

Effect of E-Learning on Knowledge Retention and Student's Achievement in Obstetrical and Gynecological Nursing Curriculum

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Abstract: E-learning is the use of internet technology to enable students to learn anytime and anywhere. It can include training, the delivery of just-in-time information and guidance from experts. Hence, it has an increasingly popular learning approach in higher educational institutions-learning must be a part of strategy in many institutions trying to make success in basic education, higher education, continuing education, and training. **Design:** An intervention (Quasi experimental) study design was used. **Aim:** To study effect of E-learning on knowledge retention and student's achievement in obstetrical and gynecological nursing curriculum. **Setting:** The study was conducted at Faculty of Nursing Benha University. (Obstetrical and Gynecological Department). **Subjects and methods:** A purposive sample with an intervention group of 80 third year students enrolled for the course of obstetrical and gynecological nursing using e-learning and 78 students taught by the traditional method as control. **Tools:** 1) Self-administered questionnaire to assess: - Student's overall satisfaction with the traditional method of teaching the curriculum for the control group. Student's satisfaction as well as the opinions regarding advantages and barriers of E-learning for the intervention group. 2) Knowledge assessment sheet to assess student's knowledge acquisition and retention as well as: A pre and posttest exam of each unit for the students & Final academic score result to assess student's final grads in obstetrical and gynecological nursing curriculum. **Results:** All students in both groups had low scores in the pretest. At the posttest and final exams the scores were statistically significantly higher among students in the intervention group in compared with those in the control group ($p < 0.001$). At the final exam, 75% of the students in the intervention group had "very good" grades, and 25% had "excellent" grades, while 35.9% of the students in the control group had "very good" grades and 64.1% had "good" grades ($p < 0.001$). Students' satisfaction with their learning experience was higher in the intervention group ($p < 0.001$), and correlated positively with their test scores. **Conclusion and recommendations:** E-learning leads to better acquisition and retention of knowledge; these are affecting positively on student's achievement and influenced by high level of satisfaction. It is recommended to use this approach in various nursing curriculums and in other nursing specialties, with provision of needed resources to improve the student's achievement.

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1. Introduction

Historically, the traditional lecture has been the teaching method of choice and the most used in education. However, changes in the health care environment and the advances in technology have challenged this practice (*Spiva et al, 2012*). Reforms in educational methods to meet the needs of learners are increasingly being considered by university departments in the 21st century. This has led to combining e-learning with more conventional classroom-based methods of teaching (*Young and Randall, 2013*).

There are issues related to the establishment and implementation of E-learning as an aid for teaching especially in continuous evaluation of students' achievements. Hence, E-learning is growing rapidly worldwide, especially in the health related sectors such as medicine and nursing (*Segal et al, 2013*), (*Harris et al, 2011*) & (*Frehywot et al, 2013*).

There is growing evidence that using E-learning and digital technology can support students in their learning. Moreover, further enhance learning and knowledge retention among students. E-Learning is one of the most significant changes to occur in nursing education. Teaching clinical skills must accommodate the different needs of nursing students, particularly in view of their increasing numbers (*Bloomfield and Jones, 2013*), (*Johnston et al, 2013*) & (*Button et al, 2013*). It has been shown that nurses can learn clinical nursing skills by E-learning, but many factors influence how well nurses adopt learned clinical skills using this approach in education (*Blackman et al, 2013*).

E-Learning encourages more critical reasoning than traditional learning because interaction takes place better in small group of students. Students in E-Learning courses better understand topic of lecture than in a traditional course (*Harris et al,*

2011). Learners had more peer contact with others in the class, enjoyed it more, spent more time on class work, understood the material better, and performed better than students in the traditional classroom (Allan *et al*, 2013). Traditional methods of evaluation including written examinations which have proven to be time consuming and inaccurate reflection of students' achievements (Brunero and Lamont, 2010).

Significance of the study:

E-learning has not been sufficiently integrated in nursing education, and more use of e-learning methodologies has been advocated in it (Sinclair *et al*, 2011) (Petit dit Dariel *et al*, 2013).

