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Developing open disclosure strategies to medical error using simulation in final-year medical students: linking mindset and experiential learning to lifelong reflective practice

Andrew Stuart Lane ,[1,2] Christopher Roberts[1]

► Additional material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjstel-2020-000659).

[1]Sydney Medical School, Faculty of Medicine and Health, University of Sydney, Sydney, New South Wales, Australia
[2]Department of Intensive Care Medicine, Nepean Hospital, Penrith, New South Wales, Australia

Correspondence to
Professor Andrew Stuart Lane, Sydney Medical School, Faculty of Medicine and Health, University of Sydney, Sydney, NSW 2006, Australia; stuart.lane@sydney.edu.au

Accepted 17 November 2020
Published Online First 3 December 2020

ABSTRACT

Introduction and objectives Open disclosure is a policy outlining how healthcare practitioners should apologise for mistakes, discussing them with the harmed parties. Simulation is a training and feedback method in which learners practise tasks and processes in lifelike circumstances. We explore how final-year medical students experience the learning of open disclosure.

Methods A qualitative study of final-year medical students who had been involved a high-fidelity simulation session based on open disclosure after medication error was conducted. Students were selected using purposive sampling. Focus groups illuminated their experiences and interpretation of simulated open disclosure experiences. The data were analysed using interpretative phenomenological analysis and supported two superordinate themes: (1) identifying learning needs; and (2) learning to say sorry

Results The medical students constructed their learning in three different ways: negotiating environmental relationships; embracing challenge and stress; and achieving learning outcomes. The data reinforced the need for psychological safety, emphasised the need for emotional arousal and demonstrated the need for both individual and collective reflective learning. Our data linked the benefits of experiential learning to the development of growth mindset and Jarvis's theory.

Conclusions The lived experience of the final-year medical student participants in this study reinforced the notions of continuous psychological safety and the need for emotional arousal during learning. Our data also demonstrated the variety of participant experiences when preparing to give open disclosure, reinforcing the need for facilitators to optimise learning for the whole group as well as the individuals, given that participants are at different parts of their learning cycle.

What is already known on this subject

- Errors are common within healthcare environments, particularly errors involving the prescribing of medications. Open disclosure (OD) is a policy that states that doctors should apologise for errors and discuss them with the harmed parties.
- Many junior doctors take part in OP without any formal training or experience. This can result in the doctor not delivering an apology and not admitting to the error, leaving patients and their families feeling confused, frustrated and angry when the truth finally emerges.
- There are recommendations that OP should be taught to medical practitioners early in their career, potentially as part of medical student education. However, most literature on OD focuses on senior opinions and patients' experiences

What this study adds

- Medical students construct their learning of OP via simulation in three different ways: negotiating environmental relationships; embracing challenge and stress; and achieving learning outcomes, reinforcing the notion of psychological safety and the need for emotional arousal during learning.
- Medical students negotiated the learning of OP with a family member in two different ways: preparing to say sorry and navigating the impact of saying sorry, with a variety of participant experiences when preparing to have a simulated discussion of open disclosure and a variety of emotions when preparing to say sorry,
- The learning of OP via simulation by final-year medical students aligned with Dweck's theory of developing a growth mindset and Jarvis' theory of experiential learning.

INTRODUCTION

Errors are common within healthcare environments,[1] particularly error involving the prescribing of medications. The literature indicates that in some cases, 67% of all patients admitted to hospital are exposed to a medication prescription error,[1] many of which have the potential to cause patient mortality. A widely acknowledged and appropriate response to an error by prescribers is an apology.[2] Open disclosure (OD) is a policy that states that doctors should apologise for errors and discuss them with the harmed parties. It is a process that is part of state and national policy in Australia[3] and elsewhere around the world.[4 5] The context of OD is based around an incident that resulted in harm to a patient while receiving healthcare. The specific elements of OD are: an expression of regret, a factual explanation of what happened, the potential

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To cite: Lane AS, Roberts C. *BMJ Simul Technol Enhanc Learn* 2021;**7**:345–351.

consequences and the steps being taken to manage the event and prevent a recurrence.[6]

Yet, despite policy expectations, data suggest that there is still a significant under-reporting of medication errors, with a recent report suggesting it as low as 8% in some settings.[7] As well as systemic changes in prescribing safety, active interventions aimed at reducing prescription errors should be focused on the education and training of prescribers.[8] OD should be learnt about in the context of medication error.

