

Students' perception towards medical-simulation training as a method for clinical teaching

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Abstract

Objective: To explore the satisfaction and perception of medical students towards simulation-based learning approach.

Methods: The cross-sectional study was conducted at the College of Medicine, Jouf University, Sakaka, Saudi Arabia, in 2018, and comprised medical students of either gender in preclinical and clinical years who were exposed to simulation-based learning. A reliable questionnaire was used to collect data, and it was scored on a 5-point Likert scale (1 = very dissatisfied; 5 = very satisfied). Overall satisfaction level was graded on a scale ranging 6-10 (6 = sufficient; 10 = excellent). Data was analysed using SPSS 20.

Results: Of the 400 students approached, 230(56%) responded. Of them, 198(86%) were from the preclinical years and 32(14%) were from the clinical years. Students from all years were satisfied with instructors' cooperation 191(83%), organization of skills 179(78%), clear intended learning outcomes 189(82%), updated knowledge 179 (78%) . The deficiencies cited were lack of proper training rooms 40/230(17.40), shortage of training times 80/230(34.50%), inadequate facilities 52/230(22.6%) of students were satisfied. Overall satisfaction was graded by 170(73.9%) students as >6 and there was a significant difference between satisfaction scores of preclinical and clinical years ($p=0.001$).

Conclusion: Most students were satisfied that simulation-based learning improved their clinical skills, ability to retain learning materials, clinical decision-making and communication skills with patients.

Keywords: Simulation-based learning, Perception, Clinical skills laboratory, Kirkpatrick's four-level model. (JPMA 70: 618; 2020) <https://doi.org/10.5455/JPMA.6481>

Introduction

The transformation of an undergraduate medical student into a competent general practitioner fit for medical practice necessitates mastery of clinical skills. Such skills can be defined as discrete and observable acts within the overall process of patient care. It has three components: learning how to perform certain movements (procedural knowledge), why one should do so (underlying basic science knowledge), and what the findings might mean (clinical reasoning).^{1,2}

One of the most important strands in the college curriculum is professional skills course. Medicine is a practical science, not a theoretical one. So, to be a good doctor, one must have a certain amount of knowledge, as well as be capable of practising what one knows.³ Unfortunately, deterioration of the level of clinical skills of medical graduates has recently been noted which could be due to difficulty in training on patients because of

many reasons (humane, ethical or social) and constraints of time, and it is for these reasons that developing clinical skills laboratory has become mandatory.⁴

On graduation, medical students must have all the competencies that enable them to carry out the duties of House Officers, after which they must possess the competencies essential for working as primary healthcare providers. Professional skills are acquired during the undergraduate education, and continue throughout the House Officer year. The medical school must ensure before graduation that the student should have acquired an acceptable level of knowledge and understanding; exhibited satisfactorily intellectual, practical and professional attitude and behaviours; and demonstrated sufficient communication, and general and transferable skills.⁵

Hundert defined competence in medicine as "the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individuals and communities being served". Competence is not an achievement, but a habit of lifelong learning.⁶

Simulation refers to the technique of imitating the

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behaviour in some situation or process by means of a suitably analogous situation or apparatus, especially for the purpose of study or personnel training.⁷ Both undergraduate and postgraduate medical curricula are increasingly adopting simulation for various reasons, including the changes in healthcare delivery, students' satisfaction with simulation-based learning (SBL), limited clinical encounters, and potential of simulation to improve clinical training. Many studies have emphasised the importance of the introduction of medical SBL in curriculum development.⁸

SBL enables learning clinical skills in a safe atmosphere that closely resembles real life, aimed at careful and gradual transfer of learned skills into actual practice, i.e. role play and standardised patients.⁹

SBL can help mitigate trainee's and patient's stress by developing health professionals' knowledge, skills and attitudes while protecting patients from unnecessary risk. Healthcare has lagged behind in simulation applications for a number of reasons, including cost, lack of rigorous proof of effect and resistance to change.⁸ Moreover, SBL helps alleviate ethical tensions and resolve practical dilemmas. SBL as training technique, tool and strategy can be applied in designing structured-learning experiences (SLEs), as well as be used as a measurement tool linked to targeted teamwork competencies and learning objectives. SBL for medical education is a valuable strategy for patient safety as it can reduce error and risk, skills like cardiopulmonary resuscitation (CPR), airway management, procedural training, trauma and risk and crisis management.¹⁰

Since SBL is implemented at our institution and involves all students in different study years from year 1 to 5, there was a necessity for measuring their perception towards such a learning strategy. The current study was planned to fulfil that necessity by exploring the satisfaction and perception of medical students towards SBL.

