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Simulation based education training: Knowledge and perception of the participants

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Abstract

Introduction: Simulation-based education (SBE) uses simulated patients or aids to teach and coach healthcare professionals to gain competence in real-life clinical scenarios. The study aimed to assess the effectiveness of training program on acquisition of knowledge and perception regarding SBE and training.

Method: With support from AMPATH Nepal, Nursing and Midwifery Program, Kathmandu University School of Medical Sciences organised a 5-day SBE training for 3 batches from Jul 2023 to Aug 2024. Ethical approval was obtained. A one-group pre- and post-test design using semi-structured questionnaires was used to evaluate knowledge and perceptions regarding SBE and training program. Data were analysed using SPSS 21, significance level set at $p \leq 0.05$.

Result: Out of 60 participants, the mean difference in perception of SBE before and after training was significant ($p<0.05$) for eleven statements, including improved communication skills ($p=0.045$), managing rare cases ($p<0.001$), reduced stress compared to wards ($p<0.001$), superiority to bedside teaching ($p=0.005$), use as an adjunct not a replacement ($p=0.016$), importance of evidence ($p=0.001$) and interpersonal relationships ($p=0.001$), preparation of rating scales ($p=0.007$) and checklists ($p<0.010$), application in clinical subjects ($p<0.001$), and needs to ready materials/equipment beforehand ($p=0.002$). There was a significant difference between knowledge ($p<0.001$) and perception ($p<0.001$) regarding SBE before and after participation in the training.

Conclusion: The SBE training led to significant improvements in participants' knowledge and perceptions. They also viewed the training as highly effective in enhancing their understanding of SBE.

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Introduction

Medical education curricula and teaching methods worldwide have undergone significant changes, driven in part by concerns for patient safety.[1] Simulation allows trainees to acquire and practice clinical skills and competencies, bridging the gap between theory and practice without direct patient contact.[2]

Simulation-based education (SBE) is a modern approach that uses simulated patients or aids to teach and coach healthcare professionals in real-life clinical scenarios, helping learners gain competence while avoiding the challenges and stress associated with working with real patients.[3–5] Simulation is an educational strategy using mock patient care components, involving standardised patients, mannequins, virtual reality, or a mix of these.[6] Use of simulation enhances clinical learning, thereby improving the quality of care, minimising medical errors, and decreasing the risk of harm to patients.[7,8] SBE training should be integrated at all levels of healthcare education, with faculty being aware of its importance, uses, modalities and delivery methods. [3]

It is thriving globally, offering trainees the chance to experience real or rare clinical situations while enhancing cognitive, procedural, communication, and teamwork skills.[9] Despite SBE's proven effectiveness, its successful implementation in Nepal requires educators to be well-trained and confident. With support from AMPATH Nepal, Department of Nursing and Midwifery, KUSMS has organised 5 days of training on SBE for 60 faculty to introduce SBE, and to enhance their confidence in simulation. The objective of the study was to assess the effectiveness of the training program on acquisition of knowledge and perception regarding the SBE and the SBE training.

Method

With support from AMPATH Nepal, KUSMS organised a 5-day SBE training for 3 batches. The first batch training was organised from 30 Jul to 03 Aug 2023, second batch from 25-29 Feb 2024 and the third one from 25-29 Aug 2024. The overall goal of the training was to orient faculty members about SBE. The objectives of the training were to introduce faculty to the utility and benefits of SBE and enhance their confidence in using simulation to increase the efficiency of learners.

The schedule was divided into 5 days:

- Day I: Introduction to circle of learning, Peyton's model of debriefing, orientation of simulation lab and practical session of skill teaching using a checklist
- Day II: Practical session of evaluation of skills using OSCE, developing and testing checklist and OSCE and introduction to decision making using case studies
- Day III: Introduction to simulation and debriefing, and practical session of developing and testing case studies, and demonstration of simulation scenario
- Days IV and V: Practice on conducting a simulation in teams among the group

Sixty faculty members participated in the training: Sixteen from Kathmandu University School of Medical Sciences, six each from Scheer Memorial College of Nursing, Kathmandu Medical College, Nepal Medical College, Lumbini Medical College Teaching Hospital and Manipal College of Medical Sciences, five from Birat Medical College Teaching Hospital, three each from Nobel Medical College and Devdaha Medical College, two from Nepalgunj Medical College and one from College of Medical Sciences, Bharatpur. Each affiliated college nominated the faculty members following an invitation by the Director, Nursing and Midwifery Program, KUSMS. Faculty members of KUSMS were nominated by the Head of the respective departments. Ethical approval was obtained from Institutional Review Committee (KUSMS). All the participants agreed to participate in pre-

test and post-test evaluation and consented to publish the findings.