Many junior doctors who undertake OD discussions with families do so without any formal practical training or prior experience, leaving them in a stressful situation they feel underprepared for.[9] This stress is more significant when an error has led to patient harm and in some circumstances even death. An already tricky conversation combines with their concerns that admitting error could leave them or their colleagues facing legal action. Accordingly, they fail to navigate the seemingly straightforward act of saying the word 'sorry' in admitting to a mistake.[9] When doctors do not deliver an apology and do not admit to the error, patients and their families feel confused, frustrated and angry when the truth finally emerges. There are recommendations that OD should be taught to medical practitioners early in their career. Therefore, the question arises as to whether training in OD concerning medication error should be taught even earlier, as part of medical student education. However, there is a paucity of evidence in this area, and the healthcare simulation literature reinforces the need for more research and theory development of this issue. As there are difficulties regarding the learning and teaching of OD in the current healthcare workforce, rather than using current doctors to research it further, it may be more beneficial that this research is done studying medical students—the doctors of the future.

In order to address this gap, we aimed to explore the experiences of final-year medical students who had been involved a high-fidelity simulation session based on OD after medication error and interpreted how they made sense of this experience. We used high-fidelity mannequins and human actors to create a clinical scenario of having to manage a healthcare team dealing with a deteriorating patient. This was followed by the students taking part in OD communication with the patient's relative. In this context, we sought to elicit students' experiences of this event with a view to optimising student's preparedness to practise in future iterations of the simulation. Our research question was 'What are the ways in which final-year medical students experience the learning of open disclosure, using high fidelity mannequins and human actors, in the context of medication error'. Understanding this question could optimise the future clinical practice of junior doctors. Having a greater understanding of how they experience and learn about OD might improve their ability in this specific process. It may also give greater insights as to how they develop their learning from simulation education and develop lifelong reflective learning.

METHODOLOGY AND METHODS

The theoretical framework that informed the design of the study was based on an extensive literature review, with the constructural framework for the actual study delivery based around three well-recognised learning theories that have been commonly associated with simulated learning environments. First, the learning cycle theory of Jarvis,[10] as this focuses on reflective learning that leads to specified learning outcomes. Second, Barrett's model of the circumplex theory of human emotion,[11] as this focuses on the emotional engagement of a learner with their learning environment. Third, Dweck's notion of a growth mindset,[12] as this focuses on the ability of a learner to learn from mistakes that they have made in the learning environment. As the study was based around human experience, it was designed as a qualitative study using hermeneutic phenomenology, with a theoretical perspective of interpretivism.[13] The epistemological stance was constructivism,[14] underpinned by an ontological stance that was naturalistic[15]

Sampling was purposive and criterion based for final-year medical students of a 4-year postgraduate medical programme who were undergoing clinical rotations within Western Sydney Local Health District. The students were recruited via an email request for volunteers from the executive officer (senior professional staff member) of the teaching hospital. Eight final-year medical students were selected from 12 volunteers, based on availability for the 4-hour education session.

The cited information/identifiable (online supplemental appendix 1) are not from an actual patient, and any resemblance to any real person living or deceased is coincidence.

Development of the simulation activity

The clinical scenarios for the session were developed using the blueprinting format of an objective structured clinical examination (OSCE).[16] This method was chosen to ensure a rigorous yet standardised and fair clinical scenario for their level of knowledge and expertise[17] and was developed against a recognised OSCE checklist.[18] The simulation activity involved four clinical scenarios. Each station used a clinical scenario that was feasible for the level of experience of the participants and practically possible within the realms of medical simulation. The scenarios were piloted and agreed by an expert panel to be developmentally appropriate. The final scenarios that were used are shown in online supplemental appendix 1.

Logistics of the simulation session

The eight final-year medical students (five female, three males between the ages of 24 and 27 years) were divided into two teams: four students attended in the morning session and the remaining four students attended the afternoon session. The morning and afternoon sessions were identical in structure, and before the commencement of each session, there was a prebriefing for the four participants, where the principles of the session were outlined: that everybody was attending voluntarily and we would respect everybody's' intentions as 'wanting to learn, and do the best they could'. It was also made clear that the session was taking place in a psychologically safe environment. Each team of four students were exposed to a clinical scenario involving a high-fidelity mannequin to simulate a deteriorating patient. One of the students then spoke to a family member (played by a human actor) to explain what had happened to their relative (the mannequin). The rest of the team watched this interaction via a video link. When the doctor/family member discussion was finished, all four team members engaged in the debriefing session, with the lead author (ASL). This process was repeated four times within the session, with each one of the four students having a turn at leading the team during the mannequin deteriorating patient simulation and speaking to the human actor.

