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Using a flipped teaching strategy in undergraduate nursing education: students' perceptions and performance

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Abstract

Background Flipped teaching is an interactive learning strategy that actively engages students in the learning process. Students have an active role in flipped teaching as they independently prepare for the class. Class time is dedicated to discussion and learning activities. Thus, it is believed that flipped teaching promotes students' critical thinking, communication, application of knowledge in real-life situations, and becoming lifelong learners. The aim of this study was to describe the students' perception of flipped teaching as an innovative learning strategy. And to assess if there was a difference in students' academic performance between those who participated in a traditional teaching strategy compared to those who participated in flipped teaching intervention.

Method A quasi-experimental design with intervention and control groups. A purposive sampling technique of undergraduate nursing students was used.

Results A total of 355 students participated in both groups, and 70 out of 182 students in the intervention group completed the survey. The students perceived a moderate level of effectiveness of the flipped teaching classroom as a teaching strategy. The result revealed that there is a statistically significant difference in the mean students' scores for the intervention group ($M=83.34$, $SD=9.81$) and control group ($M=75.57$, $SD=9.82$).

Conclusion Flipped teaching proves its effectiveness in improving students' learning experience and academic performance. Also, students had a positive perception about flipped teaching as it allowed them to develop essential nursing competencies. Future studies must consider measuring the influence of flipped teaching on students' ability to acquire nursing competencies, such as critical thinking and clinical reasoning.

Keywords Flipped teaching, Active learning, Teaching strategy, Nursing education, Undergraduate nursing education

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Background

The successful outcome of individualized nursing care of each patient depends on effective communication between nurses and patients. Therapeutic communication consists of an exchange of verbal and non-verbal cues. It is a process in which the professional nurse uses specific techniques to help patients better understand their conditions and promote patients' open communication of their thoughts and feelings in an environment of mutual respect and acceptance [1]. Effective educational preparation, continuing practice, and self-reflection about one's communication skills are all necessary for becoming proficient in therapeutic communication. Teaching therapeutic communication to nursing students explains the principles of verbal and non-verbal communication that can be emphasized through classroom presentation, discussion, case studies and role-play. It also helps them develop their ability to communicate effectively with patients, families, and other health care professionals. Nursing students should be able to critically think, conceptualizing, applying, analyzing, synthesizing, and evaluating information generated by observation, experience, reflection, reasoning, and communication. Utilizing a traditional teaching strategy can be a challenge to meet the previously stated requirements [2]. Therefore, nurse educators should adapt unique teaching methods to help students learn and participate in their own education.

The "flipped classroom" is a pedagogical approach that has gained popularity worldwide to foster active learning. Active learning is defined as instructional strategies that actively engage students in their learning. It requires them to do meaningful learning activities and reflect on their actions [3]. Flipped teaching is a teaching strategy that promotes critical thinking and the application of information learned outside of the classroom to real-world situations and solves problems within the classroom. It is used in a way that allows educators to deliver lectures by using technologies such as video, audio files, PowerPoint or other media. Thus, the students can read or study those materials on their own at home before attending the class. As a result, discussions and debates about the materials take place throughout the lecture time. Some of the main principles of flipped teaching are increasing interaction and communication between students and educators, allocating more time for content mastery and understanding, granting opportunities for closing gaps and development, creating opportunities for active engagement, and providing immediate feedback [4, 5]. This teaching/learning methodology is supported by constructivism learning theory. A "problem-solving approach to learning" is how constructivism is frequently described. In which, it requires a shift in the nurse educator's epistemic assumptions about the teaching-learning

process. Constructivism requires nursing educators to take on the role of a learning facilitator who encourages collaboration and teamwork as well as guides the students in building their knowledge. The underlying assumptions of constructivism include the idea that learning occurs as a result of social interaction in which the student actively creates their own knowledge, while prior experiences serve as the foundation for the learning process. The "flipping classroom" reflects that approach, which integrates student-centered learning [6].

