REVIEW
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A review of participant satisfaction, stress and anxiety associated with video assisted feedback in simulation based medical education

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Abstract

In this review we aim to determine the benefits of video assisted feedback during simulation training in order to evaluate the development of VAF as an educational tool with studies. Simulation acts as a replication of components of a clinical situation and allows a learner to practice in an 'artificial' and controlled simulated environment with guided exposure and has been used in the healthcare arena for more than twenty years. Video assisted feedback (VAF) should augment the learning experience, facilitating reflection and feedback through an accurate 'observation' of the performance. VAF involves the video recording of participants during the simulation activity with replay of portions or the entire performance allows self-reflection or targeted feedback, highlighting learning points. Although video assisted feedback is an exciting addition to the feedback techniques utilised in simulation training, facilities for providing VAF are expensive and not often available. Hence, their development should be supported by evidence based justification. Studies of VAF compared to verbal feedback alone have not established a benefit in learning despite involving a number of assessment measures.

In summary, in this review, the utility of video assisted feedback in simulation training has not been established, thus calling in to question the development of this teaching tool. However, the optimal strategy for VAF is not known and the effect on learning of extending the duration of feedback, incorporating VAF, and the number of 'doses/exposures' of VAF should be investigated in future studies.

Keywords: *simulation based medical education, video assisted feedback, verbal feedback, skill acquisition*

Introduction

In this review we aim to determine the benefits of video assisted feedback during simulation training. Studies have shown inconsistent results when assessing the benefit of video assisted feedback (VAF), when compared to verbal feedback (VF) alone, in terms of improved performance or learning during simulation training. This has called into question the development of VAF as an educational tool with studies being limited and often descriptive in nature.

Medical and nursing education involves exposure to live patients in real clinical situations, through which doctors and nurses acquire skills and gain competence necessary to provide effective and safe care. However, exposing patients to staff at an inexperienced novice or advanced beginner stage [1] (Figure 1) of their training in order to learn, exposes the patient to risk as there is an increased likelihood of the learner making errors, is associated with reduced productivity and patients prefer to be managed by experienced staff [2]. In addition, often clinical encounters are opportunistic with many important clinical situations occurring infrequently.

Dreyfus et al. [1], in their model of skill acquisition (Figure 1) described a progression through stages of learning, resulting in an increase in capability and improved performance, until a level of expertise had been achieved in a particular attribute, skill or task. Their model was based on four binary qualities of recognition, awareness, recollection and decision making. However, once expertise is attained, if the skill or situation is not encountered often or practised, then there is likely to be a regression in capability rendering that individual less able to perform.

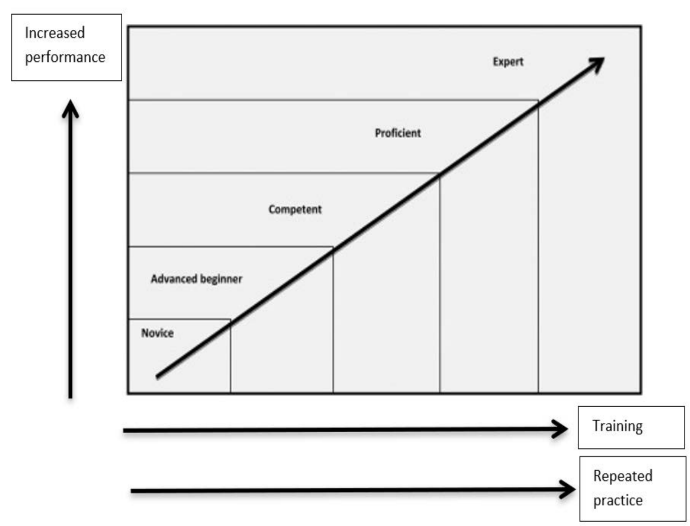

Figure 1. *Dreyfus's model of skill acquisition (modified from Dreyfus [1]).*

Simulation training

'Simulation is a technique-not a technology to replace or amplify real patient experiences with guided experiences, artificially contrived, that evoke or replicate substantial aspects of the real world in a fully interactive manner' [3].

Simulation acts as a replication of components of a clinical situation and allows a learner to practice in an 'artificial' and controlled simulated environment with guided exposure. There is reduced risk to the patient or no risk, where the patient is replaced by a surrogate (actor) or a computer enhanced manikin [4]. Simulation provides an opportunity for concentrated exposure allowing particular skills to be obtained, especially where encounters in real life clinical practice would rarely occur. An example of this, in clinical practice, is the ability to manage acute medical emergencies that are not commonly encountered, but where effective and prompt management may determine a patient's survival.