The simulation with a computerised mannequin (SIMMAN 3G) lasted up to 15 min. Each time the students entered the room as the medical emergency team (MET) and encountered the mannequin making moaning noises. There was a bedside nurse present (an actor) who had called the student team. The

patient had deteriorated due to a medication error. If the team failed to establish the cause of the patient's deterioration within 5 min, the bedside nurse found information and gave it to the student team who hinted a medication error had caused the deterioration. If the hint was not picked up within 5 min, the patient continued to deteriorate, and another piece of information was given by the bedside nurse giving a further hint to ensure that the correct management was instituted, thus preventing cardiac arrest. All the clinical scenarios were eventually correctly managed by the medical students involved, meaning the discussion with the family members were of the same degree of severity. The scenario ended when the error had been corrected or a senior person (human actor) intervened to take the patient to the intensive care unit (ICU), with the patient more stabilised. The team leader then spoke to a simulated family member (simulating the patient's sister). The team leader was given no hints as to what they needed to say. The rest of the team and the primary investigator watched the conversation via a video link. The discussion with the simulated family member lasted up to 15 min, at which point the simulated family member would find a reason to leave. An immediate debriefing of the simulation involving all the students and the primary investigator provided the method to collect the data of the student's experiences. The debriefing acted as a focus group discussion for collection of the qualitative data. Each clinical scenario involved a different medication error, but the two groups both encountered the same four clinical scenarios. At the end of debriefing after the fourth clinical scenario, time was allocated to allow participants to derole and defuse. Attrition was addressed by: using a place of safety, having no time limits, being a voluntary exercise; and providing plenty of refreshment and support. The nurse assisting the medical students was a trained simulation educator, and all the human actors were trained and experienced in simulation education. The session took place at the Sydney Clinical Skills and Simulation Centre.

Data collection

The debriefing sessions moderated by ASL were considered as the focus groups for the data collection, defined as a group of people interacting with one another around a predetermined topic or research question.[19] The debriefing model was based on the advocacy–inquiry model.[20] It was combined with the use of the plus/delta model. Most debriefing sessions lasted for about 30 min.

Although the debrief was focused on the events of the simulation, questioning sought to determine participants' experiences of the clinical scenario, and how they used this experience to develop their learning. This approach elicited topics that were difficult to discuss in one-on-one interviews and encouraged reflections that participants may not have had if they were reflecting alone.[19] For example, it explored the process of reasoning and allowed debate on topics among the students, giving opportunity for participants to disagree with each other, misunderstand one another, question one another and try to persuade each other the justice of their own point of view. As with any debriefing or focus group, there was a wind-down period at the end for everybody to 'defuse'.[13]

Data analysis

The debriefing/focus groups were audio-recorded and transcribed. Data analysis used interpretative phenomenological analysis (IPA). Thematic and theoretical saturation was reached by using the data from the eight medical students who were part of the focus groups, consistent with the IPA method.[21] Reflexivity of the two researchers was ensured by using the Learning Pathways Grid, an activity that explores the researchers internally held cognitive frames on a subject, leading to reflexivity being considered a dynamic process rather than a moment in time, by constantly challenging the obvious and making it explicit at all stages during the research process.[22]

RESULTS

The data were developed into two superordinate themes that were: (1) identifying learning needs and (2) learning to say sorry. The superordinate themes and themes are outlined and explained, with a selection of the supporting quotes that illustrate and clarify the descriptions and interpretations.

Superordinate theme 1: identifying learning needs

The three themes describe how the medical students constructed their learning during the simulation session in three different ways: negotiating environmental relationships; embracing challenge and stress; and achieving learning outcomes. The themes within this superordinate theme are: (1) feeling safe and bold; (2) emotional arousal; and (3) completing the cycle.

Theme 1: feeling safe and bold

This theme describes the ways in which the participants described their relationship with their educational environment during the simulation session. The participants describe the safety they felt in terms of the physical environment and also the people they were sharing the educational experience with. This safety allowed the participants to consider the potential of risk taking.

