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Psychological safety during a large-scale simulation-based learning event

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ABSTRACT

Psychological safety (PS) is currently endorsed as best practice in simulated learning environments. PS refers to the belief that a student can express their ideas and concerns without fear of negative consequences. Students who participate in simulation-based scenarios often experience psychological distress during such events if they are immersed in an environment that is not psychologically safe. This phenomenon has been researched in the field of nursing during both the briefing and debriefing phases of simulation. The aim of this study was to determine the level of PS of emergency care students at a large-scale simulation rescue training exercise. A quantitative survey design was used on student participants at an annual rescue training exercise in 2021. Students who participated in a high-fidelity rescue event scored a mean PS score of 48.76. Reluctance to take interpersonal risks and fear of making mistakes in a team setting were identified as areas of concern. When PS is understood and improved, the learning experience for students will be enhanced and they will be able to participate without fear of humiliation.

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Introduction

PS forms part of the hidden curriculum in healthcare education and many educators often do not realise how this complex notion can enhance learning (Torralba, Jose & Byrne, 2020). PS in learning refers to a belief that a student can express his or her ideas or concerns without fear of negative consequences (Henricksen, Altenburg & Reeder, 2017; Jang & Park, 2021). In medical education, a sense of PS seems to free students from being self-conscious about projecting an image of competence (McClintock, Kim & Chung, 2022). It also allows the student to be present in the moment and to concentrate on the presented learning task (Tsuei, Lee, Ho, Regehr & Nimmon, 2019), such as during a simulation-based learning (SBL) event.

When simulation-based experiences are added to any medical teaching programme, attempts are made to authentically model reality for the student. This provides an opportunity for the student to acquire certain skills, engage in problem-solving, and attain an understanding of a phenomenon that they may encounter in their professional career (Lateef, 2020). It is, therefore, not surprising that creating a psychologically safe environment in an SBL is currently endorsed as the best practice (Kostovich, O'Rourke & Stephen, 2020). Authors even call PS the holy grail of SBL (Mukerji, 2021). Kostovich *et al*. (2020) indicate that students who participate in simulation-based scenarios can indeed experience psychological distress during these events (Lateef, 2020). Although not the focus of this study, it is worth noting that there are various documented behaviours of students which can contribute to increased feelings of psychological distress (Klenke-Borgmann, DiGregorio & Cantrell, 2022).

PS is an important concept for all educational settings, not only those that implement simulation-based training. Literature suggests that students in a psychologically safe environment demonstrate a willingness to express themselves physically, cognitively, and emotionally (Lateef, 2020; Perrmann-Graham, Liu, Cangioni & Spataro, 2022). In healthcare training, specifically, a lack of PS is said to lead to clinical errors (Henricksen *et al.*, 2017; Lateef, 2020). To ensure that a simulated experience is psychologically safe, PS should be included in all three phases of simulation (Mukerji, 2021), namely, Briefing, Scenario, and Debriefing. Currently, most literature explores PS in the briefing as well as the debriefing phases of medical simulation, but not in the scenario phase. There is also limited research on rescue scenarios that form part of the Emergency Medical Care (EMC) curriculum.

Background to the study

This study looked at the PS of emergency care students partaking in a large-scale SBL event that focused on rescue scenarios. In South Africa, emergency care training is offered through higher education (HE) institutions in one-year, two-year or four-year programmes. In the two-year diploma and four-year bachelor's degree programmes, different rescue modules form part of the respective curricula (Vincent-Lambert, 2019). Simulations are used to enhance practical teaching sessions of these rescue modules. Rescue simulations create life-like scenarios that require the use of technical rescue techniques to search for, access, treat, extricate, and transport a patient or victim. Rescue simulations allow for the teaching, assessment, and practice of approaches and techniques in several rescue disciplines. Such disciplines may include high angle, aquatic, confined space, trench, structural collapse, or motor vehicle rescue. The fidelity of these scenarios is increased by immersing the students in real-life urban or rural settings.

During the SBL large-scale rescue event, students work in austere or harsh rescue environments, in unfamiliar teams, and with facilitators whom they may not know. Furthermore, the nature of these events can be physically dangerous to the participants. Research on PS within simulation-based rescue exercises could not be traced. Hence this study focused on how students rate their own PS during these high-fidelity simulated rescue scenarios. By measuring the PS score during this rescue event, the study could allow facilitators and the event organisers an opportunity to improve the learning in areas that are identified as problematic. By doing so, a baseline PS score will serve as an important point of departure for creating an environment that supports the learning behaviour of students. Recognising the area where PS is lacking is an important first step towards creating future strategies that enable the full participation of students. Particular attention can be given to the areas that are identified as problematic. It is important to determine where students feel unsafe so that future SBL scenarios can be planned and adjusted accordingly and bring the professed benefits of SBL to fruition.

Literature review

This literature review aims to briefly explain the concept of SBL and the importance of PS. Attention is given to the four PS factors and how PS can be fostered in SBL events.

