Simulation-based Mastery Improved Nursing Skills in Bsc Nursing Students: A Quasi-experimental Study

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Research article

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Abstract

**Background:** Clinical education is an essential part of nursing education. Selected clinical teaching methods influence it. Simulation-based mastery learning has been used to improve clinical skills among nursing students and may provide a novel way to enhance nursing skills. The object of this study was to assess the effect of the simulation-based mastery learning on the clinical skills of undergraduate nursing students from 2017 till 2019.

**Methods:** This study was a quasi-experimental study with two groups (the control and intervention). After receiving written consent, one 117 students selected random convenience sampling. The intervention group participated in a simulation-based mastery learning intervention, and the control group received no intervention except for traditional training. The students of both groups completed the demographic information questionnaire and the checklist before and after the intervention. The results were analyzed by SPSS version 21 using descriptive and inferential statistics.

**Results:** The results showed that there were no significant differences between the two groups before the intervention (p > 0.05). Also, that students’ performance in the intervention group and control group improved significantly at the post-test compared to baseline (p<0.05), implying that the simulation-based mastery model of the intervention group significantly more effective compared to that of the control.

**Conclusion:** These findings showed that mastery learning strategy improved the clinical skills of undergraduate nursing students. The results suggest that other nursing and health profession’s programs can develop a successful mastery-based learning model.

**Background**

Clinical education is an essential part of nursing and midwifery education [1]. It has been [2] training is that the students do clinical skills through professional standards.

The educators try to create conditions that can lead to learning professional behaviors in nursing students, and they can respond appropriately to specific clinical situations [3]. There is a trend in nursing education to adopt competency-based education (CBE) models. Anima and McCoy define competency as acquiring the integration of knowledge, skills, values, and attitudes expected and required of a competent nurse [2]. Also, it is the basis of nursing education [4].

Mastery models differ from traditional curricula by defining progression as achieving a series of competencies [5]. Educators make a valuable contribution to the learning process by creating competency-based models that can enhance training [6]. In conclusion, students acquire the ability to do clinical skills [7].

Nursing students need to be able to combine knowledge from nursing, biological, and social sciences to be able to make clinical decisions and manage different situations in the clinical settings [8].
Mastery is a new applied method for training students in medical sciences, and it is one of the individual learning styles [9]. It originates from Carroll's belief that if sufficient time is given to the full extent of education, the right level of education can be achieved [10]. Mastery learning features the use of frequent formative assessments to provide feedback and to evaluate whether students have mastered an instructional standard [5]. But some studies indicated that it creates anxiety in the student due to frequent evaluations, and it is time-consuming. Mastery models engage learners in deliberative practice with repetitive tasks of increasing difficulty while providing coaching to guide their progress [11]. Also, this method makes students more active [12].

For students failing to attain mastery, the assessment provides a diagnostic tool to develop an individualized learning plan to guide corrective action and to address deficiencies. Students who initially fail to demonstrate ability, receive additional opportunities to study and to re-evaluate until they achieve mastery [13]. Using a mastery model offers the potential for greater accountability, flexibility and focus on the learning [14].

The merits of this method are doing the clinical skills correctly by the student and fulfilling professional responsibilities in the future [15]. A study by Wayne et al., showed that mastery learning is influential in CPR skills [16]. Frogameni et al also indicated symbolic-based mastery learning is an effective strategy to train residents on mechanical ventilator management. Relying on traditional training methods in ICU may leave residents ill-equipped to safely manage patients receiving mechanical ventilation [17].

But there is little in the nursing literature about programs based on a mastery model. Also, in Iran, Most educators traditionally educated subject-centered, time-based, and summative evaluation with little feedback, and they do not apply the mastery method for skills training. Besides, mastery models are unknown for educators, and there are limitations to implement it. Due to the benefits of this method mentioned, the research team decided to assess the effects of simulation-based mastery on the clinical skills of B.Sc. nursing students.

**Methods**

This quasi-experimental study was conducted with a two-group pretest-posttest design from 2017 till 2019 in Kerman. The research population consisted of 100 BSc nursing students who met the inclusion criteria. The study was performed in the nursing department. Students were selected first using convenience sampling and were then randomly divided into control and intervention groups by drawing lots. The inclusion criteria included 7th and 8th-semester nursing students and not educated by this method previously.

