ORIGINAL ARTICLE

Midwifery Students' Acquisition and Retention of Essential Newborn Care Competencies: An Experimental Study

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ABSTRACT

Introduction: Annually, over two million newborns die worldwide immediately after birth, mostly because of failure to initiate and sustain breathing. A significant decline in newborn deaths can be achieved by using proper essential newborn care (ENC) techniques. Competency-based education (CBE) could successfully build ENC skills. The purpose of the present study was to investigate the effect of applying CBE on Midwifery students' knowledge and skills acquisition and retention of ENC. **Methods:** This quasi-experimental study recruited third-year under-graduate midwifery students (n=54). They were equally assigned to the interventional and control group. The interventional group was taught ENC by using CBE, whereas the control group was taught by using traditional methods. Students' ENC knowledge was assessed three times using a multiple-choice question exam. The ENC skills were measured twice by using the Essential Neonatal Care Performance Checklist. **Results:** The intervention group exhibited significant ENC knowledge and skills, performance acquisition, and retention ($p<0.001$). **Conclusion:** CBE is a useful educational model for the acquisition and retention of ENC.

Keywords: Competency-Based Education, Essential Newborn Care, Midwifery Students, Knowledge, and Skills

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INTRODUCTION

An essential quality of education produces knowledgeable graduates with the required transferable skills. However, achieving these aims is confronted with changes and challenges (1, 2). Specifically, midwifery education faces challenges at different levels, such as including insufficient training opportunities for students to acquire psychomotor skills in health care settings, inconsistencies of clinical practicum experiences for students, crowdedness of clinical areas and faculty shortage (3, 4).

In order to accomplish the educational aims and overcome the challenges higher education teaching mechanisms went through a massive state of transition from traditional teacher-focused pedagogy to a more student-focused education. Several innovative participatory models have been utilized widely in midwifery education, such as Problem-Based Education, Brain-Based Education, and Competency-Based Education (5,6).

Competency-Based Education (CBE) is an emerging model that can improve students' knowledge and their psychomotor skills via its innovative, active student-centered nature which focuses on what students need to know and be able to do in varying and complex situations. The CBE allows students to realistically integrate all the components of the desired skills before actual patient interaction. Empirical researches provide evidence about the vital feature of CBE, such as a flexible, evidence-based, and outcome-focused curriculum. Additionally, CBE is built around core competencies, which are considered the performance standards that students are expected to accomplish at the end of their study (7-10).

Student progress is based on demonstration of learning competencies (outcomes). The CBE offers students a flexible time frame to master the required skills; it utilizes a variety of active, student-centered instructional strategies such as discovery, cooperative, and simulation (8, 11). In CBE, the classroom activities ensure students' active participation and cooperation among them. The CBE activities include many techniques, such as think-pair-share and team-pair-solo. Assessment and evaluation in CBE are carried out through direct measuring of student practice and learning, such as simulation, skills checklists, and peer, patient, and self-

evaluations (12-14).

In midwifery education, students need to acquire the necessary knowledge psychomotor skills and attitudes. Such skills prepare students to start their careers safely and confidently in a complex and demanding healthcare settings. Recently, a major concern of midwifery educators is that the new graduate midwives are not adequately competent in essential newborn care (15, 16, 17).

The World Health Organization (WHO) estimated that more than 100 million newborn are born annually worldwide (18). Of this number, 2.4 million neonatal deaths occur immediately after birth, and more than one quarter (27%) of all neonatal deaths are caused by failure to initiate and sustain breathing at birth (19). It has been found that proper ENC techniques can decrease neonatal deaths by about 42%. The WHO recommended that at least one qualified person (for instance, a physician, nurse, or midwife) who has been trained for ENC and neonatal resuscitation should attend every delivery case (9).

Competent and well-trained midwives can provide almost 87% of ENC proficiently (16). In the Hashemite Kingdom of Jordan, preparing well-trained midwives has always been a major concern for educational institutions and the health care system. Nowadays, this concern is intensified due to the increasing number of women of childbearing age, which coincides with the constant shortage of qualified midwifery staff (20).