SBL

SBL is a rapidly advancing educational methodology that includes teaching, learning, and assessment pedagogies (Henrico & Oostdam, 2022). The professed benefits of SBL are well documented in the literature, especially the usefulness of SBL in increasing patient safety and preparing students for medical emergencies (Hadfield, Thompson, Hall & Diaz-Navarro, 2017). SBL is conducted in learning environments that mimic real-life events, and it makes use of experiential learning processes that focus on problem-solving approaches and should be supported by self-reflection and feedback (Park & Kim, 2021a) for effective learning to take place. Therefore, sufficient time is necessary for all three phases of simulation during the event. These phases are a pre-brief, scenario, and debrief (Mukerji, 2021). Careful planning and design are needed to ensure that these phases are facilitated seamlessly, and that the intended learning outcomes are achieved.

Due to the interactive and controlled manner in which SBL is conducted, it allows the student an opportunity to develop and enhance their knowledge skills and attitudes towards a specific event, as well as their critical thinking, clinical judgement, and clinical decision making (Vincent-Lambert, 2019; Henrico & Oostdam, 2022; Rickman, 2022; Slabber & Henrico, 2022). Ultimately, SBL improves the student's medical competence and confidence through multiple exposures to real-life events they may or may not come across in their clinical practice, without harming the patient (Hadfield *et al*., 2017; Slabber & Henrico, 2022). Literature suggests that SBL is underpinned by the principle of Mastery Learning, as it involves mastering certain skills during a necessary amount of time within a nurturing learning environment, while being expected to achieve competency at a predetermined level of performance (Lateef, 2020).

Despite the professed benefits of SBL, authors have noted that the perceived student stress level is often higher during simulation events in comparison to the perceived stress levels of students in a clinical practice situation (Ko & Choi, 2020; Slabber & Henrico, 2022; Stein, 2020). The heightened stress and anxiety of students could be attributed to performing in front of others (Ko & Choi, 2020) or to the fact that SBL is often performed in group settings (Roussin, Larraz, Jamieson & Maestre, 2018). Partaking in high-fidelity simulations in a team setting, such as a simulated rescue event, can add to the stress for students as they may be fearful of judgement, failure, embarrassment, negative evaluation, or being ridiculed or punished, and thus carry an increased cognitive load (Stein, 2020; Rickman, 2022). These negative feelings and emotions can affect the recalling of information and

reduce student engagement. Consequently, the learning that happens during these SBL events will be reduced (Ko & Choi, 2020).

Although the very nature of a simulated experience is stressful (Stein, 2020), facilitators should still strive to maximise the learning that happens during these simulated events. This is done by encouraging learning behaviours, such as asking questions, voicing concerns, freely sharing ideas, and asking for help (Park & Kim, 2021a). Literature suggests that these learning behaviours can only be guaranteed if the student feels psychologically safe (Lyman & Mendon, 2021; Roh, Jang & Issenberg, 2022). PS seems to form part of a hidden curriculum within health education and is a relatively unknown concept to many clinical educators, trainees, and facilitators (Torralba *et al*., 2020).

PS

PS is critical for increasing the students' engagement during an SBL event (Rickman, 2022). This complex construct refers to a belief that you can express yourself freely without being fearful of negative consequences or criticism. Often, in SBL events, speaking freely, giving a comment, or acting in a way you deem suitable might elicit negative reactions (Henricksen *et al*., 2017; Lateef, 2020). PS is concerned with the willingness of students to express themselves emotionally, cognitively, and physically while participating in the SBL event (Lateef, 2020). In essence, a psychologically safe environment allows the student to be their "true self" (Grailey, Murray, Reader & Brett, 2021).

In the 1990s, Amy Edmondson unintentionally discovered the value of PS health organisations and healthcare teams (Rickman, 2022). She concluded that if members from a healthcare team feel psychologically safe, they freely report medical errors, as they are not fearful of being shamed or retributed against (Edmondson, 2018). PS is a precursor for improved patient safety and higher quality of care (Park & Kim, 2021a). In contrast to this, a lack of PS has been linked to clinical errors (Lateef, 2020).

There seems to be a paucity of studies that focus on empirical evidence that demonstrates the impact of PS on learning outcomes in medical education specifically. In a systematic review conducted by Edmondson & Bransby (2023), it is clear that learning behaviours are a prominent theme in PS literature. These authors state that PS is particularly important for learning behaviours

that include knowledge transfer, knowledge sharing, creativity, and speaking up. In a study conducted by Tsuei *et al.* (2019) it is concluded that PS allows students to focus on learning without fear of judgement, thus facilitating knowledge acquisition (Tsuei *et al*., 2019). PS also enhances communication, teamwork, and student engagement (Torralba *et al.*, 2020; McClintock *et al*., 2021). By enhancing effective communication, teamwork, and learning, PS also enables learners to focus on the present moment and engage with the learning task at hand, thus enhancing skills development (Tsuei *et al*., 2019; Ting & Chen, 2023).

It is important to note that PS is not only important for SBL, healthcare organisations and teams, but is also applicable to many other education settings and organisations (Carrera, Naweed, Leigh, Crea, Krynski, Heveldt, 2018; Torralba *et al*., 2020; McClintock *et al*., 2022; Perrmann-Graham *et al*., 2022). Google ("Project Aristotle"), amongst other corporate companies, have also explored and implemented this concept with great success (Grailey *et al*., 2021). This highlights the applicability in various teamwork settings.

