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Look at Yourself First: Self-Assessment of Non-Technical Skills During a Simulated Anesthesia Crisis Situation

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Abstract

Background: Non-technical skills are an essential element of training for healthcare professions. However, the effectiveness of training has been questioned as a result of poor ability of learners to self-evaluate their non-technical skills.

Objective: The goal of this study was to evaluate the correlation between self-assessments and expert assessments of non-technical skills in student registered nurse anesthetists (SRNAs) in a simulated crisis setting.

Methods: Thirty-five SRNAs completed a non-technical skills workshop for anesthetists, and then participated in a crisis management simulation. A post-simulation self-assessment was performed immediately after the session. The simulation was recorded for expert assessment using the Anesthetists' Non-Technical Skills framework.

Results: The self-assessment test showed an acceptable level of internal consistency (Cronbach's alpha = 0.80, 0.71, 0.84, and 0.85 for task management, teamwork, situation awareness, and decision-making, respectively). We found weak to moderate and inverse relationships in terms of the agreement between self-assessments and experts (Pearson correlation coefficient = -0.14, -0.09, -0.28, -0.45, and -0.33, P=0.45, 0.54, 0.10, 0.01 and 0.05 for task management, teamwork, situation awareness, decision-making, and the total score, respectively).

Conclusion: This study showed no correlation of the self-assessment and performance assessment from the experts.

Keywords: non-technical skills training, self-assessment, simulation assessment

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Non-technical skills, which have been defined as "the cognitive, social, and personal resource skills that complement technical skills and contribute to safe and efficient task performance"[1], are essential for every professional, especially those in the healthcare system. The development and implementation of non-technical skills training programs has been found to improve competency and safety.[2,3] However, previous studies that reported a positive result of training contained biases, and few have demonstrated results in terms of patient safety outcome.[4] Training strategies can vary between institutions and cultures. The various objectives and emphasized skills have led to different training methods, resulting in different learning outcomes. A variety of cognitive and interpersonal skills are introduced in most medical teaching programs, including those for student registered nurse anesthetists (SRNA).[5-7]

The effectiveness of non-technical skills training is an important question, for which the assessment methods, tools, and assessor characteristics are considered to be key factors. Simulation-based assessments are one of the most effective methods for evaluating non-technical skills because they can provide a safe environment, as well as a reproducible and standardized experience for the students. For assessing non-technical skills, a formative assessment using effective debriefing is considered to be an essential strategy. However, from the review by Garden et al., the benefits of debriefing in non-technical skills training were still questionable.[8] Strategic plans for debriefing such as video assisted self-debriefing[9,10], the use of structured debriefing tools[11,12], and debriefing by an experienced debriefer[13,14] have been considered. Debriefing is a complex skill that requires not only the debriefer but also the learner to have certain abilities.

Debriefing is an active process in which learners must actively participate, not only during the debriefing discussion but also in a self-discovery process. In social cognitive theory, human behavior is the result of interactions between a self-regulatory system and the influence of external factors.[15] In self-regulatory systems, behavior operates through self-observation, judgmental processes, and affective self-reaction. Ability with respect to these cognitive processes differs from person to person, which might explain the controversy regarding the benefits of non-technical skills training. To address this in the present study, we sought to determine how, compared with external assessment by experts, learners perceive their own non-technical skills performance.

In many countries, nurse anesthetists are considered to be primary anesthesia providers, especially in rural areas. They complete a one-year training program that focuses on knowledge, technical skills, and non-technical skills. Thus, they must be capable of perioperative care management, particularly in crisis situations.[16] The non-technical skills aspect of the Anesthetists' Non-Technical Skills (ANTS) behavioral marker system is used for training and evaluation. This tool has been validated extensively in both simulated and clinical environments, and its main purpose is formative

evaluation by experts.[17]

The aim of this study was to evaluate the correlation between self-assessment and expert assessment of non-technical skills performance in a simulated environment using the ANTS system. We hypothesized that this analysis might reveal gaps in non-technical skills assessment which might affect the effectiveness of non-technical skills training.

