check the flow of the simulation; (b) to check the data collection procedures; and (c) to check the face validity and reliability of the instruments.

Data collected from a pilot study included: (a) video recordings in both simulation session, and reflection and feedback session; (b) observations in both simulation session, and reflection and feedback session; and (c) recorded interviews.

Results from this pilot study resulted in the following changes and revisions to the original research design. The changes and revisions were as follows:

- Participants in the pilot study indicated the need for a more realistic simulation scenario. For example, they suggested how the mannequin could be set up (e.g., provide palpable pulses), the importance of the availability of needed tools (e.g., bag mask was not there when needed), and how the EKG monitor should be set up as in a real situation. The suggestions were incorporated in a revised simulation scenario.
- During the pilot study, some residents indicated the importance of direct instructions from the clinical facilitator prior performing simulation session, such as information about expectations of simulation, and capability of mannequin (what it can or cannot do). The medical director of the Simulation Center agreed to have a short presentation session to familiarize residents with simulation environment and equipment. She indicated that she would also provide a brief description about simulation, case scenario, as well as expectations of the outcomes.
- While conducting a pilot study, I noticed the advantages of using video recording to capture conversations among participants (between participant to participant, and between participants and clinical facilitator), and the ability of video recording to capture body language and facial expression from participants. It was

decided to use video recording to capture residents' activities and conversations during simulations, reflection and feedback sessions, and individual interviews as additional data source.

- The survey instrument used in this study was not piloted at that time; however, Dr. Fearing (medical director of the Simulation Center), had already tested the survey instrument prior to this pilot study to test the face validity and reliability of the instrument with a group of medical students in her class. Minor revisions (i.e., typographical changes) were made to the survey.
- The reflection and interview protocol were used during the pilot study with the six residents. Participants from this pilot study were very cooperative and provided valuable discussions during reflection and feedback session as well as when they answered interview questions. Based on the participants' feedback, and a final review of the reflection and interview protocols by Dr. Fearing and myself, it was determined that no substantive revisions to the reflection and interview protocol needed to be made. Some minor wording and editing revisions were made.

Data Collection Strategies

The main sources of data for this study were: (a) a survey of participants' perceived background clinical experiences and perceived skills; (b) the researcher's notes from direct observations of the simulations, and reflection and feedback sessions with the video recordings being used to verify any unclear data gathered from the observations; (c) individual interview transcripts with all of the participants; and, (d) documents collected from both the simulation sessions, and reflection and feedback sessions.

Survey

A survey had been developed by a simulation research team (comprised of Dr. Douglas Wakefield, Dr. Nicole Fearing, Ms. Robin Wootten, Dr. Kim Hoffman, Dr. Julie Caplow, Ms. Dena Higbee, Mr. Andrew Spain, Mr. Chris Sanders, Ms. Christiana Kumalasari, and Ms. Bethany Bennett) to gather information about residents intended specialties and their perceived level of preparation to develop treatments plans and perform specific procedures; and their perceptions of needed level of supervision to perform various clinical procedures. This survey was disseminated to all residents (n=12) who participated in simulations. The survey was then given to the residents in this study prior to their participation in the simulation to gather information about the above described these areas as additional data for analysis.

Observation.

According to Creswell (2005), the benefit of direct observation is to record a situation that occurs in a real setting while participants are doing their activities. During an observation, the researcher is required to give detailed attention to any communications between participants and to focus on the visual detail. Hammersley and Atkinson (1995) discussed the issues that may occur when conducting observations, including the awkwardness of the researcher as an outsider to other people in the group. Regardless of the potential difficulties, conducting observations continue to be well accepted in for qualitative data collection when appropriate.

Despite the fact that all of the simulations and reflection plus feedback sessions were recorded using a video recorder, I did direct-observation of each group's activities and discussions during both the simulations, and reflection and feedback sessions. I

engaged in a broad observation at first to get a sense of general landscape of the activities and then focused on specific aspects of the participants' activities and discussions during the simulations, and reflection and feedback sessions. According to Creswell (2005), conducting broad-to-narrow observation can be used as an effective strategy due to the amount of information available during observation settings. Observation field notes were taken during the simulations, and reflection and feedback sessions to capture important activities and discussions that occurred.

Simulation Session

Each group of first-year surgical residents was presented with the same case scenario provided in Appendix B. The scenario was a post-operative (after surgery) myocardial infarction and the residents were expected to respond to the situation. Pseudonyms were given to all of the participants to ensure their confidentiality. Dr. Foster and Dr. Bland served as clinical facilitators. The simulation began with an orientation session to familiarize the participants with the simulation environment and equipment. The clinical facilitators also provided brief information about the simulation case scenario as well as expectations of the outcomes. During the simulation, the clinical facilitators monitored residents' activities and completed the simulation checklist (see Appendix B). Even though all simulation activities were recorded using a digital video recorder, I directly observed each of group as they participated in the simulation. Field notes were taken during the direct observations to capture activities and discussions that occurred while simulation was in progress.

Reflection and Feedback Session

The reflection and feedback sessions for groups A and C were immediately after simulation was completed. The clinical facilitators facilitated the reflection and feedback sessions. The purpose of this session was to allow residents to reflect on their thoughts and actions during the simulation. As previously stated, the entire simulation was video recorded, and during the reflection and feedback session, the video recording was played. Having the video recording as a focus during the reflection and feedback session allowed the clinical facilitators and group members to review an individual's activities during simulation session. In addition to asking specific reflection protocol questions pertinent to this study (see Appendix D), the clinical facilitators asked additional questions based on their observations and thoughts about the simulation. The clinical facilitators also provided any feedback they deemed appropriate during this session. A digital video recorder was set up to capture the reflection and feedback session activities for both groups A and C. I observed the reflection and feedback session and took field notes as well.

Individual Interviews

Upon completion of the reflection and feedback session, each resident in groups A and C participated in an individual interview (see Appendix E). Residents in group B, the simulation-n only group, participated in an individual interview upon completion of the simulation. The purpose of these interviews were to gather information about the residents' perceptions of how they made connections between their basic science and clinical knowledge and skills; and anticipate future actions in similar clinical situations after participating in the simulation; and to compare the perceptions of participants in

groups A and C (simulation-followed-by-reflection-and-feedback group) to those in group B (simulation-only group). This semi-structured interview has seven open-ended questions for participants in groups A and C, and eight open-ended questions for participants in group B. The interviews were recorded and transcribed verbatim for further analysis. Due to time constraints resulting from the work load of the residents and their available time, these interviews were limited to 15 minutes.

Document Collection

Documents that were collected and used as additional data source, included the simulation checklist and the handout of simulation case scenario (see Appendix B), as well as the video that recorded individual and group activities during simulation, reflection, and interview sessions. Table 2 below illustrates the data sources and data analysis matrix.

Table 2

Research Questions, Data Sources, and Data Analysis

	Research Questions	Data Sources	Data Analysis
1.	What are surgical residents' perceptions of learning after their participation in a simulation?	survey interview transcript field notes of observations video content analysis	descriptive statistics inductive analysis
2.	What are surgical residents' perceptions of learning after their participation in simulation followed by a reflection and feedback session?	survey interview transcript field notes of observations video content analysis	descriptive statistics inductive analysis
3.	What are the differences, if any, between surgical residents' perceptions of learning when they participate in simulation only, and residents' perceptions of learning when they participate in simulation followed by a reflection and feedback session?	interview transcript field notes of observations video content analysis	inductive analysis

Data Analysis

In this study, a multiple case study design was used with each group being a case and each resident being a unit of analysis. The survey responses were analyzed using descriptive statistics in order to ascertain participants' perceptions of levels of preparation in various clinical skills. The results of survey were used as to identify perceptions of level of preparation and needed supervision prior to the simulation as additional data for analyses. The recorded interviews and the audio content of the video recordings were transcribed verbatim. Then the video recordings transcriptions and field notes of

observations combined together and written into summary. The simulation checklist was used as additional data to assess simulation performance in each group. Data were analyzed using Miles and Huberman's (1994) model, consisting three concurrent actions: (1) data reduction; (2) data display, and (3) drawing conclusions and verification.

The data were categorized into themes based on analysis of the simulation observations, reflection and feedback session observations, and individual interviews. Inductive analysis was used, and a matrix of categories was created to place evidence within each category. Finally, the results are reported in narrative format.

Protection of Human Subjects

I first asked for permission from to the director and manager of the Simulation Center to conduct this study. Upon securing their permission, I sought and received approval from the University Health Science Institutional Review Board (HS-IRB). All participants were informed of the purpose of this research study. Their involvement in this study was voluntary, and it did not affect their grades or any evaluation of their performance. Therefore, there should be no substantial risks or discomforts that occurred as a result of their participation in this study. All data collected in this study were kept confidential. Each of the participants was assigned a pseudonym to ensure a reasonable level of privacy.

Role of the Researcher

As a physician who is continuing education in a doctoral program in educational technology, I was interested in understanding how medical residents learned from simulations. My thoughts were that while residents can learn practical skills from simulations, how do they connect that with their previous classroom and any case-based

learning experiences, and transfer those connections to future similar situations? An examination of extant literature indicated that there are several empirical studies that assert the benefit of simulations in enhancing residents' performances in handling simple and complicated cases before they use them with real patients. However, I could not find any empirical studies that discussed how residents actually learned or how they perceived their learning as a result of participating in a simulation. As a physician as well as an educator, I was interested in studying the perceived learning as a result of participation in simulations. While investigating this interest, I found Schön's work on reflection and reflective practice. His assertions that reflection can lead to novice and experienced professions associating their prior knowledge and experiences with an actual situation and or problems; such as a simulation, provided a conceptual basis for exploring how residents, as novices, might link prior knowledge and experiences with actual situations they will confront in practice. Furthermore, the ability to perform reflection also may give some beneficial to the residents to think ahead if they face similar clinical situation in the future.

Credibility and Trustworthiness

In the qualitative study, credibility and trustworthiness is related with the validity required on the quantitative research (Patton, 2002). The meaning of credibility on the qualitative research is associated with the quality of data collection and analysis in providing accurate results based on the information provided by participants (Denzin & Lincoln, 2000; Patton, 2002). To validate the credibility of findings and trustworthiness, triangulation was implemented by collecting data from multiple sources, including direct observation, semi-structured interview with participants, and document collections. Yin

(2003) described that by having data triangulation using multiple sources, the quality and validity of case study are highly rated than those that relied on only one single data.

Another strategy that was used in this study to enhance trustworthiness of the findings was the use of intercoder reliability. After analyzing and coding all the interview data, I randomly chose one interview transcript for analysis by a second coder to whom the coding scheme had been explained. Afterwards, we randomly chose another interview transcript and independently coded the data. Next, we compared the results of each coded unit and its category. All inconsistent codes were discussed until we reached agreement on the understanding of coding scheme and the units of codes. Once we reached agreement and consistency of coding scheme, we coded the entire transcripts independently. During the coding process, we communicated through email or meeting in person to discuss the issues that occurred. After the entire data were had done coded, all the results were compared to make sure that the coding was consistent. I worked continuously with the second coder to discuss inconsistent results until we reached the agreement.

Mertens and McLaughlin (1995) suggested that as researchers using qualitative methods, should limit their own judgment and avoid giving too much opinion while analyzing the data and making interpretations of the findings. The data that are collected should be organized so that it is easily to be referred to, if needed; and the data analysis should be explicit and detailed. I attempted to utilize these strategies to ensure the credibility and trustworthiness of this study.

Limitations

No research study can be expected to be flawless. Creswell (2005) stated that the purpose of the qualitative study is to provide meaning to a phenomenon rather than generalize the results and conclusions. Therefore, findings are not generalization to bigger population outside those directly involved in this study.

The number of participants for this study was limited by the number of residents who were scheduled to participate in the simulation. The small number of participants in each group and unequal number of participants who participated in the simulation only to those who participated in the simulation followed by reflection and feedback session (four residents in simulation-only group, and eight residents in simulation-followed-by-reflection-and-feedback group), narrowed the findings for the simulation only situation versus those for the simulation followed by reflection and feedback session.

Merriam (1998) and Patton (2002) agreed that both researcher's and participants' biases could limit the credibility of research study. In order to limit the biases, Mertens and McLaughlin (1995) suggested that researchers should restrict their personal opinion while making interpretation of the finding, which I attempted to do in data collection, analysis, and discussion for findings and conclusions. Furthermore, observation and interview data may be unreliable due to the response from participants who acted and answered questions based on what the researcher wanted to hear, and may not give honest answers during the interview session. Also, the presence of the researcher while conducting observation during simulation sessions, and reflection and feedback sessions may have affected participants' behaviors.

Chapter Summary

This chapter began with the purpose of research study following by the research questions being addressed. A research design and rationale was provided using multiple case studies method, along with multiple data sources that were used to enhance the trustworthiness of the findings. The collected data were categorized into themes based on analysis of the simulation observations, reflection and feedback session observations, and individual interviews. The findings will be reported in narrative format in Chapter Four.

CHAPTER 4

RESULTS

This chapter presents the results of multiple case studies that focused on residents' perceptions of their learning after participation in a simulation only and residents' perceptions of learning in a simulation followed by a reflection and feedback session. This chapter is divided into three main parts. The survey results are presented in the first part. In the second part, a detailed description of simulation observations for each case study and the reflection and feedback session observations for groups A and C as well as, the results of the individual interviews. The results of the study categorized into themes based on analyses of the simulation observations, reflection and feedback session observations, and individual interviews are presented in the third part. The chapter concludes with a summary of the findings.

Survey Results

The survey was distributed to all participants (n=12) prior to their participation in the simulations as the initial instrument to gather information about residents' background. The survey results were analyzed using SPSS 17.0 for descriptive statistics and frequency. Table 3 below shows the summary of participants' characteristics.

Table 3

Descriptive Characteristics of Participants

Characteristics		***N***	**%**
Gender:	Female	4	33.3
	Male	8	66.7
Intended Specialty:	General Surgery	2	16.7
	Orthopedic Surgery	3	25
	ENT (Ear Nose and Throat) Surgery	2	16.7
	Plastics Surgery	1	8.3
	Preliminary Surgery	4	33.3

The survey contained questions about residents' perceived level of preparation in developing treatment plans and performing specific procedures, as well as perceived level of supervision needed to perform various clinical procedures. Table 4 shows the summary of residents' perceived level of preparation to develop treatment plans and perceptions of needed supervision to perform specific clinical procedures that are related to this study.

Table 4

Surgical Residents' Perceived Level of Preparation

Activities	**Perceived Level of Preparation**			
	Unsupervised (%)	**With Limited Supervision (%)**	**With Direct Attending Supervision (%)**	**Not Prepared at All (%)**
Develop treatment plans for patients with:				
Acute Myocardial Infarction (MI)	16.7	33.3	41.7	8.3
Perform specific procedures:				
Placing Leads for an Electrocardiogram (EKG)	50	16.7	33.3	
Perform Clinical Procedures:				
Lead Advanced Cardiac Life Support (ACLS) in a Code Blue situation.	8.3	8.3	66.7	16.7
Communicate and know when to seek consultations.	66.7	33.3		
Collaborate with other health-care personnel.	91.7	8.3		

The results showed that only 16.7% of the participants perceived themselves able to develop treatment plans for a patient with an acute MI (Myocardial Infarction) without supervision from an attending physician. Fifty percent of the residents felt they knew how to place leads for an EKG (Electrocardiogram), and 8.3% of the participants considered

themselves able to lead the ACLS (Advanced Cardiac Life Support) in a *Code Blue* (emergency) situation with no supervision. Sixty-six point seven percent (66.7%) of the participants felt they could communicate with other team members and knew when to seek consultations without any supervision, and 91.7% of the residents thought that they could collaborate with other health-care personnel (e.g., nurses) with no supervision.

Case Study

Setting

After completing the survey, each of the three groups (named A, B, and C) participated in a simulation. A rotation schedule was used, and the same simulation was used for each group. The simulations, reflection and feedback sessions (for the applicable groups), and individual interviews occurred on the same day from 1:00 to 5:00 p.m. in the Simulation Center. The simulations were conducted in the patient simulation room at the Simulation Center, with all equipment and the environment set up identical to a hospital inpatient room. The reflection and feedback sessions for groups A and C were held in the Simulation Center conference room, and the individual interviews were conducted in one of the patient examination rooms at the Simulation Center. I was physically present as an observer in the simulation room and the room used for the reflection and feedback sessions. The simulations, reflection and feedback sessions, and individual interviews were also video-recorded. In the following section, I will describe the simulations, reflection and feedback sessions (for the applicable groups), followed by the findings from individual interviews.

Simulation Observation Description of Group A (Simulation Followed by a Reflection and Feedback Group)

Participants. Participants for this study were described in Chapter Three. Two females (Dr. Larsen and Dr. Lambert) and two males (Dr. Jordan and Dr. Earls), all first-year surgical residents, were randomly assigned to group A. All of the residents in group A had finished an ACLS (Advanced Cardiac Life Support) course prior to this study. The ACLS course is required and residents must complete it prior to surgical residency training. There were two Intensive Care Unit (ICU) nurses (Ms. Llorens and Ms. Brauss) who acted as nurses, a mannequin representing a patient (Mr. Johnson), a trained actor who played the role of the patient's family member (Mrs. Johnson), and a standardized patient (Mr. Brown), who acted as the other patient in the room. To ensure participants' confidentiality, all of the residents, the trained actor (the family member in the simulation), the standardized patient (the other patient in the room during the simulation), facilitators, and nurses have been given pseudonyms in this report.

Simulation Session. As described in Chapter Three, the room was set up to be identical to a patient room in the hospital. It had two beds for patients and a chair next to each bed for family members or visitors. Mr. Brown was in the first bed that was located closest to the door, and Mr. Johnson (the mannequin) was located on the second bed. There was a curtain to separate the two beds. Mr. Johnson was lying on the bed with the intravenous line hooked up to his right arm. His wife was sitting beside him reading a magazine.

The time showed 1:10 p.m. when the phone rang in the residents' room. One of the residents, Dr. Larsen, picked up the phone and spoke to the nurse, Ms. Llorens. The

nurse informed Dr. Larsen about a postoperative patient, Mr. Johnson, who was unresponsive. A group of residents (i.e., group A) came to the patient's room and found Ms. Llorens and the patient's wife with Mr. Johnson. The nurse had tried to wake up Mr. Johnson, but he was unresponsive. That was the only action she had taken. Mr. Brown got up from the bed and asked the nurse and residents about what was happening with Mr. Johnson.

Dr. Larsen, the resident who answered the phone in the residents' room, asked Ms. Llorens about Mr. Johnson's condition, and she explained that Mr. Johnson was a postoperative colon cancer patient. He was in good condition after surgery, but later on, he started complained about chest pain, and since then he had not moved. Dr. Larsen tried to wake Mr. Johnson, but he continued to be unresponsive. She asked the nurse if the patient had already been hooked up to the monitor. While Ms. Llorens was checking the monitor, another resident, Dr. Jordan, lowered the bed to a horizontal position. Other residents (Dr. Lambert and Dr. Earls) discussed the equipment that was needed. Another nurse, Ms. Brauss, came into the room. Even though there was no instruction from the residents, Ms. Brauss took the initiative to get a crash cart (i.e., a set of trays or shelves on wheels used in hospitals to transport emergency equipment and medications). While the residents were working to awaken the patient by calling his name and touching his arm, Mr. Brown kept coming to them and asking, "What's going on with him?" Either one of the residents or nurses responded to him to make him calm down.

Dr. Larsen appeared to be trying to manage the situation. She checked the breathing sounds to see if the patient was breathing, but he was not. After one minute passed, she instructed Dr. Jordan to do chest compressions, but he did not do it

immediately. He mentioned that they needed a bag mask (used to release pressure oxygen ventilation to a patient who is not breathing) and waited for the bag mask before doing chest compressions. The residents looked confused because they did not know where the needed equipment was located. Dr. Larsen told Dr. Jordan again to do chest compressions, and while Dr. Jordan started chest compressions, Dr. Larsen kept monitoring the airway. Dr. Earls talked to Mrs. Johnson and asked about the patient's history. Dr. Lambert was not engaged in any activities at this time.