The literature reveals that CBE offers opportunities to prepare students for higher levels of knowledge integration and application of skills (21-23). However, more empirical evidence is needed to support the use of CBE in midwifery education, specifically in newborn care (3, 16). The purpose of this study was to investigate the effect of applying competency-based education on midwifery students' knowledge and skills acquisition and retention on essential newborn care.

MATERIALS AND METHODS

Research design and samples

A quasi-experimental pretest-posttest design was used considering limited number of students who joined the midwifery programme, thus carrying out random sampling was impossible. A convenient sample of 54 third year midwifery students who enrolled in the neonatology course during the academic year 2017 at Rufidiah Al-aslamia college for Nursing and Midwifery was used in this study. The sample was randomly assigned through the standard registration process into two class sections. One of these sections was designated as an interventional group, and the other was a control group.

Pilot study

A pilot study was conducted on 30% of the actual study population for the following purposes: to test the feasibility and clarity of research instruments, to assess the time needed to train procedure, and to discover problems that may arise during data collection. The result indicated that no further modification was needed. The piloted students were excluded from the main study sample.

Data collection

Two instruments were used to collect data: the Essential Newborn Care Knowledge Test (ENCKT) and the Essential Newborn Care Performance Checklist (ENCPCL) (24). Both instruments were reviewed by five pediatric PhD holder experts to determine their feasibility and validity. After reviewing the instruments, experts suggested minor linguistic modifications that were carried out afterwards accordingly. The ENCKT consists of 30 multiple-choice questions. Each question has four choices with only one correct answer. The test score is 100. The second instrument, the ENCPCL, was developed by the United States Agency for International Development (USAID) in 2009, and no permission was required to use it.

The ENCPCL includes 14 competencies with 55 steps. The scores ranged from one point for a step if it was performed completely and correctly to zero points for a step if it was not performed, performed incorrectly, or performed incompletely. The "not applicable" (NA) option was used when a step was not relevant or was excluded for any reason. The highest total score on the ENCPCL was converted to 100. Then the scores were broken down into the following categories: ≥ 90% (Excellent), 80% to 89% (Very good), 70% to 79% (Good), 60% to 69% (Fair), and < 60% (Fail). A grade of at least 80% was determined as a competency fulfillment level. The instruments were tested for their reliability using the Chronbach Alpha test. Both instruments were reliable and showed a high internal consistency during the pilot study. The coefficient value of 0.91 and 0.94 were calculated for both ENCKT and ENCPCL respectively.

Research procedure

The current research was carried out through three phases. In the first phase, the researchers briefly explained the concept of CBE to all students: how to apply CBE on ENC, the research procedures, what was expected from them as participants, and the purposes and benefits involved. A pre-test was done using ENCKT for both groups. In the second phase, the intervention was implemented.

The interventional group received CBE instructions and training on ENC and a training in a skills lab. In each class session, the researchers incorporated a variety of active and cooperative teaching methods, such as

think pair-share, presentation, videos and multimedia, Peyton's Four Steps of demonstration, team-pair-solo techniques, simulation, and peer evaluation (12, 25, 6). After the intervention was completed, the students trained in the hospitals' delivery rooms according to the college's clinical training routines.

For theoretical part, the control group on the other hand, received traditional instructions on ENC content. Researchers used lectures and group discussions to cover scientific content material. After lectures completed, the students trained in the hospitals' delivery rooms according to the college's clinical training routines.

The third phase was the evaluation phase (Post-test I and post-test II). Students' knowledge was evaluated using ENCKT, and their skills were evaluated using ENCPCL. The post-test I was carried out immediately to measure students' gained knowledge and skills. Post-test II was conducted at the end of the semester to measure students' retention of gained knowledge. The course content and exams were the same for both groups. All tests were conducted for both groups at the same time.

