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An experimental investigation into the extent social evaluation anxiety impairs performance in simulation-based learning environments amongst final-year undergraduate nursing students

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ABSTRACT

Background: While numerous theoretical and conceptual models suggest social evaluation anxiety would likely influence performance in simulation-based learning environments, there has been surprisingly little research to investigate the extent to which this is true.
Methods: Final-year Bachelor of Science (Nursing) students (N = 70) were randomly assigned to complete one of three clinically identical simulation-based scenarios designed to elicit varying levels of social evaluation anxiety by manipulating the number of other people present with the student during the simulation (1, 2 or 3 others). Rises in acute stress were measured via continuous heart-rate and salivary cortisol. Performance scores were derived from the average of two independent raters' using a structured clinical checklist (/16).
Results: Statistically different increases were found within the first minute of the simulation between those students with one versus three other people in the room (+4.13 vs. +14.01 beats-per-minute respectively, $p = 0.01$) and salivary cortisol measures suggested significantly different changes in anxiety between these groups (−0.05 vs. +0.11 μg/dL respectively, $p = 0.02$). Independent assessments suggested students with only one other person accompanying them in the simulation significantly outperformed those accompanied by three others (12.95 vs. 10.67 respectively, $p = 0.03$).
Discussion: Students accompanied by greater numbers during simulations experienced measurably greater anxiety and measurably poorer performances. These results demonstrate the ability to manipulate social evaluation anxiety within high-fidelity simulation training of undergraduates in order to help students better acclimatise to stressful events prior to practising in real clinical settings.

1. Introduction

Simulation-based learning environments (SLEs) are often used to train undergraduates in a low-risk environment. Simulation has been defined by Gaba as "…a technique, not a technology, to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion." (Gaba, 2004; pg. i2). There is limited research to date investigating the effects of stress on performance in SLEs and opinion remains divided, with some favouring exposing novice students to stressful situations as they work to improve practice performance (i.e. 'being thrown in the deep end') (LeBlanc et al., 2005; McGraw et al., 2013; Muller et al., 2009) and others suggesting it is primarily detrimental to performance and greater learning (DeMaria et al., 2010; Keitel et al., 2011). For this reason, a number of commentators recommend a 'progressive continuum' from low- to high-fidelity simulation, whereby students are first exposed to basic scenarios void of extraneous distraction allowing focus to be narrowed to the application of clinical skills alone. Rehman et al. (1995) describe three components of simulation fidelity, being 'equipment', 'environmental' and 'psychological' fidelity. When applied to healthcare education, 'equipment fidelity' refers to the functionality and responsiveness of patients, manikins and medical instruments; 'environmental fidelity' as the extent of simulated concurrent stimuli competing for participant attention that emulate demands existing in the real world; and 'psychological fidelity' as the extent to which a simulation provides minimal interruption to the natural 'flow' of a clinical scenario and facilitates

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suspension of disbelief and participant immersion within the scenario. Previous researchers suggest psychological fidelity is usually increased by providing high equipment and/or environmental fidelity (Oser et al., 1999; Beaubien and Baker, 2004). In alignment with training progression, SLEs should evolve across these three factors into in-depth, highly-realistic scenarios more closely resembling real-world environments (Maran and Glavin, 2003). This allows early-stage students to learn new skills with minimal stress until proficiency of a clinical skill is mastered, after which time they can practice those skills in increasingly stressful simulated environments that replicate real-world demands.

The extent to which students should be deliberately stressed during clinical education is an interesting question. McGraw et al. (2013) note the physiological responses of students to acute stress are most likely when (1) behavioural or cognitive response options are undeveloped or inadequate, or (2) when the challenge is novel, intense and unpredictable. Stress is often associated with negative impacts on cognitive function (Fries et al., 2005). LeBlanc (2009) suggests that cognitive impairment is likely to be maximised if attention is divided between a core task and peripheral distractors—such as loud noises, disruptive team members or social anxiety from performing in front of a group. Thus, stress can be particularly acute amongst novice students with only limited exposure to realistic clinical environments. A study of 413 nursing students suggested one of the primary catalysts for stress in clinical settings was inexperience leading to the fear of being reprimanded in front of staff and/or patients (Lindop, 1991). Social evaluation anxiety (SEA) provides some insight into why students may experience such stress. Previous research suggests that motivation to preserve the social self is not dissimilar to the desire to preserve the physical self (Dickerson and Kemeny, 2004). Thus, individuals will monitor their environment for threats to social well-being and respond accordingly to those threats. Rohleder et al. (2007) suggest individuals are more likely to respond to perceived social-evaluative threats when: [1] a clear and important objective is sought; [2] the situation requires the display of an attribute or skill the individual values; [3] this attribute or skill is evaluated by others; and [4] achieving the objective may be encumbered by factors not entirely within the control of the individual. Arguably, students with limited experience being exposed to clinical settings are exposed to each of these aspects often as they are asked to demonstrate or perform clinical procedures (#1) for which they may only have limited experience (#4), that they themselves place inherent value upon (#2), while being evaluated by preceptors or instructors (#3). Furthermore, students must contend with the added difficulty of working on real patients in uncontrolled environments.