First, the objectives of the study were explained to the participants. The students participated in the study with full consent and agreement. They were told that attending or not participating in the study would not affect their educational process. Before starting the intervention, the skills checklist was completed by the instructor in the two groups.
The intervention was started on the second day of training of the course. The members of the intervention group were provided with a simulation-based mastery intervention in five basic clinical skills (suction, nasogastric tube feeding, packed cell transfusion, changing set and fluid box).

At first, the instructor performed each skill on the human models in skill laboratory. After that, the students showed these skills and assessed by the instructor. The assessment provided students with feedback to identify what they had learned that point (diagnostic feedback) and what they needed to learn better (prescriptive feedback).

Subsequently, the problems of implementing skills in the students were identified and presented as a list to the relevant instructor and student. After that, they set specific goals for each student based on the deficiencies identified in the first stage. In this program, the instructor used supervisory and observational methods. The instructor re-evaluated the students through a checklist and re-identified some deficiencies that were listed in the checklist daily for 12 days. Besides, students who initially fail to demonstrate ability, receive additional opportunities to study and to re-evaluate for three times.

At the end of the course, the clinical skill scores were checked. The time of training was six weeks and each week two days.

The students under the study, in the control group, were trained by an instructor in the traditional method. In traditional training, the instructor first practiced clinical skills on the human models, then the students practiced and asked questions if they had any.

In the traditional method, the instructor did education according to time-based and summative evaluation with little feedback. The content and course length was the same for the two groups. Besides, a single-blind method was used whereby the students involved in this study were not informed of the experiment being conducted.

The demographic information questionnaire and the checklist were used in this study to collect the data.

The demographic questionnaire contained questions related to age, sex, scale median, passed units, interested in the field, mean of last semester.

The checklists contain 72 items scored on a 3-point scale rating from done incorrectly and not done (score 1) till done correctly (score 2). Items are endotracheal and tracheostomy suction (19 items), the nasogastric tube feeding (19 items), packed cell transfusion (13 items), changing set and fluid box (21 items). The reliability of the checklist checked with the internal consistency alpha coefficient was 0.89, and its reliability through the test-retest method was 0.82.

The collected data were analyzed using descriptive and inferential statistics. According to the results of the Kolmogorov–Smirnov test, the data of this study had a normal distribution. Thus, parametric tests were used. Besides, the measures of central tendency and dispersion (frequency, percentage, mean, and standard deviation) were employed to compare the mean scores of hope between the intervention and
control groups before the intervention. The paired samples t-test was also used to compare the mean scores of skills in each group before and after the intervention. Finally, the independent samples t-test was run to compare the mean scores between the two groups after the intervention.

Results

The participants in this study were 117 BSc nursing students who taught to the nursing department of Kerman University of medical science. The participants were divided into two groups, Intervention group (N = 63) and control group (N = 54) with 117 participants. The mean age of students was 23.88 ± 2.06 in the mastery group, and 23.38 ± 1.78 in the control group.

Most of the participants were female (38 persons in the intervention group, and 29 persons in the control group). Most of the students were interested in nursing (52 persons in intervention group, and 43 persons in the control group). A majority of the participants were native (51 persons in the intervention group and 40 persons in the control group), most of them had no history of diseases and had good mean last semester. It was also shown that there was no significant difference between the control and intervention groups in terms of their demographic data, and the two groups were similar in terms of the demographic variables (Tables 1).

Table 1
Demographic characteristics of nursing students

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Mastery learning intervention</th>
<th>control</th>
<th>P &gt; 0.05*</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>Maximum-minimum</td>
<td>μ ± SD</td>
<td>Maximum-minimum</td>
</tr>
<tr>
<td></td>
<td>22–28</td>
<td>23.88 ± 2.06</td>
<td>22–28</td>
</tr>
<tr>
<td>Mean semester</td>
<td>13.4–18.7</td>
<td>16.4 ± 1.55</td>
<td>12.3–19</td>
</tr>
<tr>
<td>Passed unites</td>
<td>93–95</td>
<td>93.25 ± 0.84</td>
<td>92–94</td>
</tr>
<tr>
<td>Sex Female</td>
<td>N = 38 (60.3%)</td>
<td>N = 29 (53.7%)</td>
<td>P &gt; 0.05</td>
</tr>
<tr>
<td></td>
<td>N = 25 (39.7%)</td>
<td>N = 25 (46.3%)</td>
<td></td>
</tr>
<tr>
<td>Interested in nursing: yes</td>
<td>N = 52 (82.7%)</td>
<td>N = 43 (79.6%)</td>
<td>P &gt; 0.05</td>
</tr>
<tr>
<td>No</td>
<td>N = 11 (17.5%)</td>
<td>N = 11 (20.4%)</td>
<td></td>
</tr>
<tr>
<td>Native</td>
<td>N = 51 (81%)</td>
<td>N = 40 (74.1%)</td>
<td>P &gt; 0.05</td>
</tr>
<tr>
<td>Non native</td>
<td>N = 12 (19%)</td>
<td>N = 14 (25.9%)</td>
<td></td>
</tr>
</tbody>
</table>