Subjects and Methods

The cross-sectional study was conducted in 2018 at the College of Medicine, Jouf University (COM-JU), Sakaka, Saudi Arabia. Since its inception, COM-JU adopted SBL as one of numerous educational strategies for clinical skills. It has four longitudinal clinical skill training courses, designated as clinical skills lab 1, 2, 3 and 4. The main aim of these courses is to familiarise students in the preclinical phase with all the necessary clinical skills before embarking on the clinical phase where they are exposed to real patients in hospitals and clinical units. These are longitudinal courses that run throughout the curriculum in basic sciences years (1st, 2nd and 3rd) where every year

has its clinical skills lab coordinator.

Every clinical skills lab topic is integrated with the topic of educational problem. For example, students undertaking the cardiovascular block are trained on how to examine the heart; starting with inspection followed by palpation, percussion and then auscultation utilising the cardiopulmonary patient simulator (Harvey®), which realistically simulates nearly any cardiac disease at the touch of a button by varying blood pressure, pulse, heart sounds, murmurs and breath sounds. In addition, it provides users with Power Point slides for each disease, covering the pathology, epidemiology, history, all bedside findings, electrocardiogram (ECG), X-ray, echocardiogram, haemodynamic, angiogram, medical and surgical therapy, and case summary.

The other simulators, models and mannequins available in COM-JU clinical skills and simulation centre include models and mannequins for breast examination, male and female urethral catheterisation; intravenous (IV), intramuscular (IM), subcutaneous (SC) and intradermal (ID) injection models, venous cannulation, intrauterine device (IUD) insertion models, examination of pregnant women, CPR models, prostate-rectal (PR), vaginal, eye and ear-nost-throat (ENT) examination models, mass examination, male and female genital organs examination, suturing of wounds, and chest examination models with different breathing sounds.

In current practice setting, there are steps of teaching, training and practising a clinical skill at COM-JU. The students, firstly, are taught the theoretical knowledge of the skills by a lecture delivered by a subject expert, followed by demonstration of steps of the examination on a simulated patient (volunteer) or a model. Students are then divided into smaller groups of 7-10 where tutors devote their time for practical application, and peer examination is done by students after demonstration of skills by tutors, and they follow a checklist. The examined student should not stay on bed for more than 10 minutes. While performing the examination, constructive feedback is given for each student, tutor asks students why they are doing it in that manner (reflection on action). The checklist standardises the way in which the tutor performs the steps of the skill; they are available to all students and tutors at the beginning of the class. Students must follow the same checklist steps during their assessment. The tutor ensures clear demonstration of skills. Hands-on training under the supervision of a tutor is done. The tutor and student peers give feedback on any mistake done. Each skill is taught in one or two sessions, followed by individual assessment. The student is expected to acquire communication, professional and

attitudinal skills at an early stage.

For the evaluation of this educational intervention, Kirkpatrick's four-level model for assessing training effectiveness¹¹ is used. The current study started by evaluating level one: participants' initial reaction to a course or intervention.¹¹ After permission from the institutional ethics committee, the sample was raised encompassing all students of either gender who were exposed to SBL from year 1 to 5 for the males and from year 1 to 4 for the female students. The years of study for our female students were inconsistent with their male counterparts because their initial enrollment at COM-JU was done a year later. Students practising SBL in the skills laboratory belonged to the preclinical phase (phase II). However, the clinical-phase (phase III) students were eligible to be enrolled in the study in an attempt to have more mature views on the advantages and disadvantages of SBL since they were exposed to real-patient situations in a hospital setting and had, hence, gained more clinical experience. After permission from the institutional ethics committee, data was collected using a valid and reliable questionnaire described in literature¹² with minor modifications. Content validity of the modified questionnaire was measured by three medical education experts. The questionnaire assessed the overall student satisfaction and the challenges they faced during simulation learning. The rate of satisfaction was calculated by combining frequency of levels of satisfaction (satisfied and very satisfied) for each item in the questionnaire. The responses were expressed on a 5-point Likert scale; from 1 = very dissatisfied to 5 = very satisfied. Overall satisfaction level was graded on a scale

ranging 6-10 (6 = sufficient; 10 = excellent). The survey was distributed electronically to all students by batch emails, on the college blackboard Learn and via WhatsApp.

