SPECIAL COMMUNICATION

# Effect of simulation based education for learning in Medical Students: A mixed study method

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## Abstract

This mixed method study was planned to assess the medical students' experience with simulation-based learning and to identify the issues associated with the application of simulation-based education for experiential learning. Quantitative and qualitative data was collected respectively through a structured questionnaire answered by 145 undergraduate medical students and focus group interviews with six internees who experienced and practised clinical skills with simulators during academic years at King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia, between March and April 2017. Although overall respondents were satisfied with simulation-based education, lower satisfaction was identified in areas of available facilities, allocated time for skill labs and debriefing sessions. Three emerging themes that affected simulation-based education were identified as: shared benefits, professional development, and support and improved governance. Several important areas that needed improvement were recognised. The outcome of the study can be used to include more practice on simulators and skilled tutors.

**Keywords:** Simulation-based education, Mixed design, Satisfaction, Experiential learning.

## Introduction

Simulation-based education (SBE) is growing rapidly as a discipline that provides effective and secure authentic learning environment to medical students. The use of simulators in medical education had favourable effect on learning clinical skills and assessing competencies. Unlike standardised patients, simulators were easily accessible, replicated in several clinical settings and provided realistic experiences to learners.[1] The practice with high-standard simulators had suggested promising role in the development of clinical reasoning and problem-solving skills.[2]

Previous studies showed that effective use of medium fidelity simulator helped students in the management of medical emergencies[3] and learning outcomes were increased in terms of application of knowledge, mastering skills in a safe environment, communication skills, handling medical emergencies and willingness to participate in emergency situations.[4] A study with novice faculty members and students found that experience with simulation helped them in understanding the material and teaching clinical skills.[5] Moreover, it is a useful method to reduce anxiety, acquisition of knowledge and memory.[6] As the new teaching modality, recent studies demonstrated that through simulation teaching students' cognitive and psychomotor skills could be assured.[7-9] In addition, studies reported that teaching with simulators enhanced learning outcomes regarding diagnosis and patients management in healthcare system.[10,11] Use of simulation for acquisition of knowledge and clinical skills has frequently been used in many institutions but many medical colleges are still unaware of potential benefits of SBE. The current study was planned to assess medical students' experience of simulation in learning clinical skills, and to explore further the challenges and implications of simulation in a hospital setting in order to support medical educators to improve clinical teaching using simulation in the context of experiential learning and to ensure its implementation in the medical curriculum.

## Subjects and Methods

The mixed method study was conducted at the College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Riyadh (COM-KSAU-HS/R), Saudi Arabia, from March to April 2017. Quantitative data was collected with a structured questionnaire on a five-point Likert scale, and qualitative data was collected using an interpretative framework used during semi-structured focus group interviews with internees. The mixed method design was used to get a better understanding of the problems.[12] It was observed that the combination of quantitative and qualitative methods provides an accurate nature of the

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subject matter and reflects on the diversity of the needed knowledge.[13] With triangulation, the results may be used to produce a comprehensive representation of the problem being studied.[14]

The underpinning theoretical framework of the study was based on Kolb's experiential learning.[15] Simulation use in teaching stimulates student's experience of critical thinking, decision making, clinical skills and professional behaviour. Experiential learning is capable of stimulating students to reflect on the potential benefit of their learning experiences.[16] This type of experiential learning also provide opportunities to acquire decision making and motivation to engage in problematic situations.[17]

After approval was obtained from the ethics committee of King Abdullah International Medical Research Centre (KAIMRC) of the University, non-probability convenience sampling technique was utilised to enrol subjects. All students in pre-clinical and clinical years exposed to simulation-based learning (SBL) were invited to participate. Using Raosoft software, the sample size ws calculated, wth response distribution estimated to be 50%,confidence level at 95% and margin of error of 7% For qualitative approach, volunteer internees were recruited from hospital by sending emails through students and academic affairs department.

A self-administered structured questionnaire consisting of 20 items on a Likert scale was used to get the responses of the students. Items were scored as 5 - for strongly agree, 4 - for agree, 3 - for don't know, 2 - for disagree and 1 - for strongly disagree. The main variables included in the questionnaire were quality of tutor's feedback, deliberate practice, simulation fidelity, skills acquisition, problem solving and availability of facilities. To support its validity, four faculty members, including one statistician, were asked to review the initial 25-item questionnaire for relevance and clarity. Five overlapping items were eliminated based on their feedback while 20 items remained the same. The reliability of the scale was checked and the Cronbach's alpha calculated was 0.76. For the second part of the study, semi-structured focus groups discussion (FGD) was conducted using open-ended questions. Since the use of simulation is new method of experiential learning, the results from interviews were considered important for the development of medical curriculum and to improve learning strategies.

Informed written consent was obtained from all the subjects. A questionnaire with demographic information was distributed after simulated sessions. The whole procedure took not more than 10-20 minutes. The information on all domains of the questionnaire was checked for any missing information in the student's presence. Student was requested to provide missing information, if any. No incentive for participation was offered.

