



Place of Simulation in Learning Technical Skills in Emergency Medicine

Boukatta B^{1*}, Bouazzaoui A¹, Touzani S¹, Houari N¹, Benmaamar S², Kanjaa N¹

¹Department of Anesthesiology, Critical Care and Emergency, Hassan II Teaching Hospital, Fez, Laboratory ARMU, Faculty of Medicine and Pharmacy of Fez, Sidi Mohamed Ben Abdellah University, Morocco

²Laboratory of Epidemiology, Clinical Research and Community Health, Faculty of Medicine and Pharmacy of Fez, University Sidi Mohammed Ben Abdellah, Fez, Morocco

***Corresponding author:** Boukatta B, Department of Anesthesiology, Critical Care and Emergency, Hassan II Teaching Hospital, Fez, Laboratory ARMU, Faculty of Medicine and Pharmacy of Fez, Sidi Mohamed Ben Abdellah University, Morocco

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Abstract

Background: Simulation is considered one of the most interesting educational techniques, especially in health. It correspond to the use of equipment, virtual reality or a standardized patient to reproduce situations or care environments, in the aim of teaching diagnostic and therapeutic procedures, repeating medical processes and concepts, or decision-making by a healthcare professional or a team of professionals. The objective of this study is to highlight the importance of simulation as a teaching method in improving the technical skills of our medical students, in emergency situations.

Methods: The study setting was a simulation center of University Hospital Center affiliated with the Faculty of Medicine and Pharmacy of Fez, Sidi Mohamed Ben Abdellah University. Our study focused on all 5th year medical students during the 2014 and 2015 academic year. Five hundred and twelve students participated in this study. The scenarios chosen by the pedagogical team were cardiac arrest in adults, consciousness disorders and emergency management of the patient with upper airway obstruction. The training takes place in four steps. In the first step, the training begins with a pre-test, in the form of multiple-choice questions or short answer questions. The second step corresponds to the training with the real-life situations. In the third step, at the end of the training, the students are evaluated by a post-test. In the fourth step, a global evaluation of the training and the trainers is done by the participants. Thus, students are asked to anonymously complete a questionnaire. Student test was used to compare the means. The level of significance was kept at < 0.05 . Statistical analyses were performed by using R software.

Results: For 2014 academic year, the mean of the pre-test varies from 3.76 to 9.05/20. The overall mean of the pre-test is 5.004 +/- 1.569. The post-test average starts from 16.5 to 19.64/20. The overall post-test average is 18.55 +/- 1.88. For 2015 academic year, the mean of the pre-test varies from 2.50 to 6.91/20. The overall mean of the pre-test is 4.61 +/- 1.34. The post-test average starts from 18.10 to 19.53/20. The overall post-test average is 18.94 +/- 0.46. Statistical analysis (test t) showed a significant difference between the mean of pre-test and post-test of the different groups ($p < 0.0001$).

Conclusions: Our study shows that simulation sessions improve technical skills in emergency medicine. Consequently, given their crucial importance to ensuring better patient care, they must be integrated early in the training curriculum for medical and nursing students.

Keywords: Crisis management; Emergency; Medical students; Simulation; Technical skills

Introduction

There are different types of teaching methods which can be categorised into five broad types, expository, demonstrative,

interrogative, discovery or even experimental [1]. Simulation is considered one of the most interesting educational techniques, especially in health. It correspond to the use of equipment, virtual reality or a standardized patient to reproduce situations or care environments, in the aim of teaching diagnostic and therapeutic procedures, repeating medical processes and concepts, or decision-

making by a healthcare professional or a team of professionals [2]. The implementation of training through medical simulation has several advantages, educational, docimological, economic, and ethical. In fact, the simulation responds perfectly to the principle “never the first time on the patient” [3]. The objective of this study is to highlight the importance of simulation as a teaching method in improving the technical skills of our medical students, in emergency situations.

Material and methods

Setting and participants: The study setting was a simulation center of University Hospital Center affiliated with the Faculty of Medicine and Pharmacy of Fez, Sidi Mohamed Ben Abdellah University. The participants were the fifth-year medical students.

