

Surgical Education

# Feedback activities of instructors during a trauma surgery course

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**Abstract**

**BACKGROUND:** The aim of this study was to examine the quality and quantity of feedback and instruction from faculty members during an acute trauma surgery team training using a newly designed observational feedback instrument.

**METHODS:** During the training, 11 operating teams, each consisting of 1 instructor coaching 2 trainees, were videotaped and audiotaped. Forty-five minutes of identical operating scenarios were reviewed and analyzed. Using a new observational feedback instrument, feedback and instruction, containing different levels of specific information related to technical and nontechnical skills, were noted.

**RESULTS:** Instructors more often provided instruction ( $25.8 \pm 10.6$  times) than feedback ( $4.4 \pm 3.5$  times). Most feedback and instruction contained either nonspecific or less specific information and referred to technical skills. Instructors addressed communication skills more specifically.

**CONCLUSIONS:** Coaching by faculty members predominantly contained unspecific instructions regarding technical skills. The observational feedback instrument enabled scoring of the coaching activities.

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Instructor feedback is essential for acquiring surgical skills in practical training situations.<sup>1-4</sup> To be effective, instructors should provide trainees with well-timed feedback that contains specific information to improve the trainees' performance, knowledge, and skills.<sup>1,4,5</sup>

Specific feedback includes information on how trainees are doing, what went well, what needs to be improved,<sup>2,5</sup> how improvements can be accomplished, and which

alternative approaches exist.<sup>5</sup> The most effective feedback informs trainees whether a performance was correct or incorrect, enriched with specific information on how trainees should have performed and supported by an explanation why this is so.<sup>6,7</sup>

The timing for feedback is either during training, while trainees are still performing (immediate feedback), or after training (delayed feedback).<sup>8</sup> Teaching during surgery is an important aspect of surgical training and generally includes immediate feedback.<sup>9,10</sup> Immediate feedback enables instructors to provide instant correction and encouragement during the training procedure.<sup>10,11</sup> It has the advantage of training the correct skills and behavior immediately and prevents trainees from automating incorrect skills and behavior.<sup>11</sup> When applying immediate feedback, however,

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instructors risk using step-by-step and unspecified instruction instead of feedback, with possible cognitive overload of trainees.<sup>8,12</sup>

The majority of training courses in surgery are more focused on the technical and less on the nontechnical communication and team skills.<sup>13–16</sup> This is understandable for simple training such as suturing but not for training complex surgical skills that involve crew resource management. Notably, many errors in operating rooms are due to failures in nontechnical skills.<sup>13,14,17–19</sup>

The Definitive Surgical Trauma Care (DSTC) course contains complex technical and nontechnical skill exercises for a surgical and anesthesia team on anesthetized porcine models.<sup>20</sup> Life-threatening scenarios are simulated wherein traumatic injuries need to be controlled quickly and adequately. The team is subjected to stress and time constraints and may not make gross errors. To date, the feedback given in such a complex training situation has not yet been analyzed. The present study was designed to gain insight into the feedback given by instructors of the DSTC course with respect to the use of instruction, different levels of specific information, and technical and nontechnical skills. The purpose of our study was to describe how instructors guide their trainees during the practical training of complex surgical skills.

## Methods

### Participants

Eleven surgical instructors participated in the study. They were all experienced trauma surgeons and certified advanced trauma life support instructors with 2 to 12 years of teaching experience. Twenty-two Dutch surgical registrars participated as trainees. During the exercises, each instructor provided feedback to 2 surgical trainees who, with an operating room nurse, formed an operating team. An anesthesiologist trainee, instructed by an anesthetist, completed the team but was not included in this study. All operating teams were composed on the basis of alphabetic order of surname. Before the start of the training course, written informed consent from the instructors and the trainees participating in the feedback study was obtained. The institutional review board of Radboud University Nijmegen Medical Center waived the need for formal ethical approval for this educational study.