The value of PS

As mentioned, learning environments that foster and achieve PS will allow the students to take risks, to feel valued and comfortable speaking up without fear that there will be consequences to themselves or the team, and by doing so promote learning and foster a culture of improvement (Rickman, 2022). When feeling psychologically safe the student will be able to fully engage with the learning event or task due to the belief that they will not be rejected or humiliated. PS promotes an environment where students feel free to express themselves, share work-related thoughts, and where feelings are important (Lateef, 2020). This environment has been called a "safe container for learning" (Rudolph, Raemer & Simon, 2014).

In this safe container, students can make well-intentioned mistakes, team members will not think less of them, and they do not fear the possibility of being resented or penalised for asking for clarity, feedback, and/or additional information. A "psychologically safe container" will allow students to take interpersonal risks and not only focus on self-perseverance and protection (Lateef, 2020), or "knowledge-hiding" (Edmondson & Bransby, 2023). Learners will personally experience a psychologically safe learning situation as non-threatening, positive, and non-judgemental (Madsgaard, Roykenes, Smith-Strom & Kvernenes, 2022). Additionally, students feel that they can be themselves, that they can trust the treatment plan of their peers, and can allow room for errors

without fear of negative consequences. It should be noted that not only will PS have a positive effect on learning and learning behaviour, but some studies have indicated a possible negative effect on learning (Edmonson & Bransby, 2023). PS has been shown to reduce motivation to work (Deng, Leung, Lam & Huang, 2019) in students. Lackie, Hayward, Ayn, Stilwell, Lane, Andrews, (2023) state that often the barrier to PS is hierarchy, uncertainty, being observed, and simulation design and delivery that is not conducive to PS. These design delivery barriers included simulations for assessments, time constraints, not knowing what to expect when entering the simulation venue, misdirection by confederates, and variability in debriefing skills (Lackie *et al*., 2023). Many of the identified barriers are often embedded in rescue SBL scenarios.

PS can be affected by various facets in the learning and or team environment. Park and Kim (2021b) have identified four factors that will influence the PS of student in SBL events. These are: (1) dealing with uncertainty, (2) a fear of being exposed, (3) feeling supported, and (4) interpersonal risks. These factors provide a concise summary of the facets that might impede PS in learning environments and are important for all three phases of the SBL event.

Dealing with uncertainty

Often in SBL events, students experience that they are thrown into an unfamiliar academic or clinical environment and in a team setting where they are unfamiliar with others (Roussin *et al*., 2018). This unfamiliarity will negatively affect the perceived PS of students. This could be addressed by conducting a detailed, planned pre-brief (Roh, Ahn, Kim & Kim, 2018). But, despite participating in a pre-brief or an orientation before the SBL event, students might still find it difficult to understand the clinical implications of the SBL content (Park & Kim, 2021b).

Being exposed

Students often observe the negative or judgemental expressions of facilitators and peers. Although they might not be doing anything wrong, they still experience a fear of being exposed for their actions (Park & Kim, 2021b). Students will then be overly concerned and not concentrate on the SBL event (Rickman, 2022). Being mindful of this, and assuming that all actions leaners take during the SBL event are well-intentioned actions, could reduce this feeling of being exposed (Rudolph *et al*., 2014).

Being unsupported

Allowing students to feel supported is often achieved through respectful and constructive feedback delivery (Park & Kim, 2021b). This factor mirrors the students' perceived psychological state and relates to the anxiety and fear associated with receiving negative feedback (Rickman, 2022). Feeling unsupported relates to academic safety between students and peers, and students and facilitators (Lateef, 2020).

Interpersonal risk

When students take interpersonal risks, the team fosters a psychologically safe environment. Carefully forming relationships between team members, forming a comfortable atmosphere, and nurturing each other through a caring conversation will allow the team to achieve a common goal in the SBL (Park & Kim, 2021b). When these relationships are not nurtured, students will be hesitant to share their own ideas due to the fear of negative responses and rejection (Rickman, 2022).

Achieving PS

As an SBL facilitator, the goal is to avoid PS barriers that reduce learning. Previous research indicates that students experience negative psychological states such as stress and anxiety when they are afraid of making mistakes (Kang & Min, 2019), are afraid to perform in front of peers and facilitators (Rudolph *et al*., 2014), worry about negative critique from peers and facilitators (Roh *et al*., 2022), and when they are placed in unfamiliar SBL environments (Kang & Min, 2019). These issues will result in a reduced willingness to learn and perform well (Park & Kim, 2021b).

The main enablers for a psychologically safe environment are a pre-brief and debrief done by trained facilitators, designing aspects of PS into the SBL event through evidence-based simulation designs, and establishing a no-blame culture (Rudolph *et al*., 2014; Roh *et al*., 2018; Ko & Choi, 2020). This is typically done by creating a shared mental model of what is expected during the SBL event, preparing students for the simulation, and setting ground rules for all phases of the SBL event (Rickman, 2022). Additionally, SBL educators should avoid hierarchies within teams, and try to eliminate the fear of making mistakes and a feeling of uncertainty, as these are seen as PS barriers (Lackie *et al*., 2023). Facilitators should support the PS of students by creating a respectful, supportive, confidential, non-punitive, and non-threatening learning environment (Rickman, 2022).

