

EVALUATION OF EFFICACY OF COMPUTER BASED SIMULATION METHOD IN THE CLINICAL TEACHING OF BAMS STUDENTS (Undergraduate Ayurveda Students)

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Abstract: *Introduction* - Medical simulation is a branch of simulation technology related to education and training in medical fields. Different classifications of simulation devices exist. Computer based simulation is one of them. It is a low cost simulation. The extent of clinical exposure to certain basic procedures is inadequate in the Ayurvedic educational institutions. This situation made us to think of alternative options to change the scenario. Objectives - The study was undertaken to introduce computer based simulation method in clinical teaching and to evaluate its efficacy in retention of knowledge and procedural skills. *Material and method* – Final year BAMS students were randomly divided into two groups. Group A and B were taught by traditional method and computer based simulation method respectively. Knowledge gain was determined using pretest and posttest. Procedural performance was assessed on a standardized patient and manikins. Feedback was obtained from intervention group to assess their perception. *Observation and Result* - The pretest posttest analysis showed significant improvement in retention of knowledge in intervention group as compared to control group. The analysis of procedural performance indicated enhancement of procedural skills in intervention group. *Conclusion* -It is economically feasible, can apply to make the students competent in all the domains – cognitive, psychomotor and affective.

Keywords: Affective, Computer based simulation, Cognitive, Manikins, Psychomotor, Standardized patient.

INTRODUCTION

Clinical skills and theoretical knowledge are two equally important parts of medical education. A major challenge for medical undergraduates is the application of their theoretical knowledge to the management of patients. Today's medical students and graduate doctors have significant deficits in their clinical skills.¹⁻³ The actual bedside teaching has declined from a 75% in 1960s to less than 20% today.⁴ There are several reasons for this decline. To overcome this problem, medical simulation branch had developed. It is a branch of simulation technology related to education and training in medical fields. Different classifications of simulation devices exist. Computer based simulation is one of them. It is a low cost

simulation. In computer based simulation; Video is a very powerful medium for communication and learning by moving images and sound together. It can be used effectively in all three areas of learning - knowledge, skills and attitudes.

Although simulation does not exactly duplicate clinical challenges or experiences with real patients in a genuine clinical setting, it complements students' learning. Literature also suggests that it can be used to prepare students for contact with real patients.⁵

In ayurved curriculum, all the topics related to acquiring basic clinical skills are included in the course but usually theoretical aspects is more emphasized and practical application is not taking place adequately.^{6,7}

The Ayurvedic graduates play an important role in the primary healthcare delivery system of the country, it is necessary to make students confident in performing basic clinical skills. **Patwardhan (2011)** in his study also emphasized that Ayurved education needs to make some changes in clinical teaching.⁸

Rationale of Study - The extent of clinical exposure to certain basic procedures like intravenous cannulation, incision and drainage, suturing and catheterization is inadequate in the Ayurved institutions because of lack of variety of patients.³ This situation made us to think of alternative options to change the scenario. Still there is no any study conducted in Ayurved education about introduction of any technology to enhance students' clinical skill. So we decided to undertake this study to introduce computer based simulation method in clinical teaching

Aim and objectives - This study was aimed to explore the role of computer based simulation method in clinical teaching of final year BAMS students in the subject of Kayachikitsa

1. To evaluate the efficacy of computer based simulation method in understanding the topic.
2. To compare the effectiveness of traditional method and computer based simulation method in retention of knowledge.
3. To compare the procedural skills in control group and computer based simulation group

MATERIAL AND METHOD

This was a prospective randomized interventional study. The study was conducted in the E-museum of Department of Kayachikitsa and clinical skill laboratory of school of health professional education, Datta Meghe Institute of Medical sciences, Sawangi. Total 50 students were categorized as high, mid and low achievers from the result of summative examination of previous year. Two groups (A-control group and B-Intervention group) were made. 15 students for each group were randomly selected in such a way that each group had 5 high achievers, 5 mid achievers and 5 low achievers. This was done to avoid the bias in the study. The topic 'intravenous cannulation' was selected for teaching because it is an essential basic skill in which every undergraduate medical student must be competent. This topic was taught to group A by traditional

method (lecture and showing instruments) and to group B by computer based simulation method. (Showing video of I.V. Cannulation). Pre and post test were administered to both the groups before commencement and after completion of topic respectively. Total 8 BAQ type questionnaires (Level I – 6 and Level II- 2) for pre and post test were formed and validated by expert.