*qui square
The results of this study showed that the mean score of clinical skills was a statistically significant between the control and the intervention group before and after the intervention in four skills (Table 2).

<table>
<thead>
<tr>
<th>Clinical skills</th>
<th>Mastery learning group</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suction</td>
<td>before: 26.46 ± 1.51</td>
<td>before: 21.9 ± 1.11</td>
</tr>
<tr>
<td></td>
<td>after: 37.20 ± 0.95</td>
<td>after: 26.75 ± 1.04</td>
</tr>
<tr>
<td></td>
<td>p: 0.000*</td>
<td>p: 0.00</td>
</tr>
<tr>
<td></td>
<td>t = -46.13</td>
<td>t = -24.01</td>
</tr>
<tr>
<td>NG Tube feeding</td>
<td>before: 23.46 ± 1.79</td>
<td>before: 23.85 ± 1.30</td>
</tr>
<tr>
<td>19–38</td>
<td>after: 37.41 ± 0.49</td>
<td>after: 28.075 ± 1.5</td>
</tr>
<tr>
<td></td>
<td>p: 0.00*</td>
<td>p: 0.00</td>
</tr>
<tr>
<td></td>
<td>t = -63.4</td>
<td>t = -14.56</td>
</tr>
<tr>
<td>Pack cell</td>
<td>before: 17 ± 1.33</td>
<td>before: 17.79 ± 1.26</td>
</tr>
<tr>
<td>Transfusion</td>
<td>after: 25.52 ± 1.05</td>
<td>after: 20.79 ± 0.71</td>
</tr>
<tr>
<td>13–26</td>
<td>p: 0.000*</td>
<td>p: 0.00*</td>
</tr>
<tr>
<td></td>
<td>t = -44.4</td>
<td>t = -14.77</td>
</tr>
<tr>
<td>Changing fluid</td>
<td>before: 34.68 ± 0.4</td>
<td>before: 24.63 ± 1.23</td>
</tr>
<tr>
<td>box</td>
<td>after: 41.47 ± 0.64</td>
<td>after: 33.57 ± 1.46</td>
</tr>
<tr>
<td>21–42</td>
<td>p: 0.02*</td>
<td>p: 0.00*</td>
</tr>
<tr>
<td></td>
<td>t = -24.2</td>
<td>T = -47.18</td>
</tr>
<tr>
<td>Total</td>
<td>before: 25.4 ± 1.27</td>
<td>before: 22.04 ± 1.22</td>
</tr>
<tr>
<td>18–36</td>
<td>after: 35.4 ± 0.46</td>
<td>after: 27.29 ± 1.17</td>
</tr>
<tr>
<td></td>
<td>p: 0.000</td>
<td>p: 0.13</td>
</tr>
<tr>
<td></td>
<td>t = 21.3</td>
<td>t = 16.34</td>
</tr>
</tbody>
</table>

*Paired t-test

The results showed that the mean score of skills in the control group before and after the intervention was 22.04 ± 1.22 and 27.29 ± 1.17, respectively (Table 3). The results of the paired samples t-test indicated that the mean score of skills in the control group before and after the training program was statistically significant (P < 0.05).
### Table 3
Compare the mean of total skills scales between the two groups

<table>
<thead>
<tr>
<th></th>
<th>mastery learning group</th>
<th>common learning group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before</strong></td>
<td>25.4 ± 1.27</td>
<td>22.04 ± 1.22</td>
<td>p &gt; 0.05*</td>
</tr>
<tr>
<td><strong>After</strong></td>
<td>35.4 ± 0.46</td>
<td>27.29 ± 1.17</td>
<td>t = 12.24</td>
</tr>
<tr>
<td>*P = 0.000</td>
<td>*p = 0.00</td>
<td>p &lt; 0.05</td>
<td></td>
</tr>
<tr>
<td>t= 21.3</td>
<td>t = 16.34</td>
<td>t = -40.2</td>
<td></td>
</tr>
</tbody>
</table>

*independent sample t-test

*paired t -test

By comparison, the mean scores of skills scale in the intervention group before the intervention (25.4 ± 1.27) and after the intervention (35.4 ± 0.46) were statistically significant (p < 0.05) (Table 3).