### Surgical skill exercises

The study was performed during the emergency surgical trauma skill exercises on anesthetized pigs that are part of the annual 3-day DSTC course in the Netherlands. The DSTC combines interactive theoretical sessions with practical training on live porcine models and human corpses.

The exercises took place in 4 operating rooms in the central animal facility at our university. The trainees had to

control complex and multiple abdominal and thoracic injuries in 6 acute emergency scenarios within 3.5 hours. Trainees were blinded to the type of injury that had been inflicted. The local animal ethical review board approved this training.

### Study design

During all 6 scenarios, real-time audio and video recordings were made of each surgical team's operating activities. Of the 210 minutes recorded, 45 minutes were selected containing the same 2 scenarios for each team: (1) a stab wound to the infrarenal caval vein in the right midabdomen; and (2) a pericardial stab wound and injury to the left lung. In these scenarios, the technical and nontechnical skills were considered to be important.

A trained observer analyzed the 45-minute recordings to register the feedback content using an observational instrument (Table 1). This checklist for surgical skills training observation was compiled on the basis of literature research and focused on instructions and reflective feedback,<sup>8,9,11,12,21</sup> specificity levels of feedback,<sup>2,5,7</sup> and feedback on technical and nontechnical skills.<sup>13–16</sup> The checklist's main categorization was between feedback and instruction. Feedback had to be more reflective, to refer to previous executed actions, and to contain information about the (in)correctness of the performance,<sup>2,8,12,21</sup> such as "Well done!" Instruction had a steering character and directed the trainee what to do,<sup>9</sup> for example, "First, check the entire organ."

The main categories of feedback and instruction were divided into 4 subcategories within 3 domains. The subcategories distinguished between the specific, incremental levels of information.

According to previous research, information regarding skills can be directed at how a certain skill or action needs to be performed and why it has to be performed (in a certain way) or why other approaches are better.<sup>6,7</sup> On the basis of this information, we designed the following incremental levels of information specificity concerning feedback and instructions: not at all reinforced (considered least specific), reinforced with a "how" statement (moderately specific), reinforced with a "why" explanation (highly specific), and reinforced with both a "how" statement and a "why" explanation (extremely specific) (Table 1). The 3 domains were technical skills (suturing skills, instrument handling, etc), nontechnical communication skills (informing the anesthesiologist, discussing possible approaches with team members, etc), and team cooperation skills (helping with handing instruments, assisting others, etc). Nontechnical skills relate to abilities such as situational awareness, decision making, communication and teamwork, and leadership.<sup>13,16</sup> Team-related skills refer to communication skills such as sharing information, communicating options and actions to other team members, and team cooperation skills such as managing

**Table 1** The instrument for surgical skills training observation

Skill set	Feedback*				Instruction†			
	Not enforced at all	Enforced with "how" statement	Enforced with "why" explanation	Enforced with "how" statement and "why" explanation	Not enforced at all	Enforced with "how" statement	Enforced with "why" explanation	Enforced with "how" statement and "why" explanation
Technical skills								
Communication skills								
Team cooperation skills								

\*Information about the performance of the trainee during practical training (often accompanied by a value judgment).

†Information on what to do next that instructs the trainee during practical training.

team activities, supporting others, and discussing options with other team members.

An example of the subcategory “not at all reinforced” referring to feedback on technical skills would be “Terrible suturing!” Other than telling the trainee that his or her suturing is incorrect, it contains no other information as to why the suturing is terrible and how it can be improved. An example in the subcategory “reinforced with a ‘how’ statement” pertaining to instructions on communication skills would be “Never start a procedure without asking the anesthesiologist to update on the condition of the patient.” It teaches the trainee how to communicate with the anesthesiologist but does not provide a “why” explanation. An example in the subcategory “reinforced with a ‘why’ explanation” pertaining to instructions on team cooperation skills would be “Help each other. Helping your colleague saves time.” It informs the trainee why helping a colleague is a good decision but not exactly how to help his colleague. Feedback in the subcategory “reinforced with both a ‘how’ statement and a ‘why’ explanation” would be “Your suturing needs to be better. Make nice, small stitches closer to each other so that the wound will heal better.” It tells the trainee to suture correctly and explains why it is important. This subcategory contains the most specific information.

### Data analysis

Per instructor, each occurrence of feedback or instruction was scored. Feedback by the instructors was limited. Therefore, feedback and instructions were taken together to enable further analysis of level of specificity (see the 4 subcategories) and type of skill (see the 3 domains). Unintelligible feedback or instruction because of interfering noise was discarded, as were remarks irrelevant to the training. When 1 sentence contained feedback as well as instruction, contained different specificity levels, or addressed different skills, each part was scored independently. We focused on verbal feedback and did not register the duration of time spent on feedback, instruction, the different specificity levels, and the different skills. We also did not score nonverbal activities, assuming that trainees were focused on the operation and might not notice these from instructors.

The total mean scores for the 11 instructors were calculated on the basis of the total instructor scores on feedback and instructions, the 4 levels of specificity, and 3 types of skills. In this way, it was possible to determine the average frequency with which each instructor gave feedback and instructions to different levels of specificity for each type of skill. Finally, the mean differences between the total mean scores were calculated.

### Statistical analysis

Descriptive statistics analysis, paired-samples Student’s *t* tests for normally distributed variables, and nonparametric Wilcoxon’s signed-rank tests for variables not normally

distributed were used to analyze differences in the total amount of feedback and instructions, differences in the use of different specificity levels of reinforcement, and differences in the skills addressed by the 11 instructors. Correlations were tested between the frequencies in the different specificity levels and the types of skills, using Pearson's *r* for parametric and Spearman's  $\rho$  for nonparametric samples. We used SPSS version 18.0 (SPSS, Inc, Chicago, IL) for all statistical analyses. *P* values < .05 were considered significant.

### Results

All relevant feedback activities of the instructors could be classified using the instrument for surgical skills training observation. Most comments made by the instructors could be scored; approximately 20% could not be scored because they were irrelevant, not related to the training, or inaudible. These were discarded.

Table 2 shows the descriptive statistics of the 45-minutes video and audio reviews for each of the 11 instructors. Instructors provided instruction (25.8 ± 10.6 times) significantly more often than feedback (4.4 ± 3.5 times) (*t* = -8.77, *P* = .000). Instruction was correlated positively with feedback (*r* = .79, *P* = .004): instructors who gave more instruction also gave more feedback.

Most frequent were unreinforced feedback and instruction (11.7 ± 5.2 times) and those reinforced with "how" statements (12.5 ± 7.0 times). Less frequent were those reinforced with "why" explanation (1.7 ± 2.0 times) or reinforced with both components combined (4.3 ± 5.7 times) (Table 2). The frequency of reinforcements with "why" explanations was not significantly greater than that of statements with both components combined (*P* = .14). Feedback and instruction reinforced with "how" statements were correlated positively with reinforcements containing both "how" and "why" explanations ( $\rho$  = .75, *P* = .01): instructors who gave more "how" statements also gave more reinforcements combining both components.

Instructors gave more feedback and instruction pertaining to technical skills (28.2 ± 12.3 times) than communication skills (1.7 ± 1.7 times) (*t* = 7.66, *P* = .000) and also fewer team cooperation skills (.3 ± .6 times) (*P* = .003, Wilcoxon's signed-rank test). Feedback and instruction on communication skills were more frequent than on team skills (*P* = .02, Wilcoxon's signed-rank test).

Feedback and instruction on communication skills were correlated positively with the more specific feedback and instructions: reinforced with a "why" explanation (*r* = .62, *P* = .04) and reinforced with both components combined ( $\rho$  = .60, *P* = .05).