One of the nurses, Ms. Brauss, brought the crash cart into the room, and Dr. Earls took the bag mask off the cart and gave it to Dr. Lambert. Dr. Lambert took the bag and tried to find the oxygen hook-up on the wall. Dr. Larsen helped her by putting the bag mask to cover Mr. Johnson's nose and mouth, and she asked Dr. Lambert to hook up the bag mask to the oxygen hook-up on the wall. While the residents worked on Mr. Johnson, Mrs. Johnson and Mr. Brown kept approaching them and asking about Mr. Johnson's condition. Dr. Earls asked Mrs. Johnson to leave the room, but she did not want to leave the room and insisted that she wanted to stay.

Dr. Larsen asked Ms. Brauss to hand over the transparent, flat board. After Ms. Brauss gave it to her, she tried to put it underneath Mr. Johnson's back, so he would be lying on a flat and hard surface. Dr. Jordan stopped doing chest compressions while Dr. Earls was helping Dr. Larsen put the flat board under Mr. Johnson. After the board was in place, Dr. Jordan resumed chest compressions. Dr. Larsen told residents to put the defibrillator pads on the patient's chest, and Dr. Earls followed what she said and put the pads on Mr. Johnson's chest. Both of the nurses, Ms. Llorens and Ms. Brauss, reminded the residents about the heart activities on the monitor and the patient's history (who had

complained about chest pain earlier). After looking at the monitor and asking Dr. Earls and Dr. Jordan about what they saw on the monitor, Dr. Larsen made a decision to shock the patient. After making sure that everybody was clear of the patient and not touching him, Dr. Larsen instructed the nurse to shock the patient (with 200 joule). Once the shock was delivered, Dr. Larsen asked Dr. Jordan to resume chest compressions and ordered Ms. Llorens to prepare 1 mg of epinephrine. Once the medicine was prepared, Dr. Larsen told Ms. Llorens to wait until she was instructed to deliver it to the patient. Dr. Larsen asked Dr. Lambert to check the oral airway, and Dr. Lambert followed what was instructed. In the meantime, Ms. Brauss offered the ACLS algorithm (the flowcharts and procedures to manage a patient with cardiac emergency cases); Dr. Earls took it and started recording the activities following the algorithm. Dr. Larsen kept checking Mr. Johnson's pulse at the femoral artery, and she used a stethoscope to listen to the heart sound. She asked Dr. Jordan to stop chest compressions and instructed Ms. Brauss to shock the patient again. Once everybody was clear of the patient and not touching him, Ms. Brauss delivered the second shock. Then, Dr. Larsen asked Ms. Llorens to deliver the medication (1 mg epinephrine), which had already been prepared, and instructed Dr. Jordan to resume chest compressions. After Ms. Llorens delivered the medication intravenously, she informed Dr. Larsen that medication was delivered, and Dr. Larsen checked the patient’s heartbeat again. Ms. Llorens reported to Dr. Larsen that Mr. Johnson’s respiratory rate was fifteen inhalations per minutes, which was in the normal range. Dr. Larsen asked Ms. Llorens about the patient’s history. Ms. Llorens described the 78-year-old male’s post-operative cholecystectomy and told of his history of coronary artery disease and his earlier complaints about chest pain. The EKG (Electrocardiogram)

had previously been ordered by the attending physician when Mr. Johnson complained about chest pain few hours ago, but none of the attending physicians or residents had read the results. Mrs. Johnson asked the residents about the results of the EKG. Dr. Earls took the EKG result and reported the finding, "It's ST-elevation on the EKG [ST-elevation on the EKG showed the patient has myocardial infarction]." Dr. Larsen asked Ms. Llorens to prepare another medication (atropine), and then she looked at the monitor and checked the patient's heartbeat through a femoral artery. Dr. Earls also checked the pulse through the carotid artery and said, "Yeah, he does have a pulse."

Given that Mr. Johnson had a normal respiration rate and regular heart rate, Dr. Larsen notified everybody about Mr. Johnson's condition, "Okay, lets continue to make him comfortable since he's breathing on his own." Dr. Lambert put the oxygen mask on Mr. Johnson to replace the bag mask. Dr. Earls prompted the group that they needed to call the cardiologist for follow-up since Mr. Johnson was currently in stable condition. It took around thirteen minutes for the residents to manage the *Code* situation. This simulation session ended at 1:23 p.m.

Reflection and Feedback Session. After completing the simulation, all of the residents in group A went to the Simulation Center conference room. There was a large-screen projector on the wall so that residents could watch a video recording of the simulation. Two practicing physicians facilitated the sessions and the two nurses who participated in the simulation also joined the reflection and feedback session. Dr. Foster introduced herself as a clinical, surgical facilitator. Then she introduced Dr. Bland as a co-facilitator; and Ms. Llorens and Ms. Brauss, as the ICU nurses who played the role as nurses during simulation. Dr. Foster asked the group of residents, "How do you feel

you're doing the first simulation right here?" Dr. Larsen answered, "Yeah, it's impressive" and other residents also indicated that they were "impressed" by the experience and noted how realistic it was. Then, Dr. Foster asked them, "What were you thinking about when you were doing the simulation?" Dr. Jordan replied, "It's definitely different from the ACLS class where everything was available around you." All of the residents then discussed how it was different from their previous experiences, especially their experiences with the ACLS course, in which all the equipment was already set up and ready to use. For example, Dr. Jordan noted the realism of this simulation, including the need to wait for the crash cart to be brought into the room, and not having all of the needed equipment available in the room. They also discussed how the presence of standardized patients who acted as a family member and another patient in the room made the simulation more realistic.

Dr. Foster then brought up a few problems she observed with the simulation equipment. First, there was a problem with the defibrillator, which normally would not work when residents tried to shock asystole (i.e., when there is no heart activity to pump the blood into body circulation and it shows on the EKG monitor as flat line). She also mentioned the delay between delivering the shock and seeing the results on the monitor. She stated that these were identified as limitations in the simulation equipment.

After identifying the equipment problems, Dr. Foster asked, "What do you think you learned from this simulation?" Dr. Larsen responded about the complexity of the situation. She said that even though she and other residents had just completed the ACLS course a few days before the simulation, dealing with such a case in a real-life situation

was not as easy as she thought. The other residents gave non-verbal cues, such as head nodding, in agreement.

Dr. Foster stated that she noticed that Dr. Larsen took a role as a group leader, and then she asked, “How did you make the decision [to be the group leader] and how did the rest of you feel about it?” Dr. Larsen answered that because she had been the one to pick up the phone, she mentally prepared herself to be a leader. The other residents agreed with Dr. Larsen's decision and indicated they had defined their roles based on their positions in the room. For example, Dr. Jordan discussed how his position was closest to the patient's body, so he took charge of doing the chest compressions. The other facilitator, Dr. Bland, acknowledged the way they had delineated the roles, “It doesn’t matter who is going to be a leader, but there must be somebody assigned as a leader and other team members assigned with different roles.”

Next, Dr. Foster prompted a question, “What do you think went wrong and what do you think you could have done better?” In response to this question, Dr. Earls talked about his unfamiliarity with the environment. He gave as an example that he thought all the equipment was already prepared in the room; but during the simulation, he found that he had to wait for the crash cart to come. Furthermore, when Dr. Larsen asked him to give her the oxygen mask, he said that he did not know where the mask was located. This observation led a discussion among the residents about the importance of familiarity with the environment (e.g., what equipment was needed and where it was located) before responding to an actual *Code*. They discussed how their lack of familiarity with the environment led to their confusion when Dr. Larsen instructed them to “put the pads on,” because they did not know where the pads were. Dr. Foster then provided feedback that

the equipment settings in the simulation room were similar to an actual patient hospital room. She also emphasized the importance of monitoring the EKG monitor screen. She pointed out that during the simulation, the monitor showed asystole, but none of the residents was aware of that. She highlighted the importance of following the ACLS procedures in handling this situation. Dr. Foster then noted the value of having hands-on experience and practicing the skills in a safe environment with a simulation, because if residents made mistakes during a simulation, they only affected a mannequin and not a real patient. She said that residents could learn and keep practicing using simulations to improve their skills and gain some experiences, and the simulations such as this would prepare them better for the time when they would face real-life situations. Dr. Foster reminded them not to hesitate to ask for help, either from senior residents or from attending physicians because as new residents, they need to learn how to deal with this situation from experienced practitioners.

Ms. Brauss, one of the nurses who participated in the simulation, gave some suggestions about how to communicate with nurses. She stated that as a nurse, she would immediately do what was instructed by the residents. Ms. Llorens agreed with Ms. Brauss, and she said that when Dr. Larsen said, “Get epinephrine!” a nurse would think that the doctor meant for her to get the epinephrine and give it to the patient immediately. Ms. Llorens gave the feedback that it would be better if residents did not give any instructions until they wanted the nurse to do what they had asked.

Dr. Foster then brought up the topic of how to deal with a patient’s family in the room by asking, “How do you feel about the [patient’s] family [member]?” A discussion among residents then ensued, and all of them indicated that they felt uncomfortable with

Mrs. Johnson in the room, and that they would have preferred to take her outside the room. Ms. Llorens suggested that physicians could determine whether or not they would allow a patient's family members in the room or if preferred to take them outside the room. She said deciding how to handle a family member in the room depended on the physician's level of confidence. Her feedback on this issue was that if physicians felt comfortable with a family member in the room, which would be okay, as long as there was one person on the team who could explain to the family about the patient's condition. On the other hand, if the physicians felt uncomfortable, they could ask the family to go outside the room or stay in the hospital waiting room. Either way, physicians need to designate one person to keep the family members updated about the patient's condition.

After receiving feedback from Ms. Llorens on how to deal with a patient's family member, Dr. Foster asked, "Based on this simulation experience, can you identify what you might do similarly or differently when facing similar clinical situation in the future?" Dr. Larsen said that she wanted to have a clearer idea about defining the roles. She said that she thought it was important to assign responsibilities to each team member, so that everybody has his or her own responsibility; and once everybody knew the assigned role, they should act immediately. Dr. Lambert said that she was unsure what she would do differently in the future because in the simulation, she was ventilating the patient. She said that she might do something similar with what she did in the simulation if she would have to ventilate a patient in the future. The other residents (Dr. Jordan and Dr. Earls) did not say anything in response to the question. After that, Dr. Bland asked if the residents had noticed the changes in the heart rhythm on the monitor, but nobody answered him. Then he provided feedback on the importance of keeping an eye on the monitor and

checking the patient's pulse, especially after giving any treatments; such as shocking the patient or giving intravenous medication, to see if there were any changes in the heart rhythm that could be seen on the monitor.

Finally, Dr. Foster provided feedback on the importance of teamwork and sharing responsibilities with other team members. She noted that Dr. Earls could have taken responsibility as recorder and kept an eye on the monitor, reporting to Dr. Larsen as leader about what he saw on the monitor. Furthermore, she indicated that Dr. Jordan needed to observe whether or not the patient was breathing while he focused on doing chest compressions. Dr. Foster stressed that communication was one of the most critical factors that they had to remember. They needed to keep communication going and share observations with other team members.

In summary, the reflection and feedback session lasted around fifteen minutes. However, there were some technical problems with the video equipment, so the residents were not able to watch their simulation performance while they were participating in the reflection and feedback session. After the reflection and feedback session was ended and the technical problem was fixed, the residents were able to watch the video in the conference room; in the mean time, I was interviewing one of them in the patient examination room in the Simulation Center.

In addition to asking the questions based on their observations of the simulation, the facilitators asked four out of seven the reflection protocol questions: (1) What were you thinking about when you were doing the simulation? (2) What do you think you learned from this simulation? (3) What do you think went wrong and what do you think you could have done better? and (4) Can you identify what you might do similarly or

differently when facing similar clinical situation in the future? The three reflection protocol questions that were not asked including: (1) Were you aware of previous knowledge that you thought about or called upon as you were doing the simulation? (2) Were you aware of previous clinical skills and experiences that you thought about or called upon as you were doing the simulation? and (3) How did you think you did on the simulation and what do you think about the outcomes of the simulation?

Individual Interviews Group A

Dr. Larsen (the resident who picked up the phone when it rang and spoke to the nurse. She identified herself as a team leader)

Dr. Larsen indicated that she knew more about the patient's condition compared to the other residents in the group. Given that she was the person who answered the phone, she decided to take the role as leader. When asked if she consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Larsen said that she tried to remember her prior knowledge, skills and experiences from the ACLS course while she was performing the simulation. She indicated that one of the topics she learned from the ACLS course was patient coding, which was similar to the simulation case scenario (acute MI).

Comment 1:

> It's pretty much similar with the protocol for ACLS that we learned last Saturday, and one of those was a patient coding.

When asked if she learned something from the simulation, she said that she had already had knowledge, skills and experiences in managing this simulation case. As team leader, she said that she learned the importance of assigning tasks to other team members and managing the group to make sure everybody was doing his or her assigned task.

Comment 2:

> As a leader, I should know my staff, and I have to remember about what others are doing. I need to check back and make sure everybody does the right thing.

When asked if she thought about any benefits of having a simulation, she commented on the realism of this simulation as compared to her previous experience learning similar cases in the classroom, and she valued the opportunity to have hands-on experiences in a safe environment.

Comment 3:

> This simulation is more realistic than what I learned in the classroom before. It's more realistic than what I learned in the ACLS class. If you make a mistake with this patient [mannequin], you're not going to kill him.

When asked if the simulation enhanced her learning and understanding of the medical concept and clinical skills that were embedded in the simulation, she said that she learned about the importance of delegating some of the works to other members instead of trying to do everything by herself.

Comment 4:

> As a team leader, I was more dealing with the MI patient that I focused on, and toward the end, I didn't see the EKG result. I relied on other interns' [residents'] interpretations.

When asked if she thought about any benefits of having a reflection and feedback session, Dr. Larsen indicated that she felt satisfied with the opportunity to participate in the reflection and feedback session. She appreciated not only chance to receive feedback from experienced practitioners, but also the ability to engage in reflection and group discussion. When asked if she thought a simulation followed by a reflection and feedback session helped her to improve her understanding about the case that presented, Dr. Larsen

said that the reflection and feedback session allowed her to look at what she did during the simulation via video recordings, and to look at each of the resident's activities and activities as a group. She said it also afforded her ability to reflect on what she was doing and what others were doing, and to learn from them, so they could make some improvements in the future. She indicated that by watching the video, she could recognize how the time went so fast.

Comment 5:

> Through videotape, you can see your performance and other members' performance. You can learn from what you did, and it can help you to improve your skills. I also noticed the time went fast; it's ten–fifteen minutes already and you didn't know it.

When asked if she could have done differently in the simulation, Dr. Larsen said that she plans to designate roles and act quickly if she is in a similar situation in the future.

Comment 6:

> So in the future, I just want to make sure that everybody has roles. Once you know your role, just do your job immediately.

Dr. Jordan (the resident who performed chest compressions during the simulation)

When asked if he consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Jordan noted that he referred to his experiences in the ACLS course while performing the simulation. Dr. Jordan indicated even though he saw some similarities with his previous experiences, he felt this simulation was more realistic, especially with the presence of a family member and the other patient in the room. Further, he said this simulation was more stressful compared to the ACLS course.

Comment 1:

> It's more realistic here. In ACLS, we didn't learn how to deal with the family and another patient in the room. We worked under pressure on this simulation training compared to the ACLS class. We had to think under pressure, and it was also more nerve-wracking.

When asked if he thought about the benefits of having a simulation, Dr. Jordan stated the value of having this simulation, especially the ability to have hands-on experiences and practice in a safe environment. Furthermore, he indicated that simulation allowed him to practice and make mistakes without hurting anyone. He said that he could learn from his own mistakes, and it would prevent him from making similar mistakes in the future.

Comment 2:

> It's good to have experience with these simulation activities, especially with another patient who keeps looking over the curtain and asking, "what's going on?" With this simulation, you can screw up and kill the patient [a mannequin] without really hurting anyone. If I'm making a mistake, I will learn from it, so I know what I should have to do next time. The simulation allows you to do that without someone looking over your shoulder and monitoring you, "wait … don't do that because you might hurt someone!" If I make a mistake, I'll do it to a mannequin.

When asked if he learned something from the simulation, he said that he did not think about the possibility of seeking help from experienced practitioners.

Comment 3:

> Mostly I forgot to call other people for help since we have many interns [residents] over there. I also forgot to call the attending physician to consult about this patient.

In addition to the learning experiences he gained from the simulation, he also valued the opportunity to participate in the reflection and feedback session. When asked if he learned something from the reflection and feedback session, Dr. Jordan indicated

that he valued the feedback from facilitators about the group activities that went well and those that needed improvements. Furthermore, he said that he learned how to deal with a patient's family if he were to encounter a similar situation in the future.

Comment 4:

> In the discussion, we talked about things that we missed, things that we could have done better, and things that we did well. So if I did something wrong, there is a chance to fix it and do it better in the future. That's a good thing about reflection sessions overall. As far as the patient's family and another patient in the room, we need to understand the best way to deal with them.

When asked if he thought a simulation followed by a reflection and feedback session helped him to improve his understanding about the case that presented, he said that the reflection and feedback session helped him to get a better understanding about the case problem. For example, while engaging in the simulation, Dr. Jordan said he thought there was some activity on the monitor, so they decided to shock the patient. However, in the scenario there was no heart activity on the monitor, and it should be a flat line (asystole). He indicated although he knew that he was not supposed to shock an asystole patient, his misunderstanding about the case caused him and other residents in the group to treat the patient differently.

Comment 5:

> We thought there wasn't asystole and there were some EKG activities on the monitor, so we decided to shock the patient. But in the scenario, it has a different impression. We learned not to shock asystole, and from what we saw on the monitor it's not asystole. Yeah, this reflection session let us learn to get a better understanding about the case that was presented in the simulation. The simulation case was asystole, and we're not supposed to shock him.

Dr. Jordan felt he learned a great deal from his participation in the simulation followed by the reflection and feedback session. When asked if he could have done

differently in the simulation, he stated that he wants to have experience as a team leader. As a team leader, he said that he would have more pressures and responsibilities in managing the group, and he was looking forward to that role in the future. Dr. Jordan indicated that as a leader, he would try to learn more about the patient's history by asking a family member (if any) or the nurse about prior examinations (e.g., EKG) that might have been done. He stated the importance of knowing the patient's history while having to focus on the patient's condition; the better he knew the patient, the better treatments and procedures that might be given.

Comment 6:

> I would like to try being a leader in the *Code* situation in the future and see if I could get everything out of my head. To be a leader is not as easy as you think; you need to manage the groups. As team members, you can tell the leader and share what you thought. I know if I'm a leader, it will put the pressure on me, but I would like to have a turn to lead the group. I'm so excited about it.

Comment 7:

> Make sure you know everything about the patient and remember about everything, like the EKG results. We can take the patient's wife and ask if there is an EKG result available.

Dr. Lambert (the resident who ventilated the patient during the simulation)

When asked if she consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Lambert stated that she drew on her previous experiences in the ACLS course while facing this case simulation. Dr. Lambert indicated some similarities between this simulation case and her previous experiences in the ACLS course.

Comment 1:

> It's almost exactly the same as the ACLS class because we also learned how to run the *Code* situation.

When asked if she learned something from the simulation, Dr. Lambert indicated what she learned in the ACLS course was less real compared to what she learned in the simulation. For example, in the ACLS course, all the equipment was already set up, so it made it easier to find what she needed. On the other hand, in the simulation, she said that she felt unfamiliar with the environment, and she did not know where the equipment was located. She noted that she did not know that some of the equipment was on the crash cart, and she had to wait until the nurse brought the crash cart into the room.

Comment 2:

> We learned something like this in the ACLS, and we had all the equipment set up and ready to use. Right here, in the simulation, we didn't know where the mask was, and we had to wait for the crash cart to come.

When asked if she thought a simulation followed by a reflection and feedback session helped her in improving her understanding about the case that presented, Dr. Lambert nodded her head, in agreement. Then, she said that the realism of the case scenario and simulation setting made her feel as though she was working with an actual patient.