For quantitative study, the data was encoded into SPSS 20. Mean and standard deviation (SD) was calculated for continuous variables like age while frequency/percentage was reported for categorical variables like year currently studying. T-test and analysis of variance (ANOVA) was used to assess the differences across domains and demographics. The percentage of satisfaction of all students was calculated by combining frequency of levels of satisfaction (satisfied and very satisfied) and same for disagreement score for each item in the questionnaire. The responses on the Likert scale were totalled for each domain (from 1=very dissatisfied to 5=very satisfied). $P<0.05$ was considered statistically significant. Qualitatively, FGD was recorded and transcribed verbatim in addition to interviewer's notes. Interview was open-coded for emergent themes and subthemes. The themes were analysed by using the Glaser[18] constant comparison method. This was done by two researchers to include areas of agreement and to avoid disputed themes.

## Results

Of the 145 subjects, 47(32%) were females and 98(68%) were males. Besides, 13(9%) were from the first year of study, 15(10%) from the second year, 60(41%) from the third year and 57(39%) were from the fourth year. The level of satisfaction in aspects of SBE in most items were higher, while the that with adequate skill lab facilities, available time for practice, debriefing and students' reflection during the debriefing sessions were all lower (Table 1).

There were significant differences among overall satisfaction scores across all years ($p<0.01$) (Table 2).

The item wise mean satisfaction scores of male and female students were significantly different between the genders (Table 3).

The student statements gathered through the FGD were grouped into 3 main categories.

The first theme was'Shared benefits of simulation teaching'.

**Table-1:** Students' Satisfaction on Domains of Simulation Based Education (SBE).

| Items related to satisfaction | Agree n (%) | Neutral n (%) | Disagree n (%) | Mean±SD |
|---|---|---|---|---|
| **Clinical simulation process** | | | | |
| Makes subject more interesting | 110 (76) | 28 (19) | 7 (5) | 1.29 ± 0.55 |
| Frequently use in all courses | 102 (70) | 17 (12) | 26 (18) | 1.47 ± 0.77 |
| Useful for learning skill | 99 (68) | 27 (19) | 19 (13) | 1.45 ± 0.72 |
| Helps in the retention of knowledge | 94 (65) | 27 (19) | 24 (17) | 1.52 ± 0.77 |
| Helps me in the application of knowledge | 90 (62) | 34 (23) | 21 (15) | 1.52 ± 0.74 |
| Develops effective communication skills | 82 (57) | 32 (22) | 31 (21) | 1.65 ± 0.81 |
| Provides semi-realistic experience | 78 (54) | 23 (16) | 44 (30) | 1.77± 0.89 |
| Improves psychomotor skills ability | 77 (53) | 22 (15) | 46 (32) | 1.79 ± 0.89 |
| Develops clinical decision making ability | 70 (48) | 25 (17) | 50 (35) | 1.86 ± 0.90 |
| A valuable experience | 66 (46) | 20 (14) | 59 (41) | 1.95 ± 0.93 |
| Improves clinical ability | 54 (37) | 18 (12) | 73 (50) | 2.13 ± 0.93 |
| **Clinical simulation equipment** | | | | |
| Provide more training | 102 (70) | 20 (14) | 23 (16) | 1.46 ± 0.75 |
| Feel confident while practicing on simulators | 86 (59) | 30 (21) | 29 (20) | 1.61± 0.80 |
| **Clinical simulation equipment** | | | | |
| Appropriate skills-lab time | 30 (21) | 32 (22) | 83 (57) | 2.37 ± 0.80 |
| Adequate skills-lab facilities | 22 (15) | 31 (21) | 92 (63) | 2.48 ± 0.75 |
| **Tutor feedback** | | | | |
| Provide constructive feedback | 51 (35) | 28 (19) | 79 (46) | 2.10 ± 0.89 |
| Provides feedback on time | 46 (32) | 22 (15) | 77 (53) | 2.21± 0.89 |
| Provides constructive criticism in debriefing | 41 (28) | 17 (12) | 87 (60) | 2.32 ± 0.89 |
| Learner gets the chance to reflect on experiences | 26 (18) | 35 (24) | 84 (58) | 2.40 ± 0.78 |
| Debriefing sessions are always conducted | 21 (15) | 32 (22) | 92 (63) | 2.49 ± 0.74 |

It was obvious that students' previous experience with simulated patients helped them in dealing with real patients for a variety of reasons. They found connection with their patients that increased their confidence.

"Previous experience with simulated patients helped me a lot. I feel confident and calm when deals with real patient and families. Taking history and showing professionalism while dealing with real patients is not that difficult for me"(P2,6).