Methods

The study protocol was approved by the Hospital Institutional Review Board (Si 582/2019). In academic year 2019-2020, SRNAs in the nurse anesthetists training program at Siriraj Hospital, Mahidol University, Bangkok, were enrolled in this study. All SRNAs completed a four-hour training workshop focusing on the ANTS, which included a didactic interactive class and two simulation sessions. The participants were then asked to participate in a simulation assessment session in which they conducted a self-evaluation and were assessed by experts regarding their non-technical skills. SRNAs who did not participate in training session and/or simulation assessment session or unwilling for the assessment were excluded.

The simulation assessment session

The simulation session was conducted two weeks after the ANTS workshop, and took place in a simulation laboratory that was fully equipped as an operating room. A full-body manikin patient simulator (SimMan 3G; Laerdal Medical, Stavanger, Norway) with essential equipment such as an anesthetic machine, patient monitoring system, and medication cart were prepared. All participants completed the session, which involved respiratory crisis management during anesthesia. The scenario was designed and evaluated according to an event-based approach to training,[18] and involved unexpected desaturation during laparoscopic surgery. The patient was a 32-year-old woman with a BMI of 35 who was undergoing a laparoscopic myomectomy under general anesthesia, and experienced one-lung ventilation in the Trendelenburg position. The scenario was scripted according to ANTS-expected behavior. The participant was assigned to be the anesthetist nurse-in-charge working with the SRNA and the surgeon, who were confederates. The scenario was rehearsed to ensure standardization. All sessions were videotaped for performance assessment.

The assessment process

After the simulation session, all participants assessed themselves using a self-assessment form. The self-assessment items for the ANTS were developed by ANTS instructors in the Anesthesiology department at Siriraj Hospital, Mahidol University. We focused on four categories of the ANTS system, including task management, teamwork, situation awareness, and decision-making. Each category had several elements that were described in terms of desired behavior. In the first draft of the assessment, 46 items were included. The contents were validated via the index of item-objective congruence by five anesthetists who were experts in non-technical skills. Scores of +1 (agree), 0 (uncertain), and -1

(disagree) were allocated for each item. Scores of less than 0.5 were considered to indicate that an item was inappropriate and needed improvement. Each element was reevaluated in terms of one generalized expected behavior for each category. A total of 15 items with five scores for each was finalized for the self-assessment tool.

Two expert raters conducted performance assessments from the videotaped simulation sessions. Both raters were anesthesiologists, and were ANTS instructors in the department. The rater training process was conducted using ANTS system tools and a review of the simulation scenario, focusing on expected behavior regarding non-technical skills. We compared the self-assessment scores from the participants and the performance assessments from the experts.

Statistical analysis

Statistical analysis was conducted using PASW Statistics version 18 (SPSS Inc., Chicago, IL, USA). The descriptive data are presented with frequencies and mean±SD. The inter-rater reliability was assessed using an intraclass correlation coefficient (ICC), with a 95% confidence interval (95%CI) based on mean rating (K = 2), absolute agreement, and a two-way, mixed-effect model. The internal consistency of the self-assessment test was evaluated using Cronbach's alpha. The correlation between the self-assessment test and the expert assessment was calculated using Spearman's rank correlation coefficient. Statistical significance was set at $P < 0.05$.

Results

Thirty-five of the 39 students were included in the analysis. Four participants were excluded because of a technical problem with the video camera. Most of the participants (88.57%) were female, and the mean age was 28.26±2.62 years.

The performance assessment data were subjected to an inter-rater reliability test (Table 1). The ICC was 0.89 (95%CI; 0.79–0.94), 0.55 (95%CI; 0.06–0.76), 0.93 (95%CI; 0.87–0.96), and 0.94 (95%CI; 0.87–0.97) for task management, team working, situation awareness, and decision making, respectively.

