



The effect of flipped classroom on nursing students' physical examination skills: A Quasi-Experimental Study

Zahra Soltaninejad¹ , Zahra Amouzesi^{2*} , Seyed Mostafa Mohsenizadeh³ , Fateme Biabani² 

1. Student Research Committee, Birjand University of Medical Sciences, Birjand, Iran

2. Department of Nursing, School of Nursing and Midwifery, Birjand University of Medical Sciences, Birjand, Iran

3. Department of Nursing, Qaen Faculty of Medical Sciences, Birjand University of Medical Sciences, Birjand, Iran

* Correspondence: Zahra Amouzesi. Department of Nursing, School of Nursing and Midwifery, Birjand University of Medical Sciences, Birjand, Iran.

Tel: +989158653091; Email: amouzesihz9039@gmail.com

Abstract

Background: Proficiency in physical examination is a crucial aspect of the nursing process. Enhancing this skill in nursing students will improve the quality of future nursing care. However, as technology evolves, new educational methods are required to keep pace. Therefore, the present study aimed to assess the effect of the flipped classroom method on nursing students' physical examination skills.

Methods: This quasi-experimental, non-randomized study used a control group and a posttest-only design. The study was conducted at the Birjand University of Medical Sciences, Eastern Iran, in 2023. A total of 77 nursing students were selected using a census method. The intervention group received training using the flipped classroom method, while the control group followed the routine method (lectures and practice on simulators). After the intervention, the physical examination skills of both groups were evaluated using the Objective Structured Clinical Examination. Data were analyzed in SPSS 16 using the Mann-Whitney test, Chi-square test, two-way analysis of variance, Spearman's correlation coefficient, and the Point-Biserial correlation coefficient test.

Results: The mean score of physical examination skills was 14.0 ± 1.56 in the control group and 18.6 ± 1.29 in the intervention group. The Mann-Whitney test showed a statistically significant difference in the mean scores of physical examination skills between the two groups ($p=0.0001$).

Conclusion: The higher mean score of physical examination skills in the intervention group compared to the control group suggests that the flipped classroom method is effective in modern nursing education.

Article History

Received: 25 May 2024

Received in revised form: 30 May 2024

Accepted: 14 June 2024

Published online: 29 June 2024

DOI: [10.29252/jgbfm.21.2.37](https://doi.org/10.29252/jgbfm.21.2.37)

Keywords

Active learning
Problem-based learning
Physical examination
Nursing assessment
Students
Nursing

Article Type: Original Article



Highlights

What is current knowledge?

- There are limitations in traditional medical teaching methods.
- The proficiency in physical examination is a crucial aspect of the nursing process.

What is new here?

- The results of this study demonstrated that the use of the flipped classroom method in teaching physical examination skills to nursing students leads to better learning outcomes when compared to traditional teaching methods.

Introduction

A crucial nursing policy is the use of the nursing process to provide high-quality, efficient care. This process encompasses the nurse's role and combines both scientific knowledge and artistic skills (1). Assessment serves as the first step in the five stages of the nursing process, which includes regular and continuous data collection, organization, documentation, and analysis (2). According to the American Nurses Association, "assessment" includes, but is not limited to, demographic information, social determinants of health, and psychological, social, emotional, cognitive, cultural, environmental, and age-related factors (3). Physical examination is a critical component in the assessment stage, providing the nurse with information about the patient's health status and the results of the presented care (2,3). Improving physical examination skills contribute to better executive processes, improved disease management, and prevention (2). These skills serve as the basis for nursing diagnoses and the identification of abnormal findings (3).

Studies have demonstrated that enhanced knowledge and skills bridges the gap between science and practice, ultimately leading to a reduction in healthcare costs (4). Learning plays a vital role in changing behavior, making it crucial to establish an effective learning environment, especially in nursing. However, despite many changes in healthcare environments, the focus on medical education methods has been lacking (5,6). Considering the multifaceted roles of a nurse, it is necessary for nurse instructors to equip students with the necessary skills to apply in the nursing process using fundamental principles such as client-centered and holistic care (7). Lecture-based learning has long been a popular method in medical education (8,9). This method relies on a curriculum and

passive transfer of knowledge from teachers to learners (8). However, these traditional time-consuming teaching methods, characterized by one-way transfer of information, can lead to fatigue (8), reduced attention of learners (9) and rapid forgetting of the material.