A number of studies have investigated the effectiveness of E-learning programs in nursing education. Some studies demonstrated significant increases in knowledge retention, skills, confidence and reduced stress among nurses, Furthermore has proven to have a 50–60% better consistency of information than traditional learning (Mehrdad *et al*, 2011) & (O'Leary, 2012). Therefore a recent systematic review recommended further research for evaluation of the effectiveness of e-learning interventions (Lahti *et al*, 2013).

Hence, the subject of this study is deemed important as understanding nursing e-learning has not been sufficiently studied (Chang *et al*, 2011). Moreover, the subject of the curriculum under study obstetrics and gynecological nursing has a particular value given that the health of women all over the world is of concern to health care professionals so that nurse/midwives need a sound education to be able to carry out their roles effectively (Young and Randall, 2013).

Aim of the study

To study effect of E-learning on knowledge retention and student's achievement in obstetrical and gynecological nursing curriculum.

Research hypothesis

The students who learn the obstetrical and gynecological nursing curriculum through activation of E- learning will have significantly higher knowledge retention and higher achievement scores at immediate posttest and final exams with higher satisfaction level compared with those in traditional classroom-based teaching.

2. Subjects and Methods

Research design and setting:

A quasi-experimental research design was used in carrying out this study at the Obstetrical and Gynecological Nursing Department, Faculty of Nursing, Benha University.

Subjects:

All third year students enrolled for the course of obstetrical and gynecological nursing (reproductive health nursing curriculum) during the academic year

2011/2012 were included in the study. Their total number was 158 students. They were randomly divided by the students' affairs office into 78 students for the first semester and 80 students for the second semester. Students in the first semester were taught by the traditional method and served as a control group, whereas those in the second semester were taught through E-learning and constituted intervention group.

Administrative and ethical considerations

The study protocol was approved by the pertinent committees and permission to conduct the study was obtained from the Dean of the faculty of nursing Benha. Oral consent was obtained from each student before starting the study procedures. Each student was informed of the purpose and the benefits of the study.

Tool of data collection:

The researcher designed a self-administered questionnaire to assess students' opinions and satisfaction with the course.

For the control group: only asked about student's overall satisfaction with the module and the response was: high, moderate, or low.

For the intervention group: the tool included two Parts. The first part was to assess student's opinions regarding the benefits of E-learning as an approach used in Obstetrics and Gynecological Nursing Curriculum. It had seven statements covering student's effectiveness, assignment clarity, communication, learning outcome, innovation, performance skills, and attraction. The second part asked about their opinions regarding barrier (the factors that may hinder the application and use of the e-learning approach). This was open-ended.

Concerning the assessment of students' knowledge retention, it was done before each of the seven units of the curriculum (pretest), immediately after (posttest) and at the end of the semester (final). It was done in closely similar ways in the two groups to avoid any bias or confounding factors. The scores of each unit and the final were converted into percent scores to ease comparisons. The total scores at each phase were classified according to the university grading system to:

Unsatisfactory or fail (<60%),
Satisfactory or fair (60-<65%),
Good (65-<75%),
Very good (75-<85%),
and excellent (85-100%).

Procedure:

Planning phase:

The researcher prepared the course content and methods according to the curriculum course objectives and guidelines. It was reviewed by three experts in the same specialty as a requirement to obtain the approval of the supreme council of

universities. Then, the researcher contacted the E-learning centre in Benha University to prepare the E-learning course for the intervention group. The tasks were to divide the course content into units, design a pool (bank) of questions for each unit, and prepare illustrative pictures and different videos for the various topics included in the curriculum. All these were to be digitalized by the center.

Implementation phase:

All students were taught the theoretical part of the seven units in the classroom by the traditional method of teaching. Each unit lasted for two weeks with a range of four theoretical hours weekly.