Comment 3:

> In this simulation, we learned to work under pressure. We have a family member and another patient in the room. It's more realistic than what we had in the ACLS. I felt like we were doing it to the real patient.

When asked if she could have done differently in the simulation, Dr. Lambert said that she might do something similar with what she did in the simulation because her role was only ventilating the patient. Then, Dr. Lambert addressed her confusion about how to

determine the roles. She indicated that she was not sure about her role and did not know what to do, and she said that she preferred to wait for Dr. Larsen to give her instructions about what to do and then follow what she said.

Comment 4:

> We don't know who's the leader, and we don't know what to do. So I just waited for Dr. Larsen to give instruction and followed what she said.

Afterward, she stated that she thought this simulation would be easier because she just finished the ACLS course a few days before her participation in this simulation session, but in fact, it was not as easy as she thought. She indicated some difficulties in communicating and sharing her opinions with other group members.

Comment 5:

> We all thought this is only a simulation practice, since we've just finished the ACLS course, but it's not as easy as we thought. We should call an attending physician or a chief resident when running the *Code* and ask for help, but I didn't do that. I tried to tell Dr. Larsen what was in my mind, but I didn't do it. I guess, I had something in my mind, but I didn't share it with the others.

When asked if she learned something from the reflection and feedback session, Dr. Lambert indicated that she learned the necessity of calling someone who has more experience in handling this type of situation. Dr. Lambert realized the importance of checking a patient's condition, including verifying whether the intravenous fluid was running smoothly, the monitor was hooked up to the patient, etc. From the feedback, she noted she learned that they should not provide instructions to the nurse to get the medications ready until they wanted the nurse to do what they had asked.

Comment 6:

> I don't know if this is a part of the scenario, but the IV [intravenous fluid] didn't run. I think that's the first thing that we needed to do. Make sure the IV was running smoothly and the patient was hooked up to the monitor.

Comment 7:

> Apparently, we're not supposed to talk [give instructions] to the nurse to get the stuff [medicine] ready until we really want to give it, like when we wanted to give epinephrine. Yeah, I'm glad we learned about it in the reflection session.

When asked if she thought about any benefits of having a simulation, Dr. Lambert said that she appreciated the ability to have hands-on experiences and practice in a safe environment. She said if she made mistakes, she did it to a mannequin and not to a real patient; and she appreciated that she could learn from her mistakes in this simulation environment.

Comment 8:

> It's a lot of easier to learn and mess up on the dummy, especially if you can learn from your mistakes; it's better to make mistakes in the simulation environment rather than in real life.

When asked if she thought about any benefits of having a reflection and feedback session, she noted that a simulation followed by a reflection and feedback session gave her a substantial amount of learning experiences.

Comment 9:

> Reflection and feedback is always good after finishing a simulation. You will know what was good, what you could have done better, and what you should continue to do. It's a good learning experience.

Dr. Earls (the resident who took the role of recorder, the person who documented all the simulation activity to follow the ACLS protocol)

When asked if he consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Earls said this simulation reminded him of prior experiences when he was still a medical student. As a medical student, he indicated that he learned about myocardial infarction through paper-based problems in the classroom. Dr. Earls stated that he watched a person performed chest compressions while he was in medical school, and then he tried to practice it when he took the ACLS course, a few days before participating in this simulation.

Comment 1:

> As a medical student, I watched chest compressions and did a couple *Codes* [myocardial infarction cases] in a written format.

Comment 2:

> I think all of us just finished ACLS five days ago, and it's still fresh in my mind about drug [medicine] skills and how to do CPR.

Compared to his prior experiences, which were more passive, he noted this simulation was more realistic and hectic. Even though he had already learned about how to manage this situation, when it was time to do the *Code Blue* situation, he said it was difficult for him to remember the ACLS procedures, such as what medicines he needed to give, when to begin chest compressions, where the equipment was, and when to start giving pads and shocking the patient.

Comment 3:

> This simulation is more realistic than what we learned in the ACLS course. The mannequin has a pulse and he actually breathes. In the ACLS course, we only pretended to check the pulse without feeling the pulse. The environment is also different. In this simulation, I didn't know I would have to wait for the crash cart to come or where the bag mask was.

Comment 4:

> This simulation is more hectic than I thought. Even though I just learned a similar case few days ago, it's hard for me to remember what medicines I need to give, when we should start chest compressions, and how to put the pads.

When asked if he learned something from the simulation, Dr. Earls noted about the distraction of a patient's family member in the room. Because he had no experience with that, he said that he did not know what to do and how to deal with this situation. He indicated that the distractions from the patient's family influenced his concentration on the patient's condition.

Comment 5:

> That experience was being able to take myself out of the *Code* for around five seconds, and I was afraid that I missed something important about the patient.

Dr. Earls said that he expected other residents to take care of the patient's family, but he felt that no one assumed responsibility for the patient's family. He stated that he did not know what to do, and he did not want to shout to a patient's family to leave the room. He expected that this simulation and the feedback he received during the reflection and feedback session would prepare him to better deal with a patient's family in the future.

Comment 6:

> … and the family member, I was kind of dumb on what to do. My initial reaction was to have other interns [residents] take her out of the room, but they didn't do that, and I didn't want to yell to them. I didn't know what to do in that situation. So, having this simulation [and reflection] experience may help me in the future.

When asked if he learned something from the reflection and feedback session, Dr. Earls indicated that he learned about the ability to speak up and share what he thought. Dr. Earls said he was passively following what Dr. Larsen said instead of sharing what he

thought. Although he was thinking about how to do the troubleshooting with this patient while doing the simulation and had some ideas about it, he noted that he never shared his opinions.

Comment 7:

> I found myself along the line with Dr. Larsen and followed what she said. In the meantime, I was thinking about what's wrong with this patient and how we had to manage it. I did have some opinions, but I didn't say anything. I think I need to speak up and discuss with her about how to handle this patient. I just feel we should have more back-and-forth dialog across the bed rather than just quiet and follow what she said.

Then, Dr. Earls indicated he learned about the importance of having excellent communication among team members in the reflection and feedback session. What was in his mind might be different from what others had in mind, so sharing opinions was extremely important. Dr. Earls said if all the residents concentrated and focused only on what they doing, they might not pay attention to other things that might have a relationship to the patient's condition. He mentioned again that communicating what he saw or thought would have been particularly beneficial. For example, while performing the simulation, he said that he saw some heart activities on the monitor, and he believed he saw ventricular fibrillation. A group of residents provided appropriate treatment for ventricular fibrillation condition. However, during the reflection and feedback session, he found that his understanding was wrong. The facilitators and nurses mentioned that there were no heart activities on the monitor (asysytole) and they were not supposed to shock an asystole patient. Because of the lack of communication, the group of residents thought they had shocked a ventricular fibrillation patient. He said that he learned something crucial that was neglected in the simulation during the reflection and feedback session

discussion. Again, the ability to communicate, share opinions, and reach agreement about the treatments affected their success in handling this situation.

Comment 8:

> We had made a decision from the activities on the monitor and found v-fib [ventricular fibrillation]; we shocked him as an appropriate treatment for it. However, from the reflection session, we learned that the facilitator and nurses thought it was asystole. So they thought we shocked asystole, but we thought we shocked v-fib.

Dr. Earls also shared his thoughts about the need to call a chief resident or an attending physician to help them. However, in the simulation, he indicated that he did not verbalize what he thought.

Comment 9:

> While doing the simulation, in my mind I wanted to call a chief resident or an attending physician, but in reality I didn't verbalize it and say "call chief resident" or "call attending." So verbalizing what you think is very important; voicing things aloud instead of just thinking.

When asked if the simulation enhanced his learning and understanding of the medical concept and clinical skills that were embedded in the simulation, Dr. Earls nodded his head to show the agreement. He said that even though he had just finished the ACLS course and everything was still fresh in his mind about how to perform CPR and the medicine needed to handle emergency cardiac cases, after participating in the simulation, he realized that he was not ready to implement what he had learned in a real-life situation. He noted that he gained invaluable experiences from this simulation, especially due to the realism of the scenario, environment, and equipment. He said that the ability of the mannequin to mimic a real-life patient (for example, by breathing and having a pulse) made him feel like he was dealing with a real patient.

Dr. Earls said that he received a considerable amount of benefit by participating in the reflection and feedback session. He appreciated not only the opportunity to engage in reflection, but also the ability to participate in group discussions, in which each team member shared opinions and received feedback from experienced practitioners. He said it helped him to get a better understanding about the case and how to deal with it.

Comment 10:

> Reflection is always good, because when we walk in the hallway, we kind of ask each other and share what we thought. By sitting down in the room, we can talk more about our point of view and share with others. Then, from experienced people like Dr. Foster and the ICU nurses, you get some feedback about what you have done – what went well and what you need to fix.

When asked if he thought a simulation followed by a reflection and feedback session helped him to improve his understanding about the case that presented, Dr. Earls indicated that this simulation allowed him to practice the knowledge and skills without harming a real patient. However, he felt that it was very important to participate in a simulation followed by a reflection and feedback sessions rather than participate only in a simulation. He said that by having the reflection and feedback session, he could reflect and receive feedback from other residents and experienced practitioners. He stated that without the ability to reflect on his experience and receive feedback from others, he might not know if he did something right or wrong. So in the future, he might do something similar to what he did in a simulation without realizing how he could improve. He said that the ability to participate in both sessions enhanced his knowledge and skills and enriched his learning experiences.

Comment 11:

> Just simulation itself would help but not near as much as having both simulation and reflection sessions. We just finished the simulation, and then sat around the table with experienced people who told us what went well and what didn't go well. Without reflection and feedback from others, the learning process is going to stop.

When asked if he could have done differently in the simulation, Dr. Earls said that he would be more active in defining the roles in the future. For example, whoever is the first person to step into the room, he or she can take the role as leader; whoever stands closest to the chest can perform chest compressions; whoever gets the bag mask will take responsibility to do resuscitation. He acknowledged that he only stood quietly in the room, without doing anything for a couple of minutes, before taking the role as recorder, which he believed he could have done immediately. Dr. Earls indicated that he valued the ability to practice in the safe environment via simulation before he encountering an actual *Code* with a real patient.

Comment 12:

> I think because we're so close to the ACLS class, we just scattered into our position by location. So, when Dr. Larsen stepped up, we knew that she took the role as leader. Dr. Lambert grabbed the bag and started bagging, Dr. Jordan started chest compressions. I was in the middle of the group a little bit and then took the role as recorder, which I should have done immediately. Once we're doing simulation, we're okay as a group, but it took awhile to get into our delineated roles, a thing that we can definitely do better in the future.

Comment 13:

> It's always good to practice the *Code* in the simulation environment before actually doing it to a real patient.

Simulation Observation Description of Group B (Simulation Only Group)

Participants. One female (Dr. Smith) and three males (Dr. Nelson, Dr. Murphy, and Dr. Raven) first-year surgical residents were randomly assigned to group B. All of the residents in group B had already completed the ACLS course prior to their participation in this simulation. A mannequin represented a patient; a trained actor played a role as the patient's family member, a standardized patient acted as another patient in the room, and two ICU nurses played roles as nurses. To ensure confidentiality, all of the participants have been given pseudonyms.

Simulation Session. The same simulation setting used by group A was also used by group B. The time showed 2:25 p.m. when the phone in the residents' room rang. One of the residents, Dr. Smith, picked up the phone and spoke to Ms. Llorens, the nurse. Ms. Llorens informed her that a post-operative patient, Mr. Johnson, was unresponsive. The group of residents came into the patient's room (in order: Dr. Smith, Dr. Nelson, Dr. Murphy, and Dr. Raven), and they found Mrs. Johnson and Ms. Llorens beside Mr. Johnson's bed; Ms. Llorens was trying to wake him up. Dr. Smith asked Ms. Llorens what happened, and Ms. Llorens explained to her that she just came into the room and found Mr. Johnson was unresponsive. Dr. Smith came closer to Mr. Johnson and tried to wake him up by touching his arm. She asked, "Mr. Johnson, can you hear me?" but Mr. Johnson continued to be unresponsive. Dr. Smith then asked Ms. Llorens to hook up Mr. Johnson to the monitor, and Ms. Llorens responded, "He's getting hooked up." Dr. Smith tried to lower the bed into a horizontal position, and in the meantime she checked if Mr. Johnson was breathing. She put her head down close to Mr. Johnson's nose and mouth, and tried to wake him up again. Dr. Smith spoke to Ms. Llorens, "No, I don't hear any

breathing sounds." She checked with Ms. Llorens again about whether or not Mr. Johnson had been connected to the monitor. While Dr. Smith was busy taking care of the patient, the other residents stood and watched. Dr. Smith indicated that she wanted to do CPR and spoke to Dr. Raven, "This is a *Code Blue*, and I want you to call the attending. He needs 1 mg of epinephrine." Ms. Llorens said, "I'll call the attending!" and Dr. Raven looked for a crash cart.

Mr. Brown, another patient in the room, started to get up from the bed and open the curtain. He asked Dr. Murphy about what happened to Mr. Johnson. Dr. Murphy explained to him what happened with Mr. Johnson, and then pulled the curtain, so Mr. Brown could not see them. Dr. Smith said to the other team members, "I need a valve bag mask … ambu bag!" Because the bag mask was located on the crash cart, Ms. Llorens responded by saying, "Crash cart is coming!"

After one minute passed, Dr. Smith started doing chest compressions. Ms. Llorens asked Dr. Smith if she wanted to have a lowered bed, and then Ms. Llorens helped her lower the bed into a horizontal position. Dr. Murphy asked if there was any bag mask available in the room, and Dr. Raven answered, "Crash cart is coming." Dr. Smith asked Ms. Llorens to prepare 1 mg of epinephrine. Another nurse, Ms. Brauss, brought the crash cart into the room. She took a transparent flat board and gave it to Dr. Murphy. Dr. Smith, Dr. Murphy, and Dr. Raven rolled Mr. Johnson onto one side and put the flat board underneath him, and then Dr. Smith resumed chest compressions.

Ms. Brauss handed the bag mask to Dr. Nelson. He took it and tried to hook up the bag mask to the oxygen hook on the wall. Dr. Smith repeated her first request again, "Can anyone call the cardiologist?" Dr. Murphy and Dr. Raven were nodding their heads,

but they did not do anything. Ms. Llorens prepared 1 mg of epinephrine, and Ms. Brauss set up the monitor. Once the medication was ready, Ms. Llorens asked Dr. Smith if she wanted her to add the medication right now. After receiving affirmation from Dr. Smith, Ms. Llorens delivered 1 mg epinephrine through the i.v. (intravenous) line, and said "Epinephrine is given!" Ms. Brauss asked Dr. Smith again if she wanted to have the monitor hooked up, and Dr. Smith replied that Mr. Johnson needed to be hooked up to the monitor, and he was ready to shock. Ms. Llorens reminded the group of residents to look at the heart activities on the monitor. Dr. Nelson put the bag mask to cover Mr. Johnson's nose and mouth, and then looked at the monitor. Other residents also checked the heart activities on the monitor. In the meantime, Mr. Brown kept asking the residents or nurses about what was happening with Mr. Johnson; and Mrs. Johnson tried to keep close to Mr. Johnson.

Ms. Brauss took the EKG pads and gave them to Dr. Murphy. Dr. Murphy and Dr. Raven took the pads and put them on Mr. Johnson's chest. After the pads were put on Mr. Johnson's chest, Ms. Brauss asked Dr. Smith about the shock setting, "Is it manual mode?" and Dr. Smith answered, "Try to do manual, please, and shock it with 200 joule." Ms. Brauss responded, "It's charging into 200 joule." Dr. Smith asked for agreement from the other residents, "Does everybody agree?" All of them nodded. Once everybody was clear of the patient and not touching him, Ms. Brauss said "Everybody is clear." After she had delivered the shock to the patient, she said, "Shock is delivered." After the shock was delivered, Dr. Murphy started doing chest compressions, replacing Dr. Smith, and Dr. Nelson started bagging (ventilating) the patient. Dr. Raven asked Mrs. Johnson to leave the room, but she wanted to stay inside the room with her husband.

Dr. Smith spoke to the group, “We’ve already given epinephrine, shocked the patient, and then what …?” Ms. Llorens took the algorithm for ACLS protocol and gave it to Dr. Raven. Dr. Raven looked at the algorithm while Dr. Murphy did chest compressions and Dr. Nelson ventilated (bagged) the patient. Dr. Smith said that they were going to do CPR for another two minutes and then check the rhythm again. Ms. Llorens shared her opinion that the heart rhythm might change after they shocked the patient, but Dr. Smith said, “It doesn’t matter.” Dr. Raven also supported Dr. Smith’s argument that they needed to check the heart rhythm after finishing one series of chest compressions. Dr. Smith reminded Dr. Murphy to do thirty chest compressions followed by giving air. Dr. Smith instructed Dr. Raven to ask Mrs. Johnson about the patient’s history. She also asked Ms. Llorens about Mr. Johnson’s previous condition. Ms. Llorens replied that Mr. Johnson had complained about chest pain earlier and said that she had already contacted the resident and the resident ordered an EKG, but she was not sure if the EKG result was ready yet. She asked Ms. Llorens if there was any previous medication given to Mr. Johnson, and Ms. Llorens said, “I guess not.”

Dr. Murphy stated, “It’s already two minutes.” Dr. Smith replied, “Okay, let’s take a rest and look at the monitor!” and then everybody looked at the monitor. Ms. Llorens said, “The chest is moving,” and Dr. Nelson responded, “He has a pulse.” Dr. Smith repeated him, “He has a pulse. Okay, let’s go to the monitor and check the vital sign.” Ms. Llorens answered, “Pulse is 121, and his blood pressure is 90/50.”

Suddenly, Mr. Johnson was coughing, but nobody responded to him. Dr. Nelson put his head down close to Mr. Johnson’s nose and mouth to double check if he was breathing. Ms. Llorens asked Dr. Nelson if he wanted to use the oxygen mask because

Mr. Johnson was breathing by himself right now. Dr. Smith instructed Ms. Brauss to do a cardiogram. Ms. Llorens reminded the group of residents again about the EKG result, which had not been read. She gave it to Dr. Smith to read. Dr. Smith asked Ms. Llorens if they had the other EKG results, and Ms. Llorens answered that this was the only EKG result that they had. Dr. Raven asked Mr. Johnson, "How are you feeling, Sir?" He answered, "I feel nauseous." Dr. Raven checked his blood pressure, and it was 120/70 mmHg. He said, "120/70. Patient is stabilized, so that's good." It took around eleven minutes for the residents to handle this *Code* situation, and this simulation ended at 2:36 p.m.

Individual Interviews Group B

Dr. Smith (the resident who picked up the phone when it rang and spoke to the nurse. She identified herself as a team leader)

Dr. Smith said that she should be the one in charge to take the lead in running the *Code* because she was the person who picked up the phone and knew about the patient's condition better than the other residents. She was also the first resident who stepped into the patient's room, which put her in a leadership role.

Comment 1:

> The phone rang, and I was sitting close to the phone. I picked up the phone and talked to the nurse about Mr. Johnson. I thought, since I was the one who talked to the nurse over the phone, I should be the one who led the *Code*. Even though I didn't know very much about the patient, but I knew more than everyone else did. Also I was the first person [resident] in the [patient's] room, so it put me in the leadership role, I guess.

When asked if she consciously drew on previous knowledge, skills and experience during the simulation, Dr. Smith stated that she drew on her prior experiences

from the ACLS course that she took a couple weeks prior to the simulation. She indicated that the outcomes of this simulation might have been different if she had not participated in the ACLS class earlier.

Comment 2:

> We had an ACLS (Advanced Cardiac Life Support) course about a couple weeks ago. We learned all of those skills, including chest compressions, and how to work under stress. If I hadn't had that class, I think the outcomes of this simulation might be different.

Dr. Smith noted the similarities between her prior experiences in the ACLS class and this simulation.

Comment 3:

> Hmm … it's pretty much like the ACLS course. We had a mannequin, and they gave us a scenario; we're basically thrown in as a leader of the *Code*. So, a person ran the *Code* and made all the decisions. That's exactly what happened here today.