To overcome the limitations of traditional teaching methods and leverage technological advancements, there has been a growing inclination toward adopting new comprehensive approaches like blended learning. This approach entails the use of different technologies to promote active learning among students. The flipped classroom method, a subset of integrated learning (9), was developed by Jonathan Bergmann and Aaron Sams (10). In this method, educational content is prepared using new technologies, such as video files, multimedia, audio recordings, and printed texts, which are made available to learners outside the classroom through online platforms or social networks. Prior to the face-to-face class, students are provided with these materials, enabling them to engage in discussions, share opinions, and solve problems during the classroom session. This active learning method aligns with the theory of adult education, emphasizing the meaningfulness of learning and its relevance to learners' work and life (4).

In the flipped classroom method, the role of the teacher undergoes a transformation. Instead of being actively involved in the teaching-learning process, the teacher has an interactive role. As a facilitator or guide, the instructor gives individual feedback to learners and promotes cooperative learning (9). This approach is rooted in the theories of self-regulated and social-adaptive learning. The self-regulated learning theory considers the learner as an active participant in the learning process, while the social-adaptive theory emphasizes the role of classroom discussions and interactions in promoting higher-order cognitive skills (11). The flipped classroom method offers various benefits, such as facilitating question-and-answer sessions to address doubts (5,12), strengthening critical thinking skills (11), and enhancing problem-solving abilities (12). It also increases student satisfaction (13). Another advantage of this educational strategy is its personalized nature, allowing each student to learn concepts at their own pace. Students have the flexibility to play and stop lecture videos based on their preferences, and they can watch them multiple times if needed. In addition, this method allows students and nurses to learn the material at their preferred time and place, making it a flexible educational strategy (11). Several studies have reported the positive effect of this method on student learning outcomes, performance improvement, and satisfaction (9,14,15). However, a study examined the effect of the flipped classroom method on nursing students' physiology knowledge and found that most students were accustomed to social and face-to-face learning. Therefore, transitioning to new educational methods, such as the flipped classroom method, may require time and self-regulation (16).

Given the significance of examining patients' health status, the limited research on new educational methods in nursing, and the conflicting findings regarding the flipped classroom method, this study aimed to examine the effect of the flipped classroom method on nursing students' physical examination skills.

Methods

This quasi-experimental, non-randomized study used a control group and a posttest-only design. The study was conducted at the School of Nursing and Midwifery, the Birjand University of Medical Sciences, Eastern Iran, in 2023, as the practical section of the health assessment course of second semester nursing students. The study population included 77 nursing students, recruited through a census method, who had not taken similar courses in the previous few months and were willing to participate in the study. Students with no prior clinical work experience were included, while those who were absent for more than one session were excluded. The sample population was non-randomly divided into an intervention group (n=32) and a control group (n=45).

A physical examination skills checklist was developed based on the "Physical Examination & Health Assessment" textbook (17) and used to evaluate physical examination skills after implementing the flipped classroom intervention. The checklist included 52 items across cardiovascular (11 items), respiratory (7 items), abdominal (11 items), ear (15 items), and eye (8 items) systems. Each item was scored dichotomously as either correct or left blank. The sum of the station scores produced a total Objective Structured Clinical Examination score for each student. The means of the students' scores \pm one standard deviation for each of the five stations were computed. A scenario was prepared for each station and approved by the nursing professors. The tasks at the five stations were defined as follows: appropriate patient-nurse interaction (Patient interaction), oral presentation of the history (Patient presentation), and correct performance of the physical examination (Physical examination technique). The students served as models for each other (See Appendix 1. Sample Physical Examination Skill Checklist in Persian).

The face and content validity of the Physical Examination Skill Checklist were evaluated by nursing professors. To confirm the inter-rater reliability of the checklist, two observers simultaneously scored the physical examination skills of six students using the checklist. The kappa coefficient was found to be 0.8, and Cronbach's α was 0.85.

In this study, the flipped classroom method was employed for the intervention group. The research team created educational videos related to the physical examination of the cardiovascular, respiratory, abdominal, head, neck, and regional lymphatics systems. These videos were reviewed and approved by nursing professors, ensuring their sound and image quality and alignment with the study's goals. Before the intervention, a briefing session was held to familiarize the students with the flipped classroom method. One week before the face-to-face classes, the educational videos were shared with the students in the intervention group via the Bale application, which they had already joined. Subsequently, the students attended the clinical skills hall. During the face-to-face sessions, which consisted of six two-hour sessions, the teacher discussed and resolved any issues and answered students' questions in the intervention group. The students then engaged in practice using simulators (18). The educational content and number of training and practice sessions were designed according to the guidelines approved by the Supreme Council of Planning of Medical Sciences of Iran, and these aspects were kept consistent between the intervention and control groups.

