

# The Impact of Virtual-Based Education on Nurses' Self-Efficacy in the Level II Neonatal Care

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## Abstract

**Background:** Self-efficacy has an influence on nurses' professional progress, motivation, effort, perseverance, and time spent by learners on learning. It is also an interface between knowledge and practice. This study aimed to assess the impact of virtual-based education on self-efficacy of nurses in level II neonatal intensive care.

**Materials and Methods:** In this quasi-experimental study, after determining the sample size ( $n = 80$ ), nurses working in level II neonatal care unit of hospitals affiliated to TUMS were randomly divided into two groups. The study was conducted in 2015. Nurses' self-efficacy level was measured in the two groups by using Coates self-efficacy questionnaire on the first day of the study. For the intervention group, education content of level II neonatal care was developed and run on Namad system of the virtual faculty of TUMS for two months. No specific intervention was performed for the control group. At the end of the education course, nurses' psychological empowerment was reassessed in both groups by using the mentioned questionnaire. Data analysis was performed by using the paired t-test, Fisher exact test, chi-square, and independent t-test in SPSS 23.

**Results:** Research units were similar in terms of all demographic variables other than work experience in neonatal unit. Mean and standard deviation of self-efficacy scores in the control and intervention groups before the intervention were  $129.7 \pm 13.973$  and  $118.05 \pm 11.104$ , respectively, while mean and standard deviation of the two groups after the intervention were  $128.09 \pm 12.363$  and  $136.11 \pm 9.830$ , respectively. There was a statistically significant difference in the mean score of self-efficacy between the two groups before the intervention ( $P \leq 0.001$ ), self-efficacy mean score in the control group before and after the intervention ( $P = 0.002$ ), self-efficacy mean score in the intervention group before and after the intervention ( $P \leq 0.001$ ), and self-efficacy mean score between the two groups after the intervention ( $P \leq 0.004$ ).

**Conclusions:** The results of the present study indicate the effectiveness of virtual education in increased self-efficacy of nurses in level II neonatal intensive care unit. With regard to the advantages of virtual education, it can be employed as a modern educational method to provide necessary requirements and tools for training nurses and other healthcare givers.

**Keywords:** Virtual Education, Self-Efficacy, Neonatal Unit Nurse, Education

## 1. Background

Among the most important health indicators, it can be pointed out to the mortality rates of infant and mothers, which have significantly decreased by several sweeping actions and serious interventions in the process of providing services for mothers and infants. Based on the new population policies and national/international targets for reducing mortality, one of the effective ways for promoting health programs is ranking and organizing maternal and neonatal care services. Ranking services is in such a way that the best quality services must be available for those who are in need of such services while economic and ad-

ministrative limitations must be considered at the same time. Ranking prenatal services emphasizes on the promoting maternal and neonatal health services all around the country, and promoting justice in distributing facilities across the country. Prenatal services are ranked in 1 to 3 hospital levels (1).

In level I care of infants who are in 35 - 37 weeks of gestational age and are physiologically stable, routine care and assessment are presented after the infants' birth; also stabilization of less than 35 weeks infants are performed as long as their transmission to the appropriate level is not possible. The second level of care provides all services of level I in addition to taking care of infants weighing

$\geq 1500$  grams or those aged  $\geq 32$  weeks. Also, stabilization of the infants less than 1500 grams or pregnancy age less than 32 weeks is performed in this level until the infants' transmission to level III. In the second level of neonatal care, nurses take care of the infants who can be discharged to the level III (2). Providing specific care for premature and vulnerable infants needs a holistic approach. This group is physically susceptible, they are also exposed to serious dangers in terms of growing social personality due to many environmental pressures such as stimulus, pain, light, noise, etc. However, NICUs are in full interact with technology and are enjoying momentarily growth. Therefore, to increase ability and promote nursing services quality, neonatal unit nurses need to have updated scientific and practical knowledge (3).

Efficacy is a degree of an individual's sense of mastery about his/her ability for doing a special activity. The efficacy theory of Bandura emphasizes on individual's self-esteem and confidence in doing demanded behavior. Bandura states that self-efficacy is the main and important precondition in changing behavior such as health behaviors (4). Bandura states that self-efficacy is one of the personal beliefs that people need them to succeed, and it can show an individual's thinking and practice method. Therefore, professional qualification is in relation with self-efficacy (5). Self-efficacy affects clinical nurses' professional promotion (6). Self-efficacy influences individual's motivation, effort, perseverance, and time spent by learners on learning; it is also an interface between knowledge and practice (5). Studies show that people with high self-efficacy are more willing to participate in challenging behaviors, and they have better interpretation of health-related behaviors (7). Nurses who believe that they do not have enough power and motivation to work in difficult conditions may negatively have an impact on patients in terms of providing care (8). In addition, it is believed that people with high self-efficacy are more resistant in managing difficult situations and they can keep working at various times (9).