> I'm less inclined to be like, yes, I'll be the one to do the lumbar puncture, having never done one, let me. Whereas the simulation does offer that sort of safety, well no-one is going to get hurt here so I can try these things. (Participant 3)
>
> I guess it was a little bit confronting but less sort of uncomfortable because that turns it into more of a safe environment for open discussion rather than sort of the spotlight on you. (Participant 5)
>
> 'In this setting it is people I know, people like Emma who I have lived with her for a year and we are very close, and it is people that I feel very comfortable around. So, I didn't care if I had to go first. Preferred not to but didn't care if I had to. (Participant 1)

Theme 2: emotional arousal

This theme described how participants described the emotional arousal and stress they felt during the simulation session and how they embraced the challenge they perceived when they were learning via simulation. The students needed to suspend disbelief to engage with the education available optimally, and their learning was optimised if they felt arousal rather than enjoyment.

> And the clinical situation was good as well, because it sort of makes it closer to real life and you have to think quickly and you sort of feel the tension a bit more so it makes you remember a bit better. (Participant 8)
>
> I mean, it was stressful, but I think that's the point of it, to put us into a new situation as well, at least and in hindsight it was actually a very good thing. (Participant 4)
>
> Yeah you can do your multiple-choice questions and you can do your essays, but doing that at least successful is a lot different than doing what we actually do. (Participant 7)

Theme 3: completing the cycle

This theme described the variety of learning outcomes that were achieved by the participants during the simulation session. While all participants were exposed to the same clinical scenarios and

the same amount of time in the different learning roles during the simulation session, there were different perspectives between the participants regarding their own personal experiences and associated learning outcomes.

> Because it forced me to, it gave me an opportunity to realistically talk to someone how I would talk, had I had to do that, had it been my responsibility. And I wouldn't normally get it in medical school and haven't this year. (Participant 2)
>
> I like to be well versed in the theory side of things before I go anywhere near the practical. I know we mentioned it earlier, is that I learnt, although in med school I was much more comfortable if I did have a sound theoretical basis for whatever it is, we were talking about. (Participant 7)
>
> I think I'm going to re-evaluate how I do things yeah it's made me think that there's not just one way of doing things and I think I'll be a bit more attuned to the person I'm speaking to… (Participant 6)

Superordinate theme 2: learning to say sorry

The two themes describe how the medical students negotiated the learning of an awkward conversation with a family member in the simulation session. The two themes described how the students prepared to say sorry and navigated the impact of saying sorry. The themes within this superordinate theme are: (1) empathic considerations; and (2) empathy in practice.

Theme 1: empathic considerations

This theme described how participants prepared to say sorry to the simulated family member during the simulation session. They used a variety of approaches to the conversation that were contextualised by the clinical context and the potential content of the discussion, including the potential reactions of the patient and their family, and their own reactions.

> Yes, well and then there was this guilt feeling of we've overdosed this patient on Morphine and then the reason she deteriorated was us. (Participant 6)
>
> Because I didn't see the need at the moment to put the hospital at risk of litigation unnecessarily. (Participant 6)
>
> But the flagging the short story can be anything 30 seconds to a minute. It doesn't need to be long. Just enough and be really watch the person and make sure that they're understanding that it's landing. That's where your language being different to my language if you're not sure you can pick up whether I'm understanding or not so. (Participant 2)

Theme 2: empathy in practice

This theme described how the participants navigated the impact of saying sorry to the patients and their families during the simulation session. Emotional intelligence and situational awareness were important qualities that were required when interacting with the simulated family member in this simulation session. Even if the participants' concepts of what the family member was thinking were incorrect, if they were perceived as empathic, then the family member appeared satisfied with the content of the discussion.

> I was thinking something different to them. I was thinking holy crap I hope she doesn't start crying, that's what I was thinking yeah. (Participant 1)
>
> Yeah I think maybe we can look at their reaction and if they're, if they look ready or if they look like they're just not really sure what to do then that's appropriate to say what you have to say. I think you pick up often of what, where they are. (Participant 3)
>
> I think we are empathetic people, but we're also quite clinical people and I always find I still do that and in terms of applying clinical reasoning to a setting and just if just being calm and sitting back and think well what's the point of the conversation, what are we trying to get out of it. (Participant 6)

DISCUSSION

Overall, our data show new insights into how medical students develop their professional learning of OD using high-fidelity simulation. It illustrates the several ways in which final-year medical students experience the learning of OD. We summarise our findings, discuss the implications for theory and practice and reflect on the limitations of the study. What this research adds is that our data show new insights into how medical students develop their professional learning of OD, using high-fidelity simulation.