The control group received traditional training, which involved lectures and practice on simulators. After the intervention, the physical examination skills of both the intervention and control groups were evaluated using the Objective Structured Clinical Examination in the form of five stations. At each station, the students had 5 minutes to complete a task. The evaluators were experts with experience in teaching and evaluating physical examination skills. Also, the second author of the article, holding a Ph.D. in medical education, fully supervised the various stages of the study. The sampling phase started after obtaining the ethical code and oral informed consent.

Data analysis was performed in SPSS 16 software. The normality of quantitative variables was determined using the Kolmogorov-Smirnov test. Categorical variables were analyzed using the Chi-square test, and continuous variables were compared using the Mann-Whitney test and two-way analysis of variance. Moreover, Spearman's correlation coefficient and the Point-Biserial correlation coefficient test were conducted to analyze the relationships between the scores of physical examination skills and the nursing students' demographic characteristics. A confidence level of 95% and a significance level of 0.05 were considered in all statistical tests.

Results

The mean age was 20.6 ± 2.93 years in the control group and 19.5 ± 0.81 years in the intervention group (19-29 years). The results showed that the two groups did not have a statistically significant difference in the mean age and were homogeneous ($p=0.223$) (Table 1). The majority of participants in the control group (60.0%) and the intervention group (53.1%) were females. The results showed no statistically significant relationship between the groups and gender and they were homogeneous ($p=0.548$).

Interest in nursing was moderate for the majority of participants in the control group (52.2%) and high for those in the intervention group (45.2%), showing a significant difference between the two groups and heterogeneity among the participants in this aspect. The overall GPA from previous semesters was 15.6 ± 1.12 in the control group and 15.6 ± 2.35 in the intervention group. Therefore, the groups had no statistically significant difference in this regard and were homogeneous ($p=0.691$) (Table 1). The mean scores of physical examination skills were significantly different between the groups, with the control group scoring 14.0 ± 1.56 and the intervention group scoring 18.6 ± 1.29 ($p=0.000$) (Table 1).

Table 1. Comparison of Mean Age, GPA, and Physical Examination Skills Scores among student groups

Variables	Group				The result of Mann-Whitney test
	Intervention		Control		
	N	Mean \pm SD	N	Mean \pm SD	
Age (year)	31	19.5 ± 0.81	23	20.6 ± 2.93	$z=1.2$ $p=0.22$
Grade Point Average (GPA)	31	15.6 ± 2.35	22	15.6 ± 1.12	$z=0.3$ $p=0.69$
Physical examination skills	32	18.6 ± 1.29	45	14.0 ± 1.56	$z=7.1$ $p=0.00$

Since there was a significant difference in the frequency distribution of interest in nursing between the control and intervention groups, two-way analysis of variance was used, and the mean scores of physical examination skills were compared after the intervention according to the group and interest in nursing (Table 2).

Table 2. Comparison of mean differences in Physical Examination Skills Scores between control and intervention groups according to interest in nursing

Interest in nursing	Mean differences \pm SD after the intervention between the two groups	Source of changes	Sum of squares	Degrees of freedom	Mean square	F	P-value
Moderate	5.1 ± 1.43	Group	122.37	1	122.37	39.8	0.02
High	2.7 ± 1.26	Level of interest in nursing	9.70	3	3.23	1.15	0.47
Very high	4.5 ± 1.60	Group and level of interest in nursing	6.22	2	3.12	2.07	0.13

* Two-way analysis of variance

The results in Table 2 show that the mean scores of physical examination skills were significantly different between the control and intervention groups after the intervention ($p=0.023$). However, no significant difference was observed between the mean scores of physical examination skills after the intervention regarding the students' interest in nursing ($p=0.471$). Also, there was no correlation between the group and interest in nursing ($p=0.137$).

Furthermore, the statistical test of Spearman's correlation coefficient showed no significant direct correlation between age ($p=0.460$, $r=0.103$), GPA ($p=0.466$, $r=0.102$), and the physical examination skills scores of the statistical population. However, the test indicated a significant direct correlation between the level of interest in nursing and the physical examination skills scores of the statistical population ($p=0.022$, $r=0.311$). Also, the Point-Biserial correlation coefficient test revealed no significant direct correlation between gender and the physical examination skills scores of the statistical population ($p=0.907$, $r=0.014$).

