Pedagogical Framework Versus Traditional Method on Knowledge and Self-Efficacy of Nursing Students Regarding Neonatal Resuscitation: A Randomized Controlled Trial

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Abstract

Background: Since its inception, the Neonatal Resuscitation Program (NRP) has been in quest of evidence-based strategies that promises the best outcome specifically in developing regions. Hence, the present study aims to investigate the efficacy of pedagogical framework versus traditional method of education on knowledge and self-efficacy of nursing students regarding neonatal resuscitation.

Methods: A randomized controlled trial was conducted between November 2020 to March 2021. The 60 nursing students were randomly assigned to experimental and control groups taught through traditional method (Learn, Practice), and LSPPDM Pedagogical (Learn, see, practice, prove, do, maintain) steps respectively. Students were assessed at the baseline and after the intervention using validated questionnaires. Masking of data assessment was provided by assigning a code to each student. ClinicalTrials.gov registration number (NCT04748341).

Results: Both knowledge and self-efficacy had been significantly improved ($p < 0.001$) after the intervention. However, the posttest mean change in knowledge scores was significantly higher ($p < 0.001$) in the experimental group (13.3±1.30) as compared to the control (9.97±1.22) with an insignificant difference ($p = 0.655$) in mean self-efficacy level.

Conclusion: Both methods are effective in improving knowledge and self-efficacy. Yet, education through integrating diverse strategies under the umbrella of LSPPDM pedagogy is a more effective approach in enhancing knowledge regarding neonatal resuscitation.

Keywords: *Neonatal resuscitation, Nursing, students, knowledge, self-efficacy.*

Background

Globally, 2.9 million neonatal deaths occur annually [1], and one-quarter of these ensue due to asphyxia [2]. The large majority of these deaths are reported in developing countries [3] and indicated as 10 times more in number than the developed regions [4]. Pakistan is one of the top ten countries that carry two-thirds of the global burden of neonatal deaths [5]. The neonatal mortality rate in Pakistan is reported as 46/1000 live births [6]. It is suggested that 30% of these deaths can be prevented through trained emergency birth attendants'[1]. Nevertheless, the majority of health

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professionals including both doctors and nurses possess inadequate knowledge and need additional support [1].

Since nurses are the largest workforce in the healthcare system that are directly engaged in the provision of newborn care. Therefore, they should be conversant and competent in neonatal resuscitation. However, the majority of them are not skillful in the respective field [7]. The situation is consistent with nursing students, our future workforce, often is unprepared and lacking confidence in simple, yet life-saving skills such as resuscitation [8,9]. The knowledge regarding neonatal resuscitation was assessed by Malarvizhi, Glory [10] among 85 nursing students in Coimbatore and found that 52% of them had insufficient knowledge and 48% had nearly adequate knowledge. While no student had enough information on neonatal resuscitation. Thus, expressing a dire need of developing effective educational strategies in the field of resuscitation.

In Pakistan the education of nursing students is mostly based on the traditional methods that are lacking the component of adequate learning and training in neonatal resuscitation [11,12], resulting in an insufficient knowledge among many trainees on assessment [12]. Though, in recent decades the neonatal resuscitation program (NRP) has been adapted both in developing and developed countries. Yet, still in quest of evidence-based strategies to disseminate NRP knowledge, training, and guidelines to health providers that promise the best outcome specifically in developing regions [13].

The "Learn, See, Practice, Prove, Do, and Maintain" (LSPPDM) pedagogy is one of such frameworks synthesized after intensely reviewing the literature and acting as a guiding path for educators [14]. It is based on adult learning theory that can support the acquisition of knowledge [15] leading to increase self-efficacy in the area of neonatal resuscitation. The framework is based on six phases of the "Learn, See, Practice, Prove, Do, and Maintain" [14]. Hence, efficient in learning and retaining all the steps of skill.

As Knowledge is considering a prerequisite for competence in skill performance and to evaluate the effectiveness of an educational program self -efficacy measurement is an important tool [16]. Thus, the imperative variables knowledge, and self-efficacy, have been selected for this study. Moreover, to the best of our knowledge, this is the first study to determine the effectiveness of diverse strategies under the umbrella of LSPPDM pedagogy in the education of neonatal resuscitation and evaluating the outcomes concerning knowledge, and self-efficacy among nursing students.