PS is seen as a key element of successful teams in most environments (education, business, and medicine) (Torralba *et al*., 2020).

PS seems to be a group occurrence, and not an individual personality trait (Edmondson, 2018), that should be cultivated by the collective. Also, what facilitators perceive the PS levels of the students to be is often substantially different from what the students experience their PS to be (Ganley & Linnard-Palmer, 2012). Students often mention that the SBL event was difficult and stressful (Stein, 2020). It is therefore important to understand the PS level of students as this will allow SBL facilitators to improve the SBL learning environment, encourage the much-needed learning-orientated behaviour and reap the rewards a PS learning environment has to offer (Rickman, 2022).

As indicated in this literature review, current literature has identified what PS is and why it is important for optimal learning to take place in an SBL event. Authors have indicated what enables and what discourages a psychologically safe environment. The importance of PS in SBL is well-documented in the literature (Rickman, 2022).

Methods

This study followed a quantitative survey design by distributing the PS in High- Fidelity Simulation Scale (Park & Kim, 2021b) to students. The study took place at the <HIDDEN FOR PEER REVIEW> during an annual, week-long SBL rescue training event in 2021. During this rescue event, EMC students were exposed to five different simulated rescue scenarios, on a rotational basis. Several EMC role players attended the exercise, including students and facilitators from four HE institutions and provincial emergency services. The environments in which these simulated scenarios take place are specific to the scenario to ensure a high level of fidelity.

Study Population and Sample

Students from the <HIDDEN FOR PEER REVIEW> were involved in the exercise. A total of 35 students participated in this event (N=35). All students were asked to partake in the study. Only consenting students formed part of the sample (n=25).

Data Collection Procedure

Data were collected by means of the PS in High-Fidelity Simulation Scale (Park & Kim, 2021b). Due to the small population size, gender, age, race, and ethnicity were not included as these would have posed a risk to the anonymity of participants. Approval to conduct this study at the rescue training exercise was sought from the Research Ethics Committee of the University of Johannesburg, Faculty of Health Sciences (Ethical Clearance number: REC-1175-2021). Permission to recruit participants for this study was sought from the Head of Department (HoD) for each participating university before the commencement of the study. On the day of arrival at the rescue exercise (a day prior to the commencement of the rescue scenarios), the researcher, who does not teach the students and who does not have any influence on the scenarios, approached the students. An information letter and consent form were handed to prospective participants. The purpose of the study and what was expected of the individuals who wished to partake in the study were explained.

During the rescue scenarios, students are divided into groups and each group rotates through five scenarios. Once the groups are established, students stay in the same group for the whole rescue training event. Each group would participate in a maximum of two scenarios per day. The five rescue scenarios included: a (1) field hospital (where all patients of the other four scenarios were received and treated), (2) a high-angle extrication at a dam wall, (3) an aquatic search and rescue in the dam, (4) a quarry scenario that required students to access, treat, and extricate a patient, and (5) a fire search scenario that consisted of accessing, extricating and treating a patient within the dam wall, followed by patient transport off the dam.

Each consenting student was given a printed survey before the debriefing session of each scenario and was requested to complete the survey for each scenario. All surveys were then collected after the debriefing of each scenario. Worth noting is that the facilitators are assigned to a specific rescue scenario for the duration of the rescue training exercise, and they facilitate the same scenario repeatedly over the course of the event. Due to the complexity and real-life danger associated with rescue scenarios, facilitation was done in a team. There were between three – seven facilitators assigned to a scenario. Students may or may not be familiar with the SBL facilitator. Each facilitating team had experience in SBL learning and was responsible for the pre-brief, support during the scenario, and the debrief.

Data collection instrument

The PS in High-Fidelity Simulation Scale has already been validated and proven to be a reliable measuring instrument during high-fidelity simulations (Park & Kim, 2021b). This scale is the first reliable and valid tool to measure PS during high-fidelity SBL events (Rickman, 2022). The scale consists of 14 Likert scale statements that measure the perceived overall PS. This scale is divided into the four identified PS subscales. Survey questions 1 – 4 address factor 1, dealing with uncertainty; questions 5 – 8 address factor 2, being exposed; questions 9 – 11 address factor 3, being unsupported; and questions 12 – 14 address factor 4, interpersonal risk (Park & Kim, 2021b). The possible PS score ranges between 14 – 70, with a higher score associated with a higher perceived state of PS (Park & Kim, 2021b; Rickman, 2022).

Statistical analysis

The data from the PS in High-Fidelity Simulation Scale was captured into Microsoft Excel®. Since a higher score indicated a higher perceived PS level, the responses were measured using a five-point scale, with 1 = “Strongly Agree” and 5 = “Strongly Disagree”. Accuracy checks were done by the researcher. Questions 12 and 13 are positively worded and were therefore subjected to reverse scoring after the responses for each statement had been calculated (Table 1).