First semester (control group):

Students in this control group were taught the theoretical part of the seven units in the classroom using the traditional methods of teaching. The pre, post, and final examinations were done and the scores of the students recorded. The students also filled the satisfaction questionnaire at the end of the semester.

Second semester (intervention group):

The list of student's names was sent to the supreme council of universities to get the password and username for each student in this group. At the beginning of the semester, the researcher met with all the students for orientation about the methods and benefits of e-learning, and explanation of the steps of activation of the E-learning process. The students were divided into eight groups of 10 students. A schedule was set for each group in the computer lab and each student was assigned a computer with internet connection. The researcher informed the students about how to access and login, and asked them to follow the steps of e-learning activation as clarified in the annex.

Evaluation phase:

All students were tested using the same format of the module, and the questions in all examinations were randomly derived from the questions bank developed by the researcher. The result of the final examination was obtained from the faculty administration at the end of the semester.

Limitations of the study

The implementation of the e-learning module was faced with a number of obstacles such as the time availability of computer units for students' use, and the network connection that sometimes interfered with E-learning utilization.

Statistical analysis

Data entry and statistical analysis were done using SPSS 16.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Qualitative categorical variables were compared using chi-square test.

Spearman rank correlation was used for assessment of the inter-relationships among quantitative variables and ranked ones. Statistical significance was considered at p -value <0.05 .

3. Results

Table 1 demonstrates that students in the intervention (e-learning) and control groups had similarly low scores in all studied units and in the total grade at the start of the modules (pretest), with no statistically significant differences. At the posttest immediately at the end of each unit of the module, the scores rose in both groups. They ranged between 85.31% and 89.16% in the intervention group and between 71.74% and 84.31% in the control group. The scores were statistically significantly higher among students in the intervention group in all units compared with those in the control group ($p < 0.001$). At the final exam, the scores demonstrated some declines in all units in both groups. However, the decreases were more prominent among the students in the control group, and the difference between the two groups remained statistically significant in favor of the students in the intervention group.

As noticed from Table 2, none of the students in the study and control groups had a pass (fair) score at the pretest. By the end of the modules, 93.8% of the students in the intervention group had "excellent" grades, compared to none in the control group ($p < 0.001$). Similarly, at the final exam, three-fourth of the students in the intervention group had "very good" grades, and the remaining fourth had "excellent" grades. Meanwhile, 35.9% of the students in the control group had "very good" grades and 64.1% had "good" grades, and the difference between the two groups was statistically significant ($p < 0.001$).

Figure 1 displays the total scores of students in the intervention and control groups at the pre-, post-, and final exams. It indicates a similarly low starting point at the pretest. This was followed by a sharp rise in both groups, but this was significantly higher among students in the intervention group. At the final exam, there was a decline, but this more sharp in the control group, and the difference was statistically significant ($p < 0.001$).

Concerning students' satisfaction with their learning experience in the module, Table 3 demonstrates that 71.3% of those in the intervention group were highly satisfied compared with only 47.4% of those in the control group. This difference between the two groups was also statistically significant ($p < 0.001$).

Table 4 illustrates the correlation between students' level of satisfaction and their post- and final scores. It indicates moderate statistically significant positive correlations between satisfaction and test scores at both phases in the intervention group.

Meanwhile, no statistically significant correlation could be revealed among students in the control group.

As regards the intervention group students' feedback regarding E-learning, Table 5 shows that 90% of more of them agreed upon all cited advantages. Moreover, all of them agreed that e-learning increase

student's effectiveness and its tasks and assignments are clear and understandable. The least advantage agreed upon was that e-learning is attractive (90%). On the other hand, there were high agreements upon the hindering factors related to time, cost, and computer operators.