When asked if she learned something from the simulation, Dr. Smith said that she noticed some differences between the ACLS course and this simulation. She indicated that in the ACLS course, the roles were assigned so everyone knew his or her own responsibilities, but in this simulation, they needed to define the roles by themselves.

Comment 4:

> In the ACLS, before we entered the patient's room, we'd already known our roles, like I was a leader, this person did chest compressions, this person did medications, etc. But in this simulation, it's totally different. None of the roles have already been assigned. We've never had nurses and family members in the ACLS course. Also in this simulation, the mannequin was breathing and had a pulse, and in the ACLS, we only pretended that it was breathing and had a pulse.

Furthermore, Dr. Smith indicated she learned that the experienced practitioners would not always be available right away when they needed them, which meant as

residents, they had to deal with this situation while waiting for an attending physician or a senior resident. She also noted her difficulties with how to deal with family member in the room.

Comment 5:

> I definitely learned that there were not always senior residents or attending physicians available to help you right away when you needed them. So, you had to deal with this situation and it depended on how confident you were and how you drew on the previous knowledge that you had learned.

Comment 6:

> Having a family member in that situation was not an easy way. We wanted to ask her to leave the room, but she was still there. It was completely different if we had to work with or without a family member in the room.

When asked if she could have done differently in the simulation, Dr. Smith indicated the need to familiarize herself with the equipment and environment before running the *Code*. She also pointed out the communication problems that occurred among the team members.

Comment 7:

> [A] few [pieces] of equipment were different from what we used previously, but I think these would be equipment that we would use in the hospital. That would be good if we could familiarize ourselves with the equipment right now rather than during the actual *Code*.

Comment 8:

> Since we have a group of interns [residents] and we all have knowledge about this situation, we have to talk and communicate each other. We need to speak often and not be afraid to say something, like something not being done but needs to be done.

When asked if the simulation enhanced her learning and understanding of the medical concept and clinical skills that were embedded in the simulation, Dr. Smith said that this experience enhanced her learning and understanding about how to deal with the

Code situation. She appreciated the opportunity to have hands-on experiences within this simulation as well as experience a sense of realism.

Comment 9:

> We can learn the theory from a predetermined scenario about a 78-year-old man who lost his pulse. However, in this simulation, everything was different. That's more realistic since you saw everyone was running all over the place and not knowing what to do. This may happen in a real-life situation.

Comment 10:

> It was very realistic, from doing chest compressions with the simulated patient; the patient [mannequin] is breathing and having a pulse. It was very realistic, and I learned a lot from this simulation.

When asked if she thought about any benefits of having a simulation, she commented about the need to practice running the *Code* within a simulation environment to provide better treatment for the patient in a real-life situation. Then, when asked if she needed a group feedback and discussion after completed the simulation, Dr. Smith said that how feedback would be important following the simulation to enhance their learning experiences.

Comment 11:

> Obviously, we need more practice running the *Code* in this situation to provide better treatment to the patient in a real-life situation. The more you practice, the better you are.

Comment 12:

> The nice thing about doing this simulation, we can practice [the skills] and learn; with the feedback, you will learn more and go back to what you have done, your mistakes, and discuss with your peers about what you could have done better. I mean, learning with peers is one of the biggest places where a lot of people learn, especially in the medical school and residency. It's a kind of learning by doing, learning from your mistakes, and learning from other people's mistakes. If you've never discussed and received feedback, you will keep doing the same thing over and over again and you won't improve [significantly]. It would help us to improve our knowledge if we could talk to other people and discuss it.

Dr. Nelson (the resident who ventilated the patient)

When asked if he consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Nelson noted that he referred to his prior experiences in the ACLS course while performing the simulation.

Comment 1:

> It's pretty similar. We just came to the patient and did the case. It's like what we went through [in] the ACLS protocol. Just need to remember exactly about the ABC [airway, breathing, circulation] protocol.

When asked if he learned something from the simulation, Dr. Nelson indicated that he learned about the importance of assigning roles before they did the *Code*, and the need to follow the ACLS protocols to make sure everything is done correctly in the right order.

Comment 2:

> One person was deviating; everybody did like everybody else. Sometimes people like to jump into chest compressions at the same time. So it's always good to ask, "What do you want to do?"; "You bag the patient!"; "You do chest compressions!"; "You call *Code Blue*!"; "You talk to family members!"; or something like that. Everybody has an assigned role, so it would be more organized.

Comment 3:

> We started slowly to get the airway, like putting on the bag mask. Make sure that you did the ABC, airway first, breathing, and then circulation. Make sure you gave him oxygen, so he could breathe. Then you could do chest compressions. It's kind of following the order. Then, we started to think about the medicine following the algorithm.

When asked if he thought about any benefits of having a simulation, Dr. Nelson indicated about the benefit of having hands-on experiences within this simulation because this was his first experience doing the *Code* situation.

Comment 4:

> It's better to get practice running the *Code* situation rather than only practicing a specific task. I think this simulation was the most beneficial for me since I don't have a lot of experience with the *Code* situation. The best way to learn is by doing it; it's like having hands-on experiences.

When asked if he could have done differently in the simulation, Dr. Nelson said that in the future he wanted to make sure that the roles were assigned before doing the *Code* and that everything was done in order as quickly as possible.

Comment 5:

> Like I mentioned before, we need to be more efficient and get things done. Make sure everything was done in the right order as quickly as possible.

When asked if he needed a group feedback and discussion after completed the simulation, Dr. Nelson noted that it would have been beneficial to have received feedback and had the opportunity for discussion with other members following the simulation.

Comment 6:

> Having feedback from other members and the attending physician would be good to see everybody's perspective and how well we did or how to make it better.

Dr. Murphy (the resident who put the EKG pads onto Mr. Johnson's chest and the second person who did chest compressions after Dr. Smith)

When asked if he consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Murphy indicated that he referred to his prior experiences in the ACLS course while performing the simulation. Dr. Murphy indicated that he had different experiences with this simulation compared to his prior experiences in the ACLS course, and he felt that he did not follow the ACLS algorithm as he should.

He also commented on the realism of this simulation as compared to his prior experiences in the ACLS course.

Comment 1:

> It's a completely different experience from the situation that I learned in the ACLS class before. I felt that we didn't follow the steps that we should have been doing.

Comment 2:

> This simulation was more realistic than what we did in the ACLS course. We had nurses over there; also another patient who kept coming over put more realism to it.

When asked if he learned something from the simulation, Dr. Murphy indicated about the communication problem among the team members. He said that he saw the patient's chest move, which means the patient was breathing, but he did not speak up because he was afraid his opinion was wrong, so he felt it would better to be quiet.

Comment 3:

> When I did CPR, I could see the chest moved, so I knew he was breathing although we put on the [bag] mask. Since I was not a team leader, I didn't want to say anything to her because she was the one who was in charge. I think I was more afraid of what I was going to say – in case what I said was wrong. So it was better just to be quiet.

He also commented about the communication problems with the nurses. He said that he was not sure if he had good communication with nurses, because he assumed that the presence of nurses was to help them and not to keep asking questions.

Comment 4:

> We had nurses over there who kept asking, "Are you sure you want to do this?"; "Why don't you do this?" or "How about this?" Well, did she tell us what we had to do in the simulation, or probably she wanted us to do something different? Was that what she was asking for? It's not clear to me why they kept asking us those questions. I think in a real-life situation, they should help us in doing something.

From this simulation, he indicated that he learned about the importance of having good communication among the team members.

Comment 5:

> I think you have to speak up no matter what because even if you're wrong, at least someone else will listen to your opinion and think about it. In my case, I saw he could breathe, so obviously we might not have to do the CPR anymore. The output is going to be different from what we had. I wish I could say, "He's breathing," so we didn't have to do chest compressions again.

When asked if he could have done differently in the simulation, Dr. Murphy commented on the need to define roles before performing a simulation. Even though Dr. Smith finally took charge as team leader, he said that he did not feel she had done what a team leader was supposed to do. As a team leader, he expected her to speak up and have better team management.

Comment 6:

> It seems there is no one person leading. Everyone was coming and offering opinions about the patient rather than saying, "You do this!" and "You do that!"

Comment 7:

> I think Dr. Smith did a good job since this was her first time. However, as a leader, a person should speak up and have better team organization and management. Also when the nurses asked questions, should I have to answer, or let the leader answer?

When asked if the simulation enhanced his learning and understanding of the medical concept and clinical skills that were embedded in the simulation, he nodded his head, and then he said that it would be better if they had the opportunity to do more practice with the simulation to prevent harm to patients. Hence, it would enhance their self-confidence.

Comment 8:

> We should do this simulation more often because these practices could prevent patient harm and it would make us more comfortable and have better self-confidence.

When asked if he thought about any benefits of having a simulation, Dr. Murphy indicated that even though he just finished the ACLS course, he felt he was not ready to do an actual *Code* in a real-life situation. He also appreciated the chance to practice his skills with the *Code* situation in a safe environment.

Comment 9:

> This simulation showed that we're not prepared to do *Code* situations in real-life situations, even though we just finished the ACLS class. We learned about the *Code* situation in the ACLS class, and we thought we were ready. However, when the patient's heart rhythm changed, I didn't know what to do, and when Dr. Smith asked for the bag mask, I did not know where the bag mask was located. I think this simulation was good, so we can practice [the skills] in a safe environment.

When asked if he needed a group feedback and discussion after completed the simulation, Dr. Murphy indicated the need to have group discussions as well as receiving feedback from other team members and facilitators.

Comment 10:

> I think that would be nice if we sit down together and just share, "How do you feel?" So we can discuss as a group how we should work together. I think it would give us more benefits than did the simulation only, because I don't think we can [significantly] improve our skills without receiving feedback that tells us exactly what we did.

Dr. Raven (the resident who helped Dr. Murphy put the pads on Mr. Johnson's chest, and who also had the role as recorder, the person who documented all the simulation activity to follow the ACLS protocol)

When asked if he consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Raven stated that he referred to his prior experiences in the ACLS course while doing the simulation.

Comment 1:

> We did something similar in the ACLS course, such as doing the airway, breathing, and circulation stuff. The case was also similar. The differences were right here we had a patient's family and another patient in the room; the settings were more like in the hospital environment whereby in the ACLS, the setting there was a patient fell down in the subway and we had to help him. As far as a mannequin, what we used in the ACLS couldn't move and talk like what we had in the simulation. Otherwise, it was the same.

When asked if he learned something from the simulation, Dr. Raven said that he did not feel that he learned anything new from this simulation because everything he experienced in the simulation was similar to his prior experiences.

Comment 2:

> I think I was doing what I have done before. I didn't feel I learned anything new here. I know that we have a patient's setting like in the hospital, but it doesn't look like a new learning point. As far as simulation experiences, I didn't feel I was learning something new.

When asked the reason why he did not learn anything, Dr. Raven indicated that he would have preferred to have simulations of one specific procedure, such as putting on the mask or doing intubation.

Comment 3:

> I would like to learn how to put on the mask or how to do intubation. I've never done those procedures before, so I really want to learn about it.

When asked if he could have done differently in the simulation, Dr. Raven commented the importance of defining roles and acting quickly.

Comment 4:

> We need to do the ACLS protocol faster, like who's going to do chest compressions, or who's going to take notes. So basically, how we're getting on the ball faster.

As far as teamwork, he noted that the experienced practitioners should take the lead in handling the patient, but if there was nobody who had more experience than he had, he would take care of the patient, with help from other residents or nurses.

Comment 5:

> The higher level or the experienced practitioners should lead the team. If it's only me and the nurses, I will start doing chest compressions and ask the nurse to help me. If there are a few interns [residents], we can take turns to lead the *Code* until somebody who has more experience shows up. Basically what we need to do is just follow the ACLS protocol.

When asked if he needed a group feedback and discussion after completed the simulation, he said that would have been beneficial to have a discussion right after the simulation.

Comment 6:

> I think it would give us benefits if we can talk to each other and then discuss it, such as having close-group discussions between us [residents] and the facilitators about what we have done and what we need to do for improvements.

Simulation Observation Description of Group C (Simulation Followed by a Reflection and Feedback Group)

Participants. Three males (Dr. Fisher, Dr. Baker, and Dr. Carter) and one female (Dr. Flaming) first-year surgical residents were randomly assigned to group C. Dr. Fisher, Dr. Baker, and Dr. Carter had taken the ACLS course prior to their participation in this

simulation; Dr. Flaming would take the ACLS course in the next few days after this simulation. As with groups A and B, Ms. Llorens and Ms. Brauss acted as nurses in this simulation, a trained actor played a role as a member of the patient's family, a standardized patient acted as another patient in the room, and a mannequin represented the patient. Pseudonyms were given to all participants to ensure confidentiality.

Simulation Session. The same simulation settings used by groups A and B were also used by group C. The time showed 3:40 p.m. when the phone in the residents' room rang. One of the residents, Dr. Fisher, picked up the phone and talked to Ms. Llorens, the nurse. She reported that a post-operative patient, Mr. Johnson, was unresponsive. A group of residents came into the patient's room (in order: Dr. Fisher, Dr. Baker, Dr. Flaming, and Dr. Carter) and found Mr. Johnson's daughter and Ms. Llorens standing beside the bed. They saw Ms. Johnson was trying to wake her father. Dr. Fisher asked Ms. Llorens, "Tell me what happened!" and Ms. Llorens replied, "I couldn't wake him up." Dr. Fisher asked Ms. Llorens if Mr. Johnson was breathing, and Ms. Johnson answered that he was fine before. Dr. Carter asked Ms. Johnson to leave the room, but she wanted to stay inside the room with her father. Dr. Baker came closer to Mr. Johnson and put his ear close to Mr. Johnson's mouth and nose to listen if Mr. Johnson was breathing, but he was not. Dr. Flaming tried to check the pulse by touching the radial artery, but she could not feel any pulse. In the meantime, Dr. Fisher and Ms. Llorens tried to lower the arm on the bed and put the bed in the horizontal position.

Knowing there was something happening with Mr. Johnson, the other patient in the room, Mr. Brown, opened the curtain and asked the nurse and residents about what happened to Mr. Johnson. Ms. Llorens closed the curtain, but Mr. Brown opened it again.

Dr. Carter tried to explain to him about the situation and asked him to stay on his bed. Dr. Flaming tried to find a bag mask and attempted to hook up the patient to the monitor, but she did not know how to do that. Ms. Llorens said, “I will get a mask and hook him up to the monitor.” Dr. Fisher double-checked with Dr. Baker if the patient was breathing; and Dr. Baker put his ear close to Mr. Johnson’ nose and mouth and said, “No, he is not breathing.” Dr. Fisher asked Ms. Llorens how long Mr. Johnson had been unresponsive, and she answered, “I do not know. It has been awhile. Maybe it is close to three minutes.”

After a minute and a half, Dr. Flaming started doing chest compressions. Ms. Llorens said to the other nurse, Ms. Brauss, who just showed up in the room, “I need a crash cart!” and Ms. Brauss went outside the room to get a crash cart. Dr. Fisher said that they needed a bag mask and Ms. Llorens answered, “Bag mask is coming.” In the meantime, Mr. Brown kept opening the curtain and asking the residents about what happened to Mr. Johnson. Dr. Carter spoke to him to calm him down.

Ms. Brauss came into the room and brought the crash cart. Dr. Fisher ordered her, “Go get the bag mask!” and Ms. Brauss gave the bag mask to him. Dr. Fisher put on the bag mask to cover Mr. Johnson’s nose and mouth, and Dr. Baker hooked up the bag mask with the oxygen hook-up on the wall. Ms. Brauss handed the transparent flat board, and Dr. Baker took it and put it under Mr. Johnson’s back. Dr. Baker reminded the other residents about the most important thing to do right now, “Keep circulation going and make sure he is breathing!” Dr. Fisher asked Ms. Llorens, “Can I get 1 mg of epinephrine?” Ms. Llorens prepared the medication that was requested, and Ms. Brauss offered to help, “I will hook up the patient to the monitor.” Dr. Fisher took the ACLS

algorithm (ACLS chart) from the crash cart and read it, then he gave it to Dr. Carter and asked him to record the activities following the algorithm; Dr. Flaming kept doing chest compressions; and Dr. Baker was bagging (ventilating) the patient. Then Dr. Fisher took the pads from the crash cart and put them on Mr. Johnson's chest. While he was putting the pads on Mr. Johnson's chest, Ms. Llorens told him that Mr. Johnson had complained about chest pain earlier, and she had called the resident, who had ordered an EKG, but she was not sure if anybody had looked up the EKG results.

After two minutes performing CPR (Cardiopulmonary Resuscitation), Dr. Flaming and Dr. Baker switched positions; Dr. Flaming bagged the patient and Dr. Baker did chest compressions. Dr. Carter took the EKG results and discussed the findings with Dr. Flaming. Meanwhile, Ms. Llorens delivered 1 mg epinephrine i.v. Afterward, Dr. Fisher asked Dr. Baker to stop doing chest compressions and Dr. Flaming to stop bagging. He ordered Ms. Brauss to defibrillate the patient with 200 joule energy. After everybody was clear and nobody touching the patient, Ms. Brauss delivered the shock, and then Dr. Fisher ordered Dr. Baker to resume CPR. Ms. Llorens asked Dr. Fisher if he wanted her to give the patient another medication (atropine), but Dr. Fisher said, "Wait, not now." He asked Ms. Llorens if Mr. Johnson had ever had a similar previous condition, and Ms. Llorens said she did not know. Dr. Carter showed the EKG results to Dr. Fisher. After reading the EKG results, Dr. Fisher ordered Ms. Llorens to deliver atropine and she did. He asked Dr. Baker if he was tired of doing chest compressions and if he wanted to switch with others, but Dr. Baker did not answer him.

Dr. Fisher gave instructions to stop the CPR and get ready for the second shock. He asked Dr. Baker if Mr. Johnson had a pulse. When Dr. Baker checked the pulse by

touching the radial artery, he said, “Yes, he has pulse.” Dr. Fisher asked Dr. Baker to check it again from the femoral artery. After checking the femoral artery, Dr. Baker reported, “He has pulse.” Dr. Fisher looked at Mr. Johnson and said, “He is awake,” and others replied, “Oh, that’s good.” Dr. Fisher asked Mr. Johnson, “Are you okay, Sir?” but Mr. Johnson did not answer his question. Dr. Fisher gave instructions to Dr. Baker and Dr. Flaming to change the bag mask to an oxygen mask. Dr. Fisher took it from the crash cart and gave it to Dr. Flaming, then he ordered Ms. Llorens to give Mr. Johnson 2 mg morphine.

Mr. Johnson was awake and able to communicate with Dr. Fisher. Mr. Johnson asked Dr. Fisher about what had happened with him, and Dr. Fisher explained that he stopped breathing and they helped him to recover. Ms. Llorens informed Dr. Fisher that she had delivered 2 mg morphine. Dr. Fisher talked to Mr. Johnson, “Mr. Johnson, I hope you feel better. We just gave you medication to help you with the pain, okay?” Dr. Fisher and Ms. Brauss looked at the heart rhythm on the monitor to make sure everything was okay and that Mr. Johnson was in stable condition. Dr. Fisher ordered Ms. Llorens to bring Mr. Johnson into CICU (Cardiac Intensive Care Unit). It took around ten minutes for the residents to handle this *Code* situation, and this simulation was ended at 3:50 p.m.

Reflection and Feedback Session. After completing the simulation, all of the residents in group C went to the Simulation Center conference room for a reflection and feedback session. One of the facilitators, Dr. Foster, was already seated on a chair when they came into the room. The other facilitator, Dr. Bland, came into the room following the residents and then sat between two of the residents. The two nurses who participated

in the simulation (Ms. Llorens and Ms. Brauss) also joined the reflection and feedback session.

Dr. Fisher immediately brought up his concerns about how to deal with a patient's family and asked about the policy of having a family member stay in the room. In response to this question, Dr. Foster responded with feedback based on information that she received from Ms. Llorens, which was that the current policy depends on how comfortable the physicians are with family members in the room. She said that if physicians feel comfortable, they can let the family member stay in the room. However, if physicians prefer the family member stay outside the room, they can ask family to leave the room, as long as there is a person on the team who can explain to the family about the patient's condition. She said that it depends on the physicians' confidence level. Dr. Flaming shared her feelings and said, "I thought it was weird having a family member right there because it was annoying." Dr. Fisher said that he should have addressed the issue of the family member himself after asking the other group members and coming to agreement about whether they wanted to have a family member stay in the room or not. Dr. Fisher stated that he preferred to have the family member in the room, so he or she [the family member] could see that the physicians tried their best to save the patient if something bad happened.

