ORIGINAL RESEARCH

The satisfaction with simulation experience scale (SSES): A Validation Study

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Abstract

Objectives: Simulated learning environments are a vital component in paramedic education. Therefore having instruments such as the Satisfaction with Simulation Experience Scale (SSES) with strong measurement properties to use in educational research studies is important. Only one study has reported on the psychometric properties of the SSES previously. To investigate the factor structure of the SSES when completed by a group of undergraduate paramedic students from a large Australian university.

Methods: Data from the SSES completed by second and third year undergraduate paramedic students were analyzed with Principle Components Analysis (PCA) with Varimax rotation.

Results: A total of (n=167) undergraduate paramedic students participated in the study. The majority of the participants were female 58.7% (n=98) and aged < 26 years of age 80.2% (n=134). PCA of the 18 items revealed 3 factors with eigenvalues above 1, accounting for 55.5% of the total variance. Items with loadings greater than ± .40, with the factor in question were used to characterise the factor solutions.

Conclusions: Findings from the PCA provide preliminary results that the SSES has adequate construct validity and reliability. This offers those involved in paramedic education involving simulation with a practical and usable instrument.

Key words

Simulation, Undergraduate education, Reliability, Construct validity, Factor analysis

1 Introduction

Simulated learning environments (SLEs) are an essential link for healthcare educators between the virtual world of teaching and the physical world of the patient. SLEs offer a safe environment to learn and rehearse psychomotor skills, team co-ordination, communication skills and other patient care skills. While SLEs can be orchestrated in different forms[1], they can be widely defined as the recreation of a clinical scenario which mirrors real life for the purposes of education [2]. While the effect of SLEs on educational outcomes is a vital research area, student satisfaction with SLEs cannot be overlooked as satisfaction has been shown to be instrumental to active and meaningful learning [3]. As such, it is essential to develop and validate instruments to evaluate paramedic student satisfaction with SLEs.

The ability for paramedic students to learn and practice clinical skills in a controlled environment before they are required to practice on patients has become particularly important since the move from vocationally-based training to higher education. Qualified paramedics are required to rapidly deliver high level clinical skills and diagnostics while drawing on expertise from a broad range of medical disciplines in often sub-optimal and uncontrolled environments [4]. With recent advances of out-of-hospital capabilities and expectations, it has become increasingly difficult to expose and educate students to a competent level with only limited clinical placements available to reinforce classroom theory. As such, SLEs have become increasingly popular adjuncts for those involved in out-of-hospital education and training [5]. Therefore, given the importance being placed on simulation, having instruments that measure simulation attitudes, and experiences is clearly important. To the best of our knowledge, no such scales exist for the out-of-hospital educational sector.

In Australia, paramedic education SLEs usually consists of a group of persons acting as patients, bystanders or paramedics. The patients act out the symptoms of a particular presentation, while the paramedics perform an assessment and provide the appropriate management. This format allows the patients to represent clinical presentations thus consolidating their knowledge of clinical symptomology, provides an opportunity for the paramedics to practice their diagnostic procedures, clinical skills and patient management, and any observers can view and constructively critique both. The paramedic students involved in this study use a range of SLEs. For example, they are exposed to a combination of low to medium fidelity level mannequins, trauma simulation bays, and computer-based simulation programs. These SLEs are provided to all year levels of the paramedic program.

SLEs can provide numerous benefits to both students and teachers. According to a survey of paramedicine heads of school, SLEs benefit students by improving their confidence, clinical reasoning and judgement, competence, and preparation for autonomous work, as well as benefiting teachers by providing a superior opportunity to assess students in a safe environment [4]. Several studies have also proposed that SLEs have the potential to aid in the reduction of medical errors [7, 8]. In addition it been suggested that SLEs better prepare students for clinical placements, which results in a more productive experience for the students and practitioners [9]. Furthermore SLEs provide opportunities to both students and practitioners which clinical practice or placements cannot consistently offer, such as the repetitious skills maintenance of the treatment of complex, critical, or rare situations [10].

In addition to the benefits SLEs provide paramedic education, they are becoming a necessity due to the difficulties of arranging and undertaking clinical placements. It has been widely reported that there is a lack of available clinical placement opportunities for undergraduate students [11, 12]. In addition such placements are often expensive for students who have to pay their own travel and accommodation costs and there is no guarantee of quality cases or instruction. While SLEs would not be able to replace placements, they offer a low cost opportunity to learn and practice clinical skills in a realistic environment. This was affirmed in one recent prospective study where a cohort of paramedic students noted that they believe SLEs could replace certain components of clinical placements [13].