As indicated by Park & Kim (2021), the data was grouped into the suggested four factors of PS. Standard frequency analyses were conducted on each of the identified factors. The mean overall PS score of each scenario, each factor, and the mean overall PS score of the rescue event were determined. Individual mean PS score distributions were also calculated.

Results

A total of 25 students participated in this study and completed the PS survey for all five rescue scenarios (n=125). To ensure the anonymity of the respondents, biographical data were not collected for this study. Table 1 summarises the survey responses for each question of the PS in High-Fidelity Simulation Scale.

Table 1: Survey Responses

	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree		Mean	SD
Questions	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*		
1. I feel frozen in place due to being nervous during the simulated scenario.	44	35.2	53	42.4	8	6.4	19	15.2	1	0.8	2.04	1.050
2. I am afraid I would make mistakes during the simulated scenario.	26	20.8	35	28.0	7	5.6	45	36.0	12	9.6	2.86	1.362
3. I feel like I am thrown into the simulated scenario unprepared.	32	25.6	55	44.0	21	16.8	15	12.0	2	1.6	2.20	1.014
4. I feel anxious that I will not finish the simulated scenario on time.	25	20.0	45	36.0	10	8.0	40	32.0	5	4.0	2.64	1.234
5. I do not want others to evaluate me during the simulated scenario.	38	30.4	61	48.4	13	10.4	12	9.6	1	0.8	2.02	.954
6. I feel anxious that my peers see my emergency care performance.	24	19.2	63	50.4	12	9.6	24	19.2	2	1.6	2.34	1.053
7. I lose focus often due to the idea of being watched.	31	24.8	46	36.8	16	12.8	28	22.4	4	3.2	2.42	1.194
8. I feel cornered when my peers evaluate me.	26	20.8	54	43.2	21	16.8	21	16.8	3	2.4	2.37	1.065
9. I fear what the facilitator will say when (s)he gives me feedback on my performance.	32	25.6	48	38.4	14	11.2	24	19.2	7	5.6	2.41	1.233
10. I feel worried that the facilitator will point out my mistake.	35	28.0	61	48.8	4	3.2	22	17.6	3	2.4	2.18	1.095
11. I feel anxious that I will be criticized by the facilitator for my mistakes.	31	24.8	40	32.0	16	12.8	33	26.4	5	4.0	2.53	1.235
12. My peers will not criticize me for my mistakes.	15	12.0	50	40.0	35	28.0	20	16.0	5	4.0	2.60	1.017
13. I do not feel ashamed of showing my peers my mistakes.	12	9.6	39	31.2	16	12.8	36	28.8	22	17.6	3.14	1.322
14. I feel worried that my peers will tell each other about my mistakes after the simulation-based learning is over.	22	17.6	40	32.0	20	16.0	33	26.4	10	8.0	2.75	1.249

When looking at the individual questions, Questions 2, 12, and 13 seem to indicate a PS dilemma. Participants agreed with the statement of being afraid to make mistakes during the simulated scenario in Question 2. The fear of making a mistake is directly linked to a lowered perceived PS level. Also, Questions 12 and 13 are negatively worded questions, and if a student felt psychologically safe, one would assume that they would answer 'agree' or 'strongly agree'. Most of the participants answered 'disagree', hence the common response was not favourable towards PS.

Worth noting in this table is the small difference between 'agree' and 'disagree' in Questions 4, 11, 13, and 14.

As mentioned earlier, each student grouping had to participate in: a (1) field hospital (where all patients of the other four scenarios were received and treated), (2) a high-angle extrication at the dam wall, (3) an aquatic search and rescue in the dam, (4) a quarry scenario that required students to access, treat, and extricate a patient, and (5) a fire search scenario that consisted of access, extrication, treatment and transport of a patient within the dam wall. Facilitators and event organisers included structured pre-brief and debrief sessions for all scenarios through which the students rotated. Figure 1 presents the overall mean PS score per scenario, as well as the mean PS score for the entire event.

The total obtainable score for the PS in High-Fidelity Simulation scale ranges from 14 to 70 (Park & Kim, 2021a). A higher score indicates a higher level of PS in SBL experienced by a student (Rickman, 2022). The middle point between 14 and 70 is 42. The researcher, therefore, considered any PS score below 42 to indicate a low level of PS and a score above 42 to indicate a relatively acceptable level of PS. The overall mean PS score of the rescue exercise is 48.76 (SD = 9.78). The mean PS score for the Aquatic scenario was the highest at 50.32 (SD = 10.24), followed by the Field Hospital (49.4; SD = 10.23), the Quarry (49.04; SD = 10.53), and the Fire search at 48.84 (SD = 7.02). The Dam Wall scenario scored the lowest at 46.2 (SD = 10.91). There is not a significant difference in the mean PS score of the scenarios, except for the Dam Wall.