Dr. Foster asked the group of residents, "What did you guys think about the simulation?" Dr. Fisher said that he knew they [residents] would do the *Code*, and he thought all of the equipment would be ready to use, as it was in the ACLS course. However, in the simulation, everything was different. He indicated he did not know that they [residents] needed to wait for a crash cart to be brought into the room to get the

equipment that they needed. Dr. Bland then replied, “So you didn’t have any idea about where your equipment was.” All the residents gave non-verbal cues such as head nodding. Then Dr. Bland provided feedback about the importance of feeling familiar with the environment and getting comfortable with the equipment used. He said that as physicians, they should know where the equipment was located, so when they need it, it would be easier to find. Dr. Fisher also asked about the procedures for CPR. He said that he assumed they [residents] needed to wait for the bag mask before starting chest compressions. However during the simulation, he ordered Dr. Flaming to do chest compressions while waiting for the bag mask. He asked the facilitators if his decision to give instruction to Dr. Flaming to perform chest compressions without a bag mask was right. In response to Dr. Fisher questions, Dr. Bland provided the feedback that his decision was correct--they needed to perform chest compressions immediately.

Dr. Foster then asked, “What do you think went well during the simulation?” Dr. Fisher answered that he felt satisfied with the group’s ability to delineate the appropriate roles whereby everybody had his or her own role and knew what to do. Dr. Foster agreed with what Dr. Fisher said, and then asked the group of residents, “Do you all feel like that?” but none of the residents said anything in response to the question. Dr. Foster then provided feedback and said that residents could take a role based on their standing position, and whoever defined his- or herself as team leader should talk to the other members and give instructions about what to do. All of the residents gave non-verbal cues such as head nodding indicating either agreement with or understanding of the feedback.

Next, Dr. Foster asked, “What do you think you could have done better?” In response to the question, Dr. Fisher talked about the importance of knowing what equipment was available immediately when needed. Dr. Flaming indicated the necessity of defining roles before doing the simulation, so each resident would know what to do and could take action immediately. Dr. Fisher, the person who defined himself as group leader, indicated that he should be aware of what everybody else is doing. As an example, he said that as a group leader, he should have instructed Dr. Flaming to switch with another person after she had done chest compressions for two minutes.

Dr. Foster then asked a question, “Have you done something similar in [the] medical school that helped you with this simulation, such as PBL or simulation?” Three of the residents (Dr. Fisher, Dr. Baker, and Dr. Carter) indicated that they learned something similar in the ACLS course. Dr. Baker stated that he learned about heart attack case in the ACLS course and Dr. Flaming said that she learned the basic skills when she was still in medical school.

Dr. Flaming then brought up her concerns about communication problems that occurred during the simulation. She said that she expected to have better communication with the nurses to help the residents in this *Code* situation. Dr. Foster reminded then about team training they had received previously. She said that in the team training, they learned about two-way communication. Dr. Foster gave as an example that when they talked to the nurse, “Ms. Llorens, please prepare the epinephrine!” and she answered, “Doctor, do you want me to give the epinephrine now?” You replied, “Yes Ms. Llorens, give the epinephrine now,” after which she replied, “Doctor, I just gave the epinephrine.” It was back-and-forth communication, which was a good way to communicate with the

nurses. Dr. Foster also stated the need to know each team member's name and address each by name when giving instructions. For instance she said, "Dr. Flaming, I want you to do chest compressions." Ms. Llorens then provided feedback that if they did not know the nurse's name, they could refer them by title, "I need the mednurse [medical nurse]!" or they could address one of the nurses and say, "You're going to be my mednurse." Ms. Llorens reminded the residents to make sure they make eye contact with the nurse when saying this.

Afterwards, all of the residents, facilitators and nurses watched a video recording that showed the residents' activity during the simulation. After watching the video for two minutes, Dr. Foster stopped it and shared her concerns about the timeline. All of the residents and facilitators reviewed the timeline: the nurse found the patient was unresponsive and called the residents; then the residents came to the room and started doing CPR. Dr. Foster asked the residents, "What happened with the patient after a few minutes with no chest compressions and no oxygen circulating in the blood?" The residents answered, "Coma and die." Dr. Foster reminded them again about the timeline. She suggested that if residents received the call from a nurse and knew about the patient's condition, they should have asked the nurse to prepare everything, so that when they came into the room, all of the equipment needed would already be available in the room.

Finally, Dr. Foster asked, "What do you want to do the same or differently the next time around [in the future]?" Dr. Fisher indicated the importance of assigning the roles and acting quickly. Dr. Baker said the importance of having a good communication among team members. Dr. Flaming agreed with Dr. Baker about the importance of

having effective communication with other team members. During this discussion, Dr. Carter only nodded his head without saying anything.

In summary, the reflection and feedback session lasted around fourteen minutes. However, there were some technical problems in the video player equipment, so the residents were not able to finish watching the video during the reflection and feedback session. After the reflection and feedback session was ended and the technical problem was fixed, the residents were able to watch the video in the conference room; in the mean time I was interviewing one of them in the patient examination room.

In addition to asking the questions based on the simulation observation, the facilitators asked five out of seven the reflection protocol questions: (1) What did you guys think about the simulation? -- re-phrase of the reflection protocol question "what were you thinking about when you were doing the simulation"? (2) What do you think went well during the simulation and what do you think you could have done better? (3) Have you done something similar in [the] medical school that helped you with this simulation, such as PBL or simulation? – re-phrase of the reflection protocol question (3a) "were you aware of previous knowledge that you thought about or called upon as you were doing the simulation?", and (3b) "were you aware of clinical skills and experiences that you thought about or called upon as you were doing the simulation?" and (4) What do you want to do the same or differently the next time around [in the future]? – re-phrase of the reflection protocol question "can you identify what you might do similarly or differently when facing similar clinical situation in the future?" The two reflection protocol questions that were not asked were: (1) What do you think that you

learned from the simulation? and (2) How did you think you did on the simulation and what do you think about the outcomes of the simulation?

Individual Interviews Group C

Dr. Fisher (the resident who picked up the phone and spoke to the nurse. He identified himself as a team leader)

Dr. Fisher began the interview by explaining the processes by which the group defined the roles before engaging in the simulation. Dr. Fisher indicated that all of the residents in group C discussed that they would be working as a team for a *Code* situation. Dr. Fisher asked each of the team members about their experience with *Code* situations. Dr. Fisher and Dr. Baker had taken the ACLS course a few days before the simulation, and everything was still fresh in their minds about how to deal with the *Code* situation. Initially, Dr. Baker stated that he wanted to be leader, but when they were in the simulation room, Dr. Baker spoke to Dr. Fisher and asked him to lead the group and said he would take another role.

Comment 1:

> We had already discussed about how we would define our roles before the simulation session. We knew that we would be in a *Code Team*. I asked each of the team members about how recently they had the ACLS class and how comfortable they were doing it without supervision from the attending physician. Dr. Carter had it over a year ago, and Dr. Flaming will take the ACLS course next week. Dr. Baker had it recently before he came here, and actually we took the ACLS course together. Initially, he wanted to lead the group. However, when we came into the simulation room, he said, “Go ahead and take the lead!” and then he started doing CPR.

When asked if he consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Fisher said that he referred to his prior experience

in the ACLS course while engaging in this simulation, especially when they were running the *Code*.

Comment 2:

> Yes, I referred to the ACLS course, the class that I took a few days ago. The *Code* situation, scenario, and how we should work on the algorithm, was similar with what we learned in the ACLS course.

Comment 3:

> I had done the *Code* situation simulation in the past, but as a team member and not as a leader.

When asked if he learned something from the simulation, Dr. Fisher said he gained invaluable experience from this simulation, since this was his first experience as a team leader. He indicated that the ability to have hands-on experience with an acute MI patient will enhance his preparedness in facing similar cases in real-life situations.

Comment 4:

> This is the first time I became a team leader. I understood it was different. First of all, you need to recognize what you need to do; and secondly, you need to prioritize what things need to be done. Lastly, you need to make sure that everybody is doing their jobs.

Comment 5:

> In the simulation environment, you actively practice those skills. You never know exactly if you can do something or not do it. The simulation scenario like this is extremely useful since in real life, it is going to be higher energy and a higher pressure environment. Yeah, hands-on experience is more [useful] than anything.

When asked if he learned something from the reflection and feedback session, Dr. Fisher stated that by having reflection and feedback following the simulation, residents would think about what they have done, what went well, and what they need to improve. He said that he learned the importance of having good communication with the nurses.

Comment 6:

> This reflection session is crucial because you may recall some other activities that occurred during the event and something that you could have done better.

Comment 7:

> It was nice having the nurses over there, since I have never had staff [nurses] before. Knowing how to have good communication with them was a big key in this simulation.

When asked if he thought about any benefits of having a simulation followed by a reflection and feedback session, Dr. Fisher commented that the opportunity to participate in this simulation allowed him to practice his skills without hurting anybody. However, he said that participating in the simulation only would not useful without the opportunity to engage in reflection. He indicated that his participation in a simulation followed by a reflection and feedback will enhance his learning experience.

Comment 8:

> If you only watch on the video conferencing and let someone else run the *Code*, you can learn something just from sitting and watching, but if you are in the context of the scenario itself, plus sitting down, doing some reflections and visualizing again through videotape, you get two learning opportunities. That is the main issue; you can get double, triple, or more learning opportunities from doing one scene. This reflection session is especially beneficial to bring up everything to maximize learning experience as much as possible.

When asked if he could have done differently in the simulation, Dr. Fisher indicated that he learned about the importance of familiarizing himself with the available equipment to enhance their performance in the future in handling this type of situation.

Comment 9:

> This was a different setting and different environment for us. I was unfamiliar with where my equipment was and what was available in the room. It would be nice to try ahead as much as possible, recognize what equipment I have immediately, and what I need to ask for. That is one thing needs to be done better the next time.

Dr. Baker (the resident who ventilated the patient and then switched with Dr. Flaming and did chest compressions)

When asked if he consciously drew on prior knowledge, skills and experience during the simulation, Dr. Baker said he had tried to remember his prior experience from the ACLS course while performing the simulation. He stated that he had had previous experiences with how to deal with an unresponsive patient from classroom discussions and had watched someone else do the *Code* situation. Dr. Baker indicated that he had some experience with doing chest compressions simulations, but he had no experience as a person making the decisions.

Comment 1:

> Yes – I referred to my previous knowledge, mainly from ACLS course. I had simulation experience before, but it was different. My experiences were mostly in classroom discussions. I watched someone else do the *Code* from a distance.

Comment 2:

> I did some chest compressions before, but I was not the person who made decisions or led the group how to deal with the case. I was the person who mostly received the order, “you do this” or “you do that.”

When asked if the simulation enhanced his learning and understanding of the medical concept and clinical skills that were embedded in the simulation, Dr. Baker commented that this simulation was more realistic than his prior experience in the

medical school and ACLS course, such as the room setting, mannequin, and an environment that was set up identically with a typical patient hospital room.

Comment 3:

> The room setting in this simulation was different from what I had in the class before, such as we had nurses here, but we did not have nurses in the ACLS class. Right here, we had to find the bag mask and hook it to the oxygen hook on the wall, whereas in ACLS, everything was there. This simulation was more realistic than the simulations that we had in the medical school. Right here, we had more people involved in the simulation activities, and the situation was more hectic than what I had before. I think it was better to teach us with this type of simulation.

Comment 4:

> In this simulation, we used a full-size mannequin as compared to a partial mannequin that we used in the ACLS class. Furthermore, in the ACLS course, everything was pretend. We only pretended giving oxygen, pretended to insert some stuff, pretended there was a nurse, pretended having a patient's family in the room; and you did not have to look for the bag and other equipment. Everything was there and ready to use. This simulation was good and realistic. Everything was set up similarly with the patient hospital room.

When asked if he learned something from the simulation, Dr. Baker said that he satisfied with what he did during the simulation. He indicated even though the bag mask was not available in the room, he made a correct decision by checking the patient's breathing and then asking Dr. Flaming to start doing chest compressions immediately. Although he thought he made a quick decision, during the reflection and feedback session, Dr. Foster mentioned that overall, the group of residents did not act fast enough. Dr. Foster said that they should act quickly and do chest compressions immediately while waiting for the bag mask.

Comment 5:

> We had just met before we had the simulation, and we had not assigned our roles. In the simulation, I checked the breathing sounds and Dr. Flaming checked the pulse. Since the patient was not breathing and had no pulse, we started doing chest compressions without a bag mask. That was a main point – we need to start chest compressions as soon as possible even though we did not have a bag mask.

Dr. Baker shared his thinking processes while performing the simulation.

Comment 6:

> I was watching and listening to what others were doing while running the *Code*. In the meantime, I was thinking and refreshing my memory as to what I can do in this situation.

When asked if he thought about any benefits of having a simulation, Dr. Baker noted that he was pleased with the opportunity to have this hands-on experience and practice his skills in a safe environment. He indicated this simulation was the closest environment that he could learn and practice without doing it to real people.

Comment 7:

> You can sit in the classroom, be taught and read a book; it tells you everything, but it does not tell you when you are right there. This simulation is the closest that you can do. You do something similar without doing it to real people. It will prepare you better when it happens. For example, you just learned in the classroom, and then you go out and do a real *Code*. I don't think you know what is going on and how things work; this simulation helps you to see how it works. You cannot learn this hands-on experience from a book. The more you practice it, the better you are.

When asked if he learned something from the reflection and feedback session, Dr. Baker stated that he appreciated the opportunity to participate in the reflection and feedback session, especially the ability to receive feedback from facilitators, as well as

from other group members. Dr. Baker also stated the importance of prioritizing the tasks instead of doing multiple activities at the same time.

Comment 8:

> During simulation, it's hard for us to see ourselves and what others are doing at the same time. While watching the video in the reflection session, I could see what everybody is doing at that time. We also had some discussions about what went well and improvements needed.

Comment 9:

> If I am in charge doing chest compressions, make sure I focus on chest compressions and not other things.

When asked if what he could have done differently in the simulation, Dr. Baker said that he wanted everything should be in order, starting from airway, breathing, and then chest compressions. Even if the bag mask was not available, he said that he should start doing chest compressions as soon as possible.

Comment 10:

> Before you start doing chest compressions, you need to turn your thought, starting from airway, breathing, and then chest compressions. Even though you do not have a bag mask, just start doing chest compressions.

Dr. Carter (the resident who took the role of recorder, the person who documented all the simulation activity to follow the ACLS protocol)

When asked if he consciously drew on previous knowledge, skills and experiences during the simulation, Dr. Carter stated that this simulation experience was new for him. He took the ACLS course over a year ago, and he tried to recall his memory about the ABC: airway, breathing, and circulation procedures.

Comment 1:

> I had the ACLS course before, but it was over a year ago, and I tried to remember the ABC (airway, breathing, and circulation) procedures. I have never had a *Code* situation simulation like this before, so this was a new experience for me.

Comment 2:

> I have never had any simulations like this before. We only had a simulation about chest compressions, but I did not do chest compressions. However, if I have to do chest compressions or bag-mask ventilation, I am sure I know how to do that.

Dr. Carter reported that the presence of another patient in the room caused some distractions, because it was hard for him to focus on the patient's condition when another person was distracting him.

Comment 3:

> I was distracted by another patient in that room, since I could not focus on the patient himself. After he [Mr. Brown] talked to me, I felt I missed some information about the patient. So I did not know what was going on afterwards.

When asked if he learned something from the simulation, Dr. Carter said that he realized how quickly the time passed, especially while the patient was without oxygen. He also indicated the importance of defining the roles before they perform the *Code* situation.

Comment 4:

> After watching the video, I realized how quickly the time just passed by without giving oxygen to the patient.

Comment 5:

> It is important to have a team leader in this *Code* situation, and I think it would be better if we can define the roles before perform the *Code*.

When asked if he learned something from the reflection and feedback session, Dr. Carter said that he gained valuable knowledge from participating in the reflection and feedback session, especially with the opportunity to receive feedback from experienced practitioners. Furthermore, he indicated the importance of having two-way communication among the team members.

Comment 6:

> Dr. Foster gave us very good feedback… She shared information about the physicians' and nurses' responsibilities in this situation and how we should have initiated CPR when we came to the room, so it would not be considered too late.

Comment 7:

> Two-way communication is very important. Communication with other team members, communication with nurses, and making sure every team member knows what he or she is doing.

When asked if he could have done differently in the simulation, Dr. Carter stated that in the future, he will prioritize the tasks and focus on doing the main priority task instead of doing multiple tasks at the same time, which only creates distractions and difficulties in maintaining his concentration.

Comment 8:

> Next time, I will try not to do different things at the same time, and I must prioritize the tasks and focus on the main task. Prioritize the task and focus on the most important one, so I do not lose my concentration.

Dr. Flaming (the resident who did chest compressions and then switched with Dr. Baker, who ventilated the patient)

When asked if she consciously drew on previous knowledge, skills and experiences during the simulation, she indicated in the interview that she referred to her prior experience as a medical student while performing the simulation.

Comment 1:

> I am scheduled to take ACLS next week. I learned some basic things when I was still a medical student, like checking the pulse, looking for respiration, and then trying to figure out the next step to do. Sometimes, it was hard to remember something back on algorithm, but it was always ABC: airway, breathing, and then circulation.

She stated that she learned about standardized patient simulations (e.g., how to interview patient and do physical examination) when she was still a medical student, but this was her first experience doing a *Code* simulation.

Comment 2:

> I have not had this before. In my school, we did not do actual *Code* simulations. We had standardized patient simulations. We practiced it a few times so we knew what we should expect, but for *Code* simulation, it was new for me.

When asked if she learned something from the simulation, Dr. Flaming said that she did not have any experience in how to deal with this situation. She noted that this simulation experience would prepare her better when she takes the ACLS course the following week.

Comment 3:

> As a person who has not taken ACLS before and only watched from the distance when I was a medical student, I learned a great amount from this experience. This was a great experience to know what it was going to be when I have to do a *Code* situation in real life. This simulation experience will prepare me better when I take ACLS course next week.

When asked if she thought about any benefits of having a simulation, Dr. Flaming indicated that she appreciated the opportunity to have hands-on experience and practice her skills in a safe environment in addition to enhance her learning.

Comment 4:

> Within simulation, you can learn and practice your skills in a safe environment. That is very important since in medicine, you need to read a lot of books and need a lot of practice. However, you cannot read the books all day long since that will not tell you what you are supposed to do when you do the *Code*. We need simulation practices.

When asked if she learned something from the reflection and feedback session, she indicated about the importance of time management. While watching the video recording during the reflection and feedback session, Dr. Flaming realized that time went very fast, and every minute counted. She also commented that in the reflection and feedback session, she learned how to communicate with the nurses.

Comment 5:

> It was good to see the actual time to get there. How fast you want to be on the ball; because in your mind, you were trying to get everything situated. It showed a visual presentation of how much time was passing without realizing.

Comment 6:

> We learned how to communicate with nurses, especially when they want to have back-and-forth dialogue. If you say something to them, they will repeat it back to acknowledge what they are to do. That was a good reminder.

When asked if she thought about any benefits of having a reflection and feedback session, Dr. Flaming indicated that the reflection and feedback session was a safe place to discuss what they had done, and receive some feedback from experienced practitioners.

Comment 7:

> Reflection following a simulation is great because it is a safe place to get feedback. You have done something and you tried to do the best that you could do; and then, having knowledgeable people give you some feedback in a very calm [manner] and knowing this is a learning environment. That is the main point of practice, to know your strengths and weaknesses and especially to receive constructive feedback from somebody else who has more experience than you.

When asked if she could have done differently in the simulation, Dr. Flaming said that it would be helpful if after a simulation followed by a reflection and feedback session, residents could have the opportunity to perform a second round of a simulation followed by a reflection and feedback session to see if there are any changes.