Table 1: Comparison of the grade points (%) of students in the study and control groups before and after teaching course and the final exam

Units	Study (n=80)		Control (n=78)		Score difference		t-test	p-value
	Mean	SD	Mean	SD	Mean	SE		
Pre:								
Normal pregnancy	11.28	1.22	11.27	1.23	0.01	0.20	0.03	0.976
Abnormal pregnancy	10.30	0.99	10.56	0.98	-0.26	0.16	-1.69	0.093
Normal labor	10.32	0.98	10.27	0.95	0.06	0.15	0.36	0.717
Abnormal labor	10.30	0.99	10.01	0.80	0.29	0.14	2.01	0.046
Normal puerperium	11.40	1.31	11.05	1.18	0.35	0.20	1.76	0.081
Abnormal puerperium	10.31	0.99	10.54	1.09	-0.23	0.17	-1.37	0.174
Gynecology	10.24	0.98	10.32	0.97	-0.08	0.16	-0.53	0.595
Total	10.59	0.86	10.58	0.80	0.02	0.13	0.14	0.893
Post:								
Normal pregnancy	89.04	0.96	75.50	0.85	13.54	0.14	93.96	<0.001*
Abnormal pregnancy	87.38	2.69	84.31	2.57	3.07	0.42	7.32	<0.001*
Normal labor	87.38	2.69	71.74	5.87	15.63	0.72	21.59	<0.001*
Abnormal labor	85.46	1.47	74.31	4.67	11.15	0.55	20.35	<0.001*
Normal puerperium	89.16	1.19	76.20	1.01	12.96	0.18	73.95	<0.001*
Abnormal puerperium	87.38	2.69	74.00	2.31	13.37	0.40	33.46	<0.001*
Gynecology	85.31	1.38	72.27	1.19	13.04	0.21	63.43	<0.001*
Total	87.30	1.60	75.48	1.69	11.82	0.26	45.14	<0.001*
Final:								
Normal pregnancy	85.64	0.96	71.20	0.85	14.44	0.14	100.20	<0.001*
Abnormal pregnancy	81.77	2.69	71.81	2.57	9.97	0.42	23.80	<0.001*
Normal labor	84.38	2.69	66.14	5.87	18.23	0.72	25.18	<0.001*
Abnormal labor	82.16	1.47	67.11	4.67	15.05	0.55	27.46	<0.001*
Normal puerperium	86.76	1.19	70.20	1.01	16.56	0.18	94.49	<0.001*
Abnormal puerperium	84.18	2.69	66.80	2.31	17.37	0.40	43.47	<0.001*
Gynecology	82.21	1.38	60.67	1.19	21.54	0.21	104.78	<0.001*
Total	83.87	1.60	67.71	1.69	16.17	0.26	61.72	<0.001*

Table 2: Comparison of the grades of students in the study and control groups before and after teaching course and the final exam

Grades	Group				X ² test	p-value
	Study (n=80)		Control (n=78)			
	No.	%	No.	%		
Pre:						
Fail	80	100.0	78	100.0	--	--
Post:						
Good	0	0.0	25	32.1		
Very good	5	6.3	53	67.9		
Excellent	75	93.8	0	0.0	139.72	<0.001*
Final:						
Good	0	0.0	50	64.1		
Very good	60	75.0	28	35.9		
Excellent	20	25.0	0	0.0	110.1	<0.001*

Table 3: Comparison of the satisfaction with the learning experience between students in the study and control groups

Satisfaction With the course	Group				X ² test	p-value
	Study (n=80)		Control (n=78)			
	No.	%	No.	%		
Low	2	2.5	6	7.7		
Moderate	21	26.3	35	44.9		
High	57	71.3	37	47.4	9.732	<0.001*

Table 4: Correlation between students' post and final total grade points and their satisfaction scores

Total score	Satisfaction score	
	Study (n=80)	Control (n=78)
Post:		
Spearman's rank correlation	0.62	-0.10
p-value	<0.001*	0.384
Final:		
Spearman's rank correlation	0.63	-0.09
p-value	<0.001*	0.406

Table 5: Advantages of electronic learning and hindering factors as reported by students in the study group