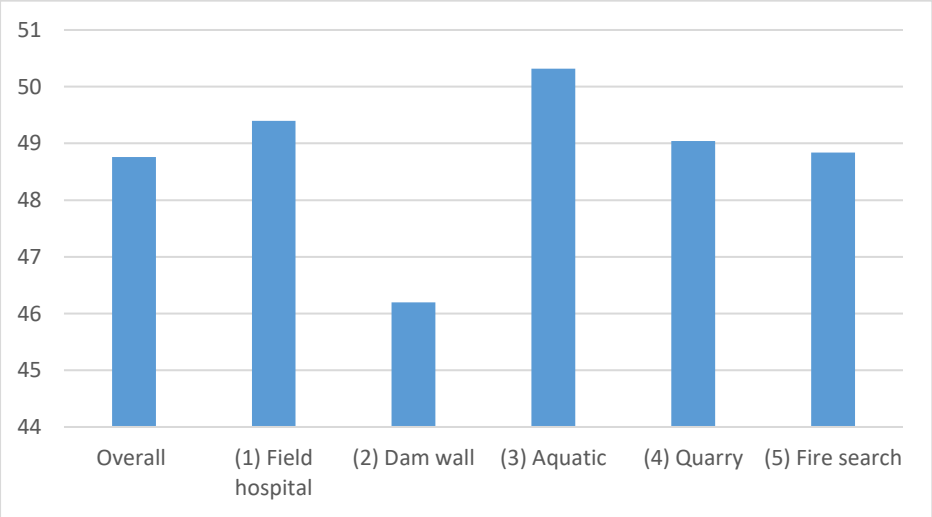

Figure 1: PS scores

The standard deviation across all scenarios seems to indicate a widely dispersed sample. When looking at the individual mean PS score of participants, the scores range from 24 to 68. The variation

in the individual scores might be attributed to the small differences between 'agree' and 'disagree' for some questions, as seen in Table 1. As mentioned, the possible PS scores range from 14-70, with 42 indicating the midpoint. Figure 2 shows the survey responses calculated in score quadrants. Four participants scored between 14-28 (quadrant 1), 28 in quadrant 2 (28-42), 67 in quadrant 3 (42-56) and 26 scored in the upper quadrant of 56-70. Although the overall mean PS score for the rescue event and each scenario indicate a positive PS score, this breakdown shows that 32 respondents are still at risk of feeling psychologically unsafe.

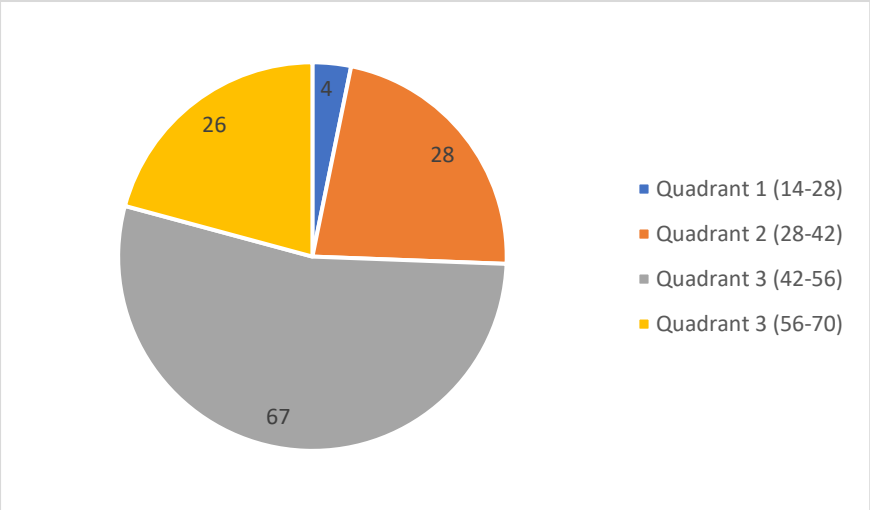

Figure 2: Individual mean PS score

PS Factor score

Survey questions 1 – 4 address factor 1, dealing with uncertainty; questions 5 – 8 address factor 2, being exposed; questions 9 – 11 address factor 3, being unsupported; and questions 12 – 14 address factor 4, interpersonal risk (Park & Kim, 2021b). These factors comprise interactions during the learning process. The first of these focuses on the process between the instructor and the student, and factor 4 the interaction between the students that are working in a team. Table 2 contains the frequencies of the results per factor statements.

Table 2: Frequency table for responses grouped in factors

	Factor 1		Factor 2		Factor 3		Factor 4	
Strongly disagree	127	25%	117	23%	94	25%	48	13%
Disagree	189	38%	226	45%	142	38%	97	26%
Undecided	47	9%	62	12%	35	9%	71	19%
Agree	117	23%	85	17%	85	23%	122	33%
Strongly agree	20	4%	10	2%	19	5%	37	10%

Generally, study participants felt psychologically safe for factor 1 (dealing with uncertainty), factor 2 (being exposed), and factor 3 (being unsupported). However, factor 4 (interpersonal risk) indicates issues with PS and taking risks within a group dynamic.