Also, in comparison, the mean score between the intervention and control group after the intervention, there was a significant difference between the two groups (p < 0.05) (Table 3).

**Discussion**

This study was one of the few studies in Iran that conducted on the effect of symbolic-based mastery learning on the clinical skills in undergraduate nursing students.

The results of this study indicated that the mean score of skills in the control group before (22.04 ± 1.22) and after the training program (27.29 ± 1.17) was statistically significant (P < 0.05). Also, the mean scores of skills scale in the intervention group before the intervention (25.4 ± 1.27) and after the intervention (35.4 ± 0.46) were statistically significant (p < 0.05). The results of this study showed that mastery learning is more effective than the traditional method in achieving clinical skills.

For empowering the nursing students, the use of new and practical teaching methods in clinical settings is essential. Also, mastery learning is considered as a new paradigm in medical education [10]. In this study, BSc nursing students educated five basic nursing skills by mastery approach because there is little in nursing literature about the program based on mastery models, especially in clinical applications.

Educators tried the students to acquire the knowledge and skills to become competent nurses, and mastery models developed it.

Barusk reported the implementation of the mastery learning for physical examination skills increased the nursing student's knowledge and skills scores [18].
He indicated that mastery learning promoted the general competency of the students[18]. The findings of the study by Tang showed mastery learning intervention caused to increase nurses' clinical competencies. [19]. Besides, Schroedl reported the mastery learning method is useful to identify the professional competence of nursing practice [11].

This finding was in line with the results of the present study. Contrary to other teaching methods, in this method, the instructor knows the deficiencies of the students, and the students know that they have enough time to learn the skills [20]. This method is applicable to establish the criteria for measuring competencies. In this study, acquiring competency was based on skills scale.

Also, This teaching method can be used to determine students' learning needs [21]. According to this study, in each stage of intervention, the instructor identified students' learning problems and retested him/her. Also, Students who initially fail to demonstrate ability, receive additional opportunities to study and to re-evaluate.

Repeated assessments of students at given intervals caused to improve the quality of education, and the students are active in the learning process [18].

But, Roberts et al indicated the main challenge of this approach is time-consuming due to the organization of various tests and the high volume of nursing education contents [22]. One of the challenges expressed by the instructor in this study was time-consuming. Also, they stated implementation was challenging with a large number of nursing students and the limitations of the Clinical Skills laboratory facilities.

In another study, Mohd Hasril concluded that Mastery learning strategies compared to traditional mastery models are significantly associated with increased learning in vocational training. Trainees mentioned who have received faster feedbacks are more successful. [23]. In this study, the trainees received their feedback immediately after each skill do. Received feedback by the nursing students caused the student identify his/her deficiencies.

Because of giving the feedback along the teaching process, the students gain the skills of high quality. According to experiences of instructors, some students have anxiety then they receive the feedback. Thus, scientific and psychological support to the students improves their clinical skills. By evaluating this model and examining its strengths and weaknesses, provided a platform for different students to apply it in various educational settings.

This study was done in the nursing department of Kerman University of medical science alone, and this caused limitations to the generalizability of the study data to some extent.

Also, it is suggested that the effect of mastery learning on self-esteem, satisfaction, and competency of students will be assessed.
Conclusion

The results of the study showed that the implementation of the mastery learning method is useful in clinical skills training. Also, the quality of clinical learning in undergraduate nursing students improved, and it is a flexible and successful approach and implemented to enhance the students' learning.

List Of Abbreviations

Not applicable

Declarations

Ethics approval and consent to participate

The approval for this study was obtained from Ethics Committee of Kerman University of Medical Sciences (IR KMUREC930241). Written informed consent was obtained from each participant. This study was performed on the fourth-year nursing students during fall and spring semesters 2018-2019.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Competing interests

The authors declare that they have no competing interests.

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Author contribution
This manuscript is the consequence of the collaboration of all the authors. Author MN designed the study, wrote the study proposal, conducted data collection, and analyzed the data. The author BB analyzed the data, and the Author RM wrote the final draft of the manuscript, prepared tables, and submitted the document to the journal.

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