Study period and population: our study focused on all 5th year medical students during the 2014 and 2015 academic year. Five hundred and twelve students participated in this study.

The program of study: The scenarios chosen by the pedagogical team were cardiac arrest in adults, consciousness disorders and emergency management of the patient with upper airway obstruction. To ensure maximum immersion, we used the standardized patient and the high-fidelity adult manikin.

Methodology: The average training simulation session duration

was four hours. It takes place in four steps. In the first step, the training begins with a pre-test, in the form of multiple-choice questions or short answer questions. This step makes it possible to assess the knowledge of the students, making it possible to determine their needs. The second step corresponds to the training with the real-life situations. It includes a theoretical part and a practical part, in the form of workshops. Several teaching techniques are used, the interrogative method, the discovery method, the role-playing game and the simulation on low fidelity and high-fidelity mannequin. In the third step, at the end of the training, the students are evaluated by a post-test. In the fourth step, corresponding to the end of the session, a global evaluation of the training and the trainers is done by the participants. Thus, students are asked to anonymously complete a questionnaire. This questionnaire includes 18 questions with a section reserved for free comments. Responses are collected using a 5-point Likert scale in which [Table 1]:

- 1: Not important
- 2: Slightly important
- 3: Neutral
- 4: Important
- 5: Very important

	1	2	3	4	5
How do you qualify this training?					
Is one session sufficient for such training?					
Is the duration of the training sufficient?					
The number of learners is compatible with quality training?					
The time devoted to the theoretical part is sufficient?					
The time devoted to the practical part is sufficient?					
How do you qualify the teaching technique used?					
The trainer - learner interactivity was?					
The training session is well organized?					
The training room is good for this kind of practical training?					
This training can improve your behavior in an emergency situation?					
The quality of the material used is good for training?					
The number of mannequins and equipment used is sufficient for the training?					
The number of teachers per session is sufficient?					
Did the training meet your expectations?					
This type of training must be integrated into the training curriculum for medical students?					

Would you like to participate in other trainings?	Yes: No:
What part of the training touched you the most?	
Free comments:	

Table 1: Training evaluation questionnaire by students of the 5th year of Medicine.

The session of simulation begins with a briefing, during which the medical teachers presented the material, the environment, the clinical context with a presentation of the clinical case. The scenario lasts 15 minutes. The debrief was structured into four phases (reactions, facts, analysis and summary). During this phase, and in the most relaxed atmosphere possible, we assess the overall feeling of participants, analyze the technical and soft skills.

Statistical analysis: The means and standard deviations (SD) were used for results of pre and post- test. Student test was used to compare the means. The level of significance was kept at <0.05. Statistical analyses were performed by using R software.

Results

Five hundred and twelve students participated in this study. Two hundred and fifty seven students in 2014 and two hundred and fifty five students in 2015 (Figure 1). The students are divided into groups of 15 to 20 people ; all students undergo an assessment before (pre-test) and after (post-test) training. For each group, the general average is calculated on a scale of 20. For 2014 academic year, the mean of the pre-test varies from 3.76 to 9.05/20. The overall mean of the pre-test is 5.004 +/- 1.569. The post-test average starts from 16.5 to 19.64/20. The overall post-test average is 18.55 +/- 1.88 (Tables 2&3 and Figure 2). For 2015 academic year, the mean of the pre-test varies from 2.50 to 6.91/20. The overall mean of the pre-test is 4.61 +/- 1.34. The post-test average starts from 18.10 to 19.53/20. The overall post-test average is 18.94 +/-0.46 (Tables 4&5), (Figure 3). Statistical analysis (test t) showed a significant difference between the mean of pre-test and post-test of the different groups (p <0.0001) (Tables 3&5). The most of students have expressed their great satisfaction concerning the technique of training. 99.22% for the 2014 academic year and 97.26% for the 2015 academic year. About 65% of students are satisfied of the global duration of the training course. But the most of students realize that one course is not sufficient. More than 97% of students want of this kind of training to be obligatory during cursus. More than 95% of students are satisfied by the training global organization. More than 89% of students are satisfied by the simulation material quality. As far as pedagogic technic more than 98% of students are satisfied by the learning techniques as workshops and interactivity student-trainer (Table 6). Finally, the students insist on the interest of to organize other courses, to extend the training duration and to programming of this kind of training since the first cycle.

