Using Video-Facilitated Feedback to Improve Student Performance Following High-Fidelity Simulation

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Abstract

Background: This pilot study evaluated the effect of videotape-facilitated human patient simulator (HPS) practice and guidance on clinical performance indicators.

Method: Nursing and nurse anesthetist students in the treatment group ($n=20$) participated in HPS practice and guidance using videotape-facilitated debriefing, and the control group ($n=20$) participated in HPS practice and guidance using oral debriefing alone.

Results: Students in the intervention group were significantly more likely to demonstrate desirable behaviors concerning patient identification, team communication, and vital signs. The role students played in the simulation significantly impacted their performance. When scores of both the intervention and control groups were combined, team leaders, airway managers, and nurse anesthetists had higher mean total performance scores than crash cart managers, recorders, or medication nurses.

Conclusion: Video-facilitated simulation feedback is potentially a useful tool in increasing desirable clinical behaviors in a simulated environment.

Cite this article:


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Introduction

Health practitioners must possess the knowledge and skills necessary to perform basic and complex skills, assure patient safety, and manage sophisticated medical equipment. Demands for accountability, increased patient acuity levels, scarce quality clinical placements, and increased enrollments in professional programs have led health professionals to embrace alternative opportunities such as simulation to develop student clinical expertise. Indeed, simulation has been used in health care for more than 15 years (Jeffries, 2008, 2009; Morgan, Cleave-Hogg, McIlroy, & Devitt, 2002). Through clinical simulation, students can learn basic and advanced skills and provide interventions in scenarios ranging from routine care to
life-and-death situations. Students learn and practice skills in a simulated environment, which is thought to prepare them to apply this learning when they enter the practice setting. Schools of health professions must become much more effective in developing their students’ clinical judgment to better prepare them to manage very complex patients in health care settings (Jeffries, McNelis, & Wheeler, 2008; Lasater, 2007).

Sophisticated high-fidelity simulation models provide exposure to clinical situations that enable students to assess, plan, intervene, and evaluate outcomes in patients just as they would in real life, without compromising patient safety (Seropian, Brown, Gavilanes, & Driggers, 2004; Terman, 2007). Students can participate in “mock” real-life clinical scenarios without any risk to patients (Terman, 2007). The ability to provide these types of experiences in a safe learning environment is particularly important when scheduling constraints and a shortage of clinical spaces do not allow for experiences such as caring for complex or acutely ill patients.

Essential tools needed to maximize the impact of simulation include high-fidelity manikins, computer technology, environmental reality (props representing the practice environment), realistic scenarios, audiovisual equipment (Seropian, 2003), and adequately trained faculty. However, the use of human patient simulators (HPSs) to systematically evaluate students is still at an early stage, and more work is needed to measure or identify clinical performance parameters that are influenced by using HPSs with audiovisual feedback. Although the literature suggests high-fidelity simulation should be useful for practicing clinical thinking skills and teaching clinical judgment, there is limited published evidence to support this premise (Lasater, 2007; Nehring & Lashey, 2004).

A literature review of high-fidelity simulation indicated scenario feedback (e.g., debriefing) is the most important feature of simulation-based education (Issenberg, McGaghie, Petrusa, Gordon, & Scalese, 2005). There are few empirical studies and inconsistent results regarding the effectiveness of videotape-facilitated debriefing (Bond et al., 2004; Savoldelli et al., 2006; Scherer, Chang, Meredith, & Battistella, 2003; Schievenato, 2009).

**Purpose**

Therefore, the purpose of this pilot project was to evaluate the effect of videotape-facilitated human patient simulator (HPS) practice and guidance on clinical performance indicators. Roles assumed by students in this study were that of team leader, airway manager, crash cart manager, recorder, medication nurse, and nurse anesthetist. Students were evaluated on behaviors related to patient safety, communication among team members, basic- and problem-focused assessment, prioritization of care, implementation of appropriate interventions, and delegation to health care team members. The study compared 20 students from nursing and nursing anesthetist programs who participated in HPS practice and guidance that used videotape-facilitated oral feedback with a group of 20 students who participated in HPS practice and guidance that used oral feedback alone, in order to identify performance indicators that were sensitive to improvement.