Simulation training has been used in the healthcare arena for more than twenty years [5] facilitating a learner's progression through Dreyfus et al. [1] stages of skill acquisition with the healthcare professional being able to acquire, practice and maintain skills necessary for clinical practice. Simulation training allows trainees to progress/ascend through the levels of the Miller's pyramid of knowledge (knows), which is followed by competence (knows how), performance (shows how), leading to action (does) [6]. While acting out a clinical scenario, the student gains knowledge, which affects understanding and shapes future actions and practice. This creates the transformational processes which are central to Activity Theory (study of individual and social reality) and a constructivist approach to learning (learning moving from experience to knowledge) [7]. In doing so, the More Knowledgeable Other (MKO) (teacher) helps/guides the learner, extending their Zone of Proximal Development (ZPD) (difference between the learner's current ability to solve problems independently and that which they can achieve with guidance and collaboration) [8]. As learning takes place, acquired facts/knowledge are built upon and linked together to form 'chains of knowledge.' This enables the student to reach their goal and understand the theoretical concepts behind the problem/scenario [9].

Simulation training is effective at improving the cognitive skills and critical thinking of the learner [10]. Simulation has also been shown to improve clinical skills and performance [11-13] with increases in self-confidence and self-efficacy [14-16]. Simulation training enhances leadership, teamwork and communication skills [17,18]; in addition to safety [19,20]. Simulation has been used to help students in their transition into professional practice [21,22] allowing them to engage in the same thought processes and decision making that is intrinsic to safe clinical practice [23,24].

Simulation training using high fidelity manikins and sophisticated computer programmes allow students to evaluate scenarios, plan strategies and intervene to alter outcomes, just as they would in the 'real life' clinical situation. Fidelity relates to the degree of accuracy with which the clinical scenario is replicated by the simulation [2]. Unlike real life, the simulated encounter is safe and there is no compromise to patient safety. This is particularly important in situations that are too rare or dangerous to be practiced using actual patients [25]. Realistic scenarios with environmental reality, high fidelity manikins, computer technology and audio-visual recording and display equipment are essential tools in order to maximise the impact of simulation training [26,27]. Feedback of the trainee's performance during and after the simulation activity is an essential component of simulation training [28].

Scenario feedback

Kluger et al. [29] defined feedback as 'actions taken by an external agent to provide information regarding some aspect(s) of one's task performance.' Feedback relates to specific information given to the learner, comparing what they observed/performed and a set standard, with the intention to improve/refine the learner's performance [30]. Hattie et al. [31] considered feedback to be information provided to the learner, with the aim of reducing the gap between what is now and what should or could be, what is understood and what is aimed to be understood.

Feedback allows the trainee to gain insight as to the aspects of the simulation that were performed well and, more importantly, those aspects of the scenario that could be improved upon and how these could be addressed [32]. Scenario feedback (debriefing) is the most important aspect of simulation-based education [33] and all teaching activity should have debriefing at its heart, acting as a dynamic dialogue between teacher and learner, facilitating effective reflection and aiding learning.

Simulation without feedback results in no improvement in performance [34] with significant improvements resulting from scenario feedback [35-37]. Feedback is vital and 'learners value feedback highly with valid feedback being based on observation' [38]. Teachers should 'deal with observable behaviours and should be practical, timely and concrete.' 'Learning opportunities are wasted…..if the learner cannot reflect honestly on his or her performance' [38].

Learning is experiential and this applies particularly to simulation training, where learners learn by doing, and occurs in a circular fashion. Ideas are continually being formed and modified through experience.

This experiential learning involves four learning contexts [39] (Figure 2):

- *Concrete experience*
- *Reflective observation*
- *Abstract conceptualisation (forming and processing new ideas and integrating them into logical theories)*
- *Active experimentation (theories are tested in new situations and used to solve problems)*
- *Feedback may be given during or after the simulation scenario and plays a fundamental role in facilitating the learner's movement around Kolb's Learning Cycle [35].*
- *Decker [40] suggested four core educational components of simulation training that build critical and reflective thinking [26,41]:*
- *Cueing*
- *Questioning*
- *Debriefing*
- *Reflection*

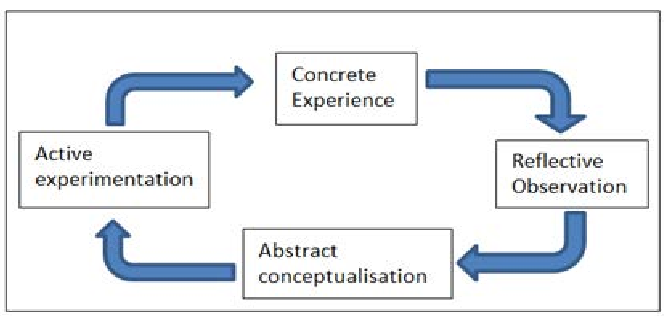

Figure 2. *Kolb's learning cycle.*

Reflection is a type of self-analysis exposing trainee thoughts and feelings, forcing them to address discordance in their practice [26]. Hewson showed giving the right amount of feedback was also important, in addition to basing feedback on observed facts.