Discussion

The current study investigated the effect of the flipped classroom method on the physical examination skills of nursing students. The research findings revealed that the intervention group achieved a significantly higher mean score in physical examination skills compared to the control group. These results are consistent with the results of various studies with different statistical populations and educational content. Khoshnoudi-far investigated the effect of the flipped classroom method on general practitioners' knowledge about type 2 diabetes. The study found that the mean post-test score was significantly higher in the intervention group than in the control group, indicating that the flipped classroom method was effective for the continuous training of general practitioners (4). Joseph studied the effect of the flipped classroom method on Omani nursing students' knowledge of anatomy and physiology and found that the mean post-test score of the intervention group was significantly higher than that of the control group (5). Furthermore, Park investigated the effect of the flipped classroom method on adults' nursing knowledge and reported that the mean post-test score was significantly higher in the intervention group compared to the control group (13). In another study, Mortazavi Moghadam examined the effect of the flipped classroom method on the knowledge of pathophysiology among

medical students and demonstrated that the mean post-test score of the intervention group was significantly higher than that of the control group (19). The study by Qutob examined the effect of the upside-down class on laboratory science students' knowledge of hematology (20). This significant difference can be attributed to the dynamic change in the presentation of topics offered in the flipped classroom, especially for complex procedures (8). In addition, the flipped classroom is an active and student-centered educational method (12) that promotes group discussion and improves problem-solving skills (21). However, the study by Fakhari did not find any statistical difference between the intervention and control groups (8). This discrepancy could be due to the study's cross-sectional design, where two topics with a similar difficulty level were taught using different methods. One group received the lecture format for the first topic, while the other used the new method. The groups then switched the methods for the second topic.

The present study found a significant direct correlation between the level of interest in nursing and the physical examination skills scores among the participants. Salari's study also showed a positive and significant relationship between nursing students' interest in nursing and their academic motivation and progress. According to Salari, a higher level of interest in nursing enhances motivation and subsequent efforts, leading to greater academic achievements and success, which is in line with the results of the present study (22).

One limitation of our study was the use of a non-random sampling method, which limits the generalizability of our findings. Therefore, it is recommended to conduct a study using random sampling. Additionally, assessing students' prior knowledge before practical sessions can lead to more effective teaching by addressing individual weaknesses.

Conclusion

The results of the present study showed that the mean score of physical examination skills was higher in the intervention group than in the control group. Given the importance of physical examination skills in enhancing the quality of nursing care and accelerating the treatment process, it is recommended that medical sciences educational centers take appropriate measures to incorporate this teaching method for clinical skills, including physical examination.

Acknowledgement

The authors would like to thank Mr. Ali Mohammad Izadpanah, Mr. Mohammad Ismailzadeh, and Mr. Erfan Yavari for their cooperation in the data collection phase. The authors would also like to appreciate all nursing students who participated in this study. This research was approved by the Vice-Chancellor of Research and Technology of the Birjand University of Medical Sciences.

Funding sources

Not applicable.

Ethical statement

All methods were conducted in compliance with pertinent ethical guidelines and regulations. Prior to commencement, the students were notified that their involvement was part of a research project. The participants' data were gathered and examined confidentially, and the participants joined the project with full awareness and the liberty to withdraw from the research at any point. This study was evaluated by the ethics committee of the Birjand University of Medical Sciences and granted approval with the ethics code number of IR.BUMS.REC.1402.195.

Conflicts of interest

The authors declare that they have no competing interests.

Author contributions

ZS contributed to the study design, developed the checklist, collected data for the work, and wrote the first and final drafts of the study. ZA developed the study idea, contributed to the study design, developed the checklist, collected, analyzed, interpreted data for the work, and revised the final draft of the manuscript. SMM and FB contributed to the study design, revised the research proposal, developed the checklist, and collected data for the work. All authors critically reviewed and approved the final manuscript.