**Literature Review**

**Educational Components of Simulation**

HPSs are sophisticated electronic patient manikins currently used to educate health professionals in both academic and clinical practice settings. Both theoretical and empirical literature supports the use of HPSs. Advantages associated with HPSs include students’ learning interactively and practicing skills in a risk-free environment (Haskvitz & Koop, 2004; Rauen, 2004), receiving immediate faculty feedback, having self-paced learning, applying theory to practice in an integrated manner (Rauen, 2004), receiving remediation when they experience difficulty in clinical situations (Haskvitz & Koop, 2004), and receiving curriculum content in a consistent manner (Ravert, 2002). According to Peteani (2004), the use of HPSs to practice clinical skills provides students a safe environment that fosters development of autonomy, independence, and analytical skills.

Simulation is a technique, not a technology, that ideally replaces or amplifies real experiences with guided experiences that replicate important elements of reality in a fully interactive environment. Simulation characteristics and simulation’s diverse application in health care can be categorized by the (a) aims and purposes of the simulation activity; (b) unit of participation; (c) experience level of participants; (d) health care domain; (e) professional discipline of participants; (f) type of knowledge, skill, attitudes, or behaviors addressed; (g) simulated patient’s age; (h) applicable or required technology; (i) site of simulation; (j) extent of direct participation; and (k) method of feedback used (Gaba, 2004). Table 1 identifies dimensions of this pilot study simulation application.

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**Key Points**

- This pilot study evaluated videotape-facilitated human patient simulator practice and guidance on clinical performance indicators.
- Video-facilitated simulation feedback is potentially a useful tool in increasing desirable clinical behaviors in a simulated environment.
- When conducting simulations, students need to be rotated through several team roles in order to gain desired clinical skills.

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Core educational components of simulation are cueing, questioning, debriefing, and reflection (Decker, 2007). The first component, cueing, encourages critical-reflective thinking, facilitates learning of core content, and provides a method to evaluate students’ actions. Cues can be provided during or following the simulation. For example, cues can be provided by means of a case introduction of a patient report or history or when an instructor speaks as the patient through a cordless microphone. Cues also can be provided when an instructor responds to student questioning as the patient’s family member or friend or as a fellow health care provider (Decker, 2007).

Questioning promotes critical and reflective thinking skills and needs to be realistic and nonintimidating. Questioning may be customized to accommodate the participant’s level of knowledge, comprehension, application, synthesis, and evaluation. Like cues, questions can be provided either prior to or during the simulation experience by instructors playing various roles (interdisciplinary team members, patient, and family; Decker, 2007). Questioning after the simulation has ended is most valuable when it is part of a debriefing session in which the instructor and participants reflect on performance.

Debriefing can be as important as the simulation itself. Used in conjunction with video recording, a debriefing session can provide an accurate account of events intended to stimulate learning and discussion in a nonthreatening and organized way. Facilitators or “debriefers” identify elements of the simulation that are pertinent to course objectives and facilitate discussion centered on these elements. Checklists may be used to document accomplishment of key behaviors or quality of performance (Lasater, 2007; Lederman, 1992).

The final simulation component, reflection, is a type of self-analysis that allows practitioners to uncover and expose their thoughts and feelings and forces them to face incongruities in their practice (Kuiper & Pesut, 2004; Seropian et al., 2004). Reflecting on clinical behaviors is a strategy to promote learning or gain meaning from experiences, and the ability to reflect through self-dialogue takes time for health professionals to develop. These core components—cueing, questioning, debriefing, and reflection—build both critical and reflective thinking (Kuiper & Pesut, 2004; Seropian et al., 2004).

**Video-facilitated Feedback**

There appear to be few empirical studies related to video-facilitated feedback, and frequently they are descriptive in nature (Zirkle, Blum, Raemer, Healy, & Roberson, 2005). In one quasi-experimental investigation, Byrne et al. (2002) examined whether the performance of 34 anesthetists in managing simulated anesthetic crises improved after reviewing their own videotaped performances. Participants from four hospitals were allocated randomly to one of two groups. Individuals in the first group completed five simulations with only a short discussion between each simulation. Those in the second group were allowed to review their own performance on videotape between each of the simulations. Performance was measured by time to solve the problem and by mental workload. Before each simulation started, participants were asked to keep accurate records of pulse rates, systolic and diastolic blood pressures, oxygen saturations, and end-tidal carbon dioxide concentrations at 2.5-minute intervals. When participants failed to record a value, the investigators assumed the value could not be recalled because of excessive mental workload. Trainees exposed to videotape feedback had a shorter median “time to solve” and a smaller decrease in chart error, compared with those not exposed to video feedback, although the differences were nonsignificant. The investigators attributed the nonsignificant results to deficiencies in their performance measures.