The vast majority of literature concerning the effectiveness of SLEs in health care education concerns medical populations with only a very small percentage relating to paramedicine [4]. While one valid study has proved the effectiveness of SLEs on teaching both technical and non-technical skills to paramedics [14] a recent literature review concluded that most of the available paramedic-focused studies are unreliable due to poorly designed methodologies [4], and another highlighted that the validity of many of the instruments used to evaluate the effectiveness of SLEs have never been established [15]. There does however exist a significant body of literature concerning student perceptions of SLEs, with the vast majority of students and studies reporting positive perceptions [4].

The Satisfaction with Simulation Experience Scale (SESS), which is the focus of this study, was originally developed by Levett-Jones et al. to examine the differences in satisfaction between nursing students utilizing medium and high fidelity mannequins in SLEs [6]. Their study found the scale internally reliable and valid for use with 2nd and 3rd year nursing students at an Australian university. Determining the validity of this scale for paramedic students would allow evaluation of SLEs in paramedic education, thus providing a tool to increase student acceptance of SLEs and therefore enhancing the benefits of SLEs.

The purpose of this paper is to examine the factor structure of the SSES when completed by a group of undergraduate paramedic students from a large Australian university.

2 Method

2.1 Design

A cross-sectional study using a paper-based version of the Satisfaction with Simulation Experience Scale (SSES) was administered to second and third year students from an undergraduate paramedic course during the final weeks of semester two 2011.

2.2 Participants

All undergraduate paramedic students enrolled on one campus at an Australian university were eligible to participate. At the conclusion of tutorials students were invited to participate in this study. Participants were provided with an explanatory statement and informed that participation was voluntary and anonymous. A non-teaching member of staff facilitated the process and participants completed a questionnaire containing the SSES and a brief set of demographic questions, which took approximately ten minutes to complete. Consent was implied by completion of a questionnaire.

2.3 Instrumentation

The SSES is a newly developed 18-item scale that measures students' satisfaction with simulation [6]. Participants rate their level of agreement with each item on a 5-point Likert scale (1=strongly disagree – 5=strongly agree). The SSES was originally developed by nursing researchers; however the SSES is generic in nature, allowing replication studies and further validity assumptions to be tested using other health-related disciplines. The authors of the SSES found the scale to be valid (3-factor solution) with satisfactory internal consistency (0.77) [6]. No items are reversed scored.

2.4 Procedures

Participants were informed about the study via an explanatory letter prior to completing the questionnaire. There were no exclusion criteria. Participants were advised of the anonymous and confidential nature of the study and that they could withdraw from the study prior to submitting the questionnaire. Ethical approval was obtained from the university ethics committee. Anonymity was provided for the student participants since they were not required to put any identifying information on the questionnaire and the data was analysed on a group basis. No incentives or follow-ups were undertaken.

2.5 Data analysis

The Statistical Package for the Social Sciences (SPSS; Version 18.0) was used for data storage, tabulation, and the generation of statistics. Descriptive statistics means and standard deviations were used to summarise the demographic and SSES data. Inferential statistics using independent samples t-test were used to compare the difference between year levels and gender. Initial analyses were conducted to ensure there was no violation of the assumptions of normality, linearity, multi-collinearity, and homoscedasticity. The effect sizes were calculated to evaluate the findings results are considered statistically significant if the p value is $< .05$. The data were also analysed using Principal Components Analysis (PCA) followed with Varimax Rotation.

3 Results

3.1 Participant demographics

A total of n=167 students participated in this study. This represents a response rate of 69%. The background of the participants is described in relation to year level, gender, and age. There was good distribution between both year levels (2nd years 53.9% versus 3rd years 46.1%). Of the 167 participants involved in the study the majority of participants (80.2%) were < 26 years of age n=134, and female (58.7%) n=98. The complete distribution of demographic data is reported in Table 1.

Table 1. Distribution of demographic data

Variable	Descriptor	N	Percentage (%)
Year Level	2nd year	90	53.9
	3rd year	77	46.1
Age	< 21 years	48	28.7
	21-25 years	86	51.5
	26-30 years	24	14.4
	31-35 years	4	2.4
	36-40 years	5	3.0
Gender	Male	69	41.3
	Female	98	58.7

Total item mean scores are shown in Table 2. To establish if any statistical differences existed between year levels and gender an independent-sample t-test was conducted on total scores from each year level. The item regarding 'The simulation caused me to reflect on my clinical ability' was statistically significant different between the 3rd years (M=4.29, SD=0.55) and 2nd years (M=4.47, SD=0.58; t (165) = 2.03, p=.043. The magnitude of the differences in the means (mean difference = .181, 95% CI: .005 to .356) was small (eta =0.15).