PS by scenario

Factors 1 and 2 both have a possible mean score of 20, and factors 3 and 4 have a possible mean score of 15. It is generally accepted that a higher score in each of these subsets translates to higher levels of PS in each respective area (Park & Kim, 2021a; Rickman, 2022). The overall mean PS scores for each factor are illustrated in Table 3.

Table 3: Mean PS and factor score per scenario

	Field hospital	Dam wall	Aquatic	Quarry	Fire search
Factor 1 *Dealing with uncertainty*	14.4 *(SD=3.88)*	12.96 *(SD = 3.44)*	14.8 *(SD = 3.12)*	15.08 *(SD = 3.35)*	14.2 *(SD = 3.03)*
Factor 2 *Being exposed*	14.9 *(SD = 3.46)*	14.32 *(SD = 3.51)*	15.16 *(SD = 3.31)*	14.52 *(SD = 3.98)*	15.28 *(SD = 2.6)*
Factor 3 *Being unsupported*	11.36 *(SD = 3.03)*	9.96 *(SD = 3.38)*	11 *(SD = 3.27)*	10.6 *(SD = 2.78)*	10.36 *(SD = 1.41)*
Factor 4 *Interpersonal risk*	9.72 *(SD = 2.5537)*	*8.96 (SD = 2.72)*	9.36 *(SD = 2.398)*	8.84 *(SD = 2.36)*	9 *(SD = 2.57)*
Total PS score	49.4 *(SD =10.23)*	37.8 *(SD =10.8972)*	50.32 *(SD =10.24)*	49.04 *(SD =10.53)*	48.84 *(SD =7.02)*

The Dam Wall scored the lowest for factors 1, 2, and 3. The Quarry scored the lowest in factor 4. The Quarry scenario scored the highest in factor 1, Aquatic scored the highest in factor 2, and the Field Hospital in factors 3 and 4.

Discussion

This study aimed to measure the PS of students participating in high-fidelity simulation-based rescue scenarios during a large-scale simulation rescue training event in South Africa. By measuring PS, studies such as these will help facilitators identify the psychological states of students and serve as a relevant point of departure in creating a psychologically safe learning environment that could improve a student's clinical competency (Park & Kim, 2021a), especially as this study assisted in identifying where participants might experience PS issues.

The facilitators at this SBL rescue event did include a structured pre-brief, offered support during the scenario phase of the SBL event, spent adequate time during the debrief to address the learning intent of the event, provided feedback on the teams' and individual students' performances, and answered questions the students might have had about the scenario. With these vital PS enablers (Roh *et al.*, 2018; Ko & Choi, 2020; Lackie *et al*., 2023) in place, it is not a surprise that the overall PS score for this study (48.76) was higher than the midpoint of the scale (42), indicating a higher level of PS.

Two studies were traced that used the same PS instrument on nursing students; the overall PS score for pre-licence nursing students was 45.5 (Rickman, 2022) and for third- and fourth-year nursing students were 36.24 and 39.75 (Park & Kim, 2021a), respectively. Students who participated in the large-scale simulated rescue exercises scored higher than the students from these other studies and their scores (overall and for each scenario) are in the top half of the PS scale (above 42). Although low PS in simulated scenarios is associated with anxiety, stress, distrust, fear of making mistakes, and a feeling of "being watched" (Klenke-Borgmann *et al*., 2022:1), scoring higher on a PS scale does not automatically indicate the absence of these issues. It could, however, explain why some students are able to focus better on the rescue scenario with which they are faced, rather than protecting the self (Klenke-Borgmann *et al*., 2022). As seen in the literature, when students feel psychologically safe, they will have higher self-confidence, improved learning outcomes, and a sense of satisfaction (Roh, Jang & Issenberg, 2021). Additionally, a limited, psychologically unsafe environment may diminish learning motivation, but healthy anxiety within a PS environment may help to maintain competency (Park & Kim, 2021b).

The Aquatic scenario scored the highest of all the scenarios. During this scenario, the team were transported by boat, where they were expected to search for the patient. This boat trip took some time, during which it is worth noting that the team spent a good while talking through the possible scenario, assigning roles, and discussing what they might find. This could have fostered the feeling of being able to succeed in the team setting (Roussin *et al.*, 2018).

The Quarry and the Fire search scenarios presented the students with the most unfamiliarity. During both these scenarios, students were required to search for their victim in an unfamiliar environment, with the fire search being the most difficult as it presented with smoke that reduces visibility. During the fire search scenario, students often got lost in the dam wall and had to start from the beginning

again. This unfamiliarity could contribute to a lower PS score (in comparison to the aquatic scenario) in these scenarios. This is in line with current literature that emphasises the need for students to be familiar with their SBL environment (Lackie *et al.*, 2023). In unpredictable and intimidating environments, such as the fire search and quarry rescue scenarios, students may perceive full engagement as risky and unsafe (Rickman, 2022). Unfortunately, an EMC graduate will not always be familiar with the scene to which they are called out (Vincent-Lambert, 2019), and these scenes are often physically dangerous and risky.