Objectives

The study objective was:

To compare the knowledge and self-efficacy among undergraduate nursing students learning of neonatal resuscitation through "Learn, See, Practice, Prove, Do, Maintain pedagogy" as compared to those who had learned through the traditional method.

Methods

Design and Setting

The study was a randomized control trial following the PICO (Population, Intervention, Comparator, Outcome) framework and was formerly registered at ClinicalTrials.gov (NCT04748341). The study was conducted between November 2020 and March 2021 in the College of Nursing, Allama Iqbal Medical College, Lahore Pakistan.

Sample and Sampling Technique

The sample size was calculated using the *OpenEpi* software [17] and the minimum sample size was 24 participants, having an 80% power at $\alpha = 0.05$. After adding a 20% dropout rate the final sample size was 36 and this sample size was exceeded to 72 (36 in each group). First, the list of all students enrolled in 3rd and 4th professional was established and participants

were selected through simple random sampling. The nursing students were included in the study that (a) were currently enrolled in the Bachelor of Science in Nursing (4 years) 3rd and 4th year (b) were willing to attend the education and (c) had an age of 18-25 years. The nursing students were excluded from the study that had already received any education on neonatal resuscitation and was on leave at the time of intervention.

Randomization and Allocation

Initially, 62 students were randomly assigned to experimental and control groups through the lottery method [18]. The envelop method was used to conceal the allocation. The students from each professional were equally divided into both groups. The two students were dropped in the follow-up and the final sample size remained 60 students.

Educational Intervention:

Six weeks of educational intervention was given to both groups. The lectures were prepared from the Textbook of Neonatal Resuscitation 7th edition of the American Association of Pediatrics and were the same for both groups [19]. The experimental group was learned through the six steps of LSPPDM pedagogy. The control group was taught through the 2-steps traditional method. The comparison of intervention between both groups is given in table 1.

Table1. Comparison of the intervention among two Groups.

Steps	LSPPDM PEDAGOGY (Experimental group)	Steps	Traditional Method (Control group)
1. Learn through didactic lectures (2 lectures/week). 2. See-through video on an infant resuscitation 3. Practice skill on the Low fidelity neonatal Simulator under instructor (1 skill session/week) 4. Prove skill through evaluation checklist 5. In the Do phase, students will observe neonatal resuscitation during clinical rotation. 6. Maintain skills on a simulator for self-directed learning (1 skill session/week).		1. Learn through didactic Lectures (2 lectures/week). 2. Practice skills on the Mannequins under instructor (1 skill session/week)	

Data Collection Procedure:

Data on knowledge and self-efficacy will be collected before and after the intervention. Masking of data assessment was provided by assigning a code to each student. Permission was taken from the primary tool developers. The following tools were used for data collection.

1. Demographic Data Tool

The demographic form contains information regarding age, level of education, marital status, previous result, previous resuscitation exposure.

2. Knowledge Tool

Knowledge was tested through 17 items multiple-choice questions adopted from the Knowledge Questionnaire [20]. The total score ranged from 0 to 17.

Each of the correct answers was score 1 and 0 for the wrong answer.

3. Self-efficacy Tool

Self-efficacy for Neonatal Resuscitation (SENR): The SENR instrument is a 23-item scale valued on a 10-point Likert scale. The SENR established good internal consistency with a Cronbach alpha value of 0.93 was reported [4]. The final score will be calculated by averaging the items from the subscales and thereafter averaging all 24 items for the total SENR score.

Data Analysis

The data were analyzed by using SPSS 25. Mean and SD was given for age, knowledge score, and self-efficacy score. Frequency and percentage were given for education, marital status, previous result, and previous resuscitation exposure. An independent sample t-test was used to compare the mean age, knowledge score, and self-efficacy score between both groups. The paired t-test was used to compare the pre- and post-education knowledge and self-efficacy score in both groups. A P value of ≤ 0.05 was measured as significant.

Results

Sixty-two nursing students were enrolled in the study and randomly assign to an experimental and control group. Two students were lost in follow up and the final analysis included sixty participants. The mean age in the experimental and control group was group 21.9±1.1 and 22.3±0.75 respectively. In the experimental group, 100.0% of participants were unmarried in contrast to the control group 96.7% were unmarried. In the control group, 93.3% of participants had 1st division whereas all participants in the experimental group had 1st division in previous professional. Previous neonatal resuscitation exposure among the experimental and control group was 10.0% and 16.7% respectively.