References

- Sadeghnezhad H, Yaghmaei S. Assessing Attitudes of Nursing Students from Kashmar Nursing School Regarding the Nursing Process in 2020. *Journal of Nursing Education*. 2022;11(1):10-7. [View at Publisher] [DOI] [Google Scholar]
- Toney-Butler TJ, Unison-Pace WJ. Nursing Admission Assessment and Examination. In: StatPearls [Internet]. Treasure Island (FL): Stat Pearls Publishing; 2024. [View at Publisher] [PMID] [Google Scholar]
- Ernstmeier K, Christman E, editors. Nursing Skills. In: Open Resources for Nursing (Open RN). Eau Claire (WI): Chippewa Valley Technical College; 2021. [View at Publisher] [PMID] [Google Scholar]
- Khoshnoodi Far M, Mohajerpour R, Rahimi E, Roshani D, Zarezadeh Y. Comparison between the effects of flipped class and traditional methods of instruction on satisfaction, active participation, and learning level in a continuous medical education course for general practitioners. *Scientific J Kurdistan Univ Med Sci*. 2019;24(1):56-65. [View at Publisher] [DOI] [Google Scholar]
- Joseph MA, Roach EJ, Natarajan J, Karkada S, Cayaban ARR. Flipped classroom improves Omani nursing students performance and satisfaction in anatomy and physiology. *BMC Nurs*. 2021;20(1):1. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Barbour C, Schuessler JB. A preliminary framework to guide implementation of The Flipped Classroom Method in nursing education. *Nurse Educ Pract*. 2019;34:36-42. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Sheikhnezhad L, keramati M, Hassankhani H. Role of Nurses in the Management of Diabetic Ketoacidosis: a Narrative Review. *J Diabetes Nurs*. 2022;10(4):1990-2001. [View at Publisher] [Google Scholar]
- Fakhari E, Seyfi N, Najafi M, Vakili M. Process of the utilizing of flipped classroom for knowledge and satisfaction improvement of dental students in the periodontal and pediatric per clinical courses. *Medicine and Spiritual Cultivation*. 2017;26(3):213-8. [View at Publisher] [Google Scholar]
- Dehghanzadeh S, Alizadeh S. Explaining Nursing Students' Experiences of a Flipped Classroom: A qualitative Study. *Journal of Medical Education Development*. 2018;11(31):1-15. [View at Publisher] [DOI] [Google Scholar]
- Bergmann J, Sams A. Flip your Classroom: Reach every student in every class every day. 2012. [View at Publisher] [Google Scholar]
- Dehghanzadeh S, Jafaraghaee F. comparing the effects of traditional lecture and flipped classroom on nursing students' critical thinking disposition: A quasi-experimental study. *Nurse Educ Today*. 2018;71:151-6. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Dong Y, Yin H, Du S, Wang A. The effects of flipped classroom characterized by situational and collaborative learning in a community nursing course: A quasi-experimental design. *Nurse Educ Today*. 2021;105:105037. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Park EO, Park JH. Quasi-experimental study on the effectiveness of a flipped classroom for teaching adult health nursing. *Jpn J Nurs Sci*. 2018;15(2):125-34. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Ng EKL. Student engagement in flipped classroom in nursing education: An integrative review. *Nurse Educ Pract*. 2023;68:103585. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Aydin B, Demirev V. Are flipped classrooms less stressful and more successful? An experimental study on college students. *International Journal of Educational Technology in Higher Education*. 2022;19(1):55. [View at Publisher] [DOI] [Google Scholar]
- Bingen HM, Steindal SA, Krumsvik R, Tveit B. Nursing students studying physiology within a flipped classroom, self-regulation and off-campus activities. *Nurse Educ Pract*. 2019;35:55-62. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Jarvis C. Physical Examination and Health Assessment-Canadian E-Book: Physical Examination and Health Assessment. Canada:Elsevier Health Sciences;2023. [View at Publisher] [Google Scholar]
- Tolks D, Schäfer C, Raupach T, Kruse L, Sarikas A, Gerhardt-Szép S, et al. An introduction to the inverted/flipped classroom model in education and advanced training in medicine and in the healthcare professions. *GMS J Med Educ*. 2016;33(3):Doc46. [View at Publisher] [DOI] [Google Scholar]
- MortazaviMoghadam SG, Allahyari E, Vahedi F, Zare Bidaki M. The Effect of Web-based Flipped Classroom Approach on Learning and Satisfaction of Medical Students Comparison with Lecture-based Method. *Journal of Medical Education and Development*. 2021;16(3):207-15. [View at Publisher] [DOI] [Google Scholar]
- Qutob H. Effect of flipped classroom approach in the teaching of a hematology course. *PloS One*. 2022;17(4):e0267096. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Yom KH, Diel RJ, Kemp PS. A Comparison of the Flipped Classroom Model for Medical Student Education in Ophthalmology before and during the COVID-19 Pandemic. *J Acad Ophthalmol* (2017). 2021;13(2):e228-33. [View at Publisher] [DOI] [PMID] [Google Scholar]
- Salari A, Emami-sigaroudi AH, Zaersabet F, Shakiba M, Khojasteh M, Sharifi M. Study of the relationship between academic achievement and interested in academic field in Nursing students. *Res Med Edu (GUMS)*. 2018;10(2):68-75. [View at Publisher] [DOI] [Google Scholar]

How to Cite:

Soltaninejad Z, Amouzesi Z, Mohsenizadeh SM, Biabani F. The effect of flipped classroom on nursing students' physical examination skills: A Quasi-Experimental Study. *J Res Dev Nurs Midw*. 2024;21(2):37-9 .