Questionnaires had four parts: (I) Characteristics: individual and organisational characteristics of participants (age, sex, years of working experience, degree obtained, and speciality) and organisational characteristics of the participants (designation and institute) were gathered during pre-test. (II) A structured 12-questionnaire on knowledge regarding simulation-based education was administered both pre-test and post-test. (III) Statements on perception: structured parts of both pre-test and post-test questionnaires contained 26 statements on the same topics to be responded to by participants on a 5-point Likert scale (strongly disagree=1, disagree=2, agree to some extent=3, agree=4, strongly agree=5) that had been validated by Laerdal Global Health Nepal.[7] (IV) Evaluation of simulation-based education training: The last part of the post-test questionnaire contained eight open-ended questions for evaluation of the training, suggestions for the workshop, suggestions for integration of SBE into the curriculum, and possible areas for integration. Another structured part of the post-test questionnaire contained 6 items on assessment of the training to be responded to by participants on the 5-point Likert scale, 1–5. The collected data were checked for completeness, accuracy, and consistency and entered into IBM SPSS 21 for analysis. Descriptive analysis was done for frequency, percentage and means±SD, and paired t-tests were used for pre-test and post-test comparison of responses.

Result

Out of 60 participants, >3/5th (63.35%) were aged 31-40 years. Majority (95.0%) were females. Nearly half of them had 11-20 years of working experience. Majority of the participants were from various nursing specialities. More than three-fifths (61.7%) of the participants were lecturers, Table 1.

The mean knowledge score with correct responses (multiple choice question) increased post-test in 10 out of 12 questions, Table 2.

The data is in normal distribution. Perceptions of participants of SBE depict mean scores for pre-test and post-test responses of participants to statements on perception of SBE on the Likert scale. The mean post-test score had increased compared to pre-test in 24 statements out of 26 statements, Table 3.

Feedback on SBE training from participants (Likert scale) shows mean scores >4 on 5 questions out of 6: confident on teaching using checklist (4.33±0.572), topics covered were relevant (4.40±0.616), content organized and easy to follow (4.47±0.596), training experience useful in their setup (4.55±0.594) and sufficient time allocated for training (4.13±1.033), Table 4.

The mean differences in perceptions of participants before and after the training, calculated by paired t-tests with 95% CI and 16 degrees of freedom, at $p<0.05$ as statistically significant; 11 out of 26 statements were found to be statistically significant, 6 statements showed a small effect size, indicating the training had a noticeable but modest impact on the participants' perception. In contrast, 5 statement demonstrated a moderate effect size, suggesting the training had more practical significance on perception, Table 5.

There is a significant difference in mean knowledge score in post-test compared to pre-test, as $p<0.05$ with Cohen's $d=0.78$, indicating a moderate to large effect size. Similarly, it shows that there is a significant difference in mean perception score in post-test compared to pre-test, as $p<0.05$ with $d=0.7$ reflecting a moderate effect. This showed that the training had a meaningful impact on participants' knowledge and perception regarding SBE, Table 6.

