Perceptions of staff and students of the role of clinical simulation on students' ability to perform academically

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Background. The Bachelor of Emergency Medical Care (BEMC) uses clinical simulation for teaching, learning and assessing students. The voices of staff and students in understanding how simulation affects academic performance in paramedic students have not been studied before.

Objective. To understand the aspects of clinical simulation assessments that might lead to underperformance in the BEMC degree.

Methods. An exploratory qualitative approach was used in this study. Twelve focus groups and eight semi-structured interviews were conducted with students and academic staff, respectively, at the four universities that offer the BEMC in South Africa. The data were thematically analysed using NVivo 11.

Results. Five themes emerged from the study: These included: (*i*) environmental realism; (*ii*) stress during simulations; (*iii*) cognitive process dimension; (*iv*) classroom-based v. field-based practicals; and (*v*) static evolution of simulation practice.

Conclusion. While clinical simulation is a useful educational tool for training health professions students in patient management, there are pitfalls that result in student underperformance.

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Clinical simulations represent real patient clinical scenarios with standardised patients or manikins.[1] The aim is to facilitate learning in a controlled environment without the risks of a real-life experience.[2] Performing clinical skills is not the primary aim of simulations; instead, students have to demonstrate the following abilities: problem solving, communication with the patient and bystanders, receiving hospital staff and technical skills required to achieve particular outcomes within a medical or trauma context.[1] Accordingly, competence shown during the simulation infers competence in practice.[3]

Clinical simulations have been found to increase stress and anxiety.[4-6] While the literature has been inconclusive on the influence of stress in simulation, Demaria *et al.*[7] highlighted that stress and anxiety during a simulation event enhance performance and retention of skills. However, excessive stress during simulation scenarios has been found to result in paramedics (even highly experienced individuals) making clinical judgement errors under pressure.[5,8] Stress can also influence a student's ability to recall information essential to the decision-making process.[9]

By design, simulation scenarios involve critically ill or injured patients who require real-time clinical diagnosis and intervention, with feedback being provided immediately.[10] Students must be able to demonstrate a variety of skills to manage a particular case compared with performing simple motor skills, adding to the complexity. The cognitive load theory argues that the intrinsic cognitive load is determined by the level of interactivity elements.[11] An element is defined as anything that needs to be or has been learnt, such as a concept or procedure.[11] Given that a simulation consists of multiple elements that interact, it would be considered to have high element interactivity and thus requires a high germane load.[11] The latter refers to the working memory resources required by the learner to deal with the intrinsic cognitive load.[12]

The 4-year Bachelor of Emergency Medical Care (BEMC) degree is an undergraduate programme for prospective paramedics in South Africa (SA) that commenced in 2011 at the Durban University of Technology.[13] It is currently also offered at three other universities. The BEMC was built on curricula from the previous 2-year, part-time Bachelor of Technology and the 3-year National Diploma in Emergency Medical Care programmes, but was redesigned to add scope and depth of learning to prepare paramedics for current practice demands.[14] The BEMC uses clinical simulation for teaching, learning and assessment of students.

While there is widespread use of simulation in health professions education and training,[15-17] it is difficult to determine the level of realism for educational value.[18] Some argue that the level of realism has different value for different learners[19,20] and that the most important aspect of simulation realism is to have an accurate representation of the clinical case through prompts and stimuli from the participant's perspective.[18] However, Leighton and Dubas[21] found that enhanced realism heightens and improves student learning. Repeated exposure to high-fidelity simulations has been shown to facilitate proficiency and practice readiness.[22] High fidelity refers to simulation experiences that offer a great deal of realism for the learner.[23] High-fidelity simulation may, however, not result in improved performance in assessments compared with low-fidelity simulations, but it does result in improved self-confidence.[24]

The voices of staff and students in understanding what aspects of simulation affect performance during simulation assessments have not been studied before. This article seeks to obtain the perceptions of staff and students of the role of clinical simulation on students' ability to perform academically.

Methods

An exploratory qualitative approach was used in this study, which was consistent with the author's aim to uncover the interplay between simulation and academic performance.

Study participants were BEMC staff who were teaching simulations and students who took part in simulation assessments, who were recruited from four universities that offer the BEMC programme in SA. The study participants comprised third- and fourth-year students from the four institutions and lecturers who were either teaching simulations in the first, second, third or fourth year of the programme or were departmental heads.

Twelve focus groups with a total of 81 students were conducted by the researcher at the respective institutions. Eight semi-structured interviews (2 per institution) were also conducted among the academic staff. There were no new themes generated after eight focus groups and six semi-structured interviews; therefore, data saturation was deemed to have occurred at this point. Four more focus groups and two more interviews were conducted to confirm this finding, and no new themes emerged.