Data was analysed using SPSS 20 and expressed as frequencies and percentages. Differences between satisfied and unsatisfied students in preclinical and clinical phases were calculated using Chi square test. $P < 0.05$ was considered statistically significant.

Results

Of the 400 students approached, 230(56%) responded. Of them, 198(86%) were from the preclinical years and 32(14%) were from the clinical years. In terms of year of study, 75(32.6%), 68(29.7%), 55(23.8%), 4(1.8%) and 28(12.2%) belonged to the 1st, 2nd, 3rd, 4th and 5th years respectively. The age of 123(53.4%) subjects ranged 20-23 years.

Most of the students 159(69%) said the introductory lectures for clinical skills were clear and comprehensive; 179(78%) found information updated; 189(82%) said that the intended learning outcomes of the lectures were mentioned at the outset; 170(74%) agreed that the instructors described the indications, contraindications, risks, common complications and the process of the procedure; and 170(74%) believed that each session promoted active participation (Figure-1).

Concerning the challenges, 52(22.6%), 40(17.4%) and 79 (34.5%) of the participants reported that models were enough, training laboratories were suitable for training and the time allocated for skills laboratory was appropriate, respectively, while 186(81%) reported that

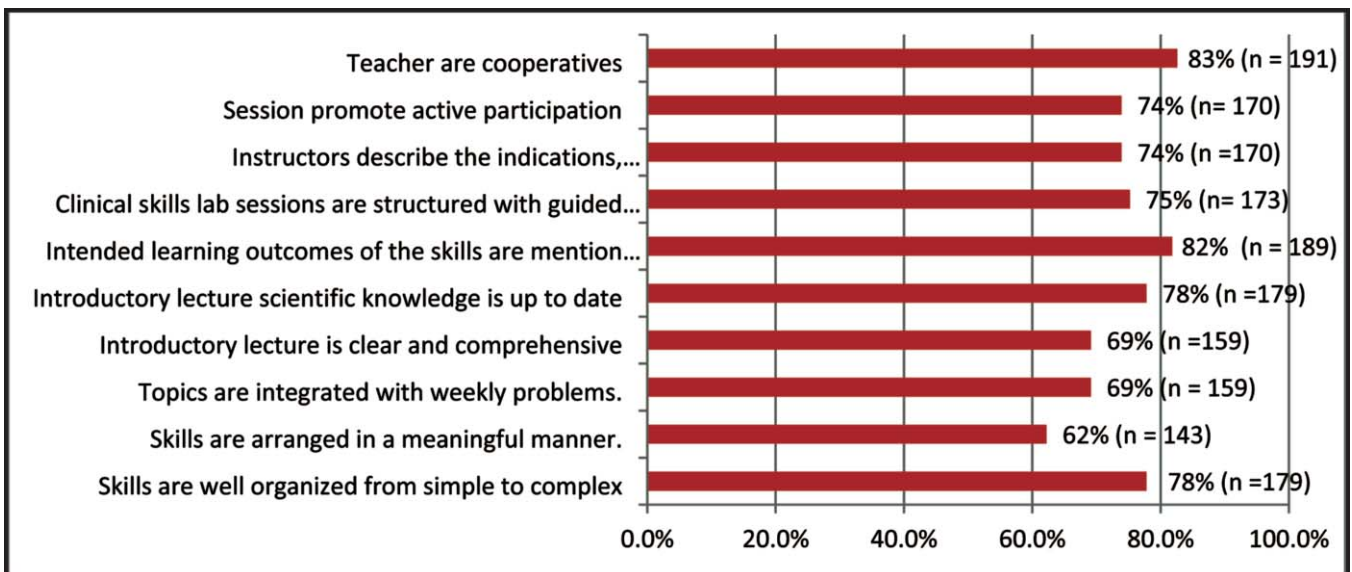


Figure-1: Distribution of medical students' satisfaction with different clinical skills lab practices (n = 230).