The participant self-assessment scores (Figure 1), the mean score was highest in the re-evaluation element (4.20±0.58) in the decision-making category and lowest in the assessing capabilities in the team working category (3.68±0.68). The Cronbach's alpha of each category in the self-assessment form was 0.80, 0.71, 0.84, 0.85 for task management, team working, situation awareness and decision-making, respectively.

For the correlation between self-assessments and expert performance assessments, there was an inverse relationship between participant and assessor scores. This was statistically significant for decision-making and the total score (Table 2 and Figure 2).

Table 1 Intraclass correlation coefficient of anesthetists' non-technical skills scores for each category

ANTS categories	Rater 1	Rater 2	ICC (95% CI)
Task management	2.88±0.47	2.86±0.49	0.89 (0.79–0.94)
Team working	2.77±0.43	2.85±0.35	0.55 (0.06–0.76)
Situation awareness	2.71±0.67	2.65±0.68	0.93 (0.87–0.96)
Decision making	2.68±0.67	2.66±0.69	0.94 (0.87–0.97)
Total score	11.06±1.79	11.00±1.78	0.96 (0.92–0.98)

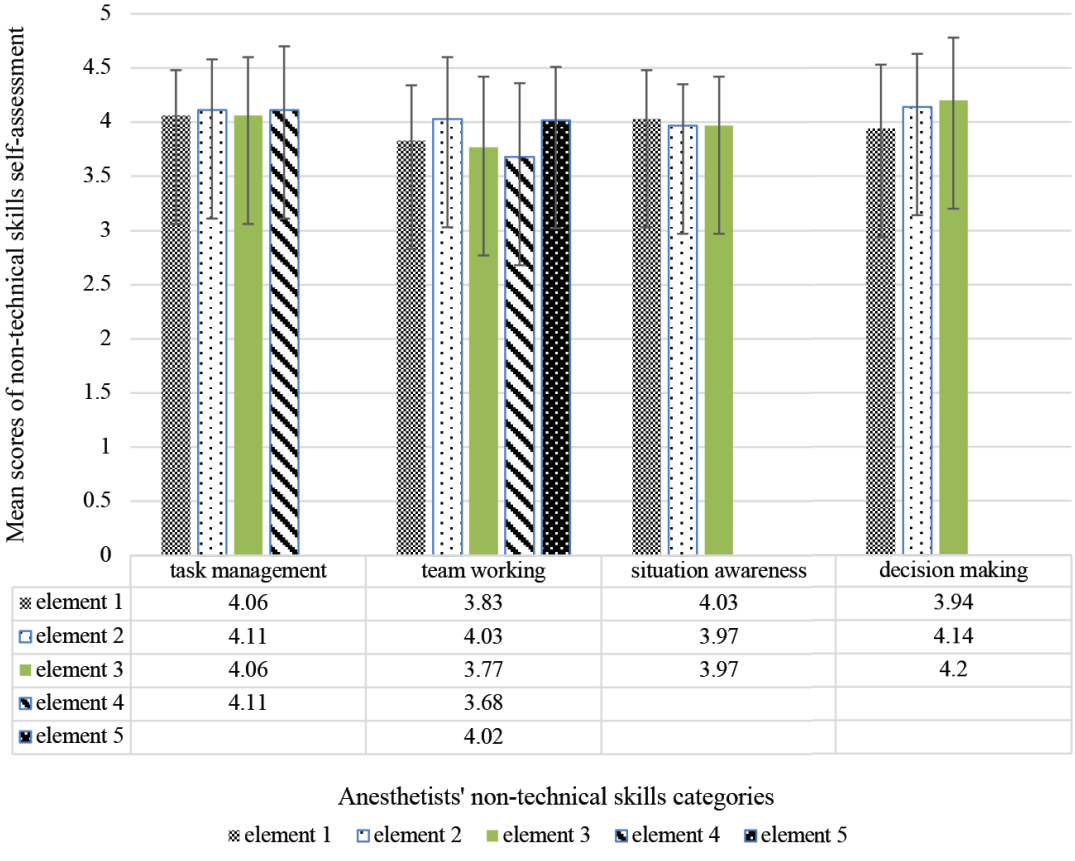

Figure 1 Mean scores from self-assessment of non-technical skills. Task management elements are planning and preparing, prioritizing, providing and maintaining standards and identifying and utilizing resources. Team working elements are coordinating activities with team members, exchanging information, using authority and assertiveness, assessing capabilities and supporting others. Situation awareness elements are gathering information, recognizing and understanding and anticipating. Decision making elements are identifying options, balancing risks and selecting options and re-evaluating.

Table 2 Spearman rank correlation coefficient between self-assessment and expert performance assessment