Comment 8:

> I think that would be helpful if we can go through the simulation again and run the same case like what we had during simulation; then do a second round of reflection to see if we can fix our mistakes and make some changes like what was suggested during the reflection session.

Themes and Categories of Perceived Learning

As described in the previous section, the simulations, the reflection and feedback session discussions, and the interview responses were transcribed verbatim and reported in a narrative format. Content analyses were conducted on the simulations, the reflection and feedback sessions, observation field notes, and interviews. From these analyses, five descriptive themes emerged and from those five themes, three explanatory categories of perceived learning are proposed as the major findings of this study.

The five themes that emerged from the analyses of the data were: (1) perceptions of preparedness to respond and ability to respond; (2) perceptions of the effect of distractions on the ability to respond; (3) expectations regarding the simulation activity and other health-care personnel; (4) recognition of lack of confidence in the ability to

respond; and (5) perceptions of the importance of reflection and feedback on learning. From these five themes, three explanatory categories of perceived learning were determined: (1) complexity; (2) distractions; and (3) teamwork.

Themes of Perceived Learning

The first theme, *perceptions of preparedness to respond and ability to respond*, describes how prior experiences affected the residents in response to the simulated case. The second theme, *perceptions of the effect of distractions on the ability to respond*, describes how distractions from the patient's family member and the other patient influenced the residents' ability to concentrate while responding to this case. The third theme, *expectations regarding the simulation activity and other health-care personnel*, describes how the residents' different expectations of the simulation activity and how other team members responded to the simulated case had an effect on how the residents responded to the patient. The fourth theme, *recognition of lack of confidence in the ability to respond*, describes how the complexity of the case scenario and the lack of familiarity with the environment affected the residents' confidence level in response to the situation. The fifth theme, *perceptions of the importance of reflection and feedback on learning*, describes how the ability to perform reflection and receive feedback from others would enrich the learning experience.

Perceptions of Preparedness to Respond and Ability to Respond

Given that the majority of participants (n=11) had completed an ACLS (Advanced Cardiac Life Support) course, it was not surprising that those participants identified similarities between what they had learned in the ACLS course and what they learned in the simulation. Prior experiences from the ACLS course affected how the

residents responded to the simulation. For instance, all three residents (Dr. Larsen, Dr. Smith, and Dr. Fisher) who each defined themselves as the team leader in their groups indicated in the interview that they had the knowledge, skills, and experience to manage this simulation case. As team leaders, they said they learned the importance of assigning tasks to other team members and managing the group to ensure everybody was doing his or her assigned task. Dr. Larsen, Dr. Smith, and Dr. Fisher indicated that they gained invaluable experience from this simulation activity, especially as this was their first experience as a team leader. Although it took awhile to respond to the simulated patient and manage the teamwork, these three residents indicated that they thought they did well on the simulation.

In addition, prior experiences gained from the ACLS course made them aware of how to respond to the simulated case. Even though the eleven residents who had taken the ACLS course referred to their prior experiences in the course, they said that this simulation was more realistic than the ACLS course. The one resident (Dr. Flaming) who did not take the ACLS course also indicated that she thought the simulation was realistic. For example, Dr. Earls said, “This simulation is more realistic than what we learned in the ACLS course. The mannequin has a pulse and he actually breathes.”

The interview responses indicated that all but one of the residents realized how much they learned from this simulation, especially given the ability to have hands-on experience with an acute MI patient. The exception was Dr. Raven who felt he did not learn anything new from this simulation. He thought that this simulation was similar with his prior experiences in the ACLS course, so he expected to do something different (e.g., simulation of one specific procedure, such as perform endotracheal intubation). The

eleven residents acknowledged that even though they could learn the theory from reading books, without the ability to practice, they never knew if they were capable of performing a procedure correctly. According to the eleven residents, the simulation scenario, including the room setting that was similar to a patient room in a hospital—along with the presence of nurses, a family member, and the other patient in the room—enhanced their sense of the realism of the simulation. Furthermore, they stated that this simulation allowed them to practice their skills in a safe environment without endangering real people. They indicated that they could also learn from their own mistakes and make improvements before they applied their skills to real patients. Thus, they said that their participation in the simulation enhanced their perceptions of their preparedness when they face similar real-life situations, as Dr. Baker stated, "You can sit in the classroom, be taught and read a book; it tells you everything, but it does not tell you when you are right there. This simulation is the closest that you can do. You do something similar without doing it to real people. It will prepare you better when it happens."

Perceptions of the Effect of Distractions on the Ability to Respond

Dealing with the patient's family member was a big challenge for the first-year surgical residents. Given that none of the residents had any experience with this, they did not know what to do and how to deal with this situation. One of the residents, Dr. Earls, felt that the distractions from a family member influenced his concentration in response to this case. Dr. Earls expected other residents would take care of the patient's family, but he felt that none of the residents took responsibility in dealing with the patient's family.

In the reflection and feedback session, participants in groups A and C discussed their concerns about dealing with a patient's family in the room. Because none of them

felt comfortable in this situation, the residents would have preferred to take the patient's family outside the room. One of the experienced practitioners, then, provided feedback in how to deal with a patient's family. Unlike residents in groups A and C, who were able to receive feedback from experienced practitioners about how to deal with a patient's family during the reflection and feedback session, residents in group B did not participate in a reflection and feedback session and thus did not have the opportunity to receive feedback from experienced practitioners about how to deal with the presence of a patient's family if they face a similar situation in the future. Even though participants in group B were able to identify distractions from a family member, in the interview they indicated that they did not know how to handle it.

The residents understood that simulations allowed them to practice handling multiple tasks. In this simulation, besides focusing on dealing with an acute MI patient, they also had to deal with the other patient (Mr. Brown) and the patient's family member at the same time. The distractions from Mr. Brown and the patient's family led them to lose focus for a few seconds. From this experience, the residents learned the importance of prioritizing the tasks and focusing on doing the most important task instead of doing multiple activities at the same time, because doing so creates distractions and difficulty in maintaining their concentration, such as Dr. Carter said, "Next time, I will try not to do different things at the same time, and I must prioritize the tasks and focus on the main task. Prioritize the task and focus on the most important one, so I do not lose my concentration."

Expectations Regarding the Simulation Activity and Other Health-Care Personnel (Nurses and Other Residents)

Most of the residents in groups A, B, and C (n=11) agreed that they learned a great deal from participating in the *Code Blue* simulation. However, one resident who participated in the simulation-only group stated that he felt he did not learn anything new from this simulation. Dr. Raven had different expectations for the simulation activities and thought that everything he saw in this simulation was similar to his prior experiences. Instead of having a simulation of a *Code Blue* situation, Dr. Raven thought that it would have been more beneficial to him to have simulations in performing specific procedures (e.g., endotracheal intubation).

As previously discussed, eleven of the participants (except Dr. Flaming) had completed the ACLS course. In the ACLS course, these residents indicated that they had learned how to deal with cardiac emergency cases. As a result, they thought this simulation would be easy since they just finished the ACLS course. However, they indicated during the interviews that it was not as easy as they thought. The ACLS cases that were presented were well-structured, and all of the equipment needed was available in the room. Therefore, the residents said that they had expected all of the equipment would already be set up and ready to use for the simulation. Since this simulation was set up to be identical to a hospital inpatient room, the residents did not know what equipment was available in the room and what was not. They did not know that some of the equipment needed was on the crash cart, and they had to wait for the crash cart to be brought into the room, such as Dr. Earls said, “In ACLS, we had all the equipment ready for us; but in this simulation, we did not know where the bag mask was, and we had to

wait for the crash cart to come." From this experience, all the eleven residents (except Dr. Raven) indicated that they learned about the importance of feeling familiar with the environment and getting comfortable with the equipment used.

While engaging in the simulation, all the residents said they recognized the importance of teamwork, including how they were delineating the roles and acting quickly. As first-year surgical residents, they indicated that they thought they should have the knowledge and skills required for this simulated case; however, they recognized that without good teamwork, the outcome of a simulation could be negatively affected.

Given that all of the residents in the group worked as a team, communication was seen as an important aspect to achieve a positive outcome. Two-way communication among team members and the ability to acknowledge what they were doing was necessary. Interestingly, although 91.7% responding to the survey indicated that they felt capable of collaborating with other team members without supervision and 66.7% of the participants considered themselves be able to communicate with other team members and know when to seek consultations, the findings on the simulation did not support these perspectives. During the simulation, there were some communication problems that occurred among team members. For example, while Dr. Murphy was performing CPR, he saw the simulated patient's chest move, which meant the patient was breathing. However, he did not share what he saw with other team members. He expected another resident (i.e., a team leader) to be aware of this and to share with the group. The ability to speak up and verbalize the thoughts to other members was crucial in this simulation, but it did not always happen. Another example is the need to call an attending physician or a chief resident and ask for their help in dealing with this situation. Even though the majority of

residents in the three groups (n=11) said in the interviews that they had thought during the simulation that it might be important to call an attending physician, only one resident, Dr. Smith, clearly stated during the simulation that they might need to call an attending physician or a senior resident.

In addition, the eleven residents indicated that there were communication problems with the nurses. They assumed that the nurses were there to help the residents in this *Code Blue* situation. However, the residents found that the nurses did not act as expected during the simulation. One of the residents, Dr. Murphy, stated that instead of taking the initiative in helping, the nurses only did something if the residents asked them directly to help with a specific task. Furthermore, the residents indicated that they did not know that they were not supposed to give instructions to the nurses to prepare the medication unless they wanted the nurses to deliver the medication at that time. The residents' different expectations about how the nurses should have responded and what they should have done to help during the simulation affected how the residents responded to the patient.

Recognition of Lack of Confidence in the Ability to Respond

The ACLS course experience led the residents to think that they could do well in handling the case. However, the outcome of the simulation showed something different. The complexity of the case scenario and the residents' lack of familiarity with the equipment and environment affected their confidence levels as well as actions in response to the situation. For example, Dr. Smith said during the interview, "it looks like none of us is ready and feels confident to solve this simulation case. Everybody scattered all over the place without being sure what is going on and what [we] need to do." From this

simulation experience, all but one resident (Dr. Raven) indicated that they needed more practice. The residents believed that if they had the opportunity to do more simulations, it would increase their skills and enhance their level of confidence.

Another aspect that also influenced residents' confidence level was the amount of information they knew about the patient (i.e., a mannequin) prior to the simulation. Dr. Jordan indicated in the interview that knowing the patient's history was very important—that the more information residents had regarding the patient's condition, the better treatments that might be given.

Perceptions of the Importance of Reflection and Feedback on Learning

In this section I will discuss the findings from participants in groups A and C regarding their perceptions of learning after participating in a simulation followed by a reflection and feedback session. These include the residents' reported thought processes after the action was completed (reflection-*on*-action).

Reflection-on-Action. Reflection-*on*-action occurred after the simulation was completed. In the reflection and feedback session, residents reflected on their actions during the simulation, discussed the simulation with their peers, and received feedback from experienced practitioners (e.g., clinical surgical facilitators and nurses). By participating in this session, the residents indicated they learned which actions were effective according to experienced practitioners and which actions they needed to improve. For example Dr. Earls said, "We just finished the simulation, and then sat around the table with experienced people who told us what went well and what didn't go well. Without reflection and feedback from others, the learning process is going to stop."

The residents in group C were able to watch part of a video recording of the simulation during the reflection and feedback session, and watched the rest of a video recording after the reflection and feedback session was finished. While watching the video in the reflection and feedback session, they talked about the importance of time management in handling this situation, since time went very fast and every minute counted. One of the facilitators, Dr. Foster, gave some suggestions about what the residents might do if they face similar situations in the future. For example, she suggested that in the future, if they receive the call from a nurse and know about the patient's condition, they should ask the nurse to prepare all the equipment needed, so when they come to the patient's room, the equipment will already be available in the room. Due to a technical equipment problem, participants in group A were only able to watch the video after the reflection and feedback session was completed. As a result, they did not have the opportunity to receive feedback from experienced practitioners about time management in handling this situation.

According to the residents in groups A and C, participating in a simulation followed by a reflection and feedback session offered some benefits. They stated that the ability to perform reflection, engage in group discussions, and receive feedback from experienced practitioners enhanced their knowledge, skills, and experiences for future similar clinical situations. They thought it would prepare them to better deal with a similar situation in the future. For instance, while performing the simulation, all the residents in groups A, B, and C referred to the theory that they had learned before. They believed that they only needed to check the patient's pulse after one series of CPR (thirty times chest compressions followed by two times ventilation, repeatedly in two minutes).

In the reflection and feedback session, one of facilitators, Dr. Bland, reminded the residents to keep an eye on the monitor to see the heart rhythm as well as check the patient's pulse after they gave any treatments, including one series of CPR, defibrillate the patient, and intravenous medications. Unlike residents in groups A and C, who were able to receive feedback from experience practitioners about the importance of checking the patient's pulse after giving any treatments, residents in group B who were performing in similar behavior while engaging in the simulation did not receive corrective feedback; and their misconception could cause incorrect action if they face a similar situation in the future. The residents in group B indicated in the interview that feedback from peers and experienced practitioners would have enhanced their understanding of the scenario presented in the simulation. They stated that *learning by doing* could enhance residents' skills and experiences, but it is equally important to learn from their own mistakes, learn from other people's mistakes, and learn with peers. They said that if they had made mistakes in the simulation, without feedback and reflection, they might make similar ones in the future.

Categories of Perceived Learning

The first category, *complexity*, explains how the residents perceived their learning in response to the complexity of the simulation scenario. The second category, *distractions*, explains how the residents perceived their learning in response to the distractions that occurred during the simulation. The third category, *teamwork*, explains how the residents perceived their learning about delegating some of the work to other team members and communicating effectively among the team members are important while working in a team.

Complexity

The interview responses of eleven residents indicated that they identified some similarities between what they had learned in the ACLS course and what they experienced in this simulation. One resident who was scheduled to take the ACLS course in the following week after the simulation, Dr. Flaming, referred to her prior experiences in the classroom about the basic life support skills, such as chest compressions. Prior experiences from the classroom and the ACLS course influenced how the residents responded to the simulation. The eleven residents acknowledged the realism and the complexity of the simulation scenario with all the unanticipated events that occurred during the simulation. For example, the residents indicated the lack of familiarity with the environment and equipment, such as they had to wait for a crash cart to be brought in the room, and not having all the needed equipments readily available in the room. The realism and complexity of the case scenario led to some misconceptions about expectations because the residents stated that they thought, based on the experience in the ACLS course, all of the equipment would be available in the room and ready to be used. The reflection-*on*-action during the reflection and feedback sessions led to residents in groups A and C to realize the importance of being familiar with the environment and needed equipment, such as the need to monitoring the EKG monitor screen. On the other hand, even though the residents in groups B were also able to identify the concerns about unfamiliarity with the environment and equipment, in the interview, they did not explicitly say what they needed to do to address those concerns. All of the residents perceived that the connections to prior procedural knowledge, skills and experience obtained in the classroom and the ACLS course, and the experience gained from this

simulation plus the reflection and feedback session (for applicable groups) prepared them better when dealing with *Code Blue* situation in the future.

Distractions

The residents indicated in the interviews that the distractions from a patient's family and the other patient in the room caused them to lose focus for a few seconds. The residents in groups A and C stated that they learned about the importance of prioritizing the tasks and focusing on the most important task instead of attempting multiple activities at the same time, as a result of their participation in the reflection and feedback session. Furthermore, they also indicated that they learned better strategies for how to deal with the presence of a patient's family if they face a similar situation in the future. On the other hand, even though the residents in group B were able to identify areas of difficulties due to the distractions from the presence of a patient's family and another patient, in the interview, they stated that they did not know how to deal with them.

Teamwork

In the interview, all the residents were able to identify the importance of teamwork, including how they delegated some of the work to other team members and communicated effectively among the team members. It acknowledged in the interviews with the residents in groups A and C that they could now articulate how they should define their roles as a result of the reflection and feedback sessions. Furthermore, they recognized the need to communicate and share their opinions with other team members, including the need to call an attending physician in order to achieve a positive outcome. This concern was discussed in the reflection and feedback session. Based on the feedback from experienced practitioners, the residents indicated that they learned strategies for

communicating with others. On the other hand, even though in the interviews residents in group B were able to identify the importance of assigning the roles and having good communication with other team members, they did not bring up any strategies that they might use to improve teamwork and communication.

Chapter Summary

The focus of this study was to examine residents' perceptions of their learning after participation in a simulation compared to residents' perceptions of learning in a simulation followed by a reflection and feedback session. This chapter was organized into three main sections. The first section described the survey results; the second section provided the findings from simulation observations, reflection and feedback session observations, and individual interviews reported in a narrative format; and the third section presented the results of the study were grouped into five themes: (1) perceptions of preparedness to respond and ability to respond; (2) perceptions of the effect of distractions on the ability to respond; (3) expectations regarding the simulation activity and other health-care personnel; (4) recognition of lack of confidence in the ability to respond; and (5) perceptions of the importance of reflection and feedback on learning. From these five themes, three explanatory categories of perceived learning were determined: (1) complexity; (2) distractions; and (3) teamwork.

The results from the survey were integrated with the observations, video recordings, and individual interview findings. Given that the majority of the participants (n=11) had completed an ACLS course, it was expected that they would see similarities between what they had learned in the ACLS and this simulation. The survey results showed only 16.7% of the participants thought they could develop treatments plans for a

patient with an acute MI without supervision from the attending physician. In the interview, the residents in groups A, B, and C indicated that as overall they were doing well in managing the case. Furthermore, the findings of the survey showed 8.3% of all participants felt that they were capable of leading the ACLS without supervision from the attending physician. In contrast, the interview responses indicated that all three residents who defined themselves as team leader in their group believed they did well on the simulation, despite it taking them a while to respond to the simulated patient and manage the teamwork.

The lack of familiarity with the environment and equipment, as well as the presence of a patient's family member and the other patient added distractions to the simulation case, and it influenced how the residents responded to the simulated case as well as their confidence. From this experience, the residents learned the importance of prioritizing tasks to maintain their concentration in handling a case. Furthermore, the residents' expectations regarding the simulation activity and how the other team members responded to the simulation influenced their behavior in dealing with this case.

Two-way communication among team members was necessary because all residents in the group worked in a team. Although the survey indicated 91.7 % of the participants felt capable of collaborating with others without supervision and 66.7 % of them thought they could communicate with other team members and knew when to seek consultations, the simulation findings did not support these perceptions. While performing the simulation, some communication problems arose among team members. Hence, the ability to speak up and verbalize their thoughts to other members, including

the need to call a chief resident or an attending physician, was crucial in this simulation but did not always occur.

The residents in groups A and C indicated that they appreciated the opportunity to participate in a simulation followed by a reflection and feedback session. They felt that the reflection and feedback session provided opportunities to gain better understanding about how to deal with a specific situation, and to plan for future clinical situations. The ability to perform reflection-*on*-action, engage in group-discussions, and receive feedback from experienced practitioners enhanced the learning experiences for participants in groups A and C as compared to participants in group B, who did not participate in the reflection and feedback session. The residents in group B believed that participating in the simulation could enhance the skills and experience. However, without reflection and feedback from peers and experienced practitioners, they stated that their knowledge and skills would not extensively improve. They might be able to identify areas of difficulties during the simulation, but they did not articulate strategies that could be used to deal with in the future similar situation.

CHAPTER 5

DISCUSSION

This chapter begins with a brief overview of the results and findings of this study. Then, the results are discussed to explain the findings that are relevant to the existing literature, followed by limitations and implications of this study. Finally, the chapter concludes with recommendations for future research and conclusions.