	Frequency	Percent
Advantages of electronic learning:		
Increase of student's effectiveness	80	100.0
Tasks and assignments are clear/understandable	80	100.0
Increase and ease communication with teachers	75	93.8
Improve learning outcome	75	93.8
Lead to innovation, good performance	74	92.5
Promote learning skills	73	91.2
Attractive	72	90.0
Factors that interfere with electronic learning:		
Faculty time is not enough	70	87.5
Increase of cost	70	87.5
Computer operators not present	68	85.0

Annex: Steps of activation of e-learning course

- Type at : [Http://cms.nelc.edu.eg](http://cms.nelc.edu.eg)
- Enter: username
- Enter: password
- Press: login
- directly to the right side of the home page that shows the names of universities
- Access to:
- Benha University
- Choose to be required course to activate: "Reproductive Health nursing"
- Browse within the curriculum and benefited from the content of each unit.
- Solve the activities within the units
- Solve the pre-test for each Unit
- Solve the post-test for each Unit
- Solve the final test for each Unit
- Note: the final post-test opens only after the solution of 7 units and passing the degree of success (75%)
- All questions are MCQ or true/false
- After solving the test press: Submit all and finish
- Your score will show up along with the percentage and the correct answers
- In the case of failure you can access the test any number of times to get the highest score.
- The final assignment at the end of the module is an essay question stating: Report on as: (nursing care of any topic in the course) in a Word file. Write the report and then click on the word "Browse" and search for the file location and then click the file name, click Open, and click on Upload This File.
- To see your grades obtained in the post tests and assignments and final, access to Grades.
- To logout from the site click Logout at the top of the page or at the end of the website page
- E -mail of learning center: elarning@bu.edu.eg

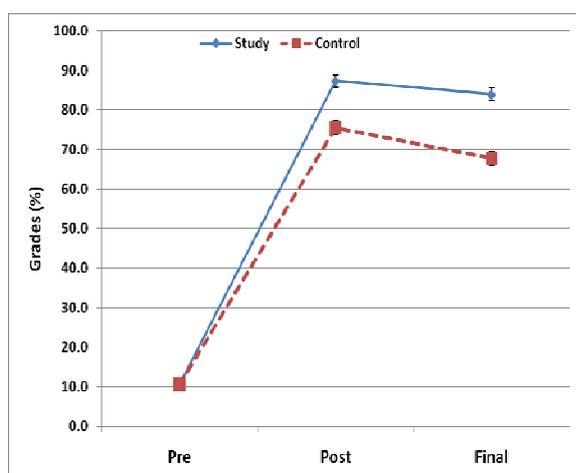


Figure 1: Comparison of the total grade points of students in the study and control groups before and after teaching course and the final exam

4. Discussion

The study examined effect of E-learning on knowledge retention and student's achievement in obstetrical and gynecological nursing curriculum. The results revealed generally better knowledge acquisition and retention which lead to better achievement among students under this innovative approach. Their satisfaction was also higher, and their grades showed a positive correlation to their level of satisfaction.

The two groups examined in the present study were similar in their basic characteristics as well as in their baseline knowledge of the subjects under study the course. Moreover, they represented a whole number of students (batch) with no selection by the researcher or self-selection or volunteering to enroll in the course. This is of importance to avoid the volunteerism bias previously reported in some studies as pointed out by *Bloomfield and Jones (2013)* in their study of the experiences and perceptions of graduate first-year pre-registration nursing students. Such volunteerism bias may confound the effect of e-learning as it is closely related to the individual level of adoption of innovations and it has been recommended to avoid it in studies dealing with the effectiveness of e-learning (*Žvanut et al, 2011*).

The study findings demonstrated that both the innovative and traditional approaches in the teaching of the obstetrics and gynecology nursing course were effective in inducing high levels of knowledge acquisition among students. However, the scores and grades attained by the students in the e-learning course turned to be significantly higher compared to those in the traditional group at the immediate posttest exams. In congruence with this, a number of studies have demonstrated the merits of e-learning in various

settings. For instance, *Morente et al (2013)* in a study evaluating the effectiveness of e-learning in the undergraduate nursing students' pressure training found that the students in the innovative educational intervention had significantly better learning acquisition results with significantly higher knowledge scores compared with those in the traditional lecture-style classes. Moreover, *Keeffe and Wharrad (2012)* reported 19.2% higher average score for nursing students undertaking the E-learning program, which is slightly higher than our finding of about 12%. On the same line, *Park and Hwang (2011)* demonstrated that nursing students' knowledge about operating room practice was significantly higher in the e-learning group compared to the control group.