Table 2. Item mean scores (n=167)

Item	M	SD
The facilitator provided constructive criticism during the debriefing	4.16	.515
The facilitator summarised important issues during the debriefing	4.29	.721
I had the opportunity to reflect on and discuss my performance during the debriefing	4.22	.605
The debriefing provided an opportunity to ask questions	4.50	.590
The facilitator provided feedback that helped me to develop my clinical reasoning skills	4.27	.653
Reflecting on and discussing the simulation enhanced my learning	4.40	.631
The facilitator's questions helped me to learn	4.10	.708
I received feedback during the debriefing that helped me to learn	4.26	.559
The facilitator made me feel comfortable and at ease during the debriefing	4.01	.871
The simulation developed my clinical reasoning skills	4.31	.608
The simulation developed my clinical decision making ability	4.38	.717
The simulation enabled me to demonstrate my clinical reasoning skills	4.31	.559
The simulation helped me to recognise patient deterioration early	3.66	.841
This was a valuable learning experience	4.51	.579
The simulation caused me to reflect on my clinical ability	4.38	.578
The simulation tested my clinical ability	4.46	.578
The simulation helped me to apply what I learned from the case study	4.41	.755

The item regarding 'I received feedback during the debriefing that helped me to learn' was statistically significant different between the females (M=4.16, SD=0.64) and males (M=4.39, SD=0.66; t (165) = -2.64, p=.008. The magnitude of the differences in the means (mean difference = -2.28, 95% CI: -.058 to -.060) was small (eta = -0.17). The item regarding ‘The facilitator provided constructive criticism during the debriefing’ was statistically significant different between the females (M=4.08, SD=0.53) and males (M=4.26, SD=0.47; t (165) = -2.24, p=.024. The magnitude of the differences in the means (mean difference = -1.79, 95% CI: -.021 to -.024) was small (eta = -0.17). No other items were statistically significant.

Pearson reliability coefficient for the 3 factors ranged between (r=.52 to r=.57). These findings suggest correlation coefficients ranged from negligible to strong correlation [16]. Interpretation of Pearson’s reliability is a commonly used by rule of thumb indicating high to low correlation, although simpler interpretation rules do exist however, for example, Hinkle, Wiersma, and Jurs suggested that correlation coefficients of less than 0.30 suggest very little relationship between variables [17].

3.2 Factor extraction results

The data was considered suitable for factor analysis following the multiple ‘rule of thumbs’ that included the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (.826) and Bartlett’s Test of Sphericity (x^2 = 1283.45, df=40136, p=0.000), the sample size to variable ratio (N:p ratio was 8:1), and inspection of the correlation matrix for loadings > 0.30. Each of these was adequately met, demonstrating the data was suitable to undertake a PCA. Potential factors were extracted by PCA followed by Varimax rotation given the high factor correlations using four criteria, these included: Kaiser’s criteria (eigenvalue > 1 rule) [18], scree test [19], cumulative percent of variance extracted and parallel analysis [20].

Analysis of the 18 items revealed three factors with eigenvalues above 1, accounting for 55.5% of the total variance. Items with loadings greater than ± .40, with the factor in question, were used to characterise the factor solutions. The parallel analysis suggested a 3-factor structure, and inspection of the scree plot and eigenvalues produced a departure from linearity also coinciding with a 3-factor solution. Further attempts at different factor structures did not significantly change the number of residuals, therefore a 3-factor structure (17-item) scale was considered best-fit for these data (see Table 3). Three items crossed-loaded; however given the exploratory nature of this study, and infancy of the scale these items were not deleted.