The aforementioned studies, principles and observations described, would indicate that video assisted feedback (VAF) should augment the learning experience, facilitating reflection and feedback through an accurate 'observation' of the performance. VAF involves the video recording of participants during the simulation activity with replay of portions or the entire performance to allow self-reflection or targeted feedback, highlighting learning points.

Feedback facilitated by video recorded clips of a learner's performance provides an exciting addition to the feedback techniques utilised in simulation training. However, facilities for providing video assisted feedback (VAF) are expensive and not often available [42] and their development should be supported by evidence based justification.

Assessment of the benefit of video assisted feedback

Although VAF provides an undeniably accurate record of the simulation training activity, stimulating learning and discussion of the observed events [43], the use of computer enhanced manikins that mimic patients with audio-visual recording facilities, to systematically evaluate students/healthcare professionals is still at an early stage. Studies are limited and often descriptive in nature [44] or have failed to show benefits in terms of learning outcomes, performance or attainment (achieving a goal towards which one has worked) [45]. There is limited evidence that simulation with VAF results in outcomes any different from those of verbal feedback alone (VF) [46,47]. More research is required to measure and identify parameters of clinical performance that are influenced by using patient simulators with audio-visual facilities in order to support the development of video assisted feedback technology and training with evidence based justification.

Improvement in clinical performance of skills, tasks and application of knowledge are taken as the 'gold standard' for assessing the effectiveness and efficacy of simulation training [48].

Effect of video assisted feedback on participant satisfaction in simulation training

Studies have shown inconsistent results when assessing the additional benefit of VAF, compared to verbal feedback alone, in terms of improved performance of tasks and demonstration of skills during simulation training, the majority showing no benefit [45,49-55]. Studies most closely related to this study were reviewed in more detail.

Byrne et al. [49] studied the performance of anaesthetists undertaking five simulations in anaesthetic emergencies (hypotension, ventricular tachycardia, bradycardia, anaphylaxis and oxygen supply failure) with thirty four participants randomised into two groups. One group received brief oral discussion between the simulations; the other group reviewed their performance on videotape. Assessment was in terms of the time taken to recall measured parameters and solve problems. Although the group that reviewed their performance on videotape had less chart errors and shorter median 'time to solve' problems compared to controls, their differences were not statistically significant ($p>0.05$). However, the trainees were only given a short explanation between scenarios rather than formal constructive feedback. Also, although the anaesthetists undertook the scenarios in the same order, no attempt was made to establish baseline level of performance and the study was undertaken at four centres. Although each scenario had specific actions that constituted successful outcomes, strict adherence to protocol was not required. Tutors were also instructed to intervene if the trainee failed to control the situation to prevent the 'possible psychological trauma' associated with death. Accuracy of chart completion was one of the outcome parameters, but some trainees were given additional time after the simulation to complete charts if they had experienced difficulty doing so during the scenario. The anaesthetic charts were difficult to decipher due to poor hand-writing. All of these factors made standardisation less robust and may have affected the final result.

Scherer et al. [50] studied trauma resuscitation scenarios which were video recorded and the recording used to provide feedback. The study was undertaken over six months with the team members receiving verbal feedback only after their performance for the first three months. A single reviewer would watch video recordings of the trauma resuscitation and then feedback on what had been seen. For the next three months, the same reviewer would select one of the recorded resuscitation videos and show this at a weekly meeting to participants with subsequent discussion. The study measured outcome in terms of targeted behaviours such as time taken to assess the patient, appropriate imaging and appropriate patient referral/handover. The study showed no improvements in behaviour over the first three months (verbal feedback alone) but did show improvements in behaviour and compliance with treatment algorithms ($p<0.05$) over the next three months (video assisted feedback). The study regarded improved compliance to treatment algorithms as a surrogate for improved patient care. However, the absence of any improvement caused by verbal feedback over the first three months is in contrast to other studies [35,49,56] and indicates a possible difference in either the composition of the groups or the teaching activity. The team leaders did change between the two periods of the study and this may have had an impact on the study outcome. The reviewer providing feedback did not attend the actual trauma resuscitation but simply reviewed a video recorded by a member of the trauma team, limiting their ability to 'observe' the event and this is likely to have had an effect on the quality of feedback provided. The same cohort of staff undertook the study in series and their level of experience and familiarisation with treatment algorithms would have improved with time and practice. In addition, only 54% of the trauma code activations were recorded and only a proportion selected to be reviewed during the video review sessions. The researchers do not specify the criteria used to select those trauma code activations chosen for review and this appears to have been at the discretion of the reviewer. It is likely that the reviewer's ability to determine aspects worthy of discussion, hence the quality of their feedback, would have improved during the study and, thus, giving the participants during the second half of the study a possible advantage.