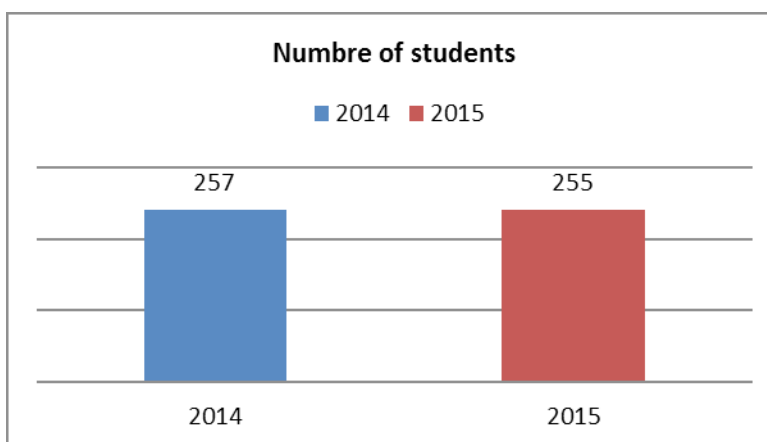


Figure 1 : Numbers of students.

N° of group	Date of training	Pre-test (mean/20)	Post-test (mean/20)	Numbers of students
1	12-02-2014	4	16.5	16
2	26-02-2014	6	17.6	20
3	05-03-2014	4.1	16.42	19
4	12-03-2014	4	17.86	16
5	26-03-2014	4.46	18.10	17
6	02-04-2014	3.76	19.54	9
7	09-04-2014	3.96	18.10	15
8	02-07-2014	3.76	19.36	21
9	03-07-2014	9.05	19.26	19
10	09-07-2014	4.46	19.35	17
11	10-07-2014	5.07	19.64	17
12	16-07-2014	4.66	18.80	21
13	17-07-2014	6.57	19.42	21
14	22-07-2014	3.84	18.75	13
15	23-07-2014	7.37	19.56	16

Table 2 : Result of the pre-test and post-test of the 2014 academic year.

	Mean +/-SD	p-value
Pre-test average	5.004 +/- 1.569	< 0,0001
Post-test average	18.55 +/- 1.08	

Table 3 : Average of the pre-test and post-test of the 2014 academic year.

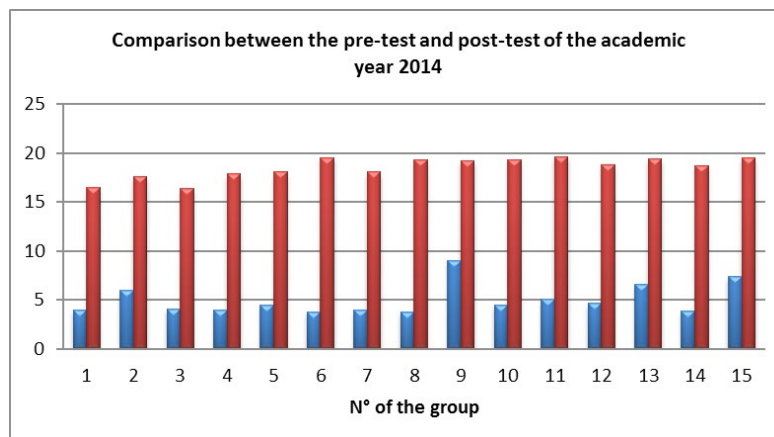


Figure 2: Result of the assesment of the students of the 2014 academic year (pre-test in blue and post-test in red).