Similarly, Savoldelli et al. (2006) compared 42 anesthesia residents who received debriefing with video-assisted oral feedback, oral feedback alone, or no debriefing (the control group). The debriefing focused on performance of nontechnical skills, guided by crisis resource management principles. Participants’ nontechnical skills did not improve in the control group, whereas the provision of oral feedback, either assisted or not assisted with videotape review, resulted in significant improvement ($p < .005$). There was no difference in improvement between the oral-alone and the video-assisted oral feedback groups. The investigators concluded the addition of a video review did not offer any advantage over oral feedback alone.

**Method**

**Participants and Setting**

Research participants in this project were a convenience sample of 40 nursing students (34 nursing seniors and 6 senior nurse anesthetists) who were enrolled in a nurse anesthetist and an accelerated nursing program at a university in the southeastern United States. The focus of senior nursing students’ coursework the term they participated in this study was adult health. The study was conducted in a learning resource center equipped with high-fidelity simulators and video debriefing equipment.

**Study Design**

A quasi-experimental design was used in this pilot study. An investigator made two initial contacts with students and respective faculty to explain the study before securing informed consent, after first obtaining approval from the institutional review committee and administration of the respective programs. All students agreed to participate, although two students preferred not to be videotaped and were assigned to the control group, which did not
participate in videotape-facilitated debriefing. All students were informed that they could withdraw at any time during the study if they wished (all completed the study).

Students in these programs normally participate in simulation activities as part of course requirements, but grades are not assigned for simulation performance. Therefore, grades were not affected by student performances, nor were their performances shared with faculty not participating in the study. All students in the control and videotape-facilitated HPS practice and guidance intervention groups participated in their usual course teaching and learning methods on caring for complex patients, including didactic discussion, online course materials, and written case studies with questions concerning complex patients with competing priorities. Although both nursing and nurse anesthetist students participate in scenarios every semester as part of their course requirements, participating together across programs and being videotaped during simulations were new experiences for these nursing and nurse anesthetist students.

**Procedures**

The study was guided by components described by Jeffries (2005) of designing, implementing, and evaluating the simulations. These components include best practices in education, student factors, teacher factors, simulation design characteristics, and outcomes. The role of teacher was that of facilitator and observer during the practice simulations and evaluation, respectively. Regarding student factors, except for the nurse anesthetists, students rotated through different roles in the practice sessions to learn different perspectives. Further, student roles were process-based. Educational practices in designing and implementing the simulations were based on principles of active learning, prompt feedback, student—faculty interactions, collaborative learning, high expectations, diverse styles of learning, and time on task. Simulation design characteristics included designing appropriate objectives, assuring fidelity, developing complex simulations, and providing consistent cues and debriefing questions. Outcomes were behaviors related to patient safety, communication among team members, basic- and problem-focused assessment, prioritization of care, implementation of appropriate interventions, and delegation to health care team members.

After they were enrolled in the study, both nursing and nurse anesthetist students were randomized to either the control or videotape-facilitated HPS practice and guidance intervention group. Two students preferred not to be videotaped and were assigned to the control group that did not participate in videotape-facilitated debriefing. Investigators who were blind to study group assignment collected final performance data. A faculty investigator with expertise in simulation conducted the simulations and debriefing with the videotape-facilitated guidance intervention group, and a graduate research assistant conducted the simulations and debriefing with the control group. Both the faculty member and the graduate research student worked together for 1 year prior to the study, facilitating simulations with other students and achieving consistency. Because both groups received cueing before and during the simulation, both the faculty member and the graduate student used the same simulation protocol to achieve consistency and assure the same set of cues were provided to both groups. Similarly, the same set of debriefing questions was provided to both groups.