Access to the participants was facilitated by the respective heads of department who arranged contact with the relevant class captains and academic staff who co-ordinated the meeting times and venues. The study information had been disseminated to the participants by the class representatives through the academic staff. The study information was also provided at the beginning of the focus group discussions and interviews. The focus group discussions took place in the boardroom or classroom, and were organised by the respective class representatives. The semi-structured interviews were held in the respective lecturers' offices. Rapport was built with participants by being accommodating and with the introduction of the researcher. Participants were informed of the researcher's role, as well as their own role. Conversation was initiated by briefly speaking about the participants' studies or current work experience before commencing with the interviews. All participants provided verbal consent. All focus group discussions and interviews were audio recorded and ranged between 25 and 60 minutes.

The audio recordings of the focus groups and interviews were transcribed verbatim into formal text. The researcher listened to the audio recordings and read through the transcripts to ensure accuracy of the transcripts and to become familiar with the dataset. Pseudonyms were used on the dataset to ensure confidentiality. The dataset was analysed using thematic analysis. Initial codes were constructed using NVivo 11 (Microsoft Corp., USA) and data were organised into meaningful groups. A further round of coding was done to re-examine the codes and categories that had been created. The researcher then looked for a pattern within the data to establish whether certain codes pointed to the same underlying idea. These were then coded with a unifying theme. A colleague was provided with the data to verify the coding. The data presented in this article were extracted from a PhD study, which explored reasons why academic success was either evident or absent among SA paramedic students. While various themes emerged from the study, this article deals with the aspects of clinical simulation assessments that might lead to underperformance in the BEMC.

The study made use of Guba's four criteria for assessing trustworthiness.[23] Triangulation was used where different study participants (staff and students) were asked the same questions using different methods (interviews and focus groups). The findings at the four institutions were comparable, thus leading to greater credibility than might have otherwise been the case. Rapport was established with the participants to ensure honesty during data collection, and they were encouraged to communicate openly without fear or discrimination or a loss of credibility with the researcher or their colleagues. A dense description of the methodology was provided to allow for the transferability of the study findings to provide sufficient information for future researchers to ascertain whether the findings could be applicable to another study. Confirmability was ensured by cross-checking of the transcription and coding. Qualitative researchers were consulted together with peer review coding to ensure dependability.

Gatekeeper permission was granted by the respective institutions, while ethical approval was granted by the University of Cape Town Human Research Ethics Committee (ref. no. HREC: 815/2015). There was voluntary participation, and all participants were free to withdraw at any time without reprisals, thereby respecting the participant's right to autonomy. Audio recordings and transcriptions were kept in a password-protected folder in a password-protected computer to ensure confidentiality. To ensure justice, interviews were conducted at a neutral venue chosen by participants and same were chosen fairly to participate in the study.

Results

Five themes emerged on analysis of the transcripts. These included: (*i*) environmental realism; (*ii*) stress during simulations; (*iii*) cognitive process dimension; (*iv*) classroom-based v. field-based practicals; and (*v*) static evolution of simulation practice. Pseudonyms were used for the study.

Theme 1: Environmental realism

Although clinical simulations aim to replicate the management of a real clinical scenario, some students suggested that managing a real patient compared with a manikin is not the same:

> 'The second part of it is that practicals are not so practical, if you know what I mean, in a sense that we have a doll – a doll and a patient are two different things. You have to learn that the chest – you don't just listen to the chest, you have to know where the speakers are for you to know what sounds are transmitted, you know, because the plastic itself transmits a certain kind of sound.' [Student Judith]

It would appear that the realism is also dependent on the type of manikin that students use:

> 'Yes, and you have to listen prior to that. You have to set the monitor on wheezing, go find your speakers and listen. Is that wheezing? Okay. This is wheezing in this doll. The next doll will be different; the other doll will be different.' [Student Esther]

The realism of the simulation might differ during the teaching and assessment, creating confusion for the students:

> 'And my opinion is that one of the reasons why simulations are so difficult for students may well be that they are encountering the simulation in a different format when they are being assessed.' [Lecturer Frank]

A student expounded on the realism of simulation assessments by stating:

> 'So when giving fluid, you're saying I'm giving 150ml bolus, you're just going to verbalise it. And that's where you lose the plot, you lose the system … So it's more of an oral exam, than a practical exam itself, and that's where we make mistakes.' [Student Judith]

Theme 2: Stress during simulations

Simulation assessments appear to be stressful, partly due to the presence of assessors in the room, who observe and score the student:

> 'And in a simulation assessment with stress and all these millions of eyes looking at you and giving comments and all of that, you confuse yourself ... and then you fail.' [Student Esther]

A lecturer acknowledged that students indeed find simulation assessments stressful:

> 'Do students still enjoy sims? I don't think so. I don't think they like them, they find them very stressful, especially if it's assessment.' [Lecturer Frank]

Another lecturer expounded that even students who have been experienced intermediate practitioners are sometimes dumbfounded during simulation assessments:

> 'It was just like because of that stress of that simulation, here is somebody – I mean, this is a person who is already an ILS [immediate life support] practitioner, years of experience. He just hit a blank for that particular thing.' [Lecturer Gordon]

Theme 3: Cognitive process dimension

Academic staff found it appropriate that students should struggle with simulation, as it tests clinical reasoning, unlike the testing of psychomotor skills:

> 'They [simulations] are now starting to assess clinical reasoning, starting to assess diagnostic reasoning with the more cognitive things, other than just the pure psycho-motor things that they used to assess.' [Lecturer Ricky]

Another lecturer stated:

> 'And I think the other challenge with simulations is that simulation is really doing what I said earlier, it's moving the student away from content knowledge and robotic OSCE [objective structured clinical examination] like performance to the area of critical decision-making, and this is, I think, where we find students struggle. And, in actual fact, it is quite appropriate that they struggle because that's what we want. That's the sharp end of the academic spear, to get someone to critically reason, think and apply knowledge. A good simulation should require these competencies to be demonstrated.' [Lecturer Frank]

Theme 4: Classroom-based v. field-based practicals

It appears that there is a disconnect between what students are taught by preceptors during clinical practice shifts and what they are taught during their emergency care practical subject. This situation creates confusion for the students, as they are unsure of the correct treatment plan:

> 'What you do on the road is not what you do in the sim.' [Student Eve]

A staff member also alluded to this point:

> 'But I think another problem with prac [practicum] comes from the road, where guys get drilled on stuff that we don't teach them. So a guy will say "You must put oxygen on every single patient", where I'm saying "Don't put oxygen on every single patient". Then they arrive in the sim and there's this sort of conflict in "I got kakked [chastised] out on Sunday for not putting oxygen on". That's fresher in their mind than when I told them don't put oxygen, so they'll arrive, put oxygen on the patient and say the patient's cool.' [Lecturer Owen]

Theme 5: Static evolution of simulation practice

Other lecturers provided alternative explanations as to the reasons why simulations are challenging for students by pointing out that paramedic training in higher education is relatively new for all programmes in SA (~30 years), with the lecturers further maintaining that the teaching and assessment of clinical simulation have not evolved since the inception of the National Diploma Emergency Medical Care in 1987 (initially National Diploma Ambulance and Emergency Technology).

A lecturer noted:

> 'What makes us different from the CCA [critical care assistant]? What makes us different from the National Diploma? And the way we've been doing simulation is the way simulations have been done for the past 30 years in EMS [emergency medical services] training.' [Lecturer Robert]

Another lecturer shared the same sentiments:

> '… higher education in emergency services is still actually relatively new. I know it has been going for 20 years or so in terms of the National Diploma, but those National Diplomas were pretty much run much like CCAs were, as was the BTech. And the BEMC – even the first BEMCs were – …, as lecturers, we ourselves are all products of the old system and, when we first started, we didn't have tertiary qualifications in education ... We are all still learning.' [Lecturer Ricky]

Discussion

This study describes various reasons that students and staff attribute to student performance in simulation assessment in the BEMC. Firstly, the manikin itself is not entirely identical to the human body and therefore students need to be comfortable regarding where to perform patient assessment techniques such as auscultation and palpating for pulses. Furthermore, each manikin is different and therefore students must familiarise themselves with each one. It could also be argued that patients are unique and present with different ailments. Campbell *et al.*[3] highlighted that simulation lacks the validity and reality subsumed in practice due to unrealistic and limited features of the manikins for replicating the human anatomy and physiology. They argue that these limitations undermine true performance of students during simulations.[3] While perceived realism differs among individuals, it is important that the simulation fidelity is not only dependent on user discernment, but also on accuracy of the given scenario relative to the real world in terms of physiology.[18] Another finding that arose from this study was that there appears to be a mismatch between how simulations are carried out in teaching and assessments. For example, during teaching and/or assessments, the students may be asked to verbalise their actions. However, at times, it seems that the students may be expected to speak to the manikin as if it were a real patient and perform actions such as opening and connecting the intravenous line. The inconsistency in teaching and assessment may be one of the causes of the students' anxiety during a simulation assessment. Likewise, Campbell *et al.*[3] highlighted that fast-tracking student actions and patient progress during simulation assessments leads to misinterpretation and may confound information gathering, as the student is unable to engage realistically in a stressful situation.