Table-1: Comparison of students' satisfaction and challenges with simulated-based learning (SBL) between preclinical (1st, 2nd and 3rd years; n = 198) and clinical (4th and 5th years; n = 32) medical students.

SNI	Statement Satisfaction/ challenges	Pre-clinical		Clinical		p-values
		Satisfied n (%)	Non Satisfied n (%)	Satisfied n (%)	Non Satisfied n (%)	
1	"Patient simulators are a useful addition to learning with real patients."	160 (80.8)	38 (19.2)	26 (81.3)	6 (18.7)	0.953
2	"I would like more training with simulators."	165 (83.3)	33 (16.7)	19 (59.4)	13 (40.6)	0.002*
3	"I am familiar with the concept of simulation based learning."	156 (78.8)	42(21.2)	28 (87.5)	4 (12.5)	0.253
4	"Simulation based learning is a useful learning strategy."	155 (78.3)	43(21.7)	23 (71.9)	9 (28.1)	0.421
5	"Simulation based learning made the subject more interesting."	163 (82.3)	35 (17.7)	23 (71.9)	9 (28.1)	0.163
6	"Simulation based learning helped me to apply what I learnt."	152 (76.8)	46 (23.2)	25 (78.1)	7 (21.9)	0.029
7	"Simulation based learning should be included in the courses frequently."	176 (88.9)	22 (11.1)	8 (25.0)	24 (75.0)	≤ 0.001*
8	"Simulation based learning helped me retain knowledge."	175 (88.4)	23 (11.6)	15 (46.9)	17 (53.1)	≤ 0.001*
9	"Simulation based learning provided a semi-realistic experience."	174 (87.9)	24 (12.1)	17 (53.1)	15 (46.9)	≤ 0.001*
10	"Simulation based learning helped me in communication skills."	147 (74.2)	51 (25.8)	28 (87.5)	4 (12.5)	0.103
11	"I felt comfortable with the simulated environment."	157 (79.3)	41 (20.7)	9 (28.1)	23 (71.9)	35.91
12	"Simulation based learning developed clinical decision making."	177 (89.4)	21 (10.6)	11 (34.4)	21 (65.6)	55.8
13	"Cooperation between the students is important for practicing at the skills-laboratory."	175 (88.4)	23 (11.6)	23 (71.9)	9 (28.1)	0.01
14	"Assessment of clinical skills lab is fair."	172 (86.9)	26 (13.1)	6 (18.8)	26 (81.3)	≤ 0.001*
15	Assessment of clinical skills lab is matching with the way I being trained."	170 (85.9)	28 (14.1)	12 (37.5)	20 (62.5)	≤ 0.001*
1	"Models are enough."	46 (23.2)	152 (76.8)	6 (18.8)	26 (81.3)	0.57
2	"Labs for training are suitable."	36 (18.2)	162 (81.8)	4 (12.5)	28 (87.5)	0.431
3	"Instructor gave me the opportunity to practice at the skills laboratory."	174 (87.9)	24 (12.1)	12 (37.5)	20 (62.5)	≤ 0.001*
4	"I was given the opportunity to see the high fidelity simulators."	165 (83.3)	33 (16.7)	13 (40.6)	19 (59.4)	≤0.001*
5	"The skills laboratory facilities are adequate."	44 (22.2)	154 (77.8)	4 (12.5)	28 (87.5)	0.209
6	"I found it difficult to treat the mannequin as a real patient."	174 (87.9)	24 (12.1)	5 (15.6)	27 (84.4)	≤0.001*
7	"The time allocated for skills lab is appropriate."	52 (26.3)	146 (73.7)	27 (84.4)	5 (15.6)	≤0.001*

Chi square is the test of significance, * p≤0.05 statistically significance differences.

instructors gave them the opportunity to practise at the skills laboratory. However, 179(78%) found it difficult to treat the mannequin as a real patient (Figure-2).