After 15 days of I post test, second post test was administered to both groups. Pretest, I post test and II post test were taken to assess the baseline knowledge of topic, understanding of topic and retention of knowledge respectively. On the next day of completion of II post test, all students of both groups were taken to the clinical skill laboratory to assess their procedural skill. They were asked to perform pre procedural steps on simulated patient and to perform the procedure on manikin. It was observed by a faculty using 13 item checklist. The observer was blinded about grouping. In the last, Intervention group had given questionnaire (open and close ended) to assess their perception about the method. As an ethical consideration, after completion of activity, all remaining students were taught the same topic by computer based simulation method.

Evaluation of interventional method was done using Kirkpatrick's Evaluation.⁹ This is a Kirkpatrick model of evaluation wherein, we could evaluate two levels i. e. Reaction and Learning (**table 1**)

Table 1: Gender wise distribution of research participants

Gender	Control group	Intervention group	Total
Male	4 (27.%)	2 (13.%)	6 (20%)
Female	11 (73 %)	13 (87%)	24 (80%)
Total	15	15	30(100%)

Evaluation parameters using Kirkpatrick's model of Evaluation

students' perceptions were evaluated using feedback questionnaire. Responses to close ended items recorded on 5-point Likert scale were expressed as percentage. Responses to open ended items were analyzed qualitatively.

Table 2 and **3** show the comparison of pre test and post test. In control group, Mean score of pretest was 0.70 ± 0.45 . The first post test score was 10.00 ± 2.05 and second post test score was 9.13 ± 1.35 . On using paired t-test, statistically significant difference was found in the

This is a Kirkpatrick model of evaluation. We could evaluate two levels i. e. Reaction and Learning

Level 1: Reaction	To what degree participants react favorably to the learning event
Level 2: Learning	To what degree participants acquire the intended knowledge, skills and attitudes based on their participation in learning event
Level 3: Behavior	To what degree participants apply what they learned during training when they are back on the job
Level 4 : Result	To what degree targeted outcomes occur as a result of learning event and subsequent reinforcement

Evaluation parameters using Kirkpatrick's model of Evaluation

Evaluation	Instrument	Type of Analysis
Level 1 Evaluation of reaction	Feedback questionnaire to evaluate students' perception (close ended items)	Quantitative analysis
	Feedback questionnaire to evaluate students' perception(open ended items)	Qualitative analysis
Level 2 Evaluation of learning	Comparison of pretest and I post test score in control group	Quantitative analysis
	Comparison of pretest and I post test score in intervention group	Quantitative analysis
Evaluation of retention of learning	Comparison of post test I and II score in control group	Quantitative analysis
	Comparison of post test I and II score in intervention group	Quantitative analysis
Evaluation of procedural skills	Comparison of both groups by checklist.	Quantitative analysis

Table 2: Comparison of pretest and post test of both groups

Method	Score	Mean \pm SD	t value	P value
Control group	Pre test score	0.70 \pm 0.45	16.53	0.000 (S, p<0.05)
Intervention group	Pre test score	0.63 \pm 0.61	24.18	0.000 (S, p<0.05)
	Post test score	11.56 \pm 1.63		

Table 3: Comparison of Pretest and II Posttest scores in both groups

Method	Score	Mean \pm SD	t value	P value
Control group	Pre test score	0.70 \pm 0.45	23.12	0.000 S, p<0.05
	II post test score	9.13 \pm 1.24		
Intervention group	Pre test score	0.63 \pm 0.61	47.09	0.000 S, p<0.05
	II post test score	12.00 \pm 0.73		

mean marks of pretest and I and II posttest. P value was statistically significant. In intervention group, the mean pretest score was 0.63 \pm 0.61 and first and second mean post test score was 11.56 \pm 1.63 and 12.00 \pm 0.73 respectively

In **Figure 1**, the comparison of Mean score of first post test of control group and intervention

group was 10.00 and 11.56 respectively. The mean score of second posttest of control group and intervention group was 9.13 and 12.00 respectively. On using unpaired t-test, statistically significant difference was found in the mean marks of control group and intervention group. It means that computer based simulation method was effective in retaining the knowledge