Nowadays, education is considered as the first human being right and a necessary factor in social change and progress. Many educational psychologists believe that learning conditions should be organized so that every learner is able to learn and practice based on his/her abilities (10, 11). Education is the basis for all learning and it is one of the most important factors in improving human source (12). Education is a purposeful activity for promoting learning. One of the strategic programs for promoting educational methods is employing information technology as an accessible and comprehensive tool. In parallel with the real world, a second space has been appeared that provides a new method for distance learning through

information technology. Due to rapid development of the internet especially in health system, employing virtual-based education has increased in learning and teaching methods (13). E-learning has made a new paradigm in education and learning and has made learning possible in every field for every person at any time and in any correspondence for the whole lifetime (14). Nurses are too busy (due to their high workload or rotational shifts etc.) to receive traditional educations. On the other hand, using traditional methods are sometimes time-consuming, costly, difficult, and sometimes learner need to attend in classes in person. On the contrary, e-learning provides learners with 24-hour learning while they do not need to attend in classroom in person and the necessary time for learning decreases by 30 - 35% (15). Therefore, regarding the nursing issues, which are mostly problem-oriented, and considering the clinical experiences, self-direction, and personality trait of nurses, conducting permanent education seems necessary to maintain qualification in nursing skills (16).

There are little documented studies in Iran regarding nurses' electronic and virtual education in taking care of patients especially infants. The urgent need to promote nursing scientific level and increase the quality of care in NICUs encouraged us to design a website to provide educational support for nurses working in level II neonatal intensive care units at TUMS. Accordingly, this study was conducted to assess the impact of virtual-based education on self-efficacy level of nurses working in level II neonatal intensive care units.

## 2. Objectives

This study aimed to determine the effectiveness of virtual-based education in self-efficacy of nurses working in level II neonatal intensive care units.

## 3. Methods

Purposeful convenient sampling method was used in this study. NICUs at hospitals affiliated to TUMS were considered in this study. Sampling for intervention and control groups was done at different hospitals to avoid samples contact. Numbers of staff who had the inclusion criteria and were working in one of the 8 hospitals affiliated to TUMS were taken from the hospital nursing offices. The eight hospitals were divided into four double groups based on the number of staff in the target group in every hospital. It was decided to do the first draw for the control group and the second draw for the intervention group; therefore, Valiasr, Jame Zanan, Ziaeean, and Baharloo hospitals were allocated to the control group and Medical Centre, Arash,

Bahrami, and Shariati children hospitals were assigned to the intervention group. The researcher referred to the considered centers in person and gave the introduction letter to the chairmanship, nursing offices, education offices, and other relevant offices; the study program and aims were explained and the hospital authorities agreed to allow the study to be conducted. Considering inclusion criteria and sample size (having work experience in neonatal units (at least for six months before study), having BA or MA of nursing and willingness to participate in the intervention) and ethical considerations (getting written permission from the ethics committee of TUMS, registration in IRCT system, getting permission from the tools producer through e-mail, providing written introduction and getting permission from the selected hospitals, introducing the researcher to the study samples, explaining the aims of the study and taking written consent from the participants, assuring all the study samples about confidentiality of the achieved information and observing privacy, voluntary participation of the samples in the study, taking informed consent, providing the results for the groups of the study, providing the education information for the control group at the end of the study) 40 samples were selected for each group.