Ethical considerations

Prior to conducting this study, ethical approval was obtained from the Research Ethics Committee, Jordanian Ministry of Health No. MOHREC160013. Informed consent was obtained from the students. The participation was on a voluntary basis, and the participants were informed that they could withdraw from the study at any time. The privacy and confidentiality of the participants information were assured. All of the research data with any identifying details were transferred to unnamed and coded data. The research was carried out in line with the Hashemite Kingdom of Jordan nursing codes and policy guidelines. Furthermore, the control group received supplementary training to enhance their knowledge and skills when the research project was completed.

Data Analysis

The data were analyzed using Statistical Package for the Social Sciences (SPSS). Both descriptive and inferential statistics were used. Descriptive statistics included: mean, standard deviation, frequency, and percentage. All statistical analysis was performed using alpha error 0.05. P-value ≤ 0.05 was considered significant. In order to test the mean differences between groups related to different variables, an independent t-test and ANOVA tests were used.

RESULTS

Students' Personal and Academic Characteristics

The total number of students who took part in the study was 54, and the attrition rate during the research project course (pre-test and post-tests) was 0%. The students were homogeneous in terms of their personal and academic characteristics. Variables of gender and nationality were ignored since all students in the selected settings were female and Jordanian. Furthermore, there was no statistically significant difference between the intervention and control groups in terms of their age (p=0.69), and Grade Point Average was p=0.44. None of the students have previous neonatal clinical experience or education (Table I).

Table I: Description of the Students' Personal and Academic Characteristics

Variable	Categories	Intervention (n= 27)		Control (n= 27)		t-test p
		$\bar{x}$	SD	$\bar{x}$	SD	
Age (years)		20.6	0.74	20.7	0.61	0.69
***GPA**		73.5	9.6	71.6	9.4	0.44
Newborn care previous experience	Yes	0	0.0%	0	0.0%	1.00
	No	27	100%	27	100%	
Newborn previous courses	Yes	0	0.0%	0	0.0%	1.00
	No	27	100%	27	100%	

*GPA = Grade Point Average
Significant level: (p<0.05)

Essential Newborn Care Knowledge Test (ENCKT)

There was no significant difference between the intervention and control groups regarding knowledge scores in the pre-test (p=0.82). However, the knowledge scores were significantly increased from pre-test to post-test I and post-test II in both groups.

The students' knowledge scores in the intervention group have significantly increased from 36.7 in the pre-test to 79.8 in post-test I and 83.1 in post-test II (p<0.001). The intervention group recorded a significantly higher knowledge scores in both post-test I and post-test II as compared to the control group, p=0.004 and p=0.002 respectively (Table II).

Table II: Comparison of ENC Knowledge Scores among Intervention and Control Groups across Pre-test, Post-test I, and Post-test II

Study phase	Intervention Group n=27		Control Group n=27		t-test: comparisons between groups		
	$\bar{x}$	(SD)	$\bar{x}$	(SD)	t	df	P
Pre Test	36.7	10.7	36.1	10.17	.218	52	0.82
Post Test I	79.8	11.9	69.4	13.2	3.03	52	0.004*
Post Test II	83.1	11.1	72.6	12.2	3.34	52	0.002*
ANOVA: comparisons within the group	F	144.1	F	77.70			
	df	2	df	2			
	P	0.001*	p	0.001*			

Significant level: (p<0.05)

Essential Neonatal Care Performance Check Test (ENCPCL)

The score in ENCPCL post-test I was significantly higher in the intervention group as compared to the control

group, (p=0.001). The mean score in post-test I for the intervention group was 85.8 (SD 5.5), while the mean score for control group was 19.3 (SD 7.47). Similarly, the ENCPCL post-test II score in the intervention group was significantly higher than the control group (p=0.001) with the mean scores of 86.3(SD 5.8) versus 42.6 (11.1) in the control group. However, there was no significant difference between the scores in post-test I and post-test II (p=0.729) in the intervention group with a mean scores of 85.8 and 86.3, respectively.