Flipped teaching approach has students learning before lectures, teaching the material to better use classroom time for cooperative learning. The discussed herein represents studies and case studies from primary through graduate schools. The literature indicated students did see value in this pedagogical approach. Most of the studies found that flipped teaching was associated with better understanding of the material learned, higher academic achievement/performance, and potentially improved psychosocial factors (self-esteem, self-efficacy) that are associated with learning. Interestingly, one article pointed out that non-didactic material used in flipped-teaching lead to an increase in performance and this did not happen with didactic material.

According to Jordan et al. [7], a flipped teaching is a methodology that was developed as a response to advancements and changes in society, pedagogical approaches, and rapid growth and advancement of technology; The flipped teaching was evolved from the peer instruction and just in time teaching approaches. Jordan and colleagues [7] state that independent learning happens outside the classroom prior to the lesson through instructional materials while classroom time is maximized to fosters an environment of collaborative learning. Qutob [8] states that flipped teaching enhances student learning and engagement and promotes greater independence for students.

Jordan et al. [7] studied the use of flipped teaching on the teaching of first- and fourth-year students' discrete mathematics and graphs, models, and applications. Across all the classes studied (pilot, graph, model and application, practices, computer and business administration), students preferred flipped teaching compared to traditional teaching. According to Jordan et al. [7], the quality of the materials and exercises, and perceived difficulty of the course and material are important to student satisfaction with this method. Additionally, it was found that interactions with teachers and collaborative learning were positive. Likewise, Nguyen et al. [9] found students favorably perceive flipped teaching. This is especially true for those students who have an understanding that the method involves preparation and interaction and how these affect the outcomes. Vazquez and Chiang [10] discuss the lessons learned from observing two large

Principles of Economics Classes at the University of Illinois; each class held 900 students. Vazquez and Chiang [10] found that the students preferred watching videos over reading the textbook. Secondly, students were better prepared after they watched pre-lecture videos compared to reading the textbook beforehand. The third finding involved the length of time pre-lecture work should take; the authors state pre-lecture work should be approximately 15 to 20 min of work ahead of each in-class session. The fourth finding is that the flipped teaching is a costly endeavor. Finally, it was found that having the students watch videos before the lectures reduced the time spent in class covering the material; the end result of this is students spend more time engaging in active learning than reviewing the material.

Qutob [8] studied the effects of flip teaching using two hematology courses. One of the courses was delivered using traditional teaching and the other course was flipped teaching. Qutob [8] found that students in the flipped course not only performed better on academic tasks, but also they had more knowledge and understanding of the material covered compared to those in the traditional format class. Additionally, Qutob [8] revealed that students in the flipped classroom found this style of learning is more beneficial than traditional teaching. Moreover, Florence and Kolski [11] found an improvement in high school students' writing post-intervention. The authors further found that students were more engaged with the material and had a positive perception of the flipped model. Bahadur and Akhtar [12] conducted a meta-analysis of twelve research articles on flipped teaching; the studies demonstrated that students taught in the flip teaching classroom performed better academically and were more interactive and engaged in the material than students taught through traditional methods. Galindo-Dominguez [13] conducted a systematic review using 61 studies and found evidence for the effectiveness of this approach compared to other pedagogical approaches with regards to academic achievement, improved self-efficacy, motivation, engagement, and cooperativeness. Webb et al. [14] studied 127 students taking microeconomics and found the delivery of flipped material (didactic vs. non-didactic) influenced students' improvements. They further found performance improvements for the students who attended flipped classes using non-didactic pre-class material. At the same time, Webb et al. [14] further found non-improvement associated with flipped classes that used didactic pre-class materials; these materials are akin to traditional lectures.