In *feeling safe and bold* (theme 1 of superordinate theme 1), participants describe their relationship with their educational environment during the simulation session. Participants emphasised the need for psychological safety and noted the safety provided to them by both their fellow participants and the facilitator. Psychological safety is a person's sense that the immediate environment is safe for interpersonal risk taking. That trying out new ways of talking or acting will not be ridiculed; that mistakes will be worked on collaboratively as a source of learning instead of being treated as a crime to be punished or covered up.[22] Calhoun *et al*[23] recommend an expert briefing should be used from the outset to frame the experience as a unique and valuable learning opportunity. By dispelling distrust and assuring learners that any events occurring as part of the scenario are intended for their educational benefit, facilitators can create and maintain a non-punitive learning environment.[23] Experimentation is a vital part of learning, since when learners experiment, they make mistakes, and making mistakes is vital to learning and for developing cognitive resilience.[24] This idea resonates with the work of Dweck, who outlines the connection between experimentation and the development of cognitive resilience. Dweck[12] describes how individuals can be placed on a continuum according to their implicit views of where ability comes from. '*Feeling safe and bold*' suggested that the feeling of psychological safety altered the way in which students approached their learning: they were more willing to take risks and therefore fail. This is a crucial part of developing the growth mindset described by Dweck.[12]

In experiencing *emotional arousal* (theme 2 of superordinate theme 1), participants describe the emotional arousal and stress they felt during the simulation session, and how they embraced the challenge they perceived when they were learning via simulation. Participants acknowledged the stress they were feeling and recognising that this was good for their learning. The data in this theme resonated with the principles of the circumplex theory of human emotion.[11] Although the simulation session might not have been a 'positive experience' in terms of emotion, for example, pleasurable, it was a 'positive experience' in terms of learning. Although the students felt stress during the simulation session, this did not mean that their learning was suboptimal. It was not comfort that was imperative to enable learning; it was arousal, and this does not have to be positive arousal. However, the circumplex theory is around a theory for learners retaining more information being if they learn in an aroused state, whereas our data demonstrate this in reality and that the lived experience of this is also a participant belief that you are learning retaining the information better.

In *completing the cycle* (theme 3 of superordinate theme 1), the participants describe described the variety of the learning outcomes that were achieved by them during the simulation session. Participants realised that they were learning in a different way to how they traditionally learnt and encouraged them to

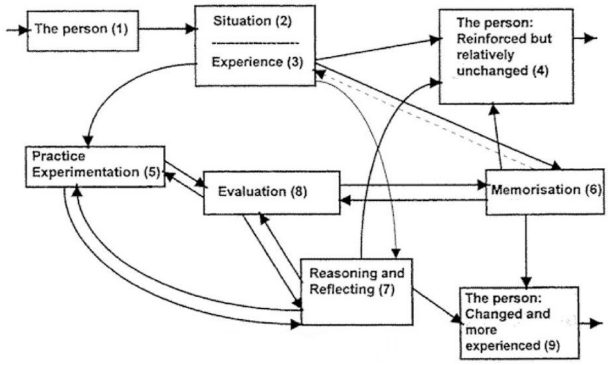

Figure 1 Jarvis's learning cycle. Lifelong learning and the person. Peter Jarvis. 2010. Routledge.

adapt their learning strategies for the future. Kolb[24] described different learning styles that are often associated strongly with learning from a simulation. However, in revisiting Kolb's theory, Jarvis[10] disagreed with Kolb's premise of sequential learning and that it was not fully developed, as it did not contain all types of learning outcomes such as memorisation. Figure 1 demonstrates Jarvis' adult learning cycle, and the difference between Kolb's learning cycle is that he demonstrates the different potential outcomes from the learning process.[10] The three outcomes that he highlights in the cycle are: non-learning where the learner does not respond to a specific learning situation (box 4); non-reflective learning, which is memorisation or acquisition of manual skills without the necessity of reflection (box 6); and reflective learning (box 9). The non-learning process may occur in simulation when participants do not 'suspend disbelief' and therefore do not engage in the experimentation or evaluation of the experience because they believe there is nothing new or beneficial in the experience.[10] Appling this cycle to the data, some students showed non-learning by not responding specific learning situation (box 4) and so on. Using the three different learning outcomes highlighted by Jarvis allows both learners and facilitators ensure they minimise non-learning and non-reflective learning. During the debriefing session, facilitators need to inspire and empower learners to go through the process of reflective observation and abstract conceptualisation. The non-learning process may occur in simulation when participants do not 'suspend disbelief' and therefore do not engage in the experimentation or evaluation of the experience because they believe there is nothing new or beneficial in the experience.[10] 'Completing the cycle' suggested that simulation could potentially lead to a variety of learning outcomes for different participants, even though they undergo the same experience. Facilitators need to ensure that the simulation session optimises collective learning—ensuring as much learning as possible for as many participants as possible.