<table>
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<th>Table 1</th>
<th>Dimensions of the Simulation Application</th>
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<td>Specific Dimension</td>
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<tr>
<td>Purpose and aims of the simulation activity</td>
<td>To evaluate the effectiveness of videotape-facilitated human patient simulator practice and guidance on roles and clinical performance indicators</td>
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<tr>
<td>Unit of participation in the simulation</td>
<td>Multiple-discipline student team members</td>
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<td>Experience level of simulation participants</td>
<td>Senior-level nursing and nurse anesthetist students</td>
</tr>
<tr>
<td>Health care domain</td>
<td>Adult health, high acuity</td>
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<tr>
<td>Health care disciplines of personnel participating in the simulation</td>
<td>Senior-level nursing and nurse anesthetist students</td>
</tr>
<tr>
<td>Type of knowledge, skill, attitudes, or behavior</td>
<td>Cognitive and psychomotor (skills) knowledge (i.e., patient safety, etc.) demonstrated with human patient simulators</td>
</tr>
<tr>
<td>Age of simulated patients</td>
<td>Adult</td>
</tr>
<tr>
<td>Technology required for simulation</td>
<td>METI man®, computer and METI software®, video recording equipment, hospital equipment and supplies to simulate a high-acuity setting (METI, n.d.)</td>
</tr>
<tr>
<td>Site of simulation participation</td>
<td>Learning resource center skills lab</td>
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<td>Extent of direct participation in the simulation</td>
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<td>Feedback method</td>
<td>Cuing, questioning, debriefing, and reflection with and without the use of a videotape</td>
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Adapted from Gaba, 2004.
The videotape-facilitated HPS practice and guidance intervention group participated in two 60-minute practice simulations, evenly spaced during the semester, in which they provided care for complex patients with pulmonary and cardiac problems that were consistent with course objectives and assigned materials. Pulmonary practice sessions related to caring for patients with acute respiratory distress who experienced a pulmonary embolus or pneumothorax. Cardiac practice sessions related to caring for patients with chest pain who experienced sinus bradycardia, ventricular fibrillation, torsades de pointes, or asystole.

Students participated in the practice simulation in groups of five or six nursing students and one nurse anesthetist student. After a brief orientation explaining the manikin and the simulation process, nursing students were randomly assigned roles and were asked to care for the simulated patient and to call the nurse anesthetist student as that student was needed in the scenario to intubate the patient. Therefore, except for the nurse anesthetist, the practice sessions allowed every student to participate one or more times in the role of team leader, airway manager, crash cart manager, recorder, and medication nurse. These practice sessions were the first time the undergraduates and nurse anesthetists worked together. Each session was videotaped for review. Immediately after the simulation, students viewed the videotape of their session and were guided by faculty through the use of cueing, questioning, debriefing, and a reflective discussion of their roles and behaviors during the simulation.

Students in the control group participated in the same simulation exercises as the intervention group did; however, their debriefing after the simulation was not aided by a videotape of the session. In the discussion of roles and behaviors, debriefing in the control group relied on the recollection of the simulation by students and faculty. Both groups received practice sessions at the same time during the semester. Nursing students assigned to the control group also were assigned roles randomly. Except for nurse anesthetists, who assumed the same role during simulations, the practice sessions allowed every student in the control group to participate one or more times in the role of team leader, airway manager, crash cart manager, recorder, and medication nurse.

In order for student performance on study variables to be evaluated, student teams completed a third 60-minute simulation session consisting of two scenarios at the end of the semester. To lessen the chance of bias in observations of students assigned to the intervention and control groups, students were purposely assigned to one of six mixed teams to reflect equal distributions of control and intervention students in each team. In addition, the researchers were interested in individual student behavior, not team performance. If group membership had been left the same, students in teams that worked well together may have differed in their scores from students who had not worked well together.

Nursing students on each team were randomly assigned to one of the roles used in the practice simulations (i.e., team leader, airway manager, crash cart manager, recorder, medication nurse), and nurse anesthetist students were assigned to their role. Both groups received the same HPS patient simulation scenarios. Student performance on the study performance indicators was recorded by means of an observational data collection tool adapted from the Clinical Simulation Tool (CSET; Radhakrishnan, Roche, & Cunningham, 2007), with behaviors articulated for nursing and nurse anesthetist roles. Faculty observing students were trained in guided simulation by a content expert.