In the context of nursing education, flipped teaching strategy has demonstrated promising and effective results in enhancing student motivation, performance, critical thinking skills, and learning quality. The flipped teaching

classrooms were associated with high ratings in teaching evaluations, increased course satisfaction, improved critical thinking skills [15], improved exam results and learning quality [16] and high levels of personal, teaching, and pedagogical readiness [17]. Another study showed that student performance motivation scores especially in extrinsic goal orientation, control beliefs, and self-efficacy for learning and performance were significantly higher in the flipped teaching classroom when compared to the traditional classroom strategy [16].

Regardless of these important findings, there have been limited studies published about the flipped teaching strategy in Saudi Arabia, particularly among nursing students. Therefore, implementing the flipped teaching strategy in a therapeutic communication course would be effective in academic performance and retention of knowledge. The flipped teaching method will fit best with the goals of a therapeutic communication course as both focus on active learning and student engagement. This approach is well-matched for a therapeutic communication course as it allows students to apply and practice the communication techniques and strategies, they have learned outside of class from the flipped teaching materials and freeing up class time for interactive and experiential activities. The flipped teaching method can provide opportunities for students to apply effective interpersonal communication skills in classes, provide more time to observe students practicing therapeutic communication techniques through role-play, group discussions, and case studies. It also allows instructors to refine and provide individualized feedback and offer real-time guidance to help students improve their interpersonal communication skills.

The current study aims to examine the students' perception of a teaching innovation based on the use of the flipped teaching strategy in the therapeutic communication course. Further, to compare if there is a difference in students' academic performance of students who participate in a traditional teaching strategy when compared with students who participate in flipped teaching intervention.

Hypotheses

- Students who participated in the intervention group perceived a high level of effectiveness of the flipped teaching classroom as a teaching/learning strategy.
- There is a significant difference in the mean scores of students' academic performance between students who participate in a traditional teaching strategy (control group) when compared with those students who participate in flipped teaching classroom (intervention group).

Methods

Design of the study

Quantitative method, quasi-experimental design was used in this study. This research study involves implementing a flipped teaching strategy (intervention) to examine the effectiveness of the flipped teaching among the participants in the intervention group and to examine the significant difference in the mean scores of the students' performance between the intervention and control group.

Setting

College of Nursing at one of the educational universities located in Saudi Arabia.

Sampling

A purposive sampling technique was conducted in this study. This sampling technique allows the researcher to target specific participants who have certain characteristics that are most relevant and informative for addressing the research questions. The advantages of the purposive sampling lie in gathering in-depth, detailed and contextual data from the most appropriate sources and ensure that the study captures a more comprehensive understanding of the concept of interest by considering different viewpoints [18]. Participants were eligible to participate in this study if they were (1) Enrolled in the undergraduate nursing programs (Nursing or Midwifery Programs) in the College Nursing; (2) Enrolled in Therapeutic Communication Course; (3) at least 18 years old or older. Participant's data was excluded if 50% of the responses were incomplete. The sample size was calculated using *G-Power*. The required participants for recruitment to implement this study is 152 participants to reach a confidence level of 95% and a margin error of 5%.

Measurement

Demographic data including the participants' age and GPA were collected from all the participants. Educational characteristics related to the flipped teaching were collected from the participants in the intervention group including the level of English proficiency, program enrollment, attending previous, attending previous course(s) that used flipped teaching strategy, time spent each week preparing for the lectures, time spent preparing for the course exams, and recommendation for applying flipped teaching in other classes.

The student's perception of the effectiveness of the flipped teaching strategy was measured by a survey that focused on the effectiveness of flipped teaching. This data was collected only from the participants in the intervention group. The survey involves 14 items that used 5-point Likert-type scale (5=strongly agree, 4=agree,

3=neutral, 2=disagree and 1=strongly disagree). The sum of the scores was calculated for the item, a high score indicates a high effectiveness of flipped teaching. The survey was developed by Neeli et al. [19] and the author was contacted to obtain permission to use the survey. The reliability of the scale was tested using Cronbach alpha, which was 0.91, indicating that the scale has an excellent reliability.