	Correlation coefficient	*P*-value
Task management	-0.14	0.45
Teamwork	-0.09	0.54
Situation awareness	-0.28	0.10
Decision-making	-0.45	0.01
Total score	-0.33	0.05

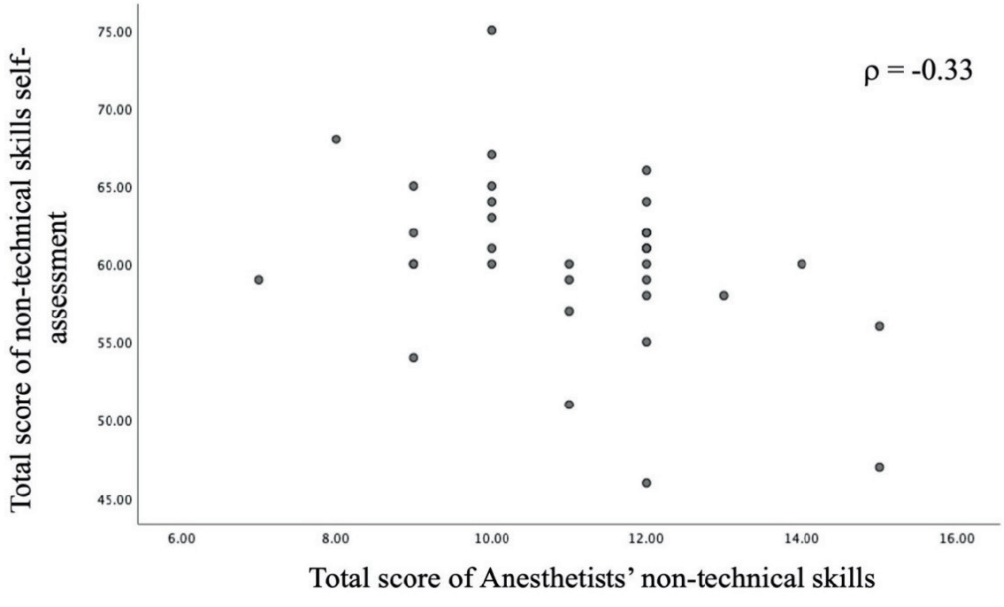

Figure 2 The correlation between self-assessments and expert assessments in terms of total non-technical skill scores

Discussion

In this study, we examined self-assessment of non-technical skills performance with the goal of identifying areas for improvement in the learning outcome from self-directive interventions. We found no correlation between evaluations of non-technical skills performance made by learners and experts. This finding could be explained from the self-regulation concept and also the limitation of the assessment process.

In the social cognitive theory of self-

regulation, the ability to observe one's own performance is crucial. However, learners must know what they need to observe. This information is different between technical and non-technical skills, as technical skills are specific and concrete while non-technical skills are not clearly defined.[19] While Arora et al. reported a strong correlation between self-assessments and faculty assessments of technical skills in surgeons during simulated laparoscopic cholecystectomy, this was not the case for non-technical skills.[20] To overcome this barrier, non-technical skills training should be done before self-assessment processes to ensure that learners understand the concept of non-technical skills. The simplified self-assessment tool is essential. The self-assessment tool was developed from a set of benchmark behaviors from each category in the ANTS system, and the wording was clarified to enhance participant's understanding.

