Original Article

The Effect of Competency-Based Education Model on Cognitive and Clinical Skills of Nursing Students

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Abstract

Introduction: Improving the quality of clinical education requires using efficient methods. Outcome-Based Education (OBE) is a corrective educational move that has influenced many countries in recent years. Despite the global acceptance of OBE, there is little evidence about its impact on clinical competence (cognitive and behavioral skills). Thus, the present study aimed to evaluate the effect of OBE on clinical competence of nursing students.

Methods: the design was quasi-experimental with two groups of pre-test and post-test, in which 52 nursing students were selected by census sampling method and randomly divided into four groups of control and two groups of experiment. Each group included 6-7 people. After performing the pre-test of cognitive skills, the students at the control group with a conventional method of education, and those at the experimental group with competency-based education were trained for 14 days. Finally, the students' cognitive skills were observed with post-test and behavioral skills checklist. The first two groups, as the control group, received conventional training in the hemodialysis department, and the training of the next two groups as the experimental group was done using a curriculum that was designed based on competency-based education. Data were analyzed by Wilcoxon, Mann-Whitney, and Fisher's exact tests in SPSS.

Results: The findings showed that competency-based education is effective in improving the cognitive and behavioral skills of students. The mean score of cognitive skills of the experimental group in posttest, as well as their behavioral skills in all cases and in general were significantly higher than the control group. The clinical competence of the experimental group students was significantly greater than the control group.

Conclusion: Competency-based learning method is more effective than traditional method for promoting the competency of nursing students, therefore it is recommended to use this method more in clinical education.

Key words: nursing education, clinical education, outcome-based education, clinical competency, nursing students

INTRODUCTION

More than 50% of nursing curricula are devoted to clinical education (1-3). Nursing curriculum planners consider clinical education to be the main part of nursing education (4 & 5). Clinical education is one of the strategies through which nurses achieve clinical competence, but unfortunately, the results of studies on nursing education in Iran have shown that the quality of clinical education is not favorable and there are deficiencies (6, 7). For example, Salimi states that nursing students' clinical skills in ICU are not satisfactory (8); and Farnia reported that most nursing students believed that they have not acquired the necessary skills for nursing occupation in their curriculum (9).

Although the need for revising the clinical apprenticeship has been emphasized in many studies, but due to the complexity of education in the clinical setting, only a few researchers have allowed themselves to study teaching and learning issue in this environment and examine how to improve it (8 - 11). Today, many clinical educators are looking for educational methods that can provide students with knowledge and clinical skills at an appropriate level (11). One of the new educational systems in which the outcome of desirable performance in the expected clinical role is considered is the Outcome-Based Education (OBE) system (12-15).

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Outcome-based education (also known as standard-based education) has moved from the traditional teaching of what the student must learn (content) to establishing unique standards of what the student is expected to know and is able to do. This corrective action emphasizes the establishment of clear standards for tangible, measurable outcomes. Over the past four decades, there were several leading advocates of this move to department outcome-based education, including competency-based education, criterion-referenced learning, mastery learning, credible assessment and interdisciplinary outcomes. Outcome-based learning features include the creation of written and fully-defined learning outcomes at the end of the course, curriculum design, learning strategies and learning opportunities to ensure the outcomes, an assessment process tailored to the outcomes and assessment of the students to ensure the achievement of outcomes, providing intermediaries, and enriching student learning to the extent necessary.

Some advantages are mentioned for the adoption of an outcome-based education model in the medical training, such as helping to increase the relevance of education to the future job. The specificity of the curriculum in this method of education will encourage the student to department self-centered education and identifies the deficiencies in the content of the curriculum. Another advantage of an outcome-base education method is the ability to recognize controversial issues in academic content, and to focus on the relationship between academic programs and clinical skills training. This method of training leads to systematic results and the training program will be aligned and homogenized as a predicted and desired program from the beginning until the achievement of outcomes. By expressing the expected results, this method determines the potential for obtaining an outcome, and in other words, describes each item along with the parameters and plans for its achievement (12, 14, and 15). However, the initial implementation of outcomes requires a great deal of time and people who are involved in setting standards (16). Today, schools are pushing for changing the role of health care examiners and educational assessors (12-15, 17, and 18) to take into account the outcomes of the curriculum beyond traditional teaching tools. This move has led to adjustment of the outcome-based approach to university students' education (15 and 16). The outcome-based system, in fact, is focused on both students' learning and their performance (19). One of the important concepts that emphasizes in the nursing education system is the concept of competency (20). An outcome-based approach to Hemodialysis traineeship can provide the ground for expressing some of the challenging outcomes, such as nurse relationship with patients and colleagues, professional standards, clinical and behavioral reasoning, and individual and professional development.

Despite the global acceptance of outcome-based education (OBE), research about its impacts is limited. In a review of the related papers, most documents are of a perceptual and anecdotal nature (21), and there was no study found that examines the effectiveness of this method in clinical education of nursing students inside or outside Iran, and the only findings were related to its impact on the competence of physicians in drug prescription (16), pharmacology education (22), dentistry (23-25), medical education (22), veterinarian training (25), e-learning at the University of Birmingham, at undergraduate level (26). Although recommendation letters, lectures and narrative descriptions found from the review of literature may be helpful and inspiring, however they cannot provide a solid basis for supporting a corrective action. The disputes on outcome-based learning are still ongoing. For Spady, an outcome-based education system is worth to be used in teaching (27).

Regarding the lack of literature on the effect of OBE in clinical training of nursing students, we have tried to use this method for nursing clinical education and, given that nurses in hemodialysis part require a high level of knowledge and skills in order to be able to diagnose and treat the risky situations of hemodialysis patients at any moment, the research was carried out in this section.

The aim of the present study was to determine the effect of the implementation of an educational program based on clinical competency of nursing students in Urumia University of Medical Sciences in an apprenticeship in hemodialysis department. It is hoped that this method can improve the quality of clinical education and serve as a new method for promoting nursing education.

METHODS

This is a quasi-experimental study with two groups of pretest-posttest. Since in human studies a full control of the situation is not possible, therefore the initial sampling was not a coincidence.

Independent variable in this study was the two methods of clinical education, including outcome-based education and conventional education; and the dependent variable was the clinical competence of nursing students in hemodialysis department, which was obtained by assessing their learning outcomes (cognitive and behavioral skills).

Data collection tools in this research included the cognitive skills test and behavioral skills checklist. First, the adjusted Delphi Technique was used to determine the expected outcomes of training in the hemodialysis department. To

briefly explain the Delphi method for determining the expected outcomes of training the apprentices, some of the coaches involved in students' hemodialysis training and a number of experienced nurses who had the experience of working in this section over three years were asked in three rounds to write the important and essential outcomes for nursing work with patients in the hemodialysis department, including their own ideas about students' apprenticeship in this section. After concluding, these comments were sent to the same individuals for reaching a group agreement and, finally, after the third round of group agreement, five major categories were identified as educational outcomes in terms of the most important behavioral activities in the hemodialysis section, and the activities for each area were specified as: a) setting up the machine including 10 activities; b) preparing the hemodialysis device including 12 activities; c) the hemodialysis venipuncture with a fistula including 18 activities; d) initiating hemodialysis and connecting the device to the patient including 23 activities; E) the completion of hemodialysis and disconnecting the device from the patient including 32 activities.

With regard to the outcomes, the content and the main areas of the OBE curricula are formulated as a complete curriculum for 7 sessions and ultimately, to achieve these outcomes, student self-assessment sheets of learning progress and the teacher's checklists were designed and distributed. This curriculum is tailored according to the principles of adult learning, communication skills, teaching methods (clinical internship), and apprenticeship training (31, 32).

In this study the population included 52 nursing senior students (semester 8) of Urumia Nursing Faculty, who were receiving the necessary training for hemodialysis as one of the care units in the first semester of the academic year 2016-2017; all of whom were selected as the sample by census method (due to the small size of the research population). Then students were asked to come to a meeting. In the meeting, the researchers explained the research objectives and assured the students of the confidentiality of the information and their consent to participate in the study was obtained. They were then randomly assigned to four groups using a randomized table; two of the four groups were selected as the control group and the other two groups as experimental group, randomly. In order to ensure that the students of both groups have the same abilities, a pre-test was conducted using a cognitive skill test at the same session.

Each curriculum included 14 days of internship in the hemodialysis department from 8 A.M to 14 P.M, which started according to the schedule of October 2016, during the conventional education in the hemodialysis department of Taleghani Hospital of Urumia for the first two groups as the control group (7 nurses in each group). When the same trainer get prepared for the second round of training, it started again in mid-December of the same year with a program designed based on OBE, and the self-assessment sheets of the student's progression were distributed among the intervention group (6 in each group). The training of both groups was done by one of the researchers, who was an instructor in the hemodialysis department. Assessment of behavioral skills of all students in two groups was done based on the checklist designed by the same trainer through observing the behavior of students at the last day of the internship in the department. After completing the educational program, all students participated in the posttest of cognitive skills (the same as pretest).

Considering the outcomes identified for assessing students' cognitive skills, a multiple-choice test was run which included 40 questions for measuring the cognitive learning of students in the field of hemodialysis (on the prevention, detection and control of hemodialysis complications, hemodialysis care, pharmacotherapy during hemodialysis, dialysis adequacy, and patient training on fistula care and dietary observation); and a checklist was designed to assess the five categories of behavioral skills (hemodialysis device preparation, venipuncture for hemodialysis with a fistula, hemodialysis start and connecting the device to the patient, finishing the hemodialysis and separating the device from the patient) with 95 activities scored as "done correctly", "done incorrectly" and "no problem".

The validity of the cognitive and behavioral skills test was confirmed through formal and content validity. To determine the reliability of the cognitive skills test the cronbach's alpha was calculated ($r= 0.78$), and for the reliability of the behavioral checklist the two observers who were provided with the necessary training simultaneously observed the subjects. They independently observed and recorded the behavior of 5 students when working with a hemodialysis patient. According to the correlation coefficient ($r = 0.93$), the checklist for behavioral skills assessment had an acceptable reliability.

SPSS v.21 was used to analyze the data. For the scoring, in cognitive skills test, the right choice was scored 1 and other options zero, and the student's total test score was obtained by summing the scores of all responses. To examine the behavioral skills at the end of the course, students' behavior checklist in five categories was examined. If the correct behavior was observed from the student, 1 and for incomplete or incorrect behavior, zero was considered as the student's score and then the total score of the behavioral skills of each student was calculated in total and each of

the five domains. Then, the clinical competency score of each student was determined by collecting the cognitive skills post-test scores and the behavioral skills scores. For data analysis, Wilcoxon test was used to check the pre and post intervention scores within the groups; the Mann-Whitney test for comparing the scores of the two groups; and Chi-square test for comparing the characteristics of the two groups with the nominal data, and Fisher's exact test if there was any limit.

RESULTS

All students continued to work together until the end of the study. The female students in both groups accounted for the highest percentage (57% to 58%) of the research units. The average age of students was 24.28±1.89 in the control group and 23.5±1.08 in the experiment group. There was no statistically significant difference between the groups in terms of age, sex, work experience, having a dialysis patient in family and close relatives, and interest in hemodialysis work. Before the training, the mean and standard deviation of the cognitive skills scores in the control group were 17.71 ± 5.81 and 15. 91 ± 6.40 in the experimental group, which was not statistically significant and the two groups were identical (P>0.05). However, after the implementation of the conventional and OBE methods, a statistically significant difference was found between the scores of cognitive skills (Table 1), and scores of behavioral skills in all five categories and in general (Table 2), and the mean and standard deviation of the clinical competency of nursing students in the conventional education (control group 102.42±9.68) compared to the OBE (experimental group 113.75 ± 8. 62) (Table 3) (P >0.05). Therefore, the

research hypothesis was accepted in terms of the affectivity of OBE on clinical competency.

DISCUSSION

The results of this study showed that the education of nursing students with outcome-based method can have a significant effect on cognitive and behavioral skills of students in hemodialysis department. In addition, in comparing this method with the conventional method of clinical education, it has been shown that this method has a greater impact on the learning of cognitive and behavioral skills of students. Therefore, the hypothesis of this research postulating the "effectiveness of outcome-based education" on clinical competence (cognitive and behavioral skills) of nursing students is supported. The results of this study are in line with the results of various studies (16, 23, 24, and 33), which indicated that the "outcome-based education program" in continuous education (16), dental education (23 and 24), and teaching medical students in Malaysia (33) has also been effective. It is also similar to the implementation of an outcome-based education approach at Medical Department of Dundee University, Scotland and the United Kingdom as a case study (25) and lessons learned from the six-year experience of Dundee University, reporting the willingness of the instructors of these centers for implementing this approach (35). In a study aimed at developing and implementing a communication skills curriculum for 67 third-year students in dentistry, the researchers designed and conducted the unit based on OBE in three stages: determining the essential outcomes for dentists, developing a lesson based on its outcome, and its implementation. The results showed that the total grade score in the second period (outcome-based group) was higher than the first period (24). Ismaili et al. (2008) also examined the impact of an outcome-based education intervention on improving the clinical competence of physicians in drug prescription, which revealed a significant difference between pre and post test scores (16).

Outcome-based education emphasizes the importance of setting curriculum, its outcomes and content, with an

Table 1: Comparison of cognitive skills of students in experimental and control groups after being trained in conventional and OBE methods

Group Level of cognitive skills	Control	Experiment
Mean and SD after the intervention	18.57±5.74	24.58±2.93
The result of statistical test *	P<0.01	

Table 2: Comparison of behavioral skills of students in experimental and control groups after being trained in conventional and OBE methods

| Group Level of behavioral skills | Mean and SD | | The result of statistical test * |
	Control	Experiment	
a. Setting the device	8.57±0.41	9.33±0.28	P<0.01
b. Preparing the device	10.21±0.47	11.16±0.36	P<0.01
c. Hemodialysis venipuncture with fistula	15.64±0.58	16.41±0.59	P<0.01
d. Starting hemodialysis and connecting the device to the patient	20.92±0.48	21.58±0.58	P<0.01
e. Finishing the hemodialysis and disconnecting the device from the patient	28.12±0.69	29.33±0.72	P<0.01
Total scores	83.48±2.63	87.81±3.03	P<0.01

Table 3: Comparison of the level of clinical competence of students in experimental and control groups after being trained in conventional and OBE methods

Group Level of clinical competence	Control	Experiment
Mean and SD	102.42±9.68	113.75±8.62
The result of statistical test *	P<0.01	

*The mean and standard deviations given in the tests are for informational purposes and have not been used for testing. To test the scores of the two groups, Mann-Whitney U test has been used for the mean of scores

educational methodology for how outcomes should be evaluated (34); and this provides a framework in which the teacher can use the design of teaching time and learning activities in maximum. Therefore, following these principles in designing the program and its implementation can explain the reasons for learning promotion in all the outcomes determined in the hemodialysis department. Another explanation for the success of an outcome-based learning program may be the attempt to map out the outcomes through the Delphi method, which has related the content of curriculum to the clinical work of the nurse in the hemodialysis department. Jenkins and Unwin point out that learning outcomes help teachers tell their students more accurately what they expect from them (36). Spady (1994) points out that it is important to note that outcome-based learning is the provision of clear expressions of the concept of learning that assures us that the learning process is designed to achieve the desired results. This form of education provides flexibility in the presentation and allows planners to design their own programs based on outcomes, without the need to follow the traditional teaching methods (28).

CONCLUSION

Outcome-based education is more effective in improving the clinical competence of students than the conventional method. The results of the research support the research hypotheses and recommend the use of OBE method in clinical training of nursing students.

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