According to the present study findings, the nursing students in the e-learning group had better retention of the gained knowledge as revealed by their significantly higher mean scores and grades at the final examination compared with those of the control group. This is an important difference between the two approaches since the retention of knowledge is essential in the process of learning as knowledge acquisition is cumulative. This issue has been scarcely investigated in the literature investigating the effectiveness of e-learning. However, in disagreement with this finding, *Fernández Alemán et al (2011)* found that both e-learning and conventional teaching methods resulted in similar knowledge retention in the 10-week follow-up test. Hence, this issue needs further investigation.

The findings of the present study indicate the superiority of the innovative approach, which may be attributed to a number of factors such as the more interactive means of learning that depends on the contribution of the student, which in turn increases the feeling of self-efficacy and independence. Another factor is the increasing tendency among new generations to use technology not only in study but also in social and other aspects of their lives. In agreement with this, *Lahti et al (2013)* showed that after the e-learning course the nurses had better critical thinking and were able to identify development areas and recommended the course to other nurses. Moreover, e-learning programs were found to have significantly improved students' clinical performance (*Feng et al, 2013*). Similarly, *Segal et al (2013)* in a prospective controlled trial revealed reported that the majority of students in the e-learning group thought it encouraged self-thinking, and helped their learning process. Other studies demonstrated statistically significant differences in self-confidence (*Spiva et al., 2012*), motivation (*Park and Hwang, 2011*), self-efficacy (*Smeekens et al., 2011*), and independent learning and critical thinking (*Fernández*

Alemán et al, 2011) among the nursing students who participated in the e-learning interventions.

Students' satisfaction with their learning experience is crucial in the success of any teaching method or learning process. The present study revealed significantly higher levels of satisfaction with the course among the students in the e-learning group compared with only those in the traditional group. This higher level of satisfaction is certainly attributed to the advantages of the innovative approach which were approved by the great majority of the students in this group. The findings are in congruence with previous studies which demonstrated higher satisfaction with e-learning compared with traditional learning (*Lee and Lin, 2013; Pintz and Posey, 2013*).

Moreover, the students' scores in the post and final exams demonstrated significant positive correlations with their level of satisfaction only in the e-learning group. This provides a further confirmation of the positive impact of the learning approach on students' acquisition and retention of knowledge. In agreement with this, *Park et al (2010)* mentioned that learning satisfaction is one of the most important factors associated with learning achievement for nursing students using E-learning.

Lastly, although the majority of the students in the intervention group of this study had high satisfaction and positive feedback regarding E-learning, still there were concerns regarding some factors that may hinder its utilization or success. These were mainly regarding time, cost, and computer availability. Therefore, in order to enhance the application of e-learning and foster its effectiveness, the necessary resources need to be available. These include the faculty capable to design and operate the modules and the availability of related infrastructure. Similar factors have been previously reported as concerns regarding the implementation of e-learning programs such as staff abilities and workload (*Button et al, 2013*), system and information quality (*Chang et al., 2011*), and computer access, computing skills and technical issues (*Moule et al, 2010*).

Conclusion and Recommendations

In the light of the research findings the conclusion achieved the research hypothesis. The students who used e-learning had better acquisition and retention of knowledge as shown in the post and final examinations' scores. The level of satisfaction with the e-learning has a positive influence on their achievement. Therefore, it is recommended to use this approach in various modules and in other nursing specialties. The faculty administration should support this through provision of the needed resources and through offering training opportunities for faculty

members in the preparation and implementation of e-learning course.

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