Stress during simulations was highlighted as one of the reasons for underperformance during assessments. Simulation has been found to induce stress and anxiety.[5,8,25] An increased heart rate in simulation correlates poorly with both perceived stress and performance.[25] Kharasch *et al.*[26] also found increased heart rate and blood pressure among physicians taking part in a simulation scenario, and psychomotor performance has been shown to deteriorate with increasing stress levels.[27] In addition, there are often at least 2 - 3 assessors, including the moderator, in the simulation room during an assessment that is also video recorded.[10] The presence of these individuals during the assessment may be one of the contributing factors to student anxiety, as mentioned by one of the participants. Mills *et al.*[28] found that paramedic students had increased peak heart rates when an instructor was present during a simulation compared with having no instructor. However, Kaddoura *et al.*[29] found that while students were uncomfortable with being observed during the simulation, their anxiety did not change their learning outcomes (critical thinking, confidence and competence), although some felt embarrassed when performing poorly in front of their peers and instructors.

Unlike an OSCE that focuses purely on clinical skills, a simulation requires students to apply their theoretical knowledge to manage a particular condition/injury. Therefore, students must apply their minds to make decisions based on evidence and decide what medication/s to administer (if indicated) and why. It is for these reasons that one respondent asserted that 'it is quite appropriate that they struggle'. The struggle could be that students experience extraneous cognitive overload during simulation assessments, especially when there is poor practicum experience and weak knowledge scaffolding. The extraneous load relates to those mental resources committed to elements that do not contribute to learning.[12] It follows that learning or performance will be impaired owing to limited memory resources available to deal with the intrinsic cognitive load, should there be more working memory resources that are devoted to extraneous cognitive load.[11]

This study also found a disconnect between classroom and field teaching. It appeared that preceptors teach students different ways of managing patients than during classroom teaching, which appears to cause confusion, as students are unsure of the treatment regimen that they should follow. Some lecturers asserted that concerns around simulation were due to the relatively new (~30 years) higher education paramedic training in SA. The lecturers further maintained that the teaching and assessment of clinical simulation have not evolved since the inception of the National Diploma Emergency Medical Care in 1987 (initially the National Diploma Ambulance and Emergency Technology).

Because simulation training has remained largely unchanged over decades, one of the respondents argued that the simulation training in higher education programmes is no different to that in the CCA programme. The CCA programme was a 9/10 month paramedic programme that was offered mostly by vocational training colleges and has now been discontinued to align all emergency care training with the Higher Education Sub-Qualifications Framework.[14] The focus of the CCA programme was on skills training and competence. The emphasis was on managing a particular condition within the defined scope of practice. However, Wheelahan and Moodie[30] argue that competency-based training fails to provide students with systems of meaning, but does provide specific elements of theory applicable to the particular context. For example, while nebulisation is indicated for a patient who wheezes owing to asthma, a student who has undergone competency-based training may find it challenging to manage a wheezing patient who is not asthmatic. The static landscape in simulation teaching and assessment may be attributed to the BEMC programme lecturers, who are graduates of the National Diploma and the Bachelor of Technology in Emergency Medical Care. In addition, because some BEMC programme lecturers are clinicians with no higher education experience, it may take some time to develop pedagogical strategies that ensure a student-centred approach to simulation teaching, learning and assessment.

Study strengths and limitations

The one strength of the study is that it was conducted in all four institutions that offer the BEMC degree in SA, making the findings applicable to all four institutions. While staff and students highlighted stress and anxiety as one of the reasons responsible for student underperformance in simulations, a future study should be conducted that objectively measures the students' stress and anxiety during simulations. The study should also include a control group of students during simulation training and during an assessment. Lastly, the study can consider having a control group that consists of assessors who are present in the venue, while assessors are absent in the other venue.

Conclusion

While clinical simulation is a useful educational tool for training health professions students in patient management, there are pitfalls that result in student underperformance. The students' perceived realism, such as the technology used, to affect performance. Simulations were perceived to be stressful, which might result in underperformance. There has been little improvement in simulation teaching and assessment in SA paramedic training. As the paramedic profession matures, the faculty needs to study further in simulation education and keep abreast with the latest simulation trends to enable authentic simulation engagements, thereby fostering true student performance. Paramedic programmes need to create pedagogical strategies that ensure a student-centred approach to teaching, learning and assessment so that clinical simulations are not a barrier but an enabler of student performance.

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