An independent sample t-test was used to compare the mean change in knowledge and self-efficacy scores between both groups. Results indicated that the mean change in knowledge scores was significantly higher ($p < 0.001$) in the experimental group as compared to the control. However, the mean self-efficacy level was almost the same among both groups. (Table 2)

Table 2: Showing The comparison of mean knowledge, and self-efficacy score between both groups

Variables	Group	Pre M±SD	p-value	Post M±SD	p-value	Difference M±SD	p-value
Knowledge score	Exp.	5.87 ± 1.83	0.946	13.3 ± 1.30	< 0.001	7.47 ± 2.03	< 0.001
	Cont.	5.90 ± 1.95		9.97 ± 1.22		4.07 ± 2.26	
Self-efficacy score	Exp.	95.9 ± 37.6	0.983	188.6 ± 24.2	0.759	92.6 ± 20.7	0.655
	Cont.	96.1 ± 35.5		186.6 ± 25.3		90.7 ± 16.5	

The Chi-square test was to compare the proportion of correct answers between both groups. Results indicated that the proportion of correct answers of statements number 2, 4, 5, 11, and 15 were significantly higher in the experimental group as compared to control while no significant difference was observed in the remaining statements. (Table 3)

Table 3: Comparison of correct answer rate between both groups

S. No	Statements	Exp. n (%)	Cont. n (%)	p-value
1.	In uncompromised neonates who do not require resuscitation after birth, when should the umbilical cord be clamped?	0 (0.0%)	5 (16.7%)	0.052
2.	Which room temperature is recommended for support of transition or resuscitation of neonates after birth?	23 (76.6%)	4 (13.3%)	< 0.001*
3.	Which three parameters should be simultaneously assessed during the initial neonatal assessment?	23 (76.6%)	18 (60.0%)	0.165
4.	What do neonates who breathe inadequately or present apneic, with normal or reduced (muscle) tone, and a heart rate of fewer than 100 min−1 require frequently?	23 (76.6%)	10 (33.3%)	0.002*
5.	Which interventions are first needed in gasping or apneic neonates?	28 (93.3%)	10 (33.3%)	< 0.001*
6.	In which situation should the oropharynx be suctioned?	28 (93.3%)	28 (93.3%)	> 0.999
7.	How should the first five positive pressure inflations be delivered?	16 (53.3%)	22 (73.3%)	0.108
8.	Which intervention is required if the chest is not rising during positive pressure ventilation?	30 (100%)	27 (90.0%)	0.237
9.	Which initial inspiratory oxygen concentration should be used in term infants?	27 (90.0%)	29 (96.7%)	0.612
10.	At which time point should an oxygen saturation of 90% be reached?	17 (56.7%)	12 (40.0%)	0.196
11.	What has to be ensured before circulatory support may be effective?	16 (53.3%)	4 (13.3%)	0.001*
12.	In which situation should chest compressions be delivered?	30 (100%)	29 (96.7%)	> 0.999
13.	Which compression-to-ventilation ratio is recommended for the resuscitation of a neonate after birth?	26 (86.7%)	20 (66.7%)	0.067
14.	At which frequency should chest compressions be delivered during resuscitation of a neonate after birth?	23 (76.6%)	19 (63.3%)	0.260
15.	Which compression depth and technique are recommended for delivery of chest compressions during resuscitation of a neonate after birth?	26 (86.7%)	4 (13.3%)	< 0.001*
16.	How often should the heart rate be re-checked during the delivery of ventilation and chest compressions?	19 (63.3%)	17 (56.7%)	0.598
17.	In which situation should the use of drugs be considered during resuscitation of a neonate after birth?	26 (86.7%)	26 (86.7%)	> 0.999

*Significant

An independent sample t-test was used to compare the mean self-efficacy score of each item between both groups. Results indicated that there was no significant difference in the mean score of each item of the self-efficacy scale between both groups. (Table 4)