CSET category items were designed for a simulation using a congestive heart and pelvic fracture scenario (Radhakrishnan et al., 2007). The data collection tool was adapted to record the occurrence of behaviors related to patient safety, communication among team members, basic and problem-focused assessment, prioritization of care, appropriate interventions, and delegation to health care team members in caring for two patients; one with a myocardial infarction and one with a stab wound to the chest. Examples of behaviors were “checks patient identification,” “assesses ABCs,” “initiates interventions,” and “communicates using situation-background-assessment-recommendation format.” Points were assigned to each behavior to yield a total score, ranging from 0 to 31 for one scenario and from 0 to 34 for another scenario. Scores varied slightly because of the different number of assessment and intervention items for the two scenarios. Points were given for initiating appropriate behaviors (e.g., assessment, intervention). No additional points were allocated if team members initiated a behavior more than once for each scenario. Each scenario was scored separately, and scores were assigned to individual students.

One investigator had extensive experience in the design and testing of observational data collection tools and therefore supervised CSET modifications (Moss, Berner, & Savell, 2007; Moss & Xiao, 2004; Moss, Xiao, Zubaidah, 2006). Faculty with expertise in conducting and evaluating clinical simulation validated the tool’s behavioral checklist. Because this tool is used strictly to record behaviors and is not a psychometric measure of a concept or conceptual clusters, no measure of internal reliability was conducted. The scenarios developed for this project were reviewed by three experts related to the health care domain (i.e., adult health, nursing, and anesthesia) and guided simulation.

While watching the simulation, five faculty scored student behaviors for the same role (e.g., recorder). Later, to determine reliability of rater scoring, all five raters viewed and scored student behaviors for all roles on videotape, and their scores were compared with those of the rater who scored the students during the actual simulation. As shown in Table 2, Fleiss’s kappa coefficients used to assess interrater reliability among data collectors ranged from .71 to .94. Percentage agreement among data collectors ranged from 85% to 97%.
Results

The sample consisted of 33 women and 7 men, representing 28 Caucasians, 10 African Americans, 1 Asian-Pacific Islander, and 1 Hispanic. Analysis of variance (ANOVA) and two-tailed t tests were used to compare control and intervention mean differences between the two groups on behaviors (e.g., initiates interventions), roles, scenarios, and student simulation teams. Although there was no significant difference between the two groups on total performance scores, the video intervention group mean score was higher (9.09) than the control group score (8.44). The total performance score was a reflection of how many times during the scenario students exhibited the desired behaviors regarding patient safety, communication among team members, basic and problem-focused assessment, prioritization of care, appropriate interventions, and delegation to health care team members. Students in the intervention group were significantly more likely to perform three behaviors: patient identification (t test, \( p < .01 \)), team communication (t test, \( p = .013 \)), and assessment of vital signs (t test, \( p = .047 \)), and their mean scores were higher than the control group scores in 9 of the 14 categories of desired behaviors.

The role students played in the simulation significantly (ANOVA, \( p = .013 \)) affected their performance on the measure’s total score. When scores of both the intervention and control groups were combined, team leaders (13.25), airway managers (9.20), and nurse anesthetists (9.08) had higher mean total performance scores than did crash cart managers, recorders, or medication nurses. Table 3 lists the type of role and the total mean score of desired behaviors associated with that role.

There was no significant difference between the six student simulation teams in their total performance score. Total performance scores for the teams ranged from 7.07 to 10.64, with a mean team score of 8.80. In addition, there was no significant difference in total performance scores by simulation scenario: myocardial infarction (9.30) and stab wound to the chest (8.30).

Discussion

Videotape-facilitated Oral Feedback Versus Oral Feedback Alone

Debriefing is an important component of effective use of HPS-facilitated simulations. When recording capabilities exist, a videotape-facilitated debriefing session can provide an undeniably accurate account of events intended to stimulate learning and discussion in a nonthreatening and organized manner (Lasater, 2007; Lederman, 1992). Although there were no significant differences between the video and control groups in total performance scores, the intervention group had higher mean scores on the majority of desired simulation behaviors. There also was a significant difference between the two groups on three of the desired simulation behaviors (patient identification, team communication, and assessing vital signs), with a higher number of desired behaviors exhibited by the intervention group. Although this was not a formal part of the study, students in the intervention group expressed satisfaction with viewing their performance on video, consistent with other studies’ satisfaction scores for video debriefing (Fanning & Gaba, 2007; Morgan & Cleave-Hogg, 1999; Scherer et al., 2003).