In contrast to Byrne's study, which looked at technical skills, Savoldelli et al. [56] undertook a study on anaesthetic residents undertaking simulation training using the SimMan manikin. They assessed non-technical skills guided by crisis resource management principles (CRM) [3]. Forty two participants were randomised to no feedback, oral feedback or video assisted feedback. Performance was assessed, pre and post simulation, by two independent blinded assessors who reviewed video tapes of the anaesthetist's performance. Task management, situation awareness, team working and decision making were all assessed. Although there was no improvement in performance between the two simulation exercises in the 'no feedback' group, there was in the group that received feedback ($p<0.05$). Video assisted and oral feedback provided no additional improvement in performance compared to oral feedback alone ($P>0.05$). This study utilised a reliable and validated Anaesthesia Non-Technical Skills (ANTS) scoring system and the assessors had been trained in this assessment tool prior to the study. Although they initially scored independently, their results were then compared and a single score selected. However, inter-rater variability was not formally assessed. Participants who received verbal and video-assisted feedback had lower scores than those receiving verbal feedback alone and the researchers felt the video assisted feedback and verbal feedback may have caused information overload. This may have caused trainees to be distracted by the video, thus paying less attention to the instructors comment and criticism. The ANTS scoring system has an imperfect distinction between non-technical skills and pure medical knowledge. It has modest inter-rater reliability which demonstrates the difficulty of consistently assessing non-technical skills. Only two scenarios were undertaken in this study and although non-technical skills would have been common between the scenarios, some may have been more important in one than the other. Also, the time spent during feedback was not strictly controlled and time taken to review the video may have resulted in less time for formal feedback. In addition, the feedback was given by different instructors, each with their own individual style, reducing standardisation.

Grant et al. [52] studied forty nursing students undertaking simulation training. Scenarios included both cardiac and respiratory emergencies and a variety of roles were adopted by the participants, allocated randomly, including team leader, airway manager, crash cart manager, recorder and medication nurse. Student performance was recorded using the Clinical Simulation tool (CSET) [57] focusing on behaviours such as patient safety, team communication, problem focused assessment, prioritisation and delegation. Immediately after the simulation scenario, students reviewed their performance on video and were guided through discussions of their roles and behaviours by using cueing, questioning, debriefing and reflection. Nurse participants showed an improvement in desirable behaviours with video facilitated feedback compared to oral debriefing alone. In nine of fourteen categories mean scores were higher, including patient identification ($p<0.01$), assessment of vital signs ($p=0.047$) and team communication ($p=0.013$). However, there was no significant difference in total performance scores between the two groups (video assisted feedback=9.09, oral debriefing alone=8.44, p=NS). The student's performances were rated by five independent raters viewing a video recording with good inter-rater reliability (Fleiss's kappa coefficient .71-.94). In this study, only twenty nurses were allocated to each group and the cohort varied significantly with regards to the clinical skills demonstrated which was most likely due to the participant's previous level of experience. The two groups were debriefed by different tutors, reducing standardisation. Five to six students undertook the simulation each session and this is likely to have limited the exposure for each student. Wagner et al. [15] suggested four is an ideal number of students in each group. The researchers were interested in individual student behaviour rather than the performance of the team. Only two scenarios were undertaken as part of the study limiting each participant's opportunity to partake in each of the roles available.