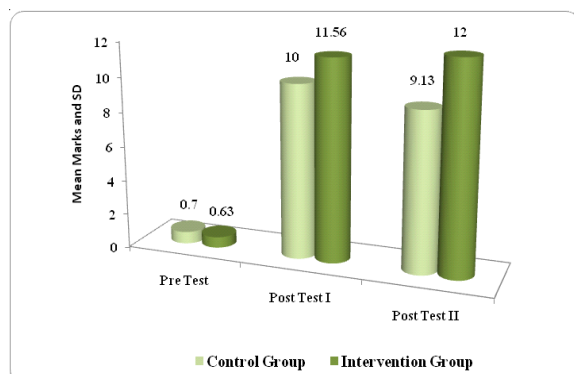


Fig.-1: Comparison of pre test and post test score in two groups

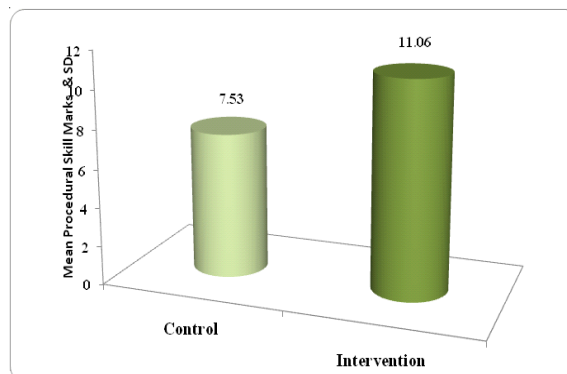


Fig.-2: Comparison of Procedural Skill in both the groups

Table 4: Cognitive learning gain

Cognitive learning gain	Control group		Intervention group	
	Post test I	Post test II	Post test I	Post test II
Absolute learning gain	62%	56.22%	72.88%	75.77%
Class average normalized gain(g)	0.64(64%)	0.58(58%)	0.76(76%)	0.79(79%)

Table 5: Comparison of Procedural Skill in both the groups

Group	N	Mean	Std. Deviation	Std. Error Mean	t-value	p-value
Control	15	7.53	1.18	0.30	8.02	0.000 S, p<0.05
Intervention	15	11.06	1.22	0.31		

Table 6 - Students' perception – Analysis of close ended question

	Item	SD(1)	DA(2)	N(3)	A(4)	SA (5)	Rating Average
1	The computer based simulation method of teaching helped in better understanding of the topic.	0 (0.00)	0 (0.00)	0 (0.00)	3 (20)	12 (80)	4.8
2	Seeing the procedure by computer based simulation method helped to remember the studied facts.	0 (0.00)	0 (0.00)	0 (0.00)	7 (46.66)	8 (53.33)	4.53
3	It was easy to perform procedure by visualization of procedure video.	0 (0.00)	0 (0.00)	0 (0.00)	8 (53.33)	7 (46.66)	4.47
4	Computer based simulation method was helpful in developing interest in the topic.	0 (0.00)	0 (0.00)	0 (0.00)	4 (26.66)	11 (73.33)	4.73
5	Computer based simulation method was effective in increasing clinical skills.	0 (0.00)	0 (0.00)	1 (6.66)	6 (40)	8 (53.33)	4.46
6	Time allocated for the topic taught through computer based simulation method was adequate.	0 (0.00)	2 (13.33)	4 (26.66)	7 (46.66)	2 (13.33)	3.6
7	computer based simulation method helped in enhancing communication skills	0 (0.00)	0 (0.00)	1 (6.66)	5 (33.33)	9 (60)	4.53
8	This teaching modality should be used in other clinical subjects	0 (0.00)	0 (0.00)	0 (0.00)	4 (26.66)	11 (73.33)	4.73
9	computer based simulation method should be included as a teaching tool	0 (0.00)	0 (0.00)	0 (0.00)	2 (13.33)	13 (86.66)	4.86

N= 15(Likert scale: SD= Strongly disagree; D= Disagree, N= Neutral, A= Agree, SA= strongly agree Values in parenthesis indicate percentage

In **Table 4**, the absolute learning gain for post test I was 62% and 72.88% and for post test II was 56.22% and 75.77% in the control and intervention group respectively. Class average normalized gain in control and intervention group for post test I was 0.64 and 0.76 respectively and for post test II, it was 0.58 and 0.79 respectively

Table 5 shows the mean score of procedural skills was 7.53 and 11.07 in control group and intervention group respectively. Significant difference in the marks indicated effectiveness of computer based simulation method in procedural skills.

Evaluation of Reaction

Response rate for the feedback taken at the end of the completion of activity was 100%.

Analysis of close ended questions –

The participants' opinion ranged between score 4 to score 5 i.e. between agree to strongly agree. Average rating score ranged from 4.46 to 4.86 except for item no. 6 it was 3.6. **Table 6** shows the score given by the participants to each item.