N° of group	Date of training	Pre-test (mean/20)	Post-test (mean/20)	Numbers of students
1	12-11-2014	3.2	18.4	15
2	19-11-2014	4.35	19.53	14
3	26-11-2014	5.72	18.45	11
4	10-12-2014	4.72	19.27	11
5	03-12-2014	5.57	19.06	15
6	28-01-2015	3.92	19.38	13
7	04-02-2015	6.91	18.75	12
8	11-02-2015	2.86	18.10	15
9	18-02-2015	3.54	18.81	11
10	04-03-2015	4.92	19.30	13
11	11-03-2015	2.5	19.33	12
12	18-03-2015	5.2	19.20	15
13	25-03-2015	4.06	17.93	15
14	01-04-2015	3.41	19.33	12
15	08-04-2015	3	19	15
16	15-04-2015	5.9	19.27	11
17	01-07-2015	6.66	18.66	12
18	08-07-2015	6.31	18.9	19
19	15-07-2015	5	19.35	14

Table 4: Result of the pre-test and post-test of the 2015 academic year.

	Mean ± SD	p-value
Pre-test average	4.61 ± 1.34	< 0,0001
Post-test average	18.94 ± 0.46	

Table 5: Average of the pre-test and post-test of the 2014 academic year.

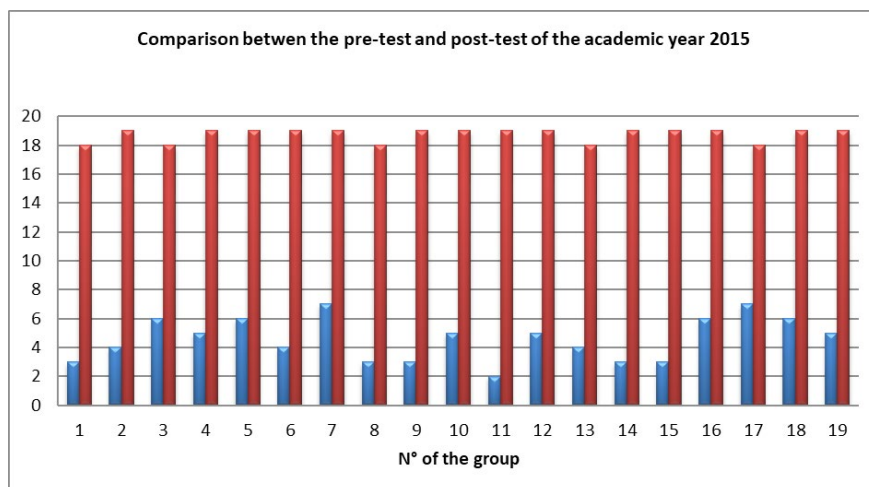


Figure 3: Result of the assessment of the students of the 2015 academic year (pre-test in blue and post-test in red).

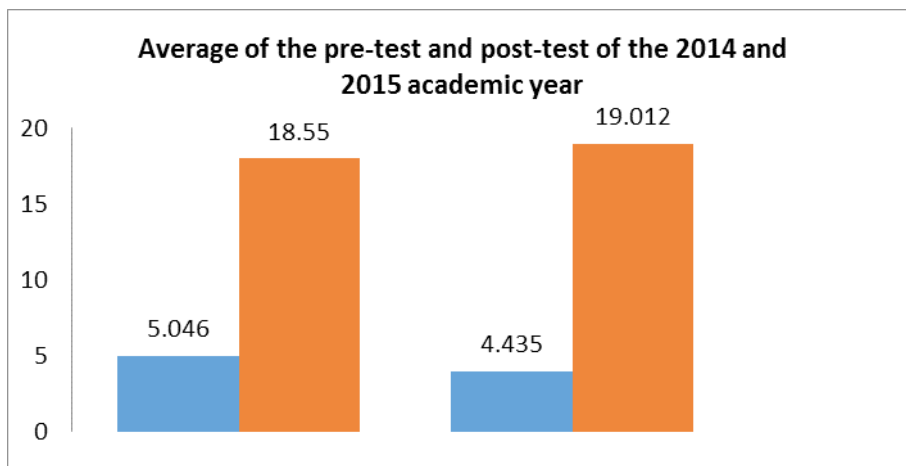


Figure 4: Result of the assessment of the students of the 2014 and 2015 academic year (pre-test in blue and post-test in red).