Table 3. Correlation Matrix (Principal Components Analysis with Varimax Rotation) (n=167)

Rotated Component Matrix				
Item	**Factor**			
	1	**2**	**3**	h^2
The simulation tested my clinical ability	.833*			.617
This was a valuable learning experience	.746*			.605
The simulation caused me to reflect on my clinical ability	.741*			.741
The simulation helped me to apply what I learned from the case study	.659*			.503
The facilitator's questions helped me to learn	.492*			.397
Reflecting on and discussing the simulation enhanced my learning	.479*			.370
The simulation helped me to recognise patient deterioration early	.441*			.235
I had the opportunity to reflect on and discuss my performance during the debriefing		.769*		.635
The facilitator summarised important issues during the debriefing		.744*		.600
The debriefing provided an opportunity to ask questions		.641*		.505
The facilitator provided constructive criticism during the debriefing		.629*		.426
I received feedback during the debriefing that helped me to learn		.552*		.464
The facilitator provided feedback that helped me to develop my clinical reasoning skills		.472*	.420	.525
The simulation developed my clinical reasoning skills			.874*	.866
The simulation developed my clinical decision making ability			.766*	.744
The facilitator made me feel comfortable and at ease during the debriefing		.488	.642*	.657
The simulation enabled me to demonstrate my clinical reasoning skills	.488		.537*	.549
Eigenvalues	6.38	1.78	1.27	
Explained Variance	37.52	10.52	7.47	

* highlight item allocation for each factor. h^2 = communality.

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The three resultant factors were descriptively labelled as: Factor 1 Clinical Learning and Reflection. There were 7 items that loaded on this factor, with loadings ranging from 0.83 to 0.44 (explained variance 37.5%). The top item within the factor was: 'The simulation tested my clinical ability'. Factor 2 was labelled Debriefing. There were 6 items that loaded on this factor, with loadings ranging from 0.76 to 0.47 (explained variance 10.5%). The top item within the factor was: 'I had the opportunity to reflect on and discuss my performance during the debriefing'. Factor 3 was labelled Clinical Reasoning. There were 4 items that loaded on this factor, with loadings ranging from 0.87 to 0.53 (explained variance 7.47%). The top item within the factor was: 'The simulation developed my clinical reasoning skills'.

Cronbach's ά coefficients were used to assess the reliability of the 3-factor solution identified from the PCA. The Cronbach ά calculation for the total scale produced a high reliability (0.88). Each factor also produced Cronbach's ά coefficients above the benchmark of 0.70 (factor one: 0.88; factor two: 0.80; factor three: 0.78) indicating good internal consistency, particularly in the studies with no priori [21, 22].

4 Discussion

This study has demonstrated that the SSES has adequate internal consistency and construct validity. While the original investigators of the SSES found a 3-factor solution (18 items), this study, using a non-nursing cohort, demonstrated a similar 3-factor solution with the deletion of one item 'The simulation helped me to recognise my clinical strengths and weaknesses'. While the majority of items loaded on the original 3-factors, the main difference between the original SSES and this study was the deletion of word 'reflection' from the factor name, which did not appear to represent the underlying latent construct. In this study, after reviewing the PCA results, we have used slightly different titles for each of the 3 factors from the Levett-Jones et al [6]: i) Clinical Learning and Reflection, ii) Debriefing teamwork and collaboration, iii) Clinical Reasoning.

The results from the PCA such as high item loading scores, and moderately high communalities highlight good scale parsimony and dimensionality. Given that three items crossed loaded suggests that further studies with larger sample sizes be undertaken. This will provide more information on inter-item covariances. In addition, the explained variance, while acceptable at 55% [16] for healthcare psychometrics, improvements to this value with ensure a more robust and multidimensional scale for other future studies. Given the growing use of simulation in healthcare and tertiary education having instruments such as the SSES with strong measurement properties to use in educational research is important.

5 Limitations

The study has several limitations. The study was limited by the small sample size. Although sample size is important in factor analysis, there are varying opinions, and several guiding criteria are cited in the literature. Future studies should strive for sample sizes greater than 300 [23]. Results from this study should be interpreted with some caution given that higher levels of fidelity were used in the study by Levett-Jones et al [6]. Another limitation of this study was the use of convenience sampling. This method, while easier to recruit participants, is less likely to recruit a representative sample of students. Those students who do volunteer to respond may bias the results as well. Given the lack of psychometric appraisal of the SSES it is essential that future studies attempt to address, and build upon other elements of validity such as criterion-related validity as simulation continues to grow throughout professional and tertiary teaching institutions.

6 Conclusion

Findings from the PCA provide preliminary results that the SSES has adequate construct validity and reliability. This offers those involved in healthcare education involved in simulation with a practical and usable instrument. It is recommended that further studies examine the SSES further from different cultural contexts and other cognate and non-cognate disciplines.

Competing interests

No competing interests.

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