Chronister et al. [53] conducted a comparative study on thirty seven undergraduate nursing students undertaking a critical care course. The study compared verbal feedback with video assisted verbal debriefing in a cross over design. Study outcomes included assessment (vital signs, airway), psychomotor (call for help, oxygen application, chest compressions), response time to initiation of CPR, and knowledge retention (evaluated using the Emergency Response Performance Tool). The verbal debriefing alone group had higher retention of knowledge rates ($p<0.008$). The video debriefing group had higher response times ($p<0.042$) and greater improvement in nursing skills ($p<0.028$). However, the study utilised a crossover design where all participants received both verbal and video assisted feedback. This type of study is susceptible to carryover effect which may be aliased (confounded). It is difficult to assess the effects of each intervention separately. In pharmacological studies, there is normally a wash out period to allow the effects of one intervention to subside, but in learning studies, the students can't unlearn what has been learnt.

Coolen et al. [45] investigated the effectiveness of video assisted real time simulation (VARS) on self-efficacy, level of knowledge and clinical performance in forty five fourth year medical students undergoing simulation training in paediatric emergencies. Students were randomly assigned to the VARS group, a problem based learning group or a scenario training group each undertaking three paediatric emergency scenarios with the outcomes being knowledge (assessed by a MCQ test), self-efficacy (assessed using the Visual Analogue Scale) and clinical performance (assessed using a checklist based on the ABC-structured approach and paediatric life support guidelines). There was an increase in self-efficacy and clinical performance in all three groups but no significant difference was seen between the groups in terms of self-efficacy, although in the VARS group had the best improvement in clinical performance ($p<0.05$). However, the number of participants was small in each group (n=15) and verbal feedback was not compared to video assisted feedback. The VARS group improvement could simply have reflected an improvement caused by feedback itself rather than the type of feedback.

Although these studies evaluated the benefit of video assisted feedback in simulation training on medical emergencies, their approach was variable and none clearly demonstrated a design based on an established conceptual framework. Conceptual frameworks derive from theories, models and best practice and help illuminate research questions by representing ways of thinking about research problems and possible solutions [58]. By stating a conceptual framework, researchers make explicit the principles that guide the development of their research project and guides towards well-grounded solutions. However, only a partial view of reality can be presented by any one conceptual framework (Schwab, in Harris, 1991).

Ericsson et al. Theory of Expertise [32] provides a useful framework to conceptualise this study. The framework emphasises deliberate practice with feedback. According to this theory of expertise, the learning task should:

- *Motivate the learner through improvements in final performance*
- *Accommodate the learner's pre-existing level of knowledge*
- *Allow the skills to be repeated multiple times*
- *Be accompanied by immediate feedback*
- *Be varied across content areas*

In reference to Ericsson's conceptual framework [32], the aforementioned studies made no assessment of baseline participant performance and the level of experience, especially in Grant et al. study [52], varied significantly. Ericsson et al's framework also required each skill to be repeated multiple times but this was not possible due to the number of participants in each scenario (five to six participants in Grant et al. study, [52]) and the number of scenarios undertaken in the study (only two scenarios in Savoldelli et al. [56] and Grant et al. [52]). This also limited the variation in content area. Although the feedback was immediate in Byrne et al. [49] and Grant et al. [52] studies, in Scherer et al. [50] study, the feedback was at a weekly review meeting at an interval from the trauma resuscitation. The feedback was not consistent in terms of the faculty giving feedback, making comparative assessment suboptimal [56]. The study design also made comparison difficult with Scherer et al. [50] utilising a linear study design and Chronister et al. [53] a cross over design. The limitations in these studies could have been addressed by using Ericsson's conceptual framework [32] and a concurrent, randomised control study design.

Conclusion

Simulation training has become established in the education of healthcare professionals over more than twenty years [5] improving clinical skills and performance [13] and learner transition into professional practice [24]. Scenario feedback (debriefing) is the most important aspect of simulation-based education and all teaching activity should have debriefing at its heart [33].

VAF provides an undeniably accurate record of the simulation training activity, stimulating learning and discussion of the observed events [43]. However, the use of computer enhanced manikins that mimic patients, with audio-visual recording facilities, to systematically evaluate students/healthcare professionals is still at an early stage. Studies are limited and often descriptive in nature [44] or have failed to show benefits in terms of learning outcomes, performance or attainment [45,59]. There is limited evidence that simulation with video assisted feedback results in outcomes any different from those of verbal feedback alone [46,47,60] indicating that it is the feedback itself that is important, not the method used.

Studies of VAF compared to verbal feedback alone have not established a benefit in learning despite involving a number of assessment measures.

In summary, in this review, the utility of video assisted feedback in simulation training has not been established, thus calling in to question the development of this teaching tool.

However, the optimal strategy for VAF is not known and the effect on learning of extending the duration of feedback, incorporating VAF, and the number of 'doses/exposures' of VAF should be investigated in future studies.

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