Also, student academic performance was measured for both the intervention and control groups though the average cumulative scores of the assessment methods of students who were enrolled in the Therapeutic Communication Course, given a total of 100. The students' grades obtained in the course were calculated based grading structure of the Ministry of Education in Saudi Arabia (The Rules and Regulations of Undergraduate Study and Examination).

Ethical approval

Institutional Review Board (IRB) approval (No. 22-0860) was received before conducting the study. Participants were provided with information about the study and informed about the consent process. Informed consent to participate was obtained from all the participants in the study.

Intervention

Therapeutic communication course was taught face-to-face for students enrolled in the second year in the Bachelor of Science in Midwifery and Bachelor of Science in Nursing Programs. There were eight sections for the therapeutic communication course, two of them were under the midwifery program and the remaining (six sections) were under the nursing program. Each section was held once a week in a two-hour length for 10 weeks during the second semester of 2022. Students in all sections received the same materials, contents, and assessment methods, which is considered the traditional teaching strategy. The contents of the course included the following topics: introduction of communication, verbal and written communication, listening skills, non-verbal communication, nurse-patient relationship, professional boundaries, communication styles, effective communication skills for small groups, communication through nursing process, communication with special needs patient, health education and principles for empowering individuals, communication through technology, and trends and issues in therapeutic communication. The course materials, course objectives and learning outcomes, learning resources, and other supporting materials were uploaded to the electronic platform "Blackboard" (A Learning Management System) for all sections to facilitate students' preparation during classes. The assessment methods include written mid-term examination, case studies, group

presentation, and final written examination. The grading scores for each assessment method were also the same for all sections.

The eight course sections were randomly assigned into traditional teaching strategy (control group) or flipped teaching strategy (intervention group). Figure 1 shows random distribution of the course sections. The intervention group ($n=182$) included one section of the Bachelor of Science in Midwifery program ($n=55$ students) and three sections of Bachelor of Science in Nursing program ($n=127$ students). The control group ($n=173$) included one section of the Bachelor of Science in Midwifery program ($n=50$ students) and three sections of Bachelor of Science in Nursing program ($n=123$ students). Although randomization of the participants is not possible, we were able to create comparison groups between participants who received the flipped teaching and traditional teaching strategy. To ensure the consistency of the information given to the students and reduce the variability, the instructors were meeting periodically and reviewed the materials together. More importantly, all students received the same topics and assessment methods as stated in the course syllabus and as mentioned above. The instructors in all sections were required to answer students' questions, provide clarification to the points raised throughout the semester, and give constructive feedback after the evaluation of each assessment method. Students were encouraged to freely express their opinions on the issues discussed and to share their thoughts when the opinions were inconsistent.

The intervention group were taught the course contents by using the flipped teaching strategy. The participants in the intervention group were asked to read the lectures and watch short videos from online sources before coming to classes. Similar materials and links were uploaded by the course instructors into the Blackboard system. During the classes, participants were divided into groups and were given time to appraise research articles and case scenarios related to the topics of the course. During the discussion time, each group presented their

answers, and the course instructors encouraged the students to share their thoughts and provided constructive feedback. Questions corresponded to the intended objectives and learning outcomes were posted during the class time in Kahoot and Nearpod platforms as a competition to enhance students' engagement. By the end of the semester, the flipped teaching survey was electronically distributed to students who were involved in the intervention group to examine the educational characteristics and assess the students' perceptions about the flipped teaching.

Data collection procedure

After obtaining the IRB approval, the PI sent invitation letters to the potential participants using their official university email accounts. The invitation letter included a Microsoft Forms' link with the description about the study, aim, research question, and sample size required to conduct the study. All students gave their permission to participate, and informed consent was obtained from them ($N=355$). The link also included questions related to age, GPA, and approval to use their scores from assessment methods for research purposes. The first part of data collection was obtained immediately after the therapeutic communication course was over. The average cumulative scores of all the assessment methods (out of 100) were calculated to measure the students' academic performance for both the intervention and control groups.