	1 (%)		2 (%)		3 (%)		4 (%)		5 (%)	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
How do you qualify this training?	0	0	0	0	0	0	2.74	0.78	97.26	99.22
Is one session sufficient for such training?	38.83	33.08	19.60	26.08	7.45%	11.29	13.72	13.62	20.4	15.95
Is the duration of the training sufficient?	7.06	9.73	11.76	14	10.2	13.23	30.2	20.62	40.78	42.42
The number of learners is compatible with quality training?	4.31	1.95	3.13	8.56	8.23	17.13	31.38	28.4	52.95	43.96
The time devoted to the theoretical part is sufficient?	1.18	1.95	2.75	5.45	2.35	8.17	36.86	28.01	56.86	56.42

The time devoted to the practical part is sufficient?	3.53	3.11	7.84	11.28	3.53	8.56	30.98	31.13	54.12	45.92
How do you qualify the teaching technique used?	0	0.39	0.39	0.78	0.39	0.78	15.69	18.67	83.53	79.38
The trainer - learner interactivity was?	0	0	0	0.39	0.39	1.17	13.73	16.34	85.88	82.1
The training session is well organized?	0	0	0.39	0.78	0.79	2.72	19.22	22.96	79.60	73.54
The training room is good for this kind of practical training?	0.78	1.94	5.88	7	9.41	15.56	32.55	21.8	51.38	53.7
This training can improve your behavior in an emergency situation?	3.53	0.78	0.39	2.34	1.56%	1.17	17.65	14%	76.87	81.71
The quality of the material used is good for training?	0.78	0	1.56	2.34	8.83	7.78	30.98	33.85	58.43	56.03
The number of mannequins and equipment used is sufficient for the training?	1.96	0.39	6.67	9.34	10.98	17.5	37.25	36.58	43.14	36.19
The number of teachers per session is sufficient?	1.17	1.56	2.75	6.22	7.84	10.9	30.2	29.18	58.04	52.14
Did the training meet your expectations?	0.39	0	1.17	0.39	1.18	1.56	21.96	23.35	75.30	74.7
This type of training must be integrated into the training curriculum for medical students?	1.18	0	0	0	0	0.79	2.35	1.94	96.47	97.27

Table 6: Training evaluation questionnaire by students of the 5th year of Medicine with five-level Likert item.

Discussion

Knowledge application in more or less realistic situations has been shown to be important for the development of complex skills [4]. However, in education programs, the opportunity to engage in real-life problem solving is limited. The simulation represents an alternative. In fact, simulation is an exercise that mimics realistic functions in a simulated environment [5-7]. It has become a routine part of education and training for healthcare students and professionals in many academic health education facilities [8-10]. During the simulation, the actions performed by the learners demonstrate reasoning or the application of related procedures. The assessment includes the analysis of technical and soft skills. Pre-tests and post-tests are among the assessment tools that measure knowledge, but they are insufficient to conclude on the acquisition of health skills. In our study, the analysis of the pre-test results showed that the initial level of theoretical and practical knowledge was roughly the same for the two groups, 5.004/20 for the 2014 academic year and 4.61/20 for the 2015 academic year. In post-test, the overall level of theoretical and practical knowledge was markedly improved compared to the pre-test, in the two groups, 18.55/20 for the 2014 academic year and 18.94/20 for the 2015 academic year. This results shows that teaching with simulation sessions improve technical skills in all medical students. In littérature, there is an increasing evidence base for the

use of simulation-based medical education. Simulation is superior to more didactic methods for teaching a range of technical and non-technical skills, and students report they often derive more educational value from it compared with other teaching methods [11]. This need is much more felt in emergency medicine, where the practitioner must have several skills, such as to making decisions quickly and being able to tolerate risk, staying calm in a pressured environment, being able to cope with a constantly varying workload, communicating well especially with anxious patients and their families and working as part of a team and in a leadership role [12-14]. The use of simulation training shows promise for helping to improve these skills in medical undergraduates, as it provides learners with the opportunity to experience realistic clinical scenarios, to make decisions, and face uncertainty [15]. This technique must be integrated into the training curriculum in developing countries in the same way as in developed countries, especially since the medical students consider the simulation as educationally valuable, and it improves their confidence in challenging and uncertain situations [16,17].

Conclusion

Medical simulation is a good technique of teaching the technical and soft skills for graduate medical education, undergraduate medical education, and continuing medical

education, so it must be integrated into the educational curriculum even before the start of clinical placements.

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