Table 1. Characteristics of participants in simulation based education (SBE) training, n=60

Characteristics	n	%
Age		
≤30 years	5	8.3
31-40	38	63.3
41-50	13	21.7
51-60	3	5.0
61-70	1	1.7
Sex		
Male	3	5.0
Female	57	95.0
Years of working experience		
≤10 years	21	35.0
11-20 years	27	45.0
21-30 years	8	13.3
31-40 years	3	5.0
Highest degree obtained		
Masters	59	98.3
PhD	1	1.7
Specialty		
Masters in women's health nursing	16	26.7
Masters in medical surgical nursing	21	35.0
Masters in child health nursing	11	18.3
Masters in community health nursing	4	6.7
Masters in psychiatric nursing	2	3.3
MD/MS in obstetrics and gynaecology	4	6.7
MPH/masters in physiotherapy	2	3.3
Designation		
Lecturer	37	61.7
Assistant professor	11	18.3
Associate professor	10	16.7
Ward in-charge	1	1.7

Table 2. Knowledge participants before and after SBE training, n=60

Statement	Pre-test n(%)	Post-test n(%)
1. Utilization of checklist	39(65.0)	59(98.3)
2. Benefits of utilisation of a checklist	60(100.0)	59(98.3)
3. Full form of OSCE	44(73.3)	53(88.3)
4. Utilisation of OSCE	53(88.3)	60(100)
5. Conventional way of teaching critical thinking	12(20.0)	23(38.3)
6. Benefits of a case study	26(43.3)	8(13.3)
7. Definition of Simulation	55(91.7)	59(98.3)
8. Meaning of fidelity	53(88.3)	60(100.0)
9. Components of debriefing	17(28.3)	37(61.7)
10. Important characteristics of a facilitator	53(88.3)	57(95.0)
11. Understanding standardised patient	36(60.0)	44(73.3)
12. Meaning of hybrid simulation	26(43.3)	37(61.7)

Table 3. Perception of participants regarding simulation-based education, n=60

Statement	Pre-test (mean±SD)	Post-test (mean±SD)
1. SBE helps to enhance communication skills.	4.67±0.475	4.80±0.403
2. SBE improves teamwork.	4.82±0.431	4.88±0.324
3. SBE supports development of clinical skills and performance of practitioners.	4.75±0.474	4.82±0.390
4. SBE helps to see and manage even rarest of cases.	4.25±0.879	4.68±0.504
5. SBE overcomes the problem of uncooperative patients.	3.68±1.081	3.85±1.117
6. SBE minimises the stressful learning environment usually seen in wards.	4.23±.981	4.72±0.585
7. SBE helps in evaluation of health care providers.	4.32±0.930	4.25±0.914
8. SBE Improves patient safety	4.67±0.705	4.73±0.446
9. SBE replaces live patients in practical examination	4.18±0.892	4.18±1.186
10. SBE better than bedside teaching	3.57±1.184	4.07±1.056
11. SBE should be integrated into medical education	4.77±0.500	4.83±0.376
12. SBE increases the confidence of the healthcare providers while dealing with the patients	4.80±0.443	4.92±0.279
13. SBE creates a highly realistic, safe, and reproducible learning environment	4.57±0.647	4.73±0.446
14. SBE makes learning easier	4.57±0.851	4.80±0.403
15. SBE reduces the importance of ethical issues by repeated use of SBE	3.58±1.441	3.70±1.533
16. SBE minimises efforts put in by a teacher in clinical teaching	3.03±1.540	3.43±1.442
17. SBE is an adjuvant for clinical practice, not as a replacement	4.32±0.725	4.60±0.669
18. SBE is relatively costly than employing a trained person	3.42±1.139	4.45±0.355
19. Evidence is important for simulation.	3.92±0.996	4.42±0.766
20. Interpersonal relationships are important in SBE.	4.37±0.901	4.72±0.585
21. I am able to prepare rating scales for skills and attitude evaluation	4.02±0.770	4.33±0.729
22. I am able to do a simulation in my clinical subject.	3.83±0.905	4.50±0.567
23. I am able to prepare checklists for skills and attitude evaluation	3.85±0.860	4.48±0.725
24. I can teach complex skills without simulation	2.25±0.836	2.38±1.263
25. Immediate feedback is important in simulation.	4.47±0.833	4.30±1.030
26. Materials and equipment should be ready before simulation.	4.70±0.530	4.9±0.303

Table 4. Feedback for SBE training from participants, n=60

Statement	Mean±SD
1. How confident do you feel in teaching the students using a checklist?	4.33±0.572
2. How confident do you feel in conducting a simulation scenario and debriefing?	3.85±0.577
3. Were the topics covered in the training relevant to you?	4.40±0.616
4. Was the content of the training organised and easy to follow?	4.47±0.596
5. Will the training experience be useful in your setup?	4.55±0.594
6. Was the time allocated to the training sufficient?	4.13±1.033