The second part of data collection was conducted after the final exam of the therapeutic communication course ($n=182$). A Microsoft Forms link was sent to the participants in the intervention group only. It included questions related to educational characteristics and students' perception of the effectiveness of flipped teaching. Students needed a maximum of 10 min to complete the study survey.

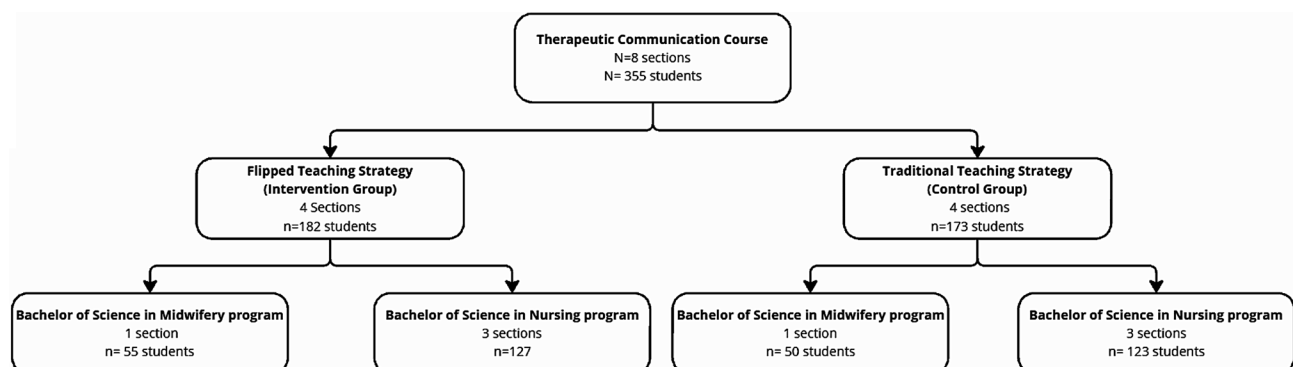


Fig. 1 Random Distribution of the Course Sections

Table 1 Description of the Educational Characteristics of Participants in the Intervention Group (N=70)

Items	Frequency	Percentage
Level of English proficiency		
Beginner	6	8.60%
Intermediate	45	64.30%
Advanced	19	27.10%
Program enrollment		
Nursing program	46	65.70%
Midwifery program	24	34.30%
Attending previous course(s) that used flipped teaching strategy		
Yes	36	51.40%
No	34	48.60%
Time spent each week preparing for the lectures		
Less than 15 min	18	25.70%
15–30 min.	22	31.40%
31–45 min.	12	17.10%
46–60 min	8	11.40%
More than 60 min.	10	14.30%
Time spent preparing for the course exams		
Less than 60 min.	10	14.30%
60–90 min.	6	8.60%
91–120 min	9	12.90%
more than 120 min	45	64.30%
Recommendation for applying flipped teaching in other classes		
Yes	35	50.00%
No	16	22.90%
Not sure	19	27.10%

Data analysis

Data was analyzed using the SPSS version 27. Descriptive analysis was used to analyze the demographic and educational characteristics and perception of flipped teaching strategy. An independent t-test was implemented to compare the mean scores of the intervention and control groups to examine whether there is a statistically significance difference between both groups. A significance level of $p < 0.05$ was determined as statistical significance in this study.

Results

The total number of students who enrolled in therapeutic communication course was 355 students. The intervention group included 182 students and the control group included 173 students. The mean age of all participants in the study was 19 years old ($M=19.56$, $SD=1.19$). The mean GPA was 3.53 ($SD=1.43$). Of those enrolled in the intervention group, only 70 out of 182 students completed the survey. Table 1 represents the description of the educational characteristics of the participants in intervention group ($n=70$). Around 65%

Table 2 Students' perception of the effectiveness of flipped teaching (N=70)

Statements	Mean \pