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Title page

FOCUSING ON EXPLICIT DEBRIEFING FOR NOVICE LEARNERS IN HEALTHCARE
SIMULATIONS: A RANDOMIZED PROSPECTIVE STUDY

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Declaration of interest

There are no perceived financial conflicts of interest related to the work reported in the manuscript.

Focusing on explicit debriefing for novice learners in healthcare simulations: a randomized
prospective study

Abstract

Introduction

Debriefing is essential in simulation-based training, but it is not clear what exactly constitutes a successful debriefing session. Research in educational sciences shows that a structured, explicit and trainer-directed approach is systematically more effective than an implicit, reflective approach with minimal guidance, particularly for novice or intermediate learners. The aim of this study is to compare explicit strongly trainer-guided debriefing with implicit and weakly guided debriefing in nursing training.

Method

Single-centre randomized prospective study comparing effectiveness of explicit and implicit debriefing techniques. We focused on the description and the analysis phases of the debriefing. Our main aim was to assess the effectiveness of debriefing in terms of knowledge improvement. We also assessed its effectiveness for self-efficacy and self-confidence.

Results

136 nursing students participated in 46 simulation sessions. Knowledge, self-efficacy and self-confidence increased in all conditions. The results also showed that debriefing with explicit analysis improved learning significantly when compared to the control session.

Conclusion

Although the results revealed a beneficial effect of simulation training on self-efficacy, the explicit debriefing technique was shown to produce greater knowledge improvement than the implicit debriefing method in novice learners. Consequently, debriefing technique should be adapted to the objectives of the training and learners.

Highlights

- Explicit debriefing is more effective than implicit debriefing for novice learners
- Explicit debriefing involves active trainer management of the debriefing
- Presenting new information in an explicit manner is more effective for novice learners

Keywords:

Simulation; Debriefing; Explicit learning; Healthcare training

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Simulation is essential in training for healthcare professionals. Therefore, it is important to identify the mechanisms applied at each step of a simulation session in order to ensure its effectiveness (Abelsson & Bisholt, 2017). The debriefing is the last step of a simulation session. It is recognised as the core of the learning process (Dieckmann et al., 2009; Krogh et al., 2016, Lavoie et al., 2015). However, debriefing remains a complex and poorly understood process that is often a source of difficulty for both trainers and learners (Nestel et al., 2016; Sawyer et al., 2016). Several reviews and meta-analyses have tried to identify effective debriefing techniques and have concluded that there is no perfect debriefing technique (Cheng et al., 2014; Dufrene & Young, 2014; Garden et al., 2015; Hall & Tori, 2017; Levett-Jones & Lapkin, 2014 ; Tannenbaum & Cesaroli, 2013). To date the reflective technique has been considered as best practice (Dreifuerst, 2009; HusebØ et al., 2015; Rudolph et al., 2008). The underlying idea is to raise learner awareness of the gaps between their performance and the objective fixed by the trainer. Learners are therefore considered as being able to make an accurate assessment of their own performance and correct their errors when necessary (Mann et al, 2009). The Debriefing Assessment for Simulation in Healthcare (DASH, Simon et al., 2011) was designed to guide learner assessment by developing debriefing skills and by encouraging learners to explore and analyse their performance, their thought processes, their emotional states, so that they can perform better in real-life situations. (Ararfeh et al., 2011). The reflectiveness induced during the debriefing also would promote the acquisition of new factual and procedural knowledge (Eppich & Cheng, 2015).

Recently, new explicit debriefing techniques have come into use. For example, the Rapid Cycle Deliberate Practice incorporates explicit debriefing stages during the simulated situation. These new techniques have proven to be particularly effective for novice learners and teams of mixed healthcare professionals (Cory et al., 2019; Lemke et al., 2019; Magee et al. 2018). This is in line with the conclusions in educational sciences literature, which clearly

prove the benefits of explicit and structured learning strategies (Rosenshine, 1986). Hattie (2009, 2012) also showed that this explicit technique is more beneficial than the implicit technique for novice learners. For more experienced learners, explicit techniques are as efficient as implicit ones (Kirshner et al., 2006).

The aim of this study is to compare the effectiveness of four simulation sessions for student nurses: one using an explicit debriefing technique, one using an implicit debriefing technique, one using implicit description and explicit analysis, and one without any debriefing. We measured the improvement in knowledge, and self-efficacy, which is a predictive factor of future behaviour. Self-efficacy is defined as an individual's belief in his or her ability to carry out a required behaviour to produce a desired result (Bandura, 1997). The confidence that an individual has in his or her ability to accomplish a specific task conditions his or her commitment and how he or she will perform in the future.

Material and methods

This study complies with the principles of the Declaration of Helsinki. It is defined as non-interventional research as mentioned in the French Public Health code. It obtained approval from the Savoie School of Nursing management committee.

1. Participants

One hundred thirty-six French students in the second year of a Bachelor's degree in nursing took part in the study. There were one hundred and twenty-three women and thirteen men. The average age of participants was 24.9 years (SD = 6.3). All the students were volunteers for this study and participants and trainers signed consent forms. There was no impact on the students' grades.

2. How the simulation session was conducted

2.1 The simulation-training programme

The study took place in the context of a full-scale simulation programme in a simulation centre. Each session lasted two hours. Three student nurses were present at every session, except one where two student nurses were present. Each session began with a “setting intro”, which included a simulator-environment briefing. The simulator used was a SimMan 3G (Laerdal, Stavanger, Norway). There were two simulations per session, each followed by a debriefing.

The first simulation, which lasted ten minutes, concerned the post-operative management of a 70-year-old patient who had undergone a total hip replacement. The scenario started with the patient’s return to his room after the surgery. He was equipped with a peripheral venous catheter with perfusion of 250 ml of NaCl 0.9%, a blood-soaked bandage on the left hip with 2 drains filled respectively with 250 ml and 300 ml of blood, with active bleeding. The initial parameters included a heart rate (HR) of 100 bpm, a respiratory rate (RR) of 20, blood pressure (BP) at 100/80 mmHg and peripheral oxygen saturation (SpO₂) of 96%. After 5 minutes, the patient complained of dizziness and the haemodynamic situation deteriorated with an HR at 120 and a BP of 80/60.

The simulation objectives were to:

- recognise life-threatening signs
- perform nursing care for a patient in circulatory distress
- give relevant information to the physician.

Based on the participants’ answers, three outcomes were possible: (1) satisfactory patient management: improved clinical condition and hemodynamics (2) sub-optimal patient management: unchanged clinical condition and hemodynamics, (3) unsatisfactory patient management: worsened clinical condition and hemodynamics.

After the scenario, the participants went to three different rooms and were individually debriefed by three separate trainers. The debriefings, which lasted 20 minutes, were carried

out individually to isolate the effects directly associated with the specific debriefing techniques. The second simulation was then completed with the same participants. This scenario concerned a 50-year-old patient hospitalised after abdominal trauma. He was equipped with a peripheral venous catheter with perfusion of 250 ml of NaCl 0.9%. After 5 minutes, the patient complained of dizziness and the hemodynamic situation deteriorated due to an internal bleeding on a spleen lesion. The changes in the patient's condition were the same as in the previous scenario. A group debriefing followed this second simulation.

2.2 Experimental debriefing techniques

Debriefing took place in four stages: reactions, description, analysis and summary. The differences between the types of debriefing were only on the description and analysis phases. Three debriefing techniques were tested: (1) explicit description and analysis, (2) implicit description and analysis, (3) implicit description and explicit analysis. A fourth condition without debriefing was added (control session).

Debriefing with explicit description and analysis (EDA)

Explicit description was done by the trainer, which used direct questions about how the scenario played out. The questions were written on a whiteboard. The trainer guided the participant in an explicit manner by giving assertive feedback.

Explicit analysis was a structured interview with considerable trainer guidance, stating objectives, providing explicit presentation of the procedure and giving frequent summaries. The content was presented in an explicit manner, with knowledge input concerning the signs of circulatory distress. The procedure for managing a patient in circulatory distress was explicitly presented by the trainer. Before the knowledge input, the trainer asked to the participant about the appropriate course of action when a patient is in circulatory distress. These questions made it possible to explore the participant's prior knowledge. When the

participant was unable to answer, the trainer provided the answers. The trainer's feedback focused on the results observed during patient management and the processes that led to this choice of patient management. The trainer made frequent summaries to check the participant's understanding and regularly asked how they could use what they had learned in a real-life clinical situation.

Debriefing with implicit description and analysis (IDA)

Implicit description: the participant described in the events that occurred during the scenario. The trainer did not interrupt the participant at the stage. When the participant finished speaking, the trainer added specific reminders but did not input additional information.

Implicit analysis was a structured interview with a low level of trainer guidance. This was to encourage the participant's to reflect upon their actions. The trainer did not provide any additional knowledge, but tried to elicit knowledge of the signs of circulatory distress and patient management procedures in this situation. When the participant did not respond, the trainer did not volunteer the knowledge. Instead, the trainer asked more general questions about the signs and management of circulatory distress and asked the participants to make a summary. The trainer did not provide summaries during this analysis phase.

Debriefing with implicit description and explicit analysis (ID-EA)

In this condition, the debriefing was associated with an implicit description phase and an explicit analysis phase.

Control session (CS)

There was no debriefing in the control session. After the scenario, the participants immediately went to three different rooms. They were told to wait for 20 minutes. No particular task was given to the participants during this time.

3. Data collection

Three different data sets were collected: factual knowledge, self-confidence and self-efficacy.

3.1 Knowledge

Knowledge was assessed by a paper questionnaire about paramedical management of circulatory distress according to the nursing curriculum. The questionnaires were pre-tested with another group of student nurses (n = 12). An emergency physician and three nursing schools teachers developed it together. This questionnaire was composed of ten open questions: three focused on clinical evaluation of circulatory function, three on the signs of circulatory distress, two on recognising circulatory distress in a specific context (post-operative, trauma patient monitoring), and two focused on circulatory distress management. Each question covered several aspects of nursing knowledge. The answers were scored 1 (satisfactory), 0.5 (partially satisfactory) or 0 (unsatisfactory). The final score was the total of the scores for each answer. These questions were given before the simulation session (pre-test) and after it (post-test), but the item order was modified.

3.2 Self-efficacy and Self-confidence

Self-efficacy (SE) and self-confidence (SC) were measured using a 22-item questionnaire (Bandura, 2006). The questionnaires were pre-tested with another group of student nurses (n = 12). Eighteen items measured SE (Cronbach $\alpha = .84$), and 4 items measured SC (Cronbach $\alpha = .76$). Twelve items were positive (e.g. “*I felt capable to check pulse of a patient with circulatory distress*”) and ten items were negative (e.g. “*I found it hard to measure the patient’s heart rate*”). The participants were asked to assess their perception of being able to complete each task on a scale of 0 (not at all) to 5 (absolutely). These items were given before the simulation session (pre-test) and after it (post-test), but the item order was modified.

4. Procedure

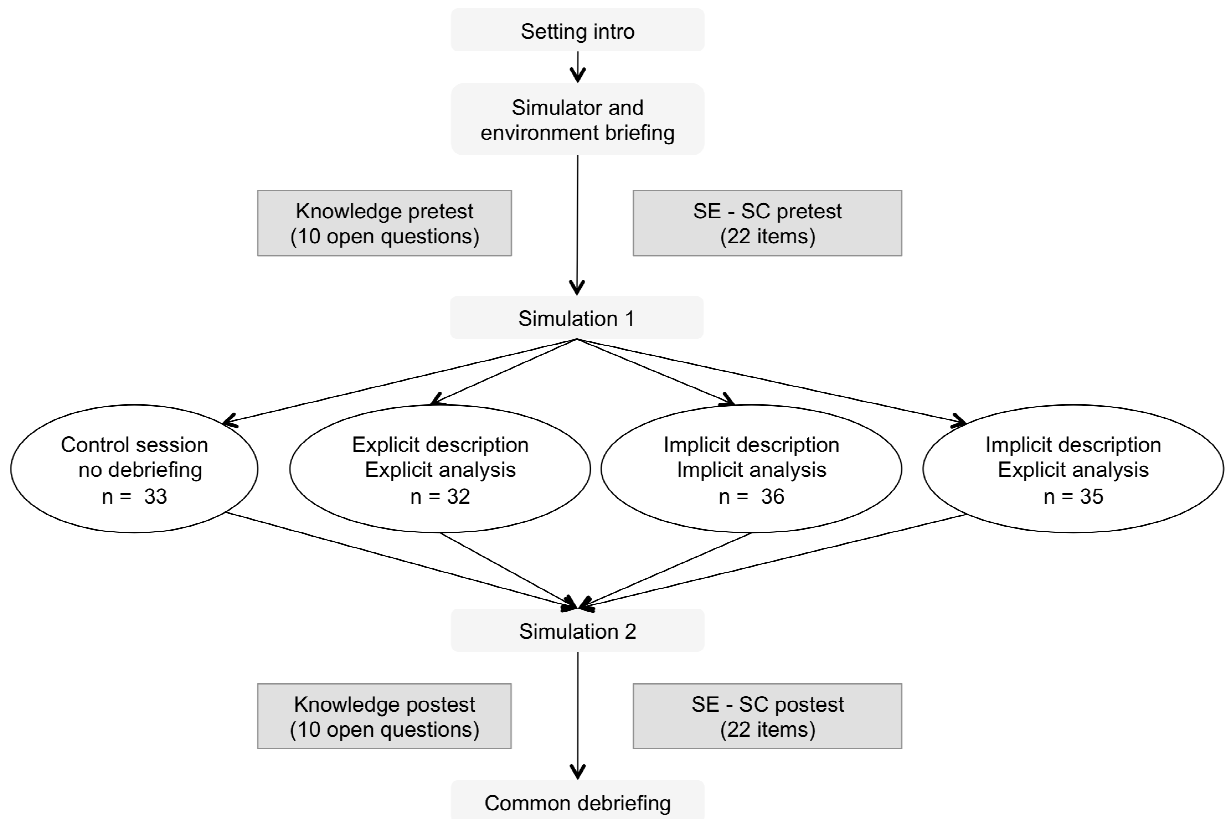


Figure 1: Study procedure

The participants were placed into one of the three experimental debriefing conditions by computer-generated randomisation. Some were placed into the control session without debriefing. After the introduction and the simulator-environment briefing, the participants completed the knowledge and the SE-SC questionnaires (pre-test measures). The first simulation was then carried out. Immediately after the simulation, an individual debriefing took place using the different experimental techniques, or no debriefing. Then, all the participants took part in the second scenario and their knowledge and SE-SC were measured

(post-test measures). Finally, a common debriefing session took place in order to give the same information at all participants.

Results

Forty-six simulation sessions were carried out during the study with 32 student nurses in the EDA group, 36 in the IDA group, 35 in the ID-EA group, and 33 in the CS group. Before the intervention, no knowledge, self-efficacy, or self-confidence differences were observed between the groups (knowledge: $F(3, 132) = 0.819, p = .486$; SE: $F(3, 129) = .819, p = .486$; SC: $F(3, 131) = 2.169, p = .095$).

1. Knowledge score

The knowledge score increased between pre-test and post-test for all four groups (Table 1). The mean pre-test knowledge score was 11.47 (SD = 4.54, Skewness = .141, Kurtosis = -.399), whereas the mean post-test knowledge score was 19.55 (SD = 5.60, Skewness = .152, Kurtosis = .137).

Table 1. Mean knowledge scores (standard deviation) according to the debriefing technique used in the simulation session

Debriefing techniques	Knowledge score			
	Pre-test	Post-test	t	p
EDA	11.25 (4.79)	21.94 (5.65)	-10.974	< .001
IDA	12.28 (4.33)	19.06 (4.63)	-8.082	< .001
ID-EA	11.66 (4.19)	21.09 (4.99)	-9.547	< .001
No debriefing (CS)	10.60 (4.79)	16.15 (5.56)	-7.443	< .001

A multivariate analysis was done to determine how a specific type of debriefing and how the pre-test SC and SE influenced the post-test knowledge score (table 2).

Table 2. Post-test knowledge scores controlling for the participants' pre-test knowledge, self-efficacy and self-confidence scores

Model	Posttest knowledge score			
	Unstandardised	Standardised	t	p

	coefficient B (SE)	coefficient β		
Step1				
Constant	13.603 (1.191)		11.421	< .001
Pre-test knowledge score	.519 (.097)	.421	5.369	< .001
Pre-test SC score				ns
Pre-test SE score				ns
Step 2				
Constant	10.843 (1.256)		8.635	< .001
Pre-test knowledge score	.501 (.090)	.406	5.572	< .001
Pre-test SC score				ns
Pre-test SE score				ns
EDA	5.464 (1.167)	.415	4.682	< .001
IDA	2.067 (1.142)	.164	1.81	.073
ID-EA	4.408 (1.144)	.345	3.854	< .001

R2 = .177 for step1; Δ R2 = .140 for step 2 ($p < .001$)

The findings showed that while pre-test knowledge explained 17.7% of post-test variance, introducing the “condition” variable explained 14% of additional variance. Pre-test SC and pre-test SE did not influence post-test knowledge. The results also showed that debriefing with explicit analysis (EDA, ID-EA) improved learning significantly when compared to the control session. The progress observed in the IDA group was not significantly different from the progress in the control session.

2. Self-efficacy

Concerning self-efficacy, the results showed that the higher the pre-test score was, the higher the post-test score was for every group (Table 3).

Table 3. Self-efficacy mean scores (standard deviation) according to the debriefing technique used in the simulation session.

Debriefing techniques	Self-efficacy score			
	Pre-test	Post-test	t	p
EDA	43.87 (8.12)	61.23 (7.48)	-11.197	< .001
IDA	39.61 (9.15)	57.30 (8.56)	-14.445	< .001
ID-EA	41.39 (12.12)	57.84 (7.71)	-14.445	< .001
No debriefing (CS)	41.12 (9.14)	47.73 (9.56)	- 4.730	< .001

The results showed that pre-test SE explained 27.6% of variance in post-test SE. Introducing the “debriefing” variable explained 24.2% of additional variance. At identical initial SE,

carrying out any type of debriefing led to a significant increase in SE compared to the control session (Table 4).

Table 4. Post-test self-efficacy scores controlling for the participants' pre-test knowledge, self-efficacy and self-confidence scores

Model	Posttest self efficacy score		t	p
	Unstandardised coefficient B (SE)	Standardised coefficient β		
Step1				
Constant	34.232 (3.188)		10.738	< .001
Pre-test knowledge score				ns
Pre-test SC score				ns
Pre-test SE score	.524 (.075)	.525	6.984	< .001
Step 2				
Constant	26.960 (2.840)		9.492	< .001
Pre-test knowledge score				ns
Pre-test SC score				ns
Pre-test SE score	.505 (.063)	.507	8.055	< .001
EDA	12.120 (1.736)	.528	6.983	< .001
IDA	10.341 (1.653)	.479	6.257	< .001
ID-EA	9.977 (.712)	.440	5.826	< .001

R2 = .276 for step1; Δ R2 = .242 for step 2 (p < .001)

3. Self-confidence

Self-confidence increased between pre-test and post-test for all the debriefing techniques and for participants in the control session (table 5).

Table 5. Self-confidence mean scores (standard deviation) according to the debriefing technique used in the simulation session

Debriefing modalities	Self-confidence score			
	Pre-test	Post-test	t	p
EDA	10.22 (2.80)	13.06 (3.46)	- 5.574	< .001
IDA	8.39 (3.25)	12.36 (3.08)	- 10.721	< .001
ID-EA	9.88 (3.73)	13.17 (2.93)	- 7,86	< .001
No debriefing (CS)	9,73(2,99)	11.94 (3.07)	- 4.126	< .001

The findings showed that post-test SC was strongly related to pre-test SC (table 6). Initial knowledge and initial SE did not influence the post-test SC score. In step 2, although we

observed a significant effect of IDA, ΔR^2 was not significant when debriefing techniques were added in the model.

Table 6. Self-confidence post-test scores controlling for the participants' pre-test knowledge, self-efficacy and self-confidence scores

Model	Posttest self-confidence score		t	p
	Unstandardised coefficient B (SE)	Standardised coefficient β		
Step 1				
Constant	6.69 (.644)		10.44	< .001
Pre-test knowledge score				ns
Pre-test SC score	.622 (.064)	.644	9.72	< .001
Pre-test SE score				ns
Step 2				
Constant	5.75 (.756)		7.601	< .001
Pre-test knowledge score				ns
Pre-test SC score	.636 (.065)	.66	9.803	< .001
Pre-test SE score				ns
EDA	.810 (.595)	.11	.363	.175
IDA	1.273 (.583)	.18	2.183	.031
ID-EA	10.080 (.585)	.149	1.845	.067

$R^2 = .415$ for step 1; $\Delta R^2 = .024$ for step 2 ($p = .144$)

Discussion

The aim of this study was to test the effectiveness of different debriefing techniques after a simulation session, compared with an absence of debriefing. Two of our results merit closer attention.

First of all, our results showed a beneficial effect of simulation training on self-efficacy (Bandura 1982). This is important because the relationship between self-efficacy and performance has been proven among learners of all ages. Although this relationship is moderate (.38 to .50), self-efficacy is considered to be a predictive behavioural factor: the higher a person's self-efficacy is, the more likely it is that the person will apply or use his/her learning/knowledge in a real-life situation. Our results show that simulation-based training, with or without debriefing, reinforces self-efficacy, and self-efficacy levels improve more rapidly when the simulation is followed by a debriefing. This is not surprising since the newly

acquired knowledge gained during the simulation session experience (successes and failures), along with vicarious experience, contribute directly to a person's self-efficacy. The debriefing is an additional source of self-efficacy reinforcement due to the verbal persuasion of feedback given to the person (encouragement, opinions of significant others, etc.). Pajares and Zeldin (1999, 2000) arrived at same conclusion in their study of self-efficacy in mathematics among women in scientific careers. They showed that verbal persuasion techniques such as feedback and encouragements, as well as vicarious experiences, contributed directly to the reinforcement of self-efficacy. Our results also revealed that the variance due to the debriefing type (24.2) is as large as the variance caused by the initial self-efficacy score (27.6). This is a clear indication of the importance of debriefing in SE development. At a similar initial SE level, carrying out any debriefing technique led to a significant increase in SE compared to the control session, which had no debriefing. As regards self-confidence, the picture is somewhat different because the introduction of the debriefing type variable does not significantly improve the model. This may be due to the fact that self-confidence is a process that develops more slowly over repeated experiences. Second, our results showed that the explicit debriefing technique is more effective for knowledge acquisition than the implicit reflective debriefing technique. This is in line with educational science research, which has emphasized the structured, explicit nature of precise, targeted feedback in apprenticeship training as a means to promote effective teaching. For example, Hattie (2009, 2012) notably studied publications on effective teaching, corresponding to the analysis of 1,200 meta-analyses, more than 65,000 studies on almost 250 million learners, from elementary to higher education. The results of Hattie's study (2012) revealed that explicit instructor-led teaching methods have greater efficacy (size effect $d = .61$) than implicit methods focusing on the learner (size effect $d = .19$). Direct teaching with a size effect of $d = .59$ appears to be one of the most effective factors. For novice learners, presenting information in an explicit manner is

more effective than eliciting the information by means of a reflective process, thus justifying the use of explicit teaching methodologies, particularly in initial training. This explicit instructor-led teaching approach consists in an explicit presentation of the lesson objectives and content, frequent checking of learner understanding, and controlled practice (Rosenshine, 2012). On the whole, our results for knowledge acquisition are similar. They show that the variance due to the debriefing type (14) is as large as the variance caused by the initial knowledge score (17.4). This is a clear indication of the importance of debriefing in knowledge development (Shinnick et al., 2011.). They also reveal that for a comparable initial knowledge level, the two explicit debriefing techniques (EDA, ID-EA) improved learning significantly when compared to the control session. This is not the case for implicit debriefing. Kihlgren et al. (2014) observed similarities in their investigations into reflection in debriefings by assessing participants' reflection levels using a framework of reflection levels developed by Fleck (2012). The participants' reflection levels were low in the cohort of novice doctors. Thus, although a reflective approach to debriefing is recommended, the real level of learner reflectivity in the debriefing seems to be rather low (HusebØ et al., 2013). In addition, recent works in healthcare simulation have confirmed the importance of a structured approach (Kim et al., 2017). Presenting information in an active manner, using a demonstration model during the debriefing, was effective in developing clinical judgment and, to a lesser degree, self-confidence in student nurses (Weaver, 2015). Using an explicit teaching model in simulations, such as the rapid cycle deliberate practice, has been shown to be as effective, or even more effective, than traditional reflective debriefing methods (Cory et al., 2019, Lemke et al., 2019, Magee et al. 2018). While explicit debriefing seems to be especially effective for student nurses, recent findings showed that for highly experienced healthcare professionals both explicit and implicit debriefing techniques can be used in an equivalent manner (Secheresse, Pansu & Lima, 2017).

Limitations

This study has some weaknesses, which limit the scope of its conclusions. First, we assessed knowledge acquisition following a short simulation session. Therefore, it is difficult to predict if this knowledge will be retained over time, and this needs to be studied in the future. Secondly, the results focus on knowledge, and while self-efficacy may be used as a predictive behavioural factor, it will also be necessary in future research to assess the impact of the debriefing type on behaviour and the transfer of learning to real clinical practice.

Conclusion

To conclude, the choice of the debriefing technique is an essential component in the in simulation-based training process as it directly influences the effectiveness of the training (Cheng & al., 2016). From an applied perspective, our results also suggest that the debriefing technique used should be adapted to the objectives of the training and learners, especially their level of expertise (Cheng et al., 2020). Today, the best way forward at this point would therefore be to consider that a changing debriefing style may be more appropriate, moving from a more explicit to a more implicit technique depending on the progress made by the learner.

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