DISCUSSION

In both the groups, knowledge was increased. In the comparison of second posttest score of both groups indicated effectiveness of computer based simulation method in retention of knowledge.

Absolute learning gain was calculated for both the groups. The score was significantly high

in the intervention group. We also calculated the class average gain (g) as a measure of effectiveness of an educational intervention as suggested by Hake. Class average normalized gain is categorized 0.1 to 0.29 as low gain, 0.3 to 0.69 as medium gain and 0.7 to 1.0 as high gain. In our study, the class average normalized gain was 0.65 in control group and 0.76 in intervention group. As per Hake's criteria, computer based simulation method was highly effective.¹⁰

Effect of intervention on procedural skills

The students of control group were unable to perform the procedure in sequential manner. It indicated that video-assisted teaching enhances procedural skills in medical students. According to previous research, video-based education interventions appear to improve medical students' procedural skills.¹¹ A similar study was conducted to show students who practiced with video instructions had substantial improvements in procedural skills in comparison to students who used a manual after watching instructions directly one time from an expert.¹²

100% students perceived that computer based simulation method helped in better understanding of the topic and to remember the studied facts as well as developed interest in learning the topic. This is supported by the study of **Sami A. AlNassar et al. (2012)**¹³

100% students thought that video based teaching helped them to enhance their procedural skills. They agreed that it was easy to perform procedure by visualization of procedural video.

Table 7 - Analysis of open ended questions –

How computer based simulation helped you to enhance the procedural skills?	% of Students
It gave exact knowledge what has to be done and not to be done	80%
Visualization of each step of procedure was very useful during performing	80%
It helped to learn practical aspect in proper manner	66.66%
It was useful in better understanding of procedure	66.66%
Video improved the attention to the topic and also had a positive impact on motivation as well as concentration levels.	60%
It helped to remember the procedure	33.33%
What are your suggestions to improve this teaching modality for enhancing clinical as well as procedural skills?	
It should be inculcated in all clinical subjects.	93.33%
Students should be taken to clinical skill laboratory at least once in a month for demonstration purpose to enhance procedural skills	86.66%
It should be compulsory to teach clinical examination and procedures by computer based simulation method.	60%

94% students opined that it is helpful in developing clinical skills. In study of SteenVigh Buch et al. (2014), it was found that video-based e-learning was more effective method than illustrated text-based e-learning for the procedural part of the OSCE in teaching the Dix- Hallpike test as video can present a smoother and more exact sequence of steps in a given clinical procedure.¹⁴ All students were felt that this method helped in enhancing communication skills also. The three main areas of the undergraduate medical curriculum are knowledge, skills and attitudes. Of these, attitude is difficult to innumerate and explains to students. Video recordings enable the student to put technical skills into the context of appropriate professional behavior with respect to attitude.

On qualitative analysis of the responses to open ended questions, majority of the students (93.33%) seemed to have favorable attitude towards computer based simulation. With respect to the enhancement in procedural skills, the students commented that this method gives exact knowledge of what has to be done and not to be done. They also emphasized that visualization of each step of procedure was very useful during performing.

Students also felt that this teaching modality should be included as a teaching tool and used in other clinical subjects. This can be incorporated in all clinical departments as there is scarcity of variety of patients and students are deprived as far as clinical as well as procedural skill is concerned.

They opined that it should be compulsory to teach clinical examination and procedures by computer based simulation method. They also suggested that video based teaching should be followed by posting in the clinical skill laboratory at least once in a month for demonstration purpose to enhance procedural skills more.

CONCLUSIONS

From the feedback given by students, it can be concluded that Computer based simulation method of teaching was well accepted. Its acceptability is reflected by their suggestion of incorporating this method in other clinical subjects. It is also useful in recollecting the facts. It is specifically helpful in enhancing procedural skills which is an integral part of medical profession. The repetition of training may increase its effectiveness.

The visit to clinical skill laboratory to assess procedural skill was enjoyable and additional experience as it allowed them performing what they have learnt. It is useful in enhancing communication skills also by observing the performer, how he explains the procedure to patient, how he counsels the patient. It is economically feasible and can be implemented

Limitations of the study

1. The study was conducted on small sample size.
2. Long term learning outcomes could not be assessed because of time restrictions.
3. Assessment on only single topic may interfere with conclusion.

Recommendation

Computer based simulation method can be recommended in all clinical departments specially Panchakarma, shalya and shalakya where student has to exposed to different procedures.

Key message

There is a need to incorporate this method in Ayurveda to enhance clinical skills of students

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Conflicts of Interest

No conflict of interest declared.

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