Table 5. Mean difference in perception of the participants of SBE before and after training, n=60

Statement	SD	95% CI Lower	Upper	t statistic	p-value	Cohen's d
1. SBE helps to enhance communication skills.	0.503	-0.263	-0.003	-2.053	0.045	0.30
2. SBE improves teamwork.	0.446	-0.182	0.049	-1.158	0.252	
3. SBE supports development of clinical skills and performance of practitioners.	0.548	-0.208	0.075	-0.942	0.350	
4. SBE helps to see and manage even rarest of cases.	0.747	-0.632	-0.235	-4.375	0.001	0.60
5. SBE overcomes the problem of uncooperative patients.	1.452	-0.542	0.208	-0.889	0.377	
6. SBE minimises the stressful learning environment usually seen in wards.	1.000	-0.742	-0.225	-3.744	0.001	0.61
7. SBE helps in evaluation of health care providers.	1.087	-0.214	0.348	0.475	0.637	
8. SBE Improves patient safety	0.800	-0.273	0.140	-0.646	0.521	
9. SBE replaces live patients in practical examination	1.276	-0.330	0.330	0.000	1.000	
10. SBE better than bedside teaching	1.321	-0.841	-0.159	-2.931	0.005	0.45
11. SBE should be integrated into medical education	0.516	-0.200	0.067	-1.000	0.321	
12. SBE increases confidence of the healthcare providers while dealing with the patients	0.524	-0.252	0.019	-1.725	0.090	
13. SBE creates a highly realistic, safe, reproducible learning environment	0.693	-0.346	0.012	-1.863	0.067	
14. SBE makes learning easier	0.909	-0.468	0.001	-1.989	0.051	
15. SBE reduces the importance of ethical issues by repeated use of SBE	1.574	-0.523	0.290	-0.574	0.568	
16. SBE minimises the efforts put in by a teacher in clinical teaching	1.564	-0.804	-.004	-1.981	0.052	
17. SBE is an adjuvant for clinical practice, not as a replacement	0.885	-.512	-0.055	-2.481	0.016	0.40
18. SBE is relatively costly than employing a trained person	1.412	-0.565	0.165	-1.0.97	0.227	
19. Evidence is important for simulation.	1.127	-0.791	-0.209	-3.435	0.001	0.57
20. Interpersonal relationships are important in SBE.	0.799	-0.556	-0.144	-3.394	0.001	0.46
21. I am able to prepare rating scales for skills and attitude evaluation	0.873	-0.542	-0.091	-2.809	0.007	0.41
22. I am able to do a simulation in my clinical subject.	0.877	-0.893	-0.440	-5.891	0.001	0.89
23. I am able to prepare checklists for skills and attitude evaluation	0.920	-0.871	-0.396	-5.333	0.001	0.79
24. I can teach complex skills without simulation	1.241	-0.454	0.187	-0.832	0.409	
25. Immediate feedback is important in simulation.	1.107	-0.119	0.543	1.166	0.248	
26. Materials and equipment should be ready before simulation.	0.480	-0.324	-0.76	-3.227	0.002	0.46

Table 6. Mean difference in knowledge and perception regarding SBE before and after training, n=60

	Pre-test (mean±SD	Post-test, (mean±SD)	t statistics	p-value	Cohen's d
Knowledge	7.98±1.702	9.27±1.614	-4.789	0.001	0.78
Perception	107.50±8.865	113.57±8.532	-5.786	0.001	0.70

Discussion

Our findings suggest that participants initially doubted the effectiveness of simulation in improving communication skills. However, following the training, their views shifted, and they recognised that simulation-based education (SBE) could, in fact, enhance these skills in students. This change in perception may be attributed to the training's broad coverage of communication-related topics, which likely contributed to a deeper understanding among the participants.