Summary of the Study

It is well documented that medical practitioners, including medical students, medical residents, and nurses who participate in simulation improve their performance in clinical practice (Kneebone, 2003; Munz et al., 2004; Schwid et al., 2001; Schijven et al., 2005). However, discussions in the existing literature about how residents perceive their learning from simulations are very limited. Further, Schön (1983) suggested that using reflective practice could serve as a learning strategy to extend understanding about a given case problem that confronts the practitioners. Therefore, this study sought to examine the differences between residents' perceptions of their learning processes after participation in a simulation and residents' perceptions of their learning processes after participation in a simulation followed by a reflection and feedback session. The three research questions were: (1) What are surgical residents' perceptions of learning after their participation in a simulation?; (2) What are surgical residents' perceptions of learning after their participation in simulation followed by a reflection and feedback session?; and (3) What are the differences, if any, between surgical residents' perceptions of learning when they participate in simulation only, and residents' perceptions of

learning when they participate in simulation followed by a reflection and feedback session?

The five themes that emerged from the analyses of the data were: (1) perceptions of preparedness to respond and ability to respond; (2) perceptions of the effect of distractions on the ability to respond; (3) expectations regarding the simulation activity and other health-care personnel; (4) recognition of lack of confidence in the ability to respond; and (5) perceptions of the importance of reflection and feedback on learning. From these five themes, three explanatory categories of perceived learning were determined: (1) complexity; (2) distractions; and (3) teamwork.

Discussion of the Findings

Due to the realism of the simulation, the residents in this study discussed the problems that they faced during the simulation in both the reflection and feedback sessions (groups A and C) and in the individual interviews (groups A, B, and C). They did not perceive difficulties with associating previously learned procedures to address the medical case presented in the simulation; rather, they talked about unanticipated problems they encountered in the context of the presenting medical case. The three categories-- *complexity*, *distractions*, and *teamwork*—that resulted from an analysis of the data, reflect the contextual elements that generated perceived problems for the residents. Recognizing problems that they had not anticipated represented perceived learning; that is, learning about unanticipated contextual events. Across all the groups, the residents did perceive that they learned about unanticipated events; such as lack of familiarity with equipment, the presence of a family member and the other patient in the room wanting information, and teamwork problems. Through a process of reflection and feedback from

experienced practitioners, the residents in groups A and C perceived that they not only learned about specific problems that could occur in a realistic situation but they also learned about solutions to those problems. Hence, the findings of this study indicate that the difference between those residents in the reflection and feedback groups and those in the simulation only group was learning about solutions to problems that were encountered.

Complexity

Learning professional skills in handling emergency situations (e.g., acute MI case) requires medical practitioners to act professionally to manage the situation. Prior knowledge, skills, and experiences positively affect how they proceed in managing the situation (Flanagan, 2004). During the individual interviews, the participants were asked if they drew on previous knowledge, skills, and experiences during the simulation. Given that all but one of residents (n=11) had completed the ACLS course (one resident was scheduled to take it in the next few weeks following the simulation), it was not surprising that they recognized some similarities between what they had learned in the ACLS and the procedural knowledge and skills they drew upon to respond to the case presented in this simulation. The one resident in group C who had not taken the ACLS course, Dr. Flaming, referred to her prior experiences in the medical school about the basic life support such as checking the pulse and doing chest compressions. All of the other eleven residents perceived that the prior knowledge and skills gained in the classroom and the ACLS course prepared them to manage the simulated case, as well as enhanced their skills in responding to a *Code Blue*.

Flanagan (2004) declared that the realism of simulation settings and scenarios enables the practitioners to feel as if they are responding to a real situation. They are expected to act as they would in a real-life situation with all of the complexity that comes to bear. In the reflection and feedback session, the facilitator prompted the residents with a question about what they learned from the simulation. In response to the question, Dr. Larsen brought up the realism and the complexity of the simulation scenario. The other residents then discussed that even though they had completed the ACLS course where they learned about how to deal with cardiac emergency cases, dealing with such a case in a real-life setting was not as easy as they thought. One of residents, Dr. Earls, talked about his unfamiliarity with the environment. He gave an example that he thought all the equipment was already set up and available in the room. He indicated that he did not know that the bag mask was located in the crash cart, and they had to wait for the crash cart to be brought in the room during the simulation. Dr. Earls' comments led to a discussion among the residents about the misconceptions of their understanding from their prior experience in the ACLS course which was all of the equipment was already set up and available to be used. The ability to have reflection and discussion led them to identify the need to be familiar with the environment and the location of the needed equipment when they responded to the *Code Blue* situation. The facilitator agreed with what the residents said and re-stated about the importance of feeling familiar with the environment and getting comfortable with the equipment used, especially the need to monitoring the EKG monitor screen. The interview responses also indicated that the residents in groups A, B, and C were able to identify the unanticipated complexity of the simulation setting. The residents also stated that the complexity of the case scenario

affected their confidence level in response to the situation. It should be noted that the questions asked during interviews might lead the residents to perform reflection-*on*-action. Paul et al. (1998) maintained that reflection-*on*-action made the participants aware of the strengths and weaknesses on their ability to perform the action. In this study, the residents indicated that the lack of familiarity with the location of needed equipment during the simulation led them to think about the importance of familiarity with the environment and equipment, such as Dr. Smith said in the interview, "That would be good if we could familiarize ourselves with the equipment right now rather than during the actual *Code*."

Even though Schön (1983) believed that reflection-*in*-action occurs while practitioners are performing the action, Eraut (1994) and Ixer (1999) argued that thoughtful reflection only occurs when the individual reflects *on* the action that has already happened. Eraut (1994) maintained that reflection-*in*-action is better characterized as the thinking process, in which an individual reflects *in* while engaged in some activity rather than in depth reflection because of the time constraints on practitioners while they are performing an action. According to Eraut, reflection-*in*-action is a metacognitive process in which the practitioners are aware of the case problem as well as the situation in which it is presented, and their thoughts focus on decisions about current actions and next steps in dealing with the situation. Eraut maintained that this may lead to *thinner* reflection rather than *thicker* reflection (i.e., reflection-*on*-action). Bengtsson (1995) agreed with Eraut's perspectives and considered reflection-*in*-action as an interruption of the activity rather than as a reflection. Because reflection-*in*-action is difficult to measure as it is an attempt to gain insight into an individual's thought

process while they are engaged in an action, this study only focused on the reflection-*on*-action.

In the interviews, all of the residents stated that they thought about connections to knowledge and skills learned in medical school and their prior experiences in the ACLS course and how they would apply them in the complicated and unfamiliar situation that they were facing during the simulation. For instance, in the simulation, the residents tried to apply what procedures they thought were accurate based on their prior procedural knowledge, such as the need to do the basic life support (airway, breathing, and circulation) in that order every time they were dealing with an unresponsive patient. In the simulation, the residents attempted to wait for the bag mask before performing chest compressions. However, since the bag mask was not available in the room and they needed to wait for the crash cart to be brought in the room, after a minute and a half, the residents finally decided to perform chest compressions while waiting for a bag mask. Then, in the reflection and feedback session, the facilitator provided feedback; the facilitator indicated that the group of residents did not act fast enough. She said that they should act quickly and do chest compressions immediately while waiting for the bag mask. In this situation, the facilitator pointed out the residents' misconceptions in how they should response to the unresponsive patient. The facilitator indicated that even though the bag mask was not available, the residents should perform chest compressions immediately. The opportunity to receive feedback from experienced practitioners led the corrections to their misconceptions in how they should respond to the unresponsive patient. Without feedback, the residents in group B might not aware of this misconception.

In summary, all the residents in groups A, B, and C indicated that they made connections while they were dealing with the simulated case, to prior procedural knowledge, skills, and experiences acquired in the classroom when they were still in the medical school as well as those acquired through the ACLS course. The results of this study support the previous findings of Flanagan et al. (2004) and Kneebone (2003) who indicated that the realism of the situations and the case that presented during the simulation led to the connections to residents' prior experiences in dealing with the simulated case. Furthermore, the residents in groups A, B, and C were also able to identify the complexity of the simulation scenario presented, such as lack of familiarity with the environment and equipment. However, the residents in groups A and C were prompted by questions from facilitators during the reflection and feedback session to reflect-*on*-action. This reflection-*on*-action resulted in the residents explicitly identifying a problem they confronted during the simulation, elaborating on it, and proposing a solution about the importance of being familiar with the environment and the equipment needed when they face something similar in the future, and this solution was confirmed by the facilitators. In addition, the feedback from experienced practitioners also rectified their misconceptions about the need to have chest compressions immediately when dealing with the unresponsive patient while waiting for the bag mask. Therefore, the residents in all three groups were able to identify and discuss the complexity of the simulation during individual interviews, hence reflection-*on*-action. However, the residents in groups A and C were able to articulate the solutions to areas of difficulties that arose due to the realism and complexity of the simulation setting as a result of the reflection and feedback session. The identification of the complexity problems was an

area of perceived learning by the residents in all three groups. However, an additional area of perceived learning for those residents in groups A and C were the solutions they generated and those provided as feedback by experienced practitioners during the reflection and feedback session.

Distractions

Dealing with the patient's family member was a big challenge for the first-year surgical residents. Since none of the residents had any experience in dealing with a family member, in the interview, they indicated that they did not know how to deal with this situation; and the presence of a family member distracted most of them as they responded to the simulated patient. Dr. Foster initiated the discussion about the presence of a family member in the room with the residents in group A by asking how they felt about it. However, one of the residents in group C, Dr. Fisher, initiated the discussion about how to deal with a patient's family member during the reflection and feedback session. All of the residents in both groups indicated that they felt uncomfortable with the presence of a patient's family, and they would have preferred to take her outside the room. One of experienced practitioners (i.e., the nurse) provided feedback in how to deal with this situation. In the interview following the reflection and feedback session, the residents in group A and C indicated that the feedback they received from the experienced practitioners allowed them to get a better understanding about how to deal with distractions from a patient's family during the simulation. They also stated that the feedback from experienced practitioners allowed them to make a better plan when they would encounter a similar situation in the future. Reflection-*on*-action helps individuals to develop new insights and understandings of experiences for later action (Kolb, 1984;

Schön, 1987), and the constructive feedback lead the residents to have better strategies in the future action (Maguire & Pitceathly, 2002).

As discussed in the previous paragraph, the residents had to focus on an acute MI patient while at the same time dealing with the distractions of a patient's family and the other patient in the room. The interview responses indicated that doing multiple activities at the same time created difficulties in maintaining their concentration. After participating in the reflection and feedback session, the residents indicated in the interview that they learned about the importance of prioritizing the tasks and focusing on the most important task while they engage in multiple activities. The result of this study supports the previous findings of Flanagan et al. (2004) who described the ability of the simulator to teach implicit skills that would be difficult to teach verbally, such as learning how to do multiple tasks. However, it extends his findings in that the simulation did enable the residents in all three groups to identify the problem, but only those residents in groups A and C were able to articulate a solutions based on feedback they received from experienced practitioners.

In summary, the residents in groups A, B, and C were able to identify a problem -- the distractions as a result of the realism of the simulation scenario that presented; however, the residents in groups A and C were able to identify solutions for the problem based on feedback they received from facilitators during the reflection and feedback session. The residents in groups A and C indicated that they learned the importance of prioritizing the tasks and focusing on doing the most important task instead of doing multiple activities at the same time as result of participating in the reflection and feedback session. The identification of the problem of distractions was area of perceived

learning for residents in all three groups, but the solutions provided as feedback from experienced practitioners during the reflection and feedback session is an additional area of perceived learning for residents in groups A and C.

Teamwork

Kohn, Corrigan, and Donaldson (1999) reported on the relationship between human factors and the system that might cause medical errors and endanger patients' safety. Simulation was seen as one solution used by medical practitioners to learn and practice their knowledge and skills. It is not only about the individual practice but also the teamwork management, as they stated, "health care organizations should establish team training programs for personnel in critical care areas… using proven methods such as crew resource management techniques employed in aviation, including simulation" (p. 149). The existing literature (Flanagan, 2004; Good, 2003; Kneebone, 2003; Weller et al., 2004) supports the notion that simulations allow residents to practice teamwork, including the ability to communicate effectively among the team members and the ability to delegate some of the work to other team members.

Given that all four residents in each group needed to work as a team in response to the simulation case, communication was seen as an important aspect to achieve desirable results. Two-way communication among team members and the ability to acknowledge what they were doing was necessary. In the present study, even though 91.7% of the participants indicated on the pre-simulation survey that they felt they were able to collaborate with other team members without supervision and 66.7% of the participants considered themselves able to communicate with others and know when to seek a consultation, interestingly, the findings based on the observations of the

simulations did not support this perspective. During the simulations, there were some communication problems that occurred among team members in each group. Speaking up and verbalizing their thoughts to the nurses and other team members about important matters, such as the need to call a chief resident or an attending physician was crucial in this simulation but did not always happen. These concerns were discussed during the reflection and feedback session. The facilitators reminded the residents to not hesitate to ask for help from an attending physician because as new residents, they need to learn how to deal with this situation from experienced practitioners. Furthermore, the facilitators stated that communication was seen as an important aspect since all of the residents work as a team. Thus, in the reflection and feedback session, the residents received feedback from experienced practitioners about the importance of communication and, specifically, how they should communicate with the nurses.

The interview responses indicated that the residents in groups A, B, and C recognized that teamwork was a problem; and then they emphasized the importance of teamwork and good communication among team members. They perceived that this simulation provided the opportunity to practice how to work together not only with other residents in the group but also with other people from across disciplines (e.g., nurses). The residents also indicated that instead of speaking up and sharing their thoughts, they tended not voice their thoughts or concerns. The residents stated that the ability to communicate and share opinions will influence their success in working as a team in handling similar clinical situation in the future.

The residents in groups A and C were able to not only acknowledge the problems that they had with teamwork, but also receive feedback about it. During the reflection and

feedback session, the facilitator noted how one of the residents took charge as a team leader, and then she asked about the process by which they decided how who would assume what role. Dr. Larsen, who was identified as the leader of group A explained that because she had been the one to pick up the phone, she was prepared to be the team leader, and the other residents gave non-verbal cues, such as head nodding, in agreement. Dr. Fisher, who was identified as the leader of group C, explained that they had already decided who would be a team leader prior to their participation in the simulation. The response from each of the residents who identified themselves as the team leader led to discussions among the residents. As a result of the group discussion, the residents agreed that they needed to define the roles based on their position in the room. For example, Dr. Jordan discussed how his position was closest to the patient's body, so he took charge of doing the chest compressions. The facilitators provided feedback on two important aspects of teamwork: communication and role-delineation. Thus, the feedback from experienced practitioners provided or reinforced solutions to the problem of teamwork. The results of this study support the previous findings of Paul et al., (1998) and Maguire and Pitceathly (2002) who maintained that feedback following a specific performance can be useful, and it offers an effective strategy that could be used to improve the knowledge and skills of medical practitioners.

In summary, the residents in groups A, B, and C were able to identify the problems that they had with teamwork including the ability to delegate some of the work to other team members as well as the ability to communicate effectively among the team members. The questions that were asked during individual interviews by the researcher may have led to reflection-*on*-action for the residents in group B and further reflection-

on-action for those in groups A and C. However, by receiving feedback from experienced practitioners about strategies in delegating the work to other team members as well as communicating effectively among team members provided solutions for teamwork problems for the residents in groups A and C. The identification of the teamwork problems was an area of perceived learning for the residents in all three groups. However, similarly to the categories of *complexity* and *distractions*, the solutions provided by the opportunity to reflect and received feedback from experienced practitioners during the reflection and feedback session can be seen as an addition area of perceived learning for those residents in groups A and C.

Limitations of the Study

There were several limitations that should be noted when considering the findings of this study. There were only 12 surgical residents who participated in this study, and they were randomly divided into three groups (named A, B, and C), with four participants in each group. The small number of participants in each group and unequal number of groups (eight residents in the simulation-followed-by-reflection-and-feedback group versus four residents in the simulation-group only) was a limitation in that the robustness of data that may have derived from more participants may have led to greater contrast in the findings related to the differences between the two groups (with and without reflection and feedback). Furthermore, due to the design of the study and the number of participants, the results cannot be generalized to the population outside those directly involved in this study.

The presence of the researcher observing during the simulations, and the reflection and feedback sessions might also have affected the participants' behavior as

well as the researcher's interpretation of the data. A digital video recorder to capture the residents' activities during simulations, reflections, and individual interviews was used to provide a check on any biases or conclusions the researcher might have had during the observations, but it might also have influenced the participants' behaviors as compared with a situation in which all of their activities were not recorded. Offsetting that, however, is that many of the residents have been subject to observation and digital video recording in the course of their education.

Due to time constraints resulting from the work load of the residents and their available time, these interviews were limited to 15 minutes per individual; and this was a major limitation of the study. The findings indicated there were discrepancies between the survey results and the simulation outcome. Even though the survey showed 91.7% of the participants felt they were able to collaborate with other team members and 66.7% of the residents believed they were able to communicate with others and know when to seek a consultation, the simulation findings did not support this perspective. Due to the interview time restrictions, the researcher was unable to obtain detailed information from participants regarding the differences between their initial thoughts and their actual teamwork performance, communications with other team members, and reasons for not seeking consults; and for group B unable to probe the residents about strategies they may have considered in response to areas of difficulties or needed improvements that they have identified.

There were some technical problems in the video player equipment, so the residents in group A were not able to watch the video recording of their simulation performance, and residents in group C only watched parts of the video recording of their

simulation performance during the reflection and feedback session. Without having the video recordings played during the reflection and feedback session, the facilitators were only able to prompt questions based on the reflection protocol questions and the simulation observation checklist; and for the residents, they were only able to discuss the topic based on what they remembered during the simulation. Without the opportunity to watch the video of the actual performance during simulation, the facilitators and residents might not able to see the detail simulation performance activities. Hence, it would limit the opportunity to see the activities that might be important for further discussions, such as the timeline. This finding led the residents in group C perceived more learning compared to the residents in groups A and B because the residents in group C were able to watch parts of the video recording of their simulation performance during the reflection and feedback session. On the other hand, the residents in group B perceived less learning compared to residents in group A and C because they participated in the simulation only.

In addition to asking the questions based on their observations of the simulation, research design called for the facilitators to also ask the specific reflection protocol questions (see Appendix D) during the reflection and feedback session. However, the facilitators did not ask all of the listed questions. The facilitators only asked four out of seven reflection protocol questions of group A, and five out of seven reflection protocol questions of group C. The questions that were not asked might have influenced the residents to reflect on some areas, such as the question “what do you think about the outcomes of the simulation?”

This study was designed whereby the residents in groups A and C participated in the interviews after a simulation followed by a reflection and feedback session; and residents in group B participated in the interview immediately after a simulation. The opportunity to participate in the reflection and feedback session (groups A and C) might implicitly affect the residents' perceptions of learning from the simulation when they responded to questions about their perceptions of learning from the simulation during the individual interviews. That is, it might have been difficult for them to distinguish between their perceptions of learning before and after the reflection and feedback session. Furthermore, there might be some discussions occurred among the residents in group B while they were walking from the simulation room to the conference room, and other discussions between the three residents in the conference room while the researcher was conducting interview with one of them in the different room. The results of these discussions might also influence individual's perceptions of learning from the simulation. Related to that, the individual interviews might have provided a situation to reflect-*on*-action for the residents in group B, therefore, it could be said that they did engage in reflection-*on*-action despite they were not participating in the reflection and feedback session.

Implications for Practice

The results of this study indicated that simulations are of benefit, as perceived by residents, in providing hands-on experience and the opportunity to practice skills in a controlled, safe environment without harming real people. The simulation also allowed the participants to be exposed to the unexpected complexity of the situation as well as the distractions that occurred while they were dealing with the patient. The realism of the

simulation scenario led to the residents becoming aware of unanticipated problematic events that could occur in an actual *Code Blue* situation, problems for which they did not readily have solutions. The residents in the reflection and feedback session groups were able to propose and, or receive feedback on solutions to those problems; whereas those in the simulation-only group were able to identify the unanticipated problems, but were not able to identify possible solutions.

This simulation not only enabled the residents to have hands-on experience in dealing with a specific medical case requiring the implementation of specific procedures, but it also allowed them experience unanticipated problems that can occur. Furthermore, although the residents in this study were able to identify those problems fairly readily, only those in the reflection and feedback groups were able to identify specific solutions for dealing with those problems. The results of this study support Schön's theory of reflective practice whereby reflection allowed residents to identify what they had learned from the experience. It should be noted that Schön discussed only reflection; and in this study design, there was feedback from experienced practitioners in conjunction with opportunities to reflect. The findings of this study indicated that the feedback from the "experts" allowed the residents to evaluate the effectiveness (or lack of effectiveness) of their skills while they were dealing with the simulated patient, and provided solutions for better strategies to improve their skills in responding to the similar situations in the future. The reflection itself without feedback might lead the residents to use a trial and error approach in the future to resolve similar problems.