In contrast, a significant improvement was documented in the score of ENCPCL post-test I and posttest II among participants in the control group, (mean score 19.3 versus 42.6, p=0.001). Regarding the duration of the procedure, the control group spent a significantly longer time (15.5 minutes) to perform the whole procedure compared with the intervention group (12.7 minutes) (p=0.001) (Table III).

Table III: Comparison of ENCPCL Scores among Intervention and Control Groups across Post Tests

Study phase	Intervention Group n=27		Control Group n=27		t-test: Comparisons between groups		
	$\bar{x}$	(SD)	$\bar{x}$	(SD)	t	df	p
Post Test I	85.8	5.5	19.3	7.47	37.2	52	0.001*
Post Test II	86.3	5.8	42.6	11.1	18.12	52	0.001*
Duration of the procedure (Minutes)	12.7	2.04	15.5	5.1	3.77	106	0.001*
t-test: Comparisons within group	t	0.34	t	9.05			
	df	52	df	52			
	p	0.72	p	0.001*			

Significant level: (p<0.05)

Figure 1 shows a comparison between intervention and control groups in terms of ENC competencies. Fourteen competencies were calculated based on the average points scored in each competency. The intervention group scored significantly higher in all competencies compared to the control group (p=0.001). Students in the intervention group scored above 90% in five competencies, they scored more than 80% in seven competencies and scored above 70% in two competencies. On the other hand, the control scored above 70% in one competency, above 60% in another competency, and they failed the rest of the twelve competencies.

DISCUSSION

Competency-Based Education (CBE) focuses on building and developing comprehensive skills and competencies that integrate different domains of knowledge, comprehension, and application (7,10, 13). Many factors have been found to contribute to the development and quality of CBE as an effective teaching method (8). Some

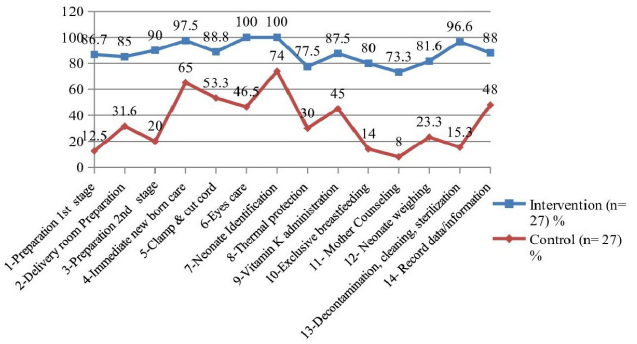

Figure 1: Comparison of the Essential Neontal Care Competencies between Study and Control Groups. ENC Competencies level: ≥ 90% = Excelent; 80% to 89% = Very good; 70% to 79% = Good; 60% to 69% = Fair; < 60% = Fail. 80% to 89% = competency fulfillment level

of those factors include the shortage of clinical settings and faculty numbers (1,4), technological development in the health care sector (1), increased tuition fees, and high unemployment rates (26). Therefore, efforts are needed at different levels to bridge in these gaps, create better learning environments, and improve learning outcomes and job readiness (7, 9).

The aim of the current study was to examine the effect of CBE on students' ENC knowledge and skills. Findings generated from the study indicate that the knowledge and skills of students in the interventional group have improved significantly in the first post-tests compared with those of the control group. This finding is consistent with the results of previous studies that showed a the positive effect of CBE on students' cognitive development, clinical skills, and competencies and knowledge acquisition (11, 13, 14, 22). The findings also revealed that knowledge and skills retention were extensively higher in the second post-tests in comparison with the control group (14, 22,23) .

The considerable effects of CBE on knowledge of ENC in the interventional group could be attributed to the use of a variety of active and collaborative teaching strategies during class sessions, such as think-pair-share (6), presentation, discussion, multimedia, and videos that displayed ENC (12). The CBE encouraged learning and elicited special responses from students, and they demonstrated active engagement and energetic interaction with the learning environment and their classmates. The students also paid more attention and showed stronger interest compared to their attention and interest in the traditional lectures (11, 26, 27).