One possible reason for less dramatic differences between the groups could be the relatively little time that the students participated in practice sessions, only a total of approximately 4 hours, including both simulation and debriefing time. Perhaps this is too small a “dose” of the intervention to reveal more differences between the groups. Repeating the study over a longer period and more practice sessions may produce stronger differences in student performance between the two types of feedback. In addition, although all students were enrolled in the same programs at the same level, there may have been variation in the level of clinical skills students demonstrated, based on their previous clinical or work experience.

Student Roles

Some students are more likely by virtue of their personality to take the lead in simulated and real emergency situations; however, in this study, the number of essential behaviors exhibited differed significantly depending on the student’s role. These data demonstrate that students’ simulation experiences differ greatly depending on the role the student is assigned. The role assigned directly affects the behaviors that students have the opportunity to perform during
simulation. These findings provide important information to consider during the design of student simulation experiences. To ensure that students have a full simulation experience, they should be rotated among simulation roles in order to have the opportunity to practice and exhibit the full range of behaviors we expect them to learn. Often, rotating students through each of these team roles is not possible because of the numbers of students who must rotate through simulations and the time allotted in the curriculum for these experiences. However, we suggest that all students have the opportunity to assume the role of team leader. This role is obviously one in which students are most challenged to exhibit their full range of interventional expertise. The most experienced students (nurse anesthesia students) did not show a significant difference between groups, but this finding may be explained by the fact that the nurse anesthesia students always assumed the same role, that of the nurse anesthetist, and that this role was relatively task oriented.

**Data Collection Tool**

The lack of differences in scores between teams and scenarios provides encouraging evidence that the data collection tool could be a stable measure of performance across multiple types of adult acute clinical situations. The tool addressed essential behaviors yet was general enough to apply to two situations: myocardial infarction and a stab wound to the chest. The tool was easy to use, and only one observer wrote additional student behaviors that were not listed on the tool. The data collected with the tool were easily translated and entered into a Microsoft Excel database and then converted to an SPSS database for statistical calculation. This tool was intended to be used only as a checklist to record student behaviors during simulation; however, perhaps a revision of the tool could provide a better measure of student skills related to specific concepts of interest for clinical performance, such as patient safety and communication.

**Limitations**

The small number of students participating in this study and their enrollment in an accelerated nursing program and nurse anesthetist program limit our ability to generalize the finding of this study to other populations. In addition, variations in clinical skills demonstrated by students may have been a result of their previous clinical or work experience. Using two different people to debrief the two groups is a limitation of the study. Further, five to six students in a group may have been too many because the literature suggests that four students in a group is more ideal (Wagner, Bear, & Sander, 2009). As mentioned earlier, increasing the number of practice sessions may demonstrate stronger differences between groups.

**Summary**

In summary, although differences in total scores between the intervention and control groups were not significant, the intervention group showed higher mean scores on total performance and exhibited more desired behaviors in the majority of areas than did the control group. Differences between the number of behaviors exhibited and the role students assumed suggest the need to ensure that students rotate through different roles in order to gain a more meaningful simulation experience. The adapted data collection tool was a useful method for recording student performance across two types of adult scenarios, and with further testing, it may prove to be useful across a variety of adult simulation scenarios. This study could be enhanced by using more and a greater variety of scenario practice sessions. Video-facilitated simulation debriefing has the potential to increase desired clinical behaviors in students in a simulated environment. Further research is needed to determine whether these advantages will transfer to actual practice.

**Acknowledgments**

This study was supported by a grant to the authors from the University of Alabama at Birmingham, Scholarship of Teaching Grant Program. Special thanks to the nursing and nurse anesthetist students (2007–2008) at the University of Alabama at Birmingham who participated in the study and to Michelle Smith, a graduate teaching assistant who assisted in conducting the study.

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