Satisfaction levels as well as response in terms of challenges were compared between the two groups (Table). Overall satisfaction level was graded by 170 (73.9%) students as >6.

Some of the comments by students about the SBL-related challenges were as follows:

"The time is important for us so we recommend changing the time of class to be more effective."

"We need more simulators, change the skills laboratory to a bigger class."

"The room is small and gets overcrowded so we could not see the doctor clearly during the explanation and because of that laboratory is disorganised."

"We need more practice and hands-on training."

"Improve laboratories."

"It's good but there aren't enough models for training. Buy new models, and offer us more practice in the skills laboratory."

"Clinical skills should be classes that bind knowledge with practice, but unfortunately they are more inclined to the theoretical component without adequate practice which made limits to their usefulness."

"Some classes are better to be with real patients in hospital (we need something related to reality)."

"There are insufficient resources (such as models)."

"The timing of such classes should be in the morning not afternoon."

"The only benefit is the knowledge from instructors, and I wish that we can apply it in more appropriate way. Thank you for considering our opinions".

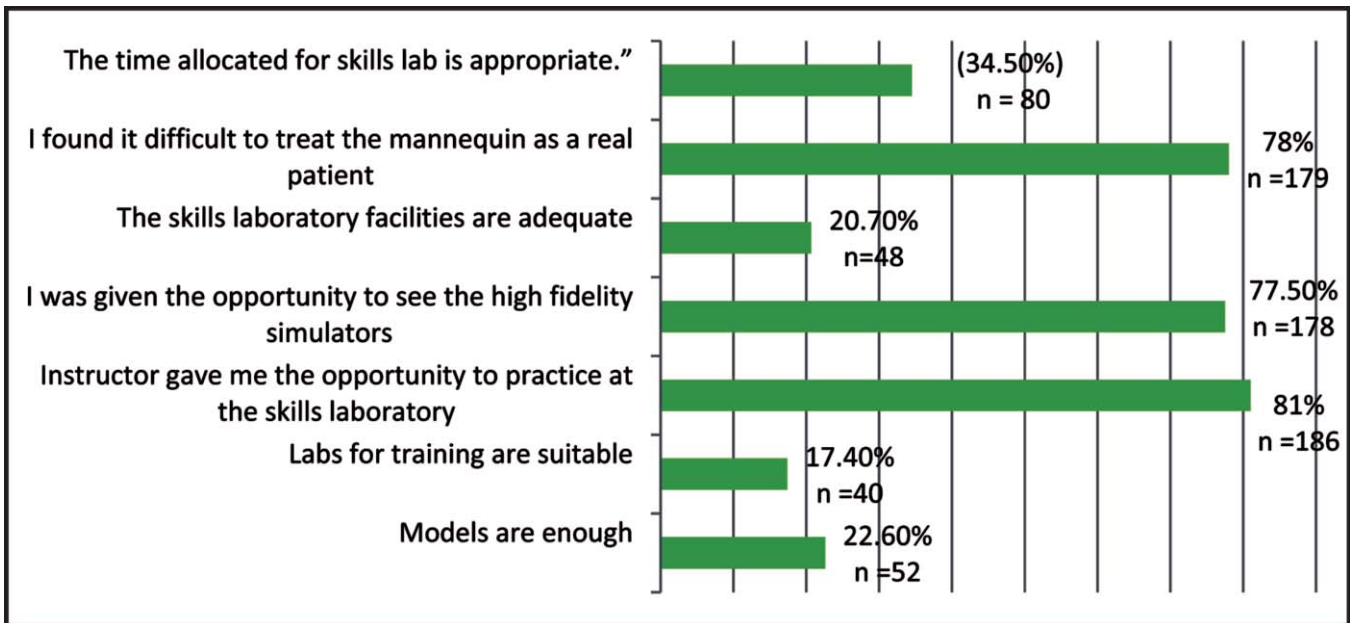


Figure-2: Distribution of medical students' opinions regarding challenges associated with simulation-based learning (SBL) (n = 230).

"The class should be held more frequent per week, it should be related to real clinical cases, we need more number of mannequins, and mannequins need to be maintained more frequently to avoid malfunctioning."