Adult learning requires various cognitive processes. One promising theory regarding adult learning is the cognitive load theory (CLT), which focuses on human cognitive architecture and ways in which instructional design can be used to maximize the learning outcome.[21] The idea of cognitive load is based on assumptions regarding the nature of the information (intrinsic load), complexity of learning instructions (extraneous load), and the way that working memory processes intrinsic cognitive loads (germane load). The simulation could be described as a safe environment, but mostly for patients, and not for the learners. The well-scripted objective and scenario are generally guaranteed to be constant for the test. However, a key element during simulation is emotion. Acute stress is a common form of extraneous load during simulation assessments.[22] Most of the participants in this study has completed less than 5 simulation sessions. Further, that they were in the role of the primary anesthesia provider in the scenario, which was not resemble their training, would likely produce a high level of stress. The level of familiarity with the situation and the specific role played might affect learning and awareness regarding their performance.

The other aspect of self-assessment is judgment. According to Bandura[15], this ability creates motivation and directs behavior. People set standards for their performance according to direct tuition, social responses, and their own reflective process. Not only the metacognitive ability of the learners, but also the safety culture of the organization can affect this process. Non-technical skills training must be embedded into routine work so that learners come to understand the expected behavior that is part of their practice. The standards of practice are usually presented in the form of guidelines or protocols, which is a part of task management in the ANTS system, but mainly focus on knowledge and technical skills. Thus, there is room for improvement in terms of teaching non-technical skills in workplace-based setting. However, such techniques may bring to question whether the faculty engages in the best practice in terms of non-technical skills on a daily basis.

In this study, we compared self-assessments with expert assessments, which are considered to be the gold standard. The validity evidence of the test should be considered.[23] The ANTS

system is a behavioral test that is widely used to assess anesthesiologists in an operating room setting. However, some tools have been developed specifically to test nurse anesthetists, such as the Nurse Anesthetists' Non-Technical Skills[24], and Nurse Anesthetists' Non-Technical Skills-Norway[6] tests. Given the overlap in the clinical point of care between a nurse anesthetist and an anesthesiologist, the categories of these tools are the same; the items are just rearranged and redefined regarding expected behavior. We chose to use the ANTS system in this study as this tool has been well validated and well-described the non-technical skills required for nurse anesthetists in our country.[17] The ANTS system was developed as a tool for assessors to make formative evaluations. However, this assessment tool should be adapted to be more specific given the skills and behaviors required in particular scenarios. In terms of evidence regarding the response process validity, an event-based approach scenario and rater training were employed to ensure quality control. That the expert assessors in this study were anesthesiologists, and not nurse anesthetists, might have caused some biases in terms of expectations.

Our data was unable to demonstrate the overall relationship between learner self-assessments and expert performance assessments of non-technical skills. The inverse correlation was demonstrated significantly in decision making category. These finding could be explained from the nature of our training system, which SRNAs do not have much chance to make decision. The performance in the situation was judged from a different perspective of the experts and trainees, which focusing on the different aspects. However, our findings highlight an important element of non-technical skills training. Namely, the lack of translation from educational training to practice might originate from a lack of self-regulation. If it is hard to expect the accuracy of self-assessment, we need feedback from the external sources[25], including the video assisting debriefing. However, the regular self-monitoring is essential with the valid tool specific to trainees' performance.

Conclusion

These results demonstrated no correlation between learners self assessment and the expert assessment in non-technical skills performance, which might indicate the sufficient in the self-assessment in non-technical skills of trainees. The focus in improving their ability of behavior self-perception and seeking for feedback are essential in order to improve non-technical skills training.

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Conflicts of Interest

The authors declare no conflicts of interest.

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