In line with previous research (10, 13, 14, 16, 21, 28), this study emphasized one of most the crucial attributes of CBE, which is students' ability to demonstrate ENC skills. The intervention group has progressed throughout training sessions, and their ENC knowledge and psychomotor skills have developed gradually from first establishing the knowledge, then applying it, and finally putting it into practice. The results revealed that in a

simulated laboratory, the students were able to achieve the ENC competencies at an extremely high level of excellence. Students in the present study who were exposed to CBE demonstrated conscious and planned actions. They met high standards of organization and coordination skills (29). The students' competency level of performance complied with the American Academy of Pediatrics (17), WHO (2012) (19), and the International Confederation of Midwives (ICM) guidelines on newborn resuscitation and essential competencies for basic midwifery practice (29).

The substantial improvement in students' ENC skills could be attributed to the fact that CBE facilitated students' application of ENC skills and techniques in real-life situations and under appropriate circumstances such as time limits, communication, and teamwork (7, 11, 22, 23). CBE offered students the opportunity to practice clinical skills until they become proficient (21- 23). The CBE in the present study offered students the opportunity to practice clinical skills to enable them to reach proficiency level through unlimited frequency and repetition of competencies, training in collaborative teams, with active participation and interaction (11, 28). The CBE's lab setting resembles the delivery room environment; this context prepared students to be part of a working team in a situation similar to the real one, which allowed them to make mistakes and learn from the consequences without harming a real newborn (13,30,31). Furthermore, working in a simulated stressful situation of ENC reduced students' anxiety from dealing with the actual delivery room environment (31). Throughout the ENC training, researchers provided students with immediate and constructive feedback which consequently increased their abilities to apply ENC knowledge, perform competencies, make clinical decisions, and improve communication among team members (7, 11, 32).

The CBE also increased students' sense of responsibility, their ability to evaluate their own competencies, and to identify their own learning needs (33). In other words, CBE helped in bridging the gap between theory and practice (22). Consistent with previous studies, the results of the current study showed that gaining competency in applying ENC skills was achieved within an appropriate time frame without supporting cues (7). Furthermore, a key finding of this study was the students' significant retention of knowledge and skills after four months of CBE intervention. This finding supports previous research findings (7, 33).

It is wise to admit that one challenge took place and considered as obstacles for faculty members in midwifery educational institutions when implementing CBE is the changing of the academic roles of faculty members. Their role in CBE is to guide, instruct, and train students on how to combine theoretical knowledge with practical skills, arrange team activities, lead the teaching process and discussions, assess students' understanding of the material, supervise students' participation in each class and help students to synthesize, apply knowledge, provide feedback on students' progress, create opportunities, and individualize learning experiences according to students' needs. Faculty member develop classrooms with a culture of cooperation among students as they take ownership for their education as well as their peers (34-37); the new role needs extensive training, preparation, and cooperation from administrative leaders (35, 36).

The strength of this study includes students who took part in the study formed a homogeneous group in terms of their personal and academic characteristics. There was no attrition across the study phases. The findings from this study support different theoretical perspectives, and various aspects of CBE were examined in more depth by using quantitative methods. Quantitative data have been deemed to be appropriate for the study because they were collected from a wide audience in an objective and unbiased approach .

Lack of randomization in addition to limiting research setting to one institution for one study course are considered limitations of the study and could affect generalizability of the findings.

CONCLUSION

The CBE is an effective teaching model for learning and developing basic ENC knowledge and skills among undergraduate midwifery students. It guarantees the safety of the newborn and has a promising future to revolutionize ENC training and assessment competencies due to the potential transfer of knowledge and skills from the learning laboratory to the actual patient care settings. The CBE guarantees students' growth as midwives and most importantly, it develops their learning skills to deliver integrated and high-quality care to their patients. Because of the numerous benefits of the CBE model, the researchers recommend generalized implementation of CBE in an educational institution. Researchers recommend replication of the present study with a larger sample size, using a randomized controlled, design and different populations of nursing students at different educational settings . This could raise the observed power of data analysis and improve the external validity and generalizability of the findings.

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