The scenario that scored the lowest in this rescue event was physically the most dangerous. During the dam wall scenario, students needed to hoist a team member down the side of the dam wall to treat a patient at the bottom. Ensuring that everything is set up correctly before lowering the member is vital. Using SBL to expose students to dangerous situations can assist students to overcome the PS dilemma of unfamiliarity and danger and is vital in graduating successful pre-hospital personnel, especially in the rescue environment.

Authors from previous studies using the same PS scale agreed that if students had multiple exposures to simulations (six or more) they should have a higher PS score (Park & Kim, 2021a; Rickman, 2022). Worth noting is that students who participated in this study were all in their third year and have had numerous (more than six) exposures to simulated scenarios. They would also experience increased exposure to these types of scenarios as the event progresses. This could explain the small variance in the PS score per scenario, as some scenarios were unfamiliar to students and others were not.

This study, as well as Rickman's (2022) study, showed high standard deviation scores. The widely dispersed scores might indicate that PS is a score unique to each individual. Participants in this study had PS scores that ranged from 24 – 68. Although PS seems to be a team construct (Roussin *et al*., 2018), educators and facilitators should still focus on how each individual perceives his/her PS state. It is noteworthy that 32 individual responses indicated a PS score lower than 42, with four of these scoring in the lowest quadrant of the possible PS score. Although the overall PS score for the event was relatively high and facilitators did try to foster PS, some participants still felt physiologically unsafe.

Additionally, the higher PS score might be attributed to the unique dynamics of the rescue event. The participants were part of a week-long rescue training exercise that included various EMC role

players; these included four HE institutions and provincial emergency services. Students were grouped into teams with students from other universities and had to rotate through the scenarios that were facilitated by lecturers from another university. Literature clearly identifies the impact of teams and the working of teams on PS (Roussin *et al.*, 2018). Additionally, the austere environment in which these simulated scenarios took place ensured the highest possible environmental fidelity. Although students had experience in simulated scenarios, the rescue event was their first exposure to real-life scenarios, in real environments, and with an unfamiliar team.

It is, therefore, no surprise that Questions 2, 12 and 13 seem to indicate areas where PS levels might be lower. Question 2 asked if participants were afraid to make mistakes during the simulated scenario, Question 12 asked if participants felt that their peers would not criticize their mistakes, and Question 13 asked if participants would feel ashamed to show their peers their mistakes. The questions that did not show a big difference between 'agree' and 'disagree' were concerned with showing mistakes and being ashamed of being perceived as being incompetent. Making mistakes with peers with whom you are familiar might be easier than making mistakes when you are unfamiliar with your group members and facilitators (Klenke-Borgmann *et al.*, 2022).

This study also explored the differences in PS factors as defined by Park and Kim (2021). Due to the unique set-up of this rescue event, it is no surprise that Factor 4 (interpersonal risk) indicates areas where improvement is needed. Interpersonal risks seem to be the essence of PS (Klenke-Borgmann *et al*., 2022). As with the questions that were deemed problematic for PS, this subscale focuses on PS while working in a team. Participants who feel psychologically unsafe in this subscale might not feel safe to take interpersonal risks within the team and might not speak honestly during the scenario and debrief (Rickman, 2022). This could be improved by emphasising professionalism and respect for team members during the pre-brief of the SBL event (Rickman, 2022). Additionally, it is recommended to have a team-building session that encourages participants to take risks and speak up before the start of an SBL team-based event.

PS is indeed a complex notion. Although all scenarios in this study scored above the 42 midpoints, some scenarios scored lower than others on certain factors. To fully understand the perceived PS states of students, not only the overall PS score should be considered. Comparing the PS factors provides valuable insight into the hidden curriculum of PS.

A limitation of this study was that, due to the need for constant changing of group members to provide exposure to a real-life situation, the comparison could only be made between scenarios with the assumption that teams had similar levels of experience. Since the study used a relatively small sample, the results can also not be generalised to all simulated rescue scenarios. However, the study provides information about the individualised nature of PS within a group of students. Future research could track the PS of each team to see how they scored for each scenario, as well as PS at SBE events from the facilitators' perspective.

Conclusion

This study indicated that students who participated in the high-fidelity rescue event scored relatively high on the PS scale. Although a complex concept, PS seems to be an individualised phenomenon that is affected by working in a team. Understanding the effect of PS on each person, and why certain students score much lower than others, needs further investigation.

Fostering PS during educational events helps participants avoid feelings of being belittled, scorned, and laughed at. In any educational setting, whether SBL, clinical learning or a formal class setting, students will form a community, of which the educator or facilitator will be a part. Being mindful of PS dilemmas, barriers, drivers, and individuality could enable the facilitator to design educational activities that allow for a higher level of PS, even on an individual level. This should allow the students to engage in behaviours that facilitate learning, such as asking questions, voicing concerns, and giving peer feedback. Establishing a no-blame culture, breaking down the hierarchy amongst team members, reducing the fear of making mistakes, and allowing students to be familiar with the team and the environment are important starting points to allow students to fully engage in the SBL event. As with the outcomes of higher PS in medical teams, allowing students to feel psychologically safe and to fully engage in the learning process could graduate in a psychologically safe workforce that understands and appreciate this dynamic and complex notion that will continue to change and evolve.

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