Recommendations for Future Research

While the research findings showed that participants in this study perceived that they did learn something as a result of their participation in the simulation and the simulation plus reflection and feedback session, further research is necessary. First, due to the small number of participants in this study, a similar study with a higher number of participants is needed. Essentially, an equal number of simulation-only and simulation-followed-by-reflection-and-feedback groups might illuminate more or clearer differences in perceived learning between those who participate in a simulation versus those who participate in a simulation followed by a reflection and feedback session. In addition, longer individual interviews with more opportunities to probe responses, particularly those in a simulation-only group might yield data on solutions to problems. Also, follow-up simulation using the same design would yield comparative data to assess how residents actually implemented solutions learned after the first simulation.

Second, this study only had survey results that gathered information about the residents' perceived level of preparation in developing treatment plans, performing specific procedures, and clinical procedures prior to their participation in the simulation. Future research that was designed to assess pre- and post-perceptions of level of preparation might help to determine whether or the residents' perceived readiness to perform certain clinical procedures changes after their participation in the simulation and after their participation in a simulation followed by reflection and feedback session; and if there would be a difference between the two situations on pre- and post-perceptions of level of preparation. Third, future research could address changes in residents' perceptions of learning as they participate in increasingly complex simulations. Such

research could also explore differences in perceived learning between simulation only and simulation followed by reflection and feedback session. Fourth, this study was designed so that the interviews were conducted immediately after participants completed the simulation for the simulation-only group and immediately after the reflection and feedback sessions for those two groups. The ability to participate in the reflection and feedback session might affect residents' perceptions of learning from the simulation. Future research was necessary to assess residents' perceptions of learning by having interviews immediately after the simulation and another interview immediately after the reflection and feedback session.

Lastly, studies are in progress to evaluate the actual transfer of knowledge and skills gained from simulations to real practice in authentic case problems with real people. Evaluating the impact of a simulation followed by a reflection and feedback session on actual patient outcomes remains an interesting topic for future study. Hence, future research is recommended to examine the effects of reflection and feedback following the simulation on the residents' retention of knowledge and skills in managing a *Code Blue* situation and other common procedures that physicians perform. The current study sought to examine residents' perceptions of learning and did not address if that learning had actually occurred or could be transferred to similar situations.

Conclusion

There is one major conclusion that can be proposed based on the results of this study; reflection may need to be coupled with feedback from experienced practitioners in order for residents to be able to explicitly identify solutions to implement when problems are encountered in future, similar situations. It was found that a simulation only or a

simulation plus reflection session can lead to the residents being able to explicitly identify unanticipated problems that they confronted when attempting to implement a previously learned procedure. However, a simulation followed by reflection and feedback may provide a learning context in which residents are able to identify unanticipated problems and also learn specific solutions for dealing with the problems.

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APPENDIX A

CONSENT FORM

CONSENT FORM

SIMULATION, REFLECTION, AND FEEDBACK IN MEDICAL EDUCATION

Research Purpose:
The purpose of this study is to examine differences between residents' perceptions of their learning after participation in a simulation, and residents' perceptions of their learning after participation in simulation followed by a reflection and feedback session. Specifically, I seek to examine how residents: (1) associate prior knowledge, skills and experiences with their thoughts and actions regarding the simulation experience; (2) how they relate their thoughts and actions regarding the simulation experience to similar events that they may encounter in future clinical situations; and (3) if there are differences occur when a simulation experience followed by a reflection and feedback session.

Research Questions:
The proposed research study will aim to answer the following questions:

1. What are surgical residents' perceptions of learning after their participation in a simulation?
2. What are surgical residents' perceptions of learning after their participation in simulation followed by a reflection and feedback session?
3. What, if any, are the differences between surgical residents' perceptions of learning when they participate in simulation only, and residents' perceptions of learning when they participate in simulation followed by a reflection and feedback session?

Voluntary Participation:
Participation in this study is **voluntary**. You may withdraw from participation at any time without any negative consequences. There is no potential risk beyond your regular activities in the simulation. There are no foreseeable risks or discomfort that may occur as a result of participation.

Confidentiality:
All records and information collected in this study will be completely confidential. Name and any data that can identify the participants will not be revealed. In any reporting of the data all individuals will be pseudonymous, so there is no risk of your participation in this study becoming publicly known. For example, Caroline Smith might be referred to as "Mary."

Result Sharing:
Results of this research may be presented or published. The findings will be presented in aggregate form with no personal identifiers.

Benefits:
The results of this study will show how actually surgical residents learn from simulation augmented with reflective practice.

Risks:
We do not foresee any risks or discomforts beyond those your regular activities in the simulation as a result of your participation in the study.

Protection:
Your participation will NOT affect your grades in any class you are taking.

Subject Rights:
If you have any questions about your rights as a participant in this study, please contact MU Health Science IRB at 573-882-3181.

Questions:
If you have any questions, please feel free to contact Christiana Kumalasari at ckef7@mizzou.edu.

To give consent, you must be 18 years of age or older. By providing your full name and signature, you provide consent to participate in this study. Thank you.

First Name: _____ Last Name: _____

Date: _____ Signature: _____

APPENDIX B

CASE SCENARIO

CASE SCENARIO
POST-OP MI (MYOCARDIAL INFARCTION)

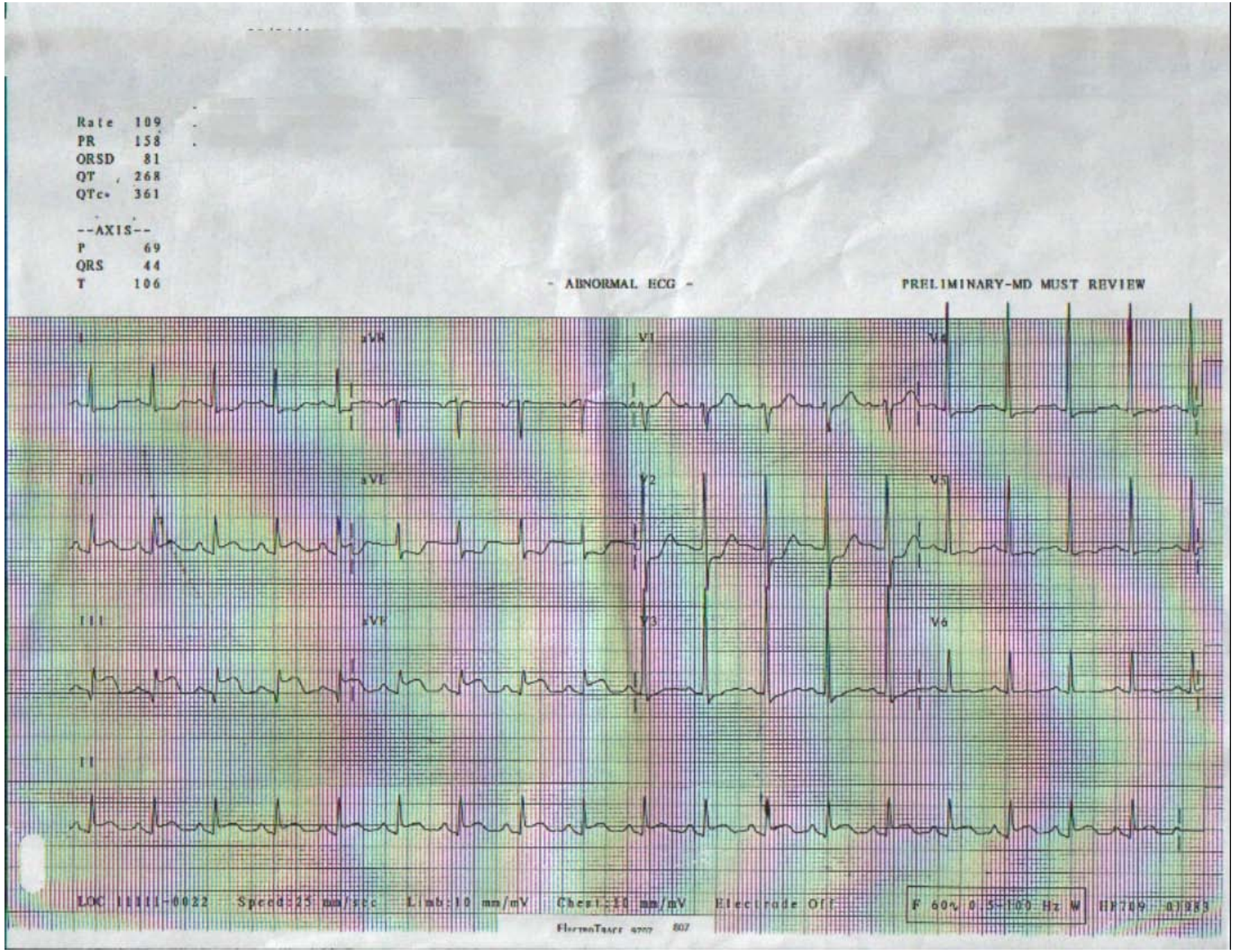
Scenario Scene Set-up
78 year old white male who is status post left colon resection for colon cancer. Procedure performed laparoscopically. Patient has had a postoperative ileus and a little shortness of breath. Patient has history of NIDDM, HTN, GERD obesity, and impotence. He is on Glyburide, Avandia, HCTZ, Prilosec, and Viagra. He smokes one pack of cigarettes per day and has occasional ETOH use. He is married and wife is present in the room. They have been married for 56 years. This is his first surgery.

Scenario:
Call to resident on call from nurse on 5West that patient is unresponsive. Residents arrive and find nurse, tech and wife in room. Nothing has been done for the patient. They are trying to arouse patient.

Moulage**:** Hal Mannequin in patient room bed in hospital gown. No leads or O2 hooked up.

		Performed	
Takes body substance isolation precautions-verbalizes aprons and wears gloves and eye protection		1	
INITIAL ASSESSMENT/PRIMARY SURVEY			
Airway (within 60 sec)	- Assess airway: nonresponsive	1	
	- Initial preparation for O2 and intubation	1	
Breathing (within 3 min)	- Auscultate	1	
	- Bag-mask patient	1	
	- Intubate patient	1	
Circulation (within 3 min) Can you get ST-elevation EKG?	- Start CPR	1	
	- Check IV and place	1	
	- Put on monitor	1	
	- Monitor: Recognize rhythm-asystole	1	
	- I.V., labs, fluid bolus	1	
	- Epinephrine then Atropine-ACLS protocol	1	
	- Obtain EKG - recognize MI on EKG	1	
	- Call Code (10 min per protocol)	1	
History	- Recent events: Intern was called when patient complained of chest pain. EKG and Labs were ordered.	1	
Communication/Family interaction	- Get family out of room	1	
	- Notify senior resident/attending	1	
	- Do not discuss patient sensitive information in inappropriate setting	1	
		18	

Black: Student perform
Red: Student findings
Blue: instructor notes or verbal questions


Rate 109
PR 158
QRSD 81
QT 268
QTc* 361
--AXIS--
P 69
QRS 44
T 106
- ABNORMAL ECG -
PRELIMINARY-MD MUST REVIEW
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Speed:25 mm/sec
Limb:10 mm/mV
Chest:10 mm/mV
Electrode Off
F 60% 0.5-100 Hz M

APPENDIX C

SURVEY

Survey

Direction: For each of the questions below, please check your response.

1. What is your gender?
   - ☐ Female
   - ☐ Male

2. What is your intended specialty?
   - ☐ General Surgery
   - ☐ Orthopedics
   - ☐ Neurosurgery
   - ☐ ENT
   - ☐ Urology
   - ☐ Plastics
   - ☐ Anesthesia
   - ☐ Preliminary
   - ☐ Other (please specify) _____

3. Please rate the level of supervision at which you feel prepared to develop treatment plans for patients with...

	Unsupervised	With Limited Supervision	With Direct Attending Supervision	Not Prepared at All
a. Chest pain	☐	☐	☐	☐
b. Congestive heart failure	☐	☐	☐	☐
c. Acute MI	☐	☐	☐	☐
d. Pneumonia	☐	☐	☐	☐
e. Surgical infection	☐	☐	☐	☐
f. Tachycardia	☐	☐	☐	☐
g. Bradycardia	☐	☐	☐	☐
h. Fever	☐	☐	☐	☐
i. Abdominal pain	☐	☐	☐	☐
j. Pulmonary edema	☐	☐	☐	☐
k. Acute shortness of breath	☐	☐	☐	☐
l. Hypotension	☐	☐	☐	☐
m. Hypertension	☐	☐	☐	☐
n. Low urine output	☐	☐	☐	☐
o. Hypoglycemia	☐	☐	☐	☐
p. Hyperglycemia	☐	☐	☐	☐
q. Hyponatremia	☐	☐	☐	☐
r. Hyperkalemia	☐	☐	☐	☐

4. Please rate the level of supervision at which you feel prepared to perform the following procedures:

	Unsupervised	With Limited Supervision	With Direct Attending Supervision	Not Prepared at All
a. Chest tube insertion	☐	☐	☐	☐
b. Endotracheal intubation	☐	☐	☐	☐
c. Lumbar puncture	☐	☐	☐	☐
d. IV insertion	☐	☐	☐	☐
e. Foley catheter insertion	☐	☐	☐	☐
f. Nasogastric tube insertion	☐	☐	☐	☐
g. Needle compression	☐	☐	☐	☐
h. Central line insertion	☐	☐	☐	☐
i. Placing leads for an EKG	☐	☐	☐	☐
j. Lumbar shunt	☐	☐	☐	☐
k. Swan Ganz catheter insertion	☐	☐	☐	☐
l. Arterial catheter insertion	☐	☐	☐	☐
m. I&D	☐	☐	☐	☐
n. Paracentesis	☐	☐	☐	☐
o. Thoracocentesis	☐	☐	☐	☐

5. Please rate the level of supervision at which you feel prepared to do the following:

	Unsupervised	With Limited Supervision	With Direct Attending Supervision	Not Prepared at All
a. Lead ACLS in a Code Blue situation	☐	☐	☐	☐
b. Assess an acute patient emergency	☐	☐	☐	☐
c. Assess a sudden onset of altered mental status	☐	☐	☐	☐
d. Present a new patient	☐	☐	☐	☐
e. Communicate and know when to seek a consult	☐	☐	☐	☐
f. Inform patients about medical error	☐	☐	☐	☐
g. Respond to an EKG emergency	☐	☐	☐	☐
h. Collaborate with other health care personnel (e.g., nurses, social workers, chaplains, etc.)	☐	☐	☐	☐
i. Deliver bad news to a patient	☐	☐	☐	☐

j.	Deliver bad news to a patient's family	☐	☐	☐	☐
k.	Discuss the pros and cons of a DNR order with a patient and family	☐	☐	☐	☐
l.	Respond to an angry patient	☐	☐	☐	☐
m.	Respond to an uncooperative patien	☐	☐	☐	☐
n.	Perform a clinical handoff	☐	☐	☐	☐
o.	Pronounce a patient dead	☐	☐	☐	☐

I appreciate your participation in this survey.

APPENDIX D

REFLECTION AND FEEDBACK SESSION PROTOCOL

REFLECTION AND FEEDBACK SESSION PROTOCOL

Reflection and feedback session questions:

1. What were you thinking about as you were doing the simulation?
2. Were you aware of previous knowledge (e.g. knowledge that learned either in the classroom or PBL cases) that you thought about or called upon as you were doing the simulation? If so, what was it?
3. Were you aware of previous clinical skills and experiences (e.g., how to response to “patient’s” condition) that you thought about or called upon as you were doing the simulation? If so, what were they?
4. What do you think that you learned from the simulation? Please explain your answers!
   (if the answer “nothing” or “very little”, why they didn’t feel as if they learned anything from the simulation?)
5. How did you think you did on the simulation? What do you think about the outcomes of the simulation? Please explain your answers!
6. What did you think you did particularly well? What do you think you need to work on to improve?
7. Based on this simulation experience, can you identify what you might do similarly or differently when facing similar clinical situations in the future?

APPENDIX E

INTERVIEW PROTOCOL

INTERVIEW PROTOCOL

SIMULATION, REFLECTION, AND FEEDBACK IN MEDICAL EDUCATION

Interviewer Name:	
Interviewee Name:	
Position of Interviewee:	
Contact Information:	
Date and Time:	
Place:	

Face-to-face Interview Script

Thank you for taking the time to help me in my doctoral study. Before we get started, I would like to state the goal of this study in which to examine surgical residents' perception of their learning when using simulation augmented with reflective practice. The results of this study are very important to medical educator in order to understand better, how residents learn from simulation, how they associate the knowledge and skills that have learned and previous experience with current situation, and how they are going to prepare their strategies when they are facing similar case(s) in the future. All information collected in this interview will be completely confidential.

Please feel free and comfortable to share your thoughts, experiences, and feelings as you answering the questions. You can also provide some examples to illustrate your experiences. Again, the purpose of this interview is to examine your learning experiences using simulation through reflective practice. Do you have any questions before we start the interview?

Interview questions for group A and C (groups of residents who participate in simulation and reflection and feedback session):

1. Did you consciously draw on previous knowledge, skills, and experiences as you were doing the simulation? If so, could you describe those thoughts? If no, how do you think your previous knowledge, skills, and experiences might have better drawn on in this simulation? How are they related?
2. Did you learn something from a) simulation session, b) reflection and feedback session? If the answer "yes", what did you learn? If the answer "no", why did you not learn anything?
3. Do you think that the a) simulation session, b) reflection and feedback session, enhanced your learning and understanding of the medical concepts that were embedded in the simulation?
4. Do you think that the a) simulation session, b) reflection and feedback session, enhanced your learning of clinical skills that were embedded in the simulation?

5. After having completed both of the simulation and the following reflection and feedback session, do you think that there was anything or things that you could have done differently in the simulation? If so, what was it? Why do you think you could have done in that way?
6. What do you think, if any, are the benefits of a) having simulation session, b) having reflection and feedback session following a simulation?
7. Do you think a simulation followed by a reflection and feedback session (including self-evaluation, peer feedback, and group discussion during reflection and feedback session) helped you in improving your understanding about the case problem? If so, how? Please explain your answer!

Interview questions for group B (group of surgical residents who only participate in simulation session):

1. Did you consciously draw on previous knowledge, skills, and experiences as you were doing the simulation? If so, could you describe those thoughts? If no, how do you think your previous knowledge, skills, and experiences might have better drawn on in this simulation? How are they related?
2. Did you learn something from simulation session? If the answer "yes", what did you learn? If the answer "no", why did you not learn anything?
3. Do you think that the simulation session enhanced your learning and understanding of the medical concepts that were embedded in the simulation?
4. Do you think that the simulation session enhanced your learning of clinical skills that were embedded in the simulation?
5. After having completed the simulation session, do you think that there was anything or things that you could have done differently in the simulation? If so, what was it? Why do you think you could have done in that way?
6. What do you think, if any, are the benefits of having simulation session?
7. Do you think a simulation session helped you in improving your understanding about the case problem? If so, how? Please explain your answer!
8. Do you think you need a group feedback/discussion after you have completed the simulation?

Well, that is it. We are done now. Thank you again for participating in this study.

VITA

Christiana Dewi Kumalasari was born in Ujung Pandang, Indonesia. She earned a B.S. (Pre-Medicine) in 1995 and an M.D (Medical Doctor) in 1998 from Trisakti Medical School, Trisakti University, Jakarta, Indonesia. She received her M.Ed. in 2004 and Ph.D. in 2010 in Educational Technology from School of Information Science and Learning Technologies at the University of Missouri, Columbia. During the past six years, Christiana Dewi Kumalasari has been working as a graduate instructor for Web Development Courses. She was awarded High Flyer Teaching Award (2005) and Graduate Student Instructor of the Year (2009) sponsored by College of Education, University of Missouri, Columbia.