Table 4: Comparison of self-efficacy score between both groups

S. No	Neonatal Resuscitation Actions	Exp. Mean ± SD	Cont. Mean ± SD	p-value
1.	Prepare area for delivery	7.4 ± 2.0	7.5 ± 1.9	0.947
2.	Prepare equipment for newborn resuscitation	8.5 ± 1.6	8.1 ± 1.8	0.419
3.	Prepare environment to keep baby warm	8.2 ± 2.1	8.9 ± 1.3	0.156
4.	Prepare solution for decontamination of materials	8.2 ± 1.3	8.0 ± 1.5	0.469
5.	Identify a helper and make an emergency plan	8.5 ± 1.3	7.8 ± 1.8	0.075
6.	Put the baby on the mother's abdomen	8.8 ± 1.2	8.8 ± 1.2	> 0.999
7.	Evaluate the amniotic fluid	7.7 ± 1.6	7.1 ± 2.5	0.265
8.	Keeping baby clean.	9.0 ± 1.4	8.9 ± 1.3	0.774
9.	Dry the baby thoroughly and provide initial steps to stimulate the baby	8.9 ± 1.1	8.9 ± 1.2	> 0.999
10.	Identify the need of helping the baby breathe.	8.4 ± 1.5	8.3 ± 1.7	0.875
11.	Evaluate: Cry, color, breath, and movement	8.7 ± 1.4	8.9 ± 1.2	0.695
12.	Time of cutting the umbilical cord.	8.3 ± 1.8	7.8 ± 1.7	0.248
13.	Able to identify the size of cutting the umbilical cord.	7.7 ± 2.1	7.5 ± 2.1	0.758
14.	Able to use chlorhexidine di-gluconate 7.1% routinely but 4% of chlorhexidine gel for care for home delivery.	7.2 ± 2.1	6.4 ± 2.0	0.162
15.	Action to take with a baby who is quiet, limp, and not breathing at birth.	7.6 ± 2.0	7.7 ± 1.4	0.819
16.	Action to take with a baby who is quiet, limp, and not crying, and does not respond to the step of stimulating breathing.	7.7 ± 2.0	7.8 ± 1.6	0.828
17.	Situation to which a baby should be suctioned.	7.9 ± 2.0	8.1 ± 1.6	0.726
18.	Ventilation with bag and mask.	8.6 ± 1.3	8.6 ± 1.3	> 0.999
19.	Action to take if a baby's chest is not moving with bag and mask ventilation	8.2 ± 2.3	8.1 ± 2.2	0.864
20.	The time when you need to stop ventilation.	8.2 ± 1.8	8.2 ± 1.9	0.944
21.	The normal range of the baby's heart rate.	8.7 ± 1.8	9.2 ± 1.0	0.189
22.	Action to take for a baby who received ventilation.	8.3 ± 1.9	8.1 ± 2.0	0.736
23.	Time of disinfecting bag and mask and suction device used.	7.8 ± 1.8	8.0 ± 1.5	0.758

Discussion

Since many factors including theory, clinical rotation, practice, and personal experience have influenced nursing student's knowledge and self-efficacy in real-life exposure to emergency pediatrics. Yet, the addition of innovative, evidence-based teaching strategies is crucial to optimize learning outcomes[17]. Therefore, the current study aims to compare the effectiveness of diverse strategies under LSSPDM pedagogy on knowledge, and self-efficacy of nursing students regarding neonatal resuscitation in a resource-limited setting.

The present study revealed that the students learned neonatal resuscitation following diverse strategies under LSPPDM pedagogy achieved significantly higher score ($p < 0.001$) on knowledge in contrast to traditional group. Though, no empirical study has reported this pedagogy to neonatal resuscitation, yet, Sall, Wigger [21] employed this framework in the education of paracentesis and ultrasound training among residents. The study reported an increase in the average score of knowledge for ultrasound 76.1% and 75.3% for paracentesis with an increase in confidence after education. These results support our results that LSPPDM pedagogy is effective in improving knowledge and self-efficacy in neonatal resuscitation after integrating diverse strategies.

Moreover, the results were in the same line with another study conducted by Tawalbeh and Tubaishat [22] in Jordan. The 100 nursing students were randomly assigned to the intervention and control group were taught through simulation scenario-based education and traditional method respectively. The study revealed that overall, both groups knowledge score was significantly improved. Yet, the scenario-based simulation group score was significantly higher ($p <0.001$) as compared to the traditional group. Furthermore, the study results were aligned with the study by Saeidi and Gholami [23] among 80 nursing students in Iran. The study finds that the simulation-based group achieved a significantly higher ($P<0.001$) score on knowledge as compare to the traditional group.