However, Selye (1985) suggests not all stress is counterproductive and describes the concept of *eustress*, being a controlled and manageable version of stress that does not extend beyond the scope of one's coping mechanisms and actually works to facilitate heightened performance, rather than inhibit it (i.e. *distress*). The Challenge Point Framework (CPF) is a theoretical paradigm that can help us clarify the effects of stress on students' performance in SLEs. It recommends providing students with optimal challenge at all times, increasing throughout their learning progression, to maximise learning outcomes. It warns that making tasks too easy for students will result in suboptimal effort, limited immersion and minimal learning but also cautions that making tasks too difficult risks students becoming overwhelmed with 'cognitive overload' also resulting in poor learning outcomes (Guadagnoli et al., 2012).

Thus there are a number of established theoretical constructs predicting how stress may impact on clinical performance amongst novice practitioners. However there remains little research to date to empirically demonstrate these models (LeBlanc, 2009; Schull et al., 2001). As pointed out by LeBlanc (2009), not fully understanding the effect of students' stress on training performance means we may impair learning and acquisition of clinical skills during training or, even worse, fail to adequately prepare individuals to function in real situations.

We therefore conducted an experiment to investigate the extent to which stress (specifically distress) can impact upon students' performances in SLEs by manipulating SEA between three simulation conditions. Given the findings of Lindop (1991) suggesting that performing clinical skills in front of staff and/or patients was one of the greatest stress catalysts amongst inexperienced students, and those from Dickerson and Kemeny (2004) suggesting that uncontrollable social threat associated with task performance are directly associated with large increases in cortisol response, we chose the amount of real people present in the room during a clinical scenario as our independent variable. Furthermore, following the call of Cant and Cooper (2010) and Rudd et al. (2010), we attempted to minimise the use of subjective measures and rely upon objective measures to test the following hypotheses:

H1. Greater numbers of actors in a SLE will result in higher levels of distress in students, as suggested by measures of salivary cortisol and cardiovascular reactivity (see Dependent variable measures section).

H2. Higher distress will result in students' poorer clinical performances in SLEs, as systematically rated by expert independent raters' review of high-definition (HD) video footage.

2. Methods

The study design was a three-group comparison experiment with SEA manipulated as the independent variable, and stress (salivary cortisol and cardiovascular reactivity) and performance measured as the dependent variables. The study design and recruitment method were approved by the Edith Cowan University (ECU) Human Ethics Committee (#9667).

2.1. Participants

Stage Six (final-year, final semester) Bachelor of Science (Nursing) students enrolled at ECU in Western Australia in 2013 were targeted for the study. This population was selected because they had completed all theoretical and 'skills lab' (which included a small amount of low-fidelity simulation-based learning) components of their course and were about to commence their final 5-week practicum. At no time throughout their curriculum had students been exposed to simulations typically classified as 'high-fidelity'. Participants were recruited via presentation at one lecture during Week 3 of semester and via online postings. Other than being over the age of 18 and being enrolled as a Stage Six undergraduate nursing student at ECU, there were no exclusion criteria. No remuneration or course credit was offered for participation but students were motivated by the opportunity to gain additional SLE clinical practice before going on practicum. It was made clear to students that participation was entirely voluntary and was not part of their mandatory program.

2.2. Materials

2.2.1. Clinical Scenario

The chosen clinical scenario was set during the morning rounds at a surgical ward in a metropolitan hospital and involved a 35-year old male patient complaining of post-operative nausea and vomiting after having undergone an emergency laparoscopic cholecystectomy 8 h prior. The patient's chart suggests an antiemetic was prescribed 'as required' (PRN) which was last administered immediately post-operation with no further medication given since that time. Students were expected to follow the correct procedure to administer a second dose of the prescribed antiemetic via a cannula already inserted into