In *empathic considerations* (theme 1 of superordinate theme 2), the participants describe how they prepared to say sorry to the simulated family member during the simulation session. Participants showed a variety of immediate considerations when they prepared to speak with the family member. 'Empathic considerations' suggested that the students had a variety of approaches to the conversation that would involve saying sorry and that their approaches were contextualised by the clinical context and the potential content of the discussion. Some immediate approaches were based on avoidance of blame for the institution along with personal feelings of guilt. In contrast, others were based around structuring a conversation that framed the situation for the family. Whichever style the participants chose, it led to framing the issue of patient deterioration early in the conversation, therefore allowing other priorities of conversation to ensue. These approaches are consistent with the work of Shaw *et al*,[25] who described three typical delivery styles that doctors used to break bad news. A blunt style characterised by doctors delivering news within the first 30 s of the interaction; forecasting, a staged delivery of the news within the first 2 min; and a stalling approach, delaying news delivery for more than 2 min. Blunting can lead to the person receiving the news not being ready for it. Although the person delivering the news is very explicit with the information, the speed at which it is delivered can lead to an inability to comprehend what has happened and to digest the information beyond this shock. Stalling can lead to the person receiving the news beginning to get confused, as they know that the person delivering the news is trying to tell them something, but they do not seem to get around to stating what it is.

In *empathy in practice* (theme 2 of superordinate theme 2), the participants describe how they navigated the impact of saying sorry to the patients and their families during the simulation session. Participants show a variety of immediate considerations and assessment of the simulated patient family member as they prepare to say sorry. The students' insights resonate with the idea that clinicians who are good communicators do so because of their high degree of emotional intelligence and situational awareness. The variety of emotional reactions from the participants demonstrates that humans can have a variety of focuses when they approach a significant communication episode such as OD. This reinforces the need for doctors to possess high degrees of emotional intelligence (EI). EI, often measured as an emotional intelligence quotient, describes a concept that involves the ability, capacity, skill or a self-perceived ability, to identify, assess and manage the emotions of one's self, of others and of groups.[26] 'Empathy in practice' suggested that emotional intelligence and situational awareness were essential qualities that were required when interacting with the simulated family member in this simulation session.

Implications

Our data show new insights into how medical students develop their professional learning of OD using high-fidelity simulation. The two superordinate themes demonstrated educational aspects relating to both learners and facilitators, for the use of simulated-learning environments to assist in the professional development of medical students. This study was based around learning of OD; however, the themes developed could be considered for many other types of simulation training, especially around communication and self-reflection.

Within *identifying learning needs* (superordinate theme 1), the first recurring aspect was the students' awareness of their own competency and emotional awareness to ensure that their learning is optimised. The second recurring aspect was the role of facilitation during the simulation session, how this optimised the students' learning by the psychological safety of the learning environment and the need to facilitate multiple learning styles in one session while trying to provide the same learning outcome. Within *learning to say sorry* (superordinate theme 2), the recurring aspect was the variety of ways in which the students approached both the OD conversation and the specific aspect of saying sorry. Looking at Jarvis's learning cycle (figure 1), a growth mindset is especially relevant in stages 5 (practice experimentation), 7 (reasoning and reflecting) and 8 (evaluating). Without a growth mindset, these stages cannot occur. This also

means that without a growth mindset, learners are less likely to reflect critically.

The two superordinate themes have clear messages for both individual learners and facilitators: the need to coconstruct a conducive learning environment. Superordinate theme 1 demonstrated that learning outcomes could be very different for individual participants, and therefore the facilitator must enable and ensure that both collective and individual learning is optimised. Psychological safety is a known requirement to optimise learning during simulation debriefing,[27] and these data suggest the need for psychological safety to be established and maintained in all parts of the simulation session, not just the debriefing. Superordinate theme 2 revealed a variety of emotions for the participants, demonstrating that they are both at quite different points in the learning cycle and experiencing arousal in different ways. This once again requires an awareness on both the part of the learner and the facilitator to ensure that individual and collective learning is optimised by promoting the development of a growth mindset for all participants.