Contrary to this study, a previous study conducted by Kim and Ahn [17] found no significant difference in knowledge among nursing students taught through the 5-step method versus the traditional method. Overall, the knowledge significantly increased post-intervention with an insignificant difference ($p= .108$) in the experimental and control groups. This discrepancy in results from our study was most likely due to differences in study design, and non-randomized allocation of participants in the intervention and control group. Particularly, the masking of assessment was not done. The significant effects of 6-step LSPPDM pedagogy in our study were attributed to many factors. The main difference was the integration of diverse educational strategies including didactic lectures, videos, practice under an instructor, observing skills through clinical, and further, maintain it through self-directed practice.

Further, a significant difference was found in individual knowledge questions. While a significant difference was observed in two questions related to room temperature maintenance. The correct answer proportion of the experimental group was significantly higher as compared to the control. Literature showed that Hypothermia in newborns is highly prevalent worldwide especially in developing countries leading to hypoxia and respiratory distress syndrome that require resuscitation [24]. Therefore, adequate knowledge on room temperature could prevent it and indirectly reduced neonatal morbidity and mortality. Further, a significant difference ($p < 0.001$) was found in the initial management of a gasping newborn. In which experimental group correct answer proportion was 28 (93.3%), while in control it was only 10 (33.3%). it is evident in research that initial management within the first 30 minutes significantly improves the survival rate [25] while delaying response progress to mortality and lifelong disabilities [3].

Furthermore, a significant difference ($p < 0.001$) was observed on knowledge level at accurate rate and depth of chest compression, an important predictor of successful resuscitation. There is evidence that accurate knowledge on the rate and depth of chest compression improves heart perfusion and reducing the recovery time [26]. While, a study conducted by Vural, Koşar [27] in India showed that 89% of nursing students had poor knowledge regarding ratio, while 84% had inadequate knowledge regarding the depth of chest compressions. Hence, our study contributed essentially to improving knowledge regarding the depth and rate of chest compression.

Self-efficacy is an important predictor of one's successful learning and improve educational outcome [28]. Overall, both the experimental and control group showed significant improvement in self-efficacy after the intervention. Yet, an insignificant difference ($p= 0.655$) was found between groups after intervention. The findings are in align with the previous study conducted by Moon and Hyun [29] in South Korea. The 120 nursing students randomly assigned to intervention and control group learned through blended learning and traditional lecture method respectively. Overall, self-efficacy was improved after the intervention. Nonetheless, the study reported an insignificant difference ($p= .066$) in self-efficacy in the intervention and control groups. Although, the mean difference in self-efficacy is similar among both. Yet, we anticipated that adult learning is best possible in a more flexible and active approach for maximizing learning outcomes [30]. Therefore, we believe that education through LSPPDM pedagogy integrating with diverse strategies is a more effective approach in enhancing knowledge and self-efficacy regarding neonatal resuscitation in resource-limited settings.

Strengths and Limitations

To our knowledge, this was the first experimental study to test the diverse strategies under the LSPPDM framework in the education of neonatal resuscitation among nursing students. The study may have a direct implication for nursing education in determining the effectiveness of a pedagogical framework in the teaching and learning of neonatal resuscitation skills, especially in a resource-limited society. The most significant limitation in this study was recruiting only female nursing students at a single institute. This may affect its generalizability to other settings with a diverse population. Moreover, the posttest assessment of knowledge and self-efficacy was done soon after the intervention. Thus, preclude the retention effect of the intervention over time.

Conclusion

The current study adds a growing body of evidence that neonatal resuscitation education through LSPPDM pedagogy integrating with diverse strategies positively affects students' knowledge and self-efficacy. Nursing students achieved higher knowledge and expressed greater self-efficacy in neonatal resuscitation after the intervention. The study provides a groundwork for future trials to investigate the retaining effect with a more diverse population is warranted.

Acknowledgment- We are thankful to the Principal college of nursing and all the nursing students who took participate in the study.

Ethical Clearance- Ethical approval was taken from the institutional review board of the University of Lahore (IRB-UOL-FAHS/775/2020). The written informed consent was taken from the students before the start of the study.

Source of Funding- Self

Conflict of Interest - Nil

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