Discussion

Results of the study showed that most of the students were satisfied with clinical skills laboratory sessions and clinical-simulation training. These results are in accordance with earlier findings. Also, our results harmonise with a study¹³ which reported that students preferred SBL over lecture-based learning (LBL).

In the current study, the medical students were satisfied with the organisation of clinical skills and said skills were integrated with weekly educational problems. This is in conformity with the stepwise model¹⁴ with 14 features for effective SBL. At COM-JU, SBL strategy is applied and students learn initially simple skills like mass examination, ID, SC, IM, IV injections, and then progress to more complex skills, like insertion of IUD and endotracheal intubation.

At COM-JU, introductory lectures to each clinical skill session are conducted by specialised faculty members for ensuring the maximum possible level of proficiency. As per the results, the teachers were effective and cooperative, and SBL developed clinical decision-making and added value to learning with real patients. These results are in line with a study.¹⁵

From pedagogical view, adult learner learns with the introduction of interactive methods.¹⁶ SBL provides such

opportunities. Also, adult learning is problem-centred, and they value learning that can be applied to actual problems that they meet in their clinical life.¹⁷

The current study also highlighted some challenges in SBL. These included inadequate models, unsuitable laboratory rooms for training, inadequate skills laboratory facilities, and inappropriate time for laboratory activities. These results are almost in keeping with earlier findings.^{12,13}

The current study showed significant difference between student satisfaction levels with SBL in preclinical and clinical phases. Preclinical students liked more training with simulators ($p \leq 0.002$). This may be because of the fact that SBL in the first three years provides direct connection between theoretical concepts and practical clinical applications. A study done at the same institution¹⁸ reported that both male and female students were mainly bimodal (44%) in basics sciences phase, and shifted to mainly unimodal in the clinical phase (40.67%). The study showed that students in basic sciences years were mainly kinesthetic (13%); preferred physical activities, needed direct demonstration and required several repetitions.¹⁸ This aligns with the findings of the current study.

Also, preclinical students said SBL helped them to retain knowledge ($p \leq 0.001$) which was reported earlier as well.¹⁹

The current study showed significant differences between students' satisfaction with SBL in preclinical and clinical phases in some areas. In a study,²⁰ results showed that various learning outcomes are achieved and

improved, such as communication skills, diagnostic skills, procedural skills, self-confidence, and integration of basic and clinical sciences. One study²¹ measured the effectiveness of a required preclinical simulation-based curriculum for fundamental clinical skills and procedures, and concluded that SBL provided early exposure, medial knowledge, professionalism and opportunity to practise skills in a patient-free environment.

We think that the students in the clinical phase find simulation experience different from the real life since dealing with a model of mannequins is different from dealing with a real patient. As such, the results showed some significant differences between students in the two phases. Also, vertical integration of clinical skills and the theme of problem-based learning (PBL) session helped integrate knowledge and highlighted the relevance of the information being gathered during the week to solve the problem.

Comparing students' opinions considering challenges they faced with SBL in the preclinical and clinical phase, the results showed significant differences ($p \leq 0.001$). A study²⁰ reported similar issues.

There was a significant difference between students' scores on satisfaction with SBL comparing between preclinical and clinical years ($p \leq 0.001$). This may be because our preclinical students have regular weekly training for more than three hours in the SBL laboratory compared to the clinical students who spend most of their time in bedside rotations in hospitals.

In terms of limitations, the current study only evaluated the first level of Kirkpatrick's four-level model¹¹ with limited participation of students in the clinical phase. Besides, the perception of faculty members towards SBL was not measured. Future studies need to explore the phenomenon further.

Conclusion

The use of simulation laboratory was found to be of great benefit to the students. Introduction of more advanced high-fidelity models and simulated three-dimensional computer models should be pursued. Simulations that can help learning other parts of the medical curriculum, like interactive virtual patients, computer-based cases and virtual cadavers, need to be considered as well.

Disclaimer: Dr. Marwa Ahmed El Naggar is a lecturer in medical education department, college of medicine, Suez Canal University, Egypt and currently working in Jouf University, Saudi Arabia.

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