All students credited simulation role in communication, sharing of information and receiving feedback constructively e.g. another internee said, "I totally agree with other colleagues that it is the best teaching method

**Table-2:** Comparison of satisfaction with Gender.

| | Gender | n | Mean ± SD | *p*-value |
|---|---|---|---|---|
| Mean score satisfaction | Male | 98 | 3.15 ± 0.79 | <0.001 |
| | Female | 47 | 3.58 ± 0.50 | |

SD: Standard deviation

**Table-3:** Correlation of Satisfaction with Year of Study.

| | Level of year | n | Mean ± SD | *p*-value |
|---|---|---|---|---|
| Mean score Satisfaction | 1st year | 13 | 2.83 ± 0.49 | 0.01 |
| | 2nd year | 15 | 3.57± 0.58 | |
| | 3rd year | 60 | 3.29 ± 0.56 | |
| | 4th year | 57 | 3.32 ± 0.63 | |

to improve interpersonal communication and relationships"(P4). She further expressed that, "I really appreciate the debriefing sessions, although the instructors needs more training on how to do it properly but now, when clinicians and other staff members give feedback on my performance, I always take it positively … also, I feel it improved my clinical reasoning skill that I use even during ward rounds" ( P1).

The second theme was 'Recognition of professional development and support'. Most of the participants commented that the provided facilities in terms of logistical support and faculty should be improved. This belief was aligned with the concern of medical students.

" So the simulation centre needs to be supported by the college administration to improve the facilities, delivery and skills of tutors…" (P3, 4, 5, 6).

Additionally, they felt that tutors should also set plan for building capacity. "So all tutors and faculty members should support the students in the process of learning by giving them chances to practise more on simulated patients. This may improve patient encounter." (P4,5)

One student, described, " For me it's easier to deal more confidently with patients I practised in my simulation sessions. I feel difficulty dealing with patients, especially when I do physical exam of patients I did not encounter before" (P1).

The third theme was 'Improving Governance'. Governance is concerned with the role of university and college level leadership in the collaboration process. The participants expressed that there was no clear directions on who was supposed to facilitate the process or who was mandated to do so.

"I had faced problems when I wanted to do more practice and wanted a debriefing session to know my progress. I was not aware whom I should talk to. Even the administrators were clueless" (P2).

"We were told many times that due to limited resources and availaibility of simulators we cannot practice more. Why doesn't the administration collaborate with other institutions that have resources?"(P3).

Another added: "We need to empower the simulation centre and faculty members " (P4).

## Discussion

The prominence and benefits associated with the simulation use in clinical setting had encouraged medical colleges to initiate its use in medical curricula. The present study assessed the SBE impact on learning. In this study the percentage scores on most of the items were all in favour of SBE. The results were comparable with a study that reported overall positive perception of medical students.[19] The result indicated that teaching on simulation had improved students' learning in terms of knowledge, critical thinking, reasoning and self-confidence. Literature also confirmed the effective use of simulation in teaching and learning medicine,[20] nursing,[21] and also management sciences.[22] In addition, students showed a general agreement on type, number and quality of the equipment provided by the college.

It is a known fact that debriefing is a crucial aspect of SBE which increased performance and improved reflective practice.[23] However, tutors' debriefing and feedback skills were highly criticised and considered inadequate by many participants. This issue of feedback and its role in the skill development is an area that needs consideration. This is vital to strengthen the deep learning process and to support development. As a reliable means to assess competencies, the contribution of tutor's constructive feedback in learning should be further investigated.[24] Moreover, results emphasised on the importance of training sessions and curriculum reform by developing experiential learning approach in teaching. From the results it is evident that within the framework of experiential learning, increasing use of simulator in teaching and more exercises may contribute to better learning outcomes. Additionally, proper implementation of debriefing may increase the influence of SBE.

In addition, the current study also compared the satisfaction scores with year of study and gender. A significant increase in the scores based on the level of the students in college was observed. The students' experience and practice on simulated patients at different levels of study might be a reason of this significant difference. Interestingly, a significant increase among genders on the domains of process, equipment and feedback suggested overall more satisfaction among female students compared to male students with this modality.

Even though few students who gave unfavourable feedback during qualitative analysis acknowledged the benefits of simulation teaching in practice. The shared benefits summarised as; confidence building, improved communication and acquisition of reasoning skills. The group of participants raised attention to two facts; first, simulation centre and tutors had a critical role in the advancement of teaching clinical skills; and second, initiative and involvement of leadership in the necessity of prioritisation with regard to standards and demands of simulation resources in the clinical setting. The findings were consistent with a study done on nursing students which argued on the critical role of stakeholders in enhancing the clinical learning experience for students.[21] Reflecting on our results, a lack of explicit directions to support faculty and students were found. The current integration between clinical teaching methods and simulation is still in its early days, and there is vast potential for further association. It would be important for educational leaders in the institution to understand that all stakeholders have a significant role in teaching clinical knowledge and skills to medical students.

Some limitations that prevented the generalisation of our finding included a small sample size at a single institution. Besides, there was no control group for comparison to see the contribution of other modalities on students' learning. The findings, despite the limitations, however, will guide the stakeholders on how students' learning needs should be addressed. This recognition is important in planning, implementation and evaluation of SBE in medical education.

## Conclusion

SBE in this study was generally recognised as useful and effective way of learning skills. Some limitations with regard to tutors and facilities were reported. There is a need to communicate benefits of simulation with faculty members and students, and to review the current strategic goals of the use of simulation to include this approach in medical curricula. Enactment of the process is an important step to make it clear and evident to all students. Further studies to explore the current and future implications of simulation in clinical learning are required.

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