### Comments

The faculty members of a complex acute trauma surgical skills training used unspecified instruction rather

**Table 2** Instructors' feedback and instruction divided into 4 subcategories (level of specificity of information) and within the 3 domains (skills)

Instructor	Category			Subcategory			Domain		
	Feedback	Instruction	Not at all	How	Why	How and why	Technical skills	Communication skills	Team cooperation skills
1	9	39	7	18	4	19	43	3	2
2	4	22	16	8	0	2	23	3	0
3	6	36	13	18	6	5	37	5	0
4	11	33	10	26	0	8	44	0	0
5	0	12	4	7	1	0	12	0	0
6	3	17	12	6	1	1	19	1	0
7	6	36	22	11	2	7	39	3	0
8	1	13	6	5	3	0	13	0	1
9	1	13	9	5	0	0	14	0	0
10	2	33	15	14	2	4	33	2	0
11	5	30	15	19	0	1	33	2	0
Mean ± SD	4.4 ± 3.5	25.8 ± 10.6	11.7 ± 5.2*	12.5 ± 7.0†	1.7 ± 2.0*†	4.3 ± 5.7*†	28.2 ± 12.3	1.7 ± 1.7	0.3 ± 0.6

\**t* = 5.79, mean difference = 10.0, *P* = .000, SD = 5.7: feedback and instruction not enforced at all (mean, 11.7) compared with reinforced with a "why" explanation (mean, 1.7); mean difference = 7.4, *P* = .03, Wilcoxon's signed-rank test, SD = 7.7: feedback and instruction not reinforced at all (mean, 11.7) compared with reinforced with both a "how" and a "why" explanation (mean, 4.3).  
 †*t* = 5.08, mean difference = 10.8, *P* = .000, SD = 7.0: feedback and instruction reinforced with a "why" explanation (mean, 1.7) compared with those with "how" statements (mean, 12.5); mean difference = 8.2, *P* = .004, Wilcoxon's signed-rank test, SD = 6.0: feedback and instruction reinforced with a "how" statement (mean, 12.5) compared with both a "how" and a "why" explanation (mean, 4.3).

than reflective feedback, referring mostly to technical skills. There seemed to be patterns for instruction and feedback with poor and rich content among the instructors; some instructors gave more specific information than others (Table 1). With the observational instrument, it was possible to classify all relevant verbal coaching activities.

Evidence-based information concerning the appropriate combination of instruction and feedback is lacking for surgical simulation training. We were surprised to find that instructions to trainees constituted the main part of the instructors' feedback activities during this advanced course. Strict guidance is expected when novices are practicing surgical skills<sup>9</sup> or when instructors themselves are relatively inexperienced at providing feedback. Although the trainees in this course were experienced surgeons, they have had limited exposure to multiple injury patients, in particular those with thoracic and abdominal stab wounds. Such relative inexperience may have elicited instruction rather than feedback in a life-threatening situation with the risk of losing the animal. All instructors were experienced faculty members and at a minimum had successfully attended the advanced trauma life support "train the trainer" course, which, however, is an acute trauma life support course lacking the complex surgical elements of the DSTC. The apparent necessity felt to provide immediate feedback could have tempted faculty members to use step-by-step instructions to achieve good performance.<sup>8,12</sup> Step-by-step instructions are a drawback of immediate feedback, known as the guidance hypothesis. That is, the use of immediate feedback could lead to the instructors' guiding and instructing the trainees step by step to correct their performance, a process that decreases learning outcomes.<sup>8,12</sup> Such feedback is not reflective but of an instructive nature. We did not formally inventory the learning and teaching expectations of the trainees or their instructors regarding guidance intensity before starting the exercises. Clarification of these expectations might have improved the balance between instructions and feedback.

Most often, feedback and instruction were either not reinforced at all or were reinforced only with "how" statements, both indicating low specificity. It is known that time constraints, present in this training, do lower the specificity of feedback.<sup>4</sup> Instructors may also have refrained from highly specific feedback or instructions judging that participants were technically skilled for this training. For high-level trainees, feedback does not necessarily have to be specific to be effective: a "good" or a "wrong" could provide enough feedback information.<sup>12,21</sup> If instructors estimated the participants as being advanced and skilled, the question remains why instruction, not feedback, did dominate the coaching.