Therefore, the data from this study can give useful directions to learners, facilitators, learning institutions and organisations. The link between the development of a growth mindset and providing psychological is the key here, since unless the environment is not clearly identified and demonstrated as being psychologically safe, participants will not take risks, will not potentially fail and will not have the ability to learn from these mistakes to develop a growth mindset. The role of the facilitators and participants is coconstruction of the learning environment is vital, with examples that can assist in this being: visual reminders (eg, posters) of the provision of psychological safety within the learning environment, explicit reminders and discussions at of the provision of psychological safety by the facilitators at multiple parts of the learning session, verbal acknowledgement by participants that they collectively are aware of the safety provided and are understanding of the reasoning and potential benefits, and the agreed ability to take be able to take 'time-out' and pause the learning process if the emotion becomes overwhelming.

However, there is also a role of the educational institutions, since even with the provision of psychological safety, the correct emotional arousal, participants still require the correct learning activities and assessments in combination with correct feedback to develop a growth mindset. This translates practically into educational institutions developing curricula and providing faculty development that promote this professional development in learners. For example, students should be exposed to the concepts of critical reflection and the development reflective practice early in their curriculum. This is especially true in medical students who have achieved high grades to be accepted into the programme, however, have often arrived at medical school without considering how they learn or how they improve their learning. If they cannot fully understand how they personally absorb, reflect and translate knowledge, this may compromise their career and professional development. This cognitive development should be seen, not just as something they acquire to navigate medical school, but something they will use to navigate the whole of their professional lives. Furthermore, beyond embedding this cognitive development in the curriculum, it needs to be delivered by skilled educators who have a deeper understanding of student learning and can tailor major educational sessions such as simulated environments to ensure that all students have the optimal learning experience and also continue to reflect and develop their learning further beyond the simulation session.

The most obvious area of further research in this area would be to follow-up the interns at a later stage of their clinical careers and to explore the influence of the education session many years later, illuminating the influence on their clinical practice. It would also be instructive to compare the cognition of error from the perspective of senior medical staff, and this could be in many different aspects including: senior medical staff who made an error while they were junior and are now reflecting on it many years after; senior medical staff who have recently made an error and are reflecting on it very acutely; and senior medical staff who have been involved in OD.

Strengths and limitations

The strength of this study lies in the appropriateness of the methodology and methods chosen, as they ideally placed to reflect the interpretation of the human experience. The method of analysis is robust, especially for the number of participants selected. IPA gives a deeply contextualised interpretation of the issues being analysed. This study is also the is first time that this level of analysis has been conducted and provides a rich theoretically informed study that is explanatory. The context of the study is also highly pertinent to medical students. The experiences in the simulation were recognised as those they were likely to encounter in their future careers. Limitations are the level of medical students sampled; as there are many levels of medical students, these experiences relate to medical students who are about to graduate and commence their clinical career, and these experiences may not reflect the practice or other levels of students.

CONCLUSION

The lived experience of the final-year medical student participants in this study reinforced current knowledge of optimal simulation education, as well as introducing new concepts for future consideration. The study strongly reinforced the notions of psychological safety and the need for emotional arousal during learning. It introduced the need for continuous psychological safety from all aspects of the experience, as well as linking the benefits of experiential learning being tied to the development of a growth mindset. Our data also demonstrated the variety of participant experiences when engaging in OD and specifically the variety of emotions when preparing to say sorry and after the impact of saying sorry. Facilitators need to optimise learning for the whole group as well as the individuals, as the participants are at different parts of their learning cycle.

Contributors Substantial contributions to the conception or design of the work; or the acquisition, analysis or interpretation of data for the work: 80% ASL and 20% CR. Drafting the work or revising it critically for important intellectual content: 80% ASL and 20% CR. Final approval of the version to be published: 80% ASL and 20% CR. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: 80% ASL and 20% CR.

Funding This work was supported by the Nepean Medical Research Foundation.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval was granted by The University of Sydney Human Research Ethics Committee - 10/20-HREC/010/NEPEAN/51.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request.

ORCID iD
Andrew Stuart Lane http://orcid.org/0000-0001-8650-5509

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