Medical education around the world has experienced swift changes due to various contemporary challenges. These transformations have been driven by numerous factors, including evolving societal needs and the surge of scientific and technological progress fuelled by evidence-based medical research. [10]

Similar to our findings of effectiveness of simulation in improving communication skills, other studies also reported SBE to be effective in enhancing communication skills.[7,11]

The result also showed a significant difference in perception regarding use of simulation to see and manage even rarest of cases. This change in perception may be attributed to the training's coverage of rare scenarios in simulation session. Another study also mentioned that SBE offers options to the candidates for practising rarely seen invasive procedures, and helps alleviate ethical dilemmas. [5,7]

Stress and learning are closely linked, with negative stress potentially impairing memory and learning. The SBE is valued for offering a safe space to learn.[12] The result of this study also showed that SBE minimises the stressful learning environment and complements traditional teaching by offering an immersive, interactive environment that closely mirrors real clinical practice.[13]

The SBE supports student learning, but direct interaction with real patients remains crucial for helping future health professionals grasp the full complexity of clinical practice. Therefore, SBE is intended to complement, not replace, hands-on patient experience.[11,14]

There was a significant difference between perception of participants to conduct simulation in their clinical subjects and perception of importance of evidence for simulation after the training [11]

Our study highlighted the importance of interpersonal relationships in SBE, recognised it as an effective tool for enhancing interpersonal communication skills in health sciences students.[15]

The findings of the study showed that there was a significant difference between perception of participants on preparation of materials and equipment beforehand and ability to prepare rating scales for skills and attitude evaluation, similar to the result of another study.[7]

This study showed that there is a significant difference in knowledge, pre- 7.98±1.702, post-test 9.27±1.614; $p<0.05$ and perception pre-107.50±8.865, post-test 113.57±8.532; $p<0.05$) regarding SBE training. This suggests that implementing SBE training is essential for improving participants' knowledge and favourable perceptions for a valuable and effective means of educational method. Mean feedback scores >4 on 5 questions out of 6, which reflects that participants' understanding was enhanced after training. The mean feedback score on one item was <4 (confident in conducting simulation scenario and debriefing, which may be attributed to the fact that the participant had only a single opportunity to facilitate a simulation session. This finding underscores the importance of providing participants with multiple opportunities to lead such sessions in order to enhance their confidence.

The generalizability of the study findings is limited due to the absence of a control group, a small sample size (60) and the over-representation of participants from KUSMS-affiliated colleges. Additionally, since the post-test assessments of knowledge and perception were conducted immediately after the training, the long-term effects of the intervention were not evaluated. Future research could incorporate demographic variables into outcome analyses to better understand individual differences and enhance the practical

application of SBE across varied educational contexts. Additionally, studies with larger and more diverse samples, longitudinal follow-up, and mixed-method designs are recommended to provide more robust evidence on the effectiveness of SBE training.

Conclusion

The study demonstrated that the training significantly enhanced participants' knowledge and perceptions of simulation-based education. It stimulated their interest and deepened their understanding of SBE's role in improving communication, fostering teamwork, and providing a standardised learning environment. These encouraging results have the potential to influence their future integration of simulation into teaching practices, thereby contributing to safer, higher-quality healthcare delivery and improved patient outcomes. Participants also regarded the training as highly effective in facilitating their understanding of SBE.

Author contribution

Concept design: JTT, AT, BT; Literature search: JTT, AT; Data collection: ALL; Data analysis: JTT; Draft manuscript: All; Final manuscript and accountability: ALL

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Conflict of interest

The authors declare no direct conflict of interest. The authors were involved as trainers in the training program. No author received personal fees from AMPATH. The grant provider had no role in the design, conduct, analysis, or publication of this study. The training program on simulation-based education was supported by a grant from AMPATH Nepal. AMPATH Nepal is a collaboration between the Arnhold Institute for Global Health at the Icahn School of Medicine at Mount Sinai, Dhulikhel Hospital, and Kathmandu University School of Medical Sciences. This study, which assessed participants' knowledge and perceptions through pre- and post-tests during the training, was conducted independently and did not utilise any grant funds. All participants provided informed consent for the research component, and appropriate ethical approval was obtained.

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Supplementary material

The data and supplementary material that support the findings of this study are available from the corresponding author upon reasonable request.

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