Instructors rarely addressed nontechnical communication and team cooperation skills, although these skills were objectives of the course. We do not believe that the choice not to emphasize teaching nontechnical skills was because participants were experienced in this area. Time constraints to repair the life-threatening injuries to the animals during

the exercises seem to have created a sense of urgency; this better explains the focus on technical skills. Possibly it was simply too great a burden for instructors to simultaneously teach nontechnical and complicated technical skills.<sup>8,22,23</sup> Alternatively, low awareness of the importance of these skills by the faculty member might account for this result. Individual scores and significant correlations suggest that some instructors were more focused on nontechnical skill teaching and on giving specific feedback than others. One strategy to increase an instructor's awareness of the importance of nontechnical skills during practical training sessions is cross-training.<sup>24</sup> During cross-training, members of operating teams are trained to perform one another's tasks and responsibilities. When a surgical instructor is trained for the role of anesthesiologist, he experiences the wants and the needs and the desire for communication and teamwork of anesthesiologists during surgery. Timeout and stop-and-check pauses during such a surgical trauma care training may also enhance feedback on communication and team skills.<sup>25</sup> Another method to increase both the quantity and quality of feedback on technical and nontechnical skills is verbalization by the trainees performing the exercise.<sup>5</sup>

We currently plan to study stop-and-check pauses in the DSTC course, in which delayed feedback on nontechnical communication and team skills will be given per training scenario executed. Thus, the feedback approach will be immediate feedback on technical skills during the scenarios and delayed feedback on nontechnical skills after each scenario. That is because, although immediate feedback enables faculty members to correct and encourage trainees instantaneously<sup>10,11</sup> and prevent them from automating skills incorrectly,<sup>11</sup> other researchers posit that immediate feedback may impair learning activities and skills acquisition.<sup>8,12,21</sup> Using immediate feedback involves the risk for cognitive overload of trainees when learning new skills and simultaneously receiving as well as understanding and responding to the feedback on their performance.<sup>8,22,23</sup> Instructors may also experience cognitive overload when assessing trainees' performance and generating immediate feedback while teaching new skills at the same time.<sup>8</sup> Overload particularly jeopardizes the specificity of the feedback that is aggravated by time constraints.<sup>4</sup>

Although we noticed differences in behaviors and teaching styles among instructors, we choose to sum the data from all instructors to provide significant numbers. Knowledge of different teaching styles and how teaching styles relate to learning styles of trainees is important when studying the learning effect of the training. Matching teachers and trainees on the basis of their learning styles seems to improve outcomes.<sup>26–28</sup> In future research, we will use learning style questionnaires to identify the preferences of the individual trainees and trainers for better goal-directed teaching and learning.<sup>29</sup>

This study had some limitations. First, only one-third of scenarios were reviewed and analyzed. Although we felt the chosen scenarios to be representative, the order of



scenarios might have influenced the amount and specificity of feedback and instruction. The observational instrument did provide clear insight into the feedback activities of instructors. However, only 1 trained observer did all the scoring. The observational instrument needs to be validated in future DSTC and other complex surgical skills (team) training courses.

For the first time, immediate feedback activities of trainers in an advanced acute trauma simulation course were categorized and investigated. Most feedback activities were instructions on technical skills and had low specificity despite the participation of advanced learners. These study outcomes prompt new research questions: the appropriateness of low-specificity or high-specificity feedback and instruction for optimal learning of advanced learners, the additional effect of nontechnical and team skills training, and the effect of “matching” instructors’ and learners’ expectations on teaching and learning outcomes. Ultimately, increased knowledge of feedback in complex surgical skills training will improve course quality, which will be transferred to clinical practice.

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