Level II neonatal care educational content was prepared according to the latest edition of valid books, articles, developmental programs, and educational sites. A specific site for educating nurses of NICU was designed and prepared and the texts were uploaded under the supervision of virtual education specialist at the virtual university of TUMS; this course was named level II professional education program. Educational content was prepared in the form of a written text, picture, educational videos, lecture, introducing resources, podcast, flash, educational links, and designing practical multiple-choice questions. Related lectures given by experienced professors were used to provide educational films. Objectives and table of contents were developed for every lesson. A group was created in telegram in the presence of a virtual education consultant for the nurses in the intervention group and the study aims were explained again. Also, how to login and work with the system and symbol of virtual university were educated through a clip; they could state their problems in the virtual media group regarding entering the system or any ambiguity or question and they could come out of the group if they did not like to continue. After approval of educational content by the supervisors, the texts were uploaded on Namad educational system ([namad.tums.ac.ir](http://namad.tums.ac.ir)) with the support of TUMS virtual faculty. Then, username and password were defined for nurses in the intervention group that had the inclusion criteria and were willing to participate in the study; the username and password were exclu-

sively provided for these nurses. After entering the system, a personal page was opened for the nurses; the personal page included an introduction to the study, the evaluation method, lesson resources, homework, tests, and sending message system. The aims of the study and chapters available for reading were provided for the volunteers in introduction section. The method of evaluating and the way of access to the tests and the questionnaires were explained in the evaluation section. The contents were uploaded in nine chapters with determined observing date in the resource section. The study questionnaires and the designed tests were respectively uploaded in the homework and test sections. In the pretest stage, Coates self-efficacy questionnaire was provided for the control group in person and it was collected after one week. Members of the intervention group received the above questionnaire through Namad system and they could observe the content at the end of the predetermined time. 35 participants from each group filled out the questionnaires. Participants (called learners) could interact with the professors through leaving messages or writing questions at Q and A (questions and answers) section through sending messages, making calls, sending SMS, and e-mail during education. The number of people referring to every lesson was measured in general. The nurses could have their tests through the internet. Educational texts were provided gradually; one chapter per week was designated according to the volume and the considered aims. Texts were provided asynchronously, so that nurses could enter the system and use the educational texts at any time during day and night. Two multiple-choice tests were designed; each test included 20 questions; the first test was given to the learners at the end of the first 5 chapters and the second test was given to them at the end of the next 4 chapters; it was explained that the achieved score is for the learners' self-evaluation and has no influence on their final evaluation. The achieved score was shown to them after the end of the test and the correct answer sheet was provided for them through virtual space, i.e. telegram. The test-related subcategories were prepared on the site for two months; one chapter for every week. The contents included: definitions of care ranking, hand hygiene, neonatal resuscitation, identifying critically ill infants, managing procedures including: oxygen therapy, regulating temperature, regulating blood sugar, fluid therapy, breastfeeding, Developmentally Supportive Care including: infants' growth and development with evolutionary approach, massage therapy, kangaroo mother care, safe and consistent all-round care, common procedures in the second level of care include: glucometry, arterial blood sampling, bladder catheterization, bladder aspiration, blood transfusions, end-expiratory positive pressure ventilation, treatable diseases at the level II care

including: Icter, sepsis, convulsion, taking care of post-term infant, and documentation.

The time of updating texts, the time of holding tests, and news related to nurses were announced through telegram. Post-test questionnaire was given to the intervention group through educational system following the completion of educational program and holding the second test; the post-test questionnaire was given to the nurses of the control group in person. Based on the exclusion criteria (including changing of the unit of intervention and control groups by selected samples, lack of using the system by the intervention group (logging in the system less than 8 times during the intervention)) 5 participants from each group were excluded from the study (5 and 3 participants respectively from the control and intervention groups did not cooperate in filling out the pre-test questionnaire and 2 participants from the intervention group left the study during the course). Questionnaires were collected after 1 week and 35 nurses in the control group and 35 nurses in the intervention group who had entered the study initially filled out the questionnaires. To observe ethical principles, an access to educational content of the second level of care was provided for the control group at the end of the educational course and holding the second test. Data analysis was done by SPSS 23 at the end of the sampling. Descriptive statistics such as absolute and relative frequency distribution table as well as mean and standard deviation were used to categorize and summarize findings; inferential statistics including Chi-square, Fisher, and paired-t and independent-t tests were used to achieve the aims of the study.

#### 4. Results

Samples of the study in two intervention and control groups were homogenized in terms of all demographic variables except work experience in nursing (Table 1). Result of Fisher exact test show that there was a statistically significant relationship between work experience in NICU and the group of the study. Therefore, the two groups were not homogenized in terms of work experience in NICU. More than half of the subjects in the control group had above 6 years of work experience, whereas it was less than a quarter in the intervention group. Considering this issue, it can be said with higher certainty that the achieved results are due to the effect of virtual education.

Results achieved from t-test show that there was a statistically significant difference in the mean score of self-efficacy between the two groups before the intervention. In other words, the mean score of self-efficacy was higher in the control group than the intervention group before the intervention (Table 2).

Results achieved from the statistical paired-t test showed that there was a statistically significant difference in the mean score of self-efficacy in the control group before and after the intervention. Comparison of the scores obtained by the control group in the pretest and posttest stages shows that self-efficacy score at the beginning of the study was higher than the score gained two months later in the posttest (Table 2).

Results achieved from paired-t test show that there was a statistically significant difference in the mean score of self-efficacy in the intervention group before and after the intervention, which indicates the increased self-efficacy in the intervention group after the intervention (Table 2).

Results achieved from independent t-test show that there was a statistically significant difference in the mean score of self-efficacy between the two groups after the intervention. Comparing the scores gained by the two groups show that self-efficacy in the intervention group was higher than that of control group after the intervention (Table 2).

#### 5. Discussion

In general, the study showed that self-efficacy level was low before the intervention, which was expected and confirmed the necessity of education in this area. Mean self-efficacy in the control group was higher than that of the intervention group before education. Mean self-efficacy in the control group was less than that of the intervention group after two-month intervention. Results achieved from independent t-test showed that there was a statistically significant difference in the mean score of self-efficacy between the two groups after intervention. This indicates that self-efficacy of the intervention group was higher than that of control group at the end of the intervention ( $t = -3.007$ ,  $P = 0.004$ ).

Findings achieved from this study are consistent with those of studies that assessed the impact of electronic education on different groups of the society; these findings indicate the effectiveness of electronic education as a modern method of education, having several advantages. Results of the study of Chiu and Tsai (2013) entitled "the roles of social factor and internet self-efficacy in nurses' web-based continuing learning" confirmed our findings; this study recognized web-based learning as an effective method in increasing learners' self-efficacy (17). In the study of Poddar et al. (2010) entitled "Web-based nutrition education intervention improves self-efficacy and self-regulation related to increased dairy intake in college students", they found out that education and intervention through web will increase self-efficacy (18). The study of

**Table 1.** Frequency Distribution of Demographic Features of Subjects in two Intervention and conTrol Groups

Variable	Intervention Group, N = 35, No. (%)	Control Group, N = 35, No. (%)	P Value
<b>Age</b>			P = 0.447
Less than 30 years old	9 (25.7)	10 (28.6)	
30 - 35	14 (40)	10 (28.6)	
35 - 40	9 (25.7)	6 (17.1)	
40 - 45	2 (5.7)	8 (22.8)	
Above 45 years old	1 (2.9)	1 (2.9)	
<b>Marital status</b>			P = 0.771
Single	8 (22.9)	7 (20)	
Married	27 (77.1)	28 (80)	
<b>Education level</b>			P = 1
BA	33 (94.3)	34 (97.1)	
MA	2 (5.7)	1 (2.9)	
<b>Rank</b>			P = 1
Nurse	37 (97.1)	33 (94.3)	
Head nurse	1 (2.9)	2 (5.7)	
<b>Work experience in Nursing, y</b>			P = 0.731
1 - 3	1 (2.9)	3 (8.6)	
4 - 6	5 (14.2)	5 (14.2)	
Above 6 years	29 (82.9)	27 (77.2)	
<b>Work experience in NICU, y</b>			P = 0.028
Less than one	1 (2.9)	3 (8.6)	
1 - 3	11 (31.4)	7 (20)	
4 - 6	15 (42.9)	7 (20)	
Above 6	8 (22.8)	16 (51.4)	
<b>Employment status</b>			P = 0.8
Official	26 (74.3)	29 (82.8)	
Contract	4 (11.4)	3 (8.6)	
Casual contract	3 (8.6)	1 (2.9)	
Project	2 (5.7)	2 (5.7)	
<b>Having degree in educational course of NICU</b>			P = 0.632
Yes	18 (51.4)	16 (45.7)	
No	17 (48.6)	19 (54.3)	

Bebenco et al. (2003) entitled “the impact of computer-based clinical conference on nursing students’ self-efficacy in Ontario” showed an increase in self-efficacy level in the intervention group at the end of the educational course (19). The study of Hoseini et al. (2014) entitled “Comparison of the impact of web-based education and cognitive and meta-cognitive learning strategies on academic and self-efficacy achievement of the nursing students”, it was

observed that students receiving web-based learning had higher self-efficacy (20). The study of Nikbakht Nasrabadi et al. (2012) entitled “The impact of continued virtual education on the psychological empowerment sense and primary teachers’ self-efficacy of Isfahan” showed that there was a significant difference in self-efficacy between teachers who passed and those who did not pass virtual course, which is in agreement with the present study (21). The

**Table 2.** Absolute and Relative Frequency Distribution of Self-Efficacy Scores in the Two Groups

Samples of the Study	Time		Results of the Test Before and After Intervention in Each Group
	Before Intervention Mean and Standard Deviation	After Intervention Mean and Standard Deviation	
Control group	129.7 ± 13.973	128.09 ± 12.363	t = 3.323, P ≤ 0.002
Intervention group	118.05 ± 11.104	136.11 ± 9.830	t = -10.06, P ≤ 0.001
Results of the tests before intervention in both groups			t = 3.8734, P ≤ 0.001
Results of the tests after intervention in both groups			t = -3.007, P = 0.004

study of Barker et al. (2013) entitled “assessing learning level of the nursing students in Africa” showed that there was a significant difference between electronic and traditional learning in terms of increasing self-efficacy and learning level in nursing students (22). Thiele states that learners of electronic education can access more information; they assume responsibility for their own learning, and can access the educational content at any time; therefore, this method is easier in application (23). The study of Hill et al. indicated the positive impact of virtual and computer-based education on people’s mental health, ability, and self-efficacy (24). In the study conducted by Zhang et al. entitled “web-based learning for nursing education”, it was demonstrated that web-based learning has a positive role in increasing nurses’ knowledge, skill, and satisfaction level (25). Results of the above studies are consistent with the findings of the present study.

There are some studies that have reported findings in contrast with the results of the present study, which have rejected the impact of modern education methods. The study of Lu et al. in Taiwan showed that electronic education along with traditional classes increased nursing students’ knowledge and skill regarding intramuscular injection (26). The study of Khatouni et al. showed that nurses’ knowledge level improved in both electronic and traditional groups after participating in the related courses, indicating the positive influence of electronic education as well as traditional education (27). Results of the study of Jeffries with the aim of comparing effectiveness of the two traditional and electronic education methods showed that both groups were satisfied with their own education method and there was no significant difference between the two groups in terms of the considered skills; both methods increased students’ knowledge; they also had the same performance in providing skill (28). The study of Moghadasi and Norouz zadeh entitled “Comparison of the knowledge, attitude and skill level of MA senior students of IT management who had used both virtual and traditional education at Islamic Azad University” showed that

there was no significant difference between knowledge, attitude and skill levels of the students (29).

Among the limitations and complications of the present study, it can be pointed out to nurses’ cooperation because of their lack of interest, lack of familiarity with the project and the way of login the site, lack of adequate time, lack of computer systems, etc. Accreditation rules were employed against restrictions. Accreditation unit and related rules were used to encourage nurses to cooperate with the study using the support of nursing offices and educational supervisors. Briefing session was held for the units’ authorities; telephone, telegram, and SMS as communication tools were used to have more interaction with the learners and to lead and motivate them; step by step education was also applied. Some conditions were provided for the nurses with the cooperation of the virtual faculty, so that nurses could refer to the system at any time during day and night and receive their educational content in this way. The duration of sending questionnaires and assignments was extended. Neonate retraining course was provided for the nurses at the end of the course to make them more cooperative and motivated.

Virtual education was performed during two months (8 weeks) in this study; it is suggested to consider longer time for future studies. In this study education was provided for nurses in the level II neonatal care unit, which can be carried out for other health care givers.

Electronic learning compared to traditional learning has many advantages such as availability during 24 hours a day, 7 days a week, higher quality in providing educational and training services, continuity and higher relevance in terms of education, measurability of the education results, learner’s auto education, the ability to keep information and educational resources, and easy access to content (30). Considering nurses’ problems in terms of education and participation in the classroom setting and their urgent need to promote their knowledge level according to updated scientific information, electronic education seems necessary to provide high quality care, thanks to its nu-



merous advantages. According to the results of the present study, the researcher believes that in the case of available equipments and necessary conditions, virtual education can lead nurses to effective and efficient learning, which has a positive role in promoting public health.

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## Footnote

**Authors' Contribution:** Developing the main idea and preparing study content Maliheh Kadivar; preparing content, designing the study, performing the project and providing information, Zohreh Hoseinzadeh; preparing study content, manuscript writing and final revision, Nayeemeh Seyed Fatemi; virtual faculty counselor, Mitra Zolfaghari; data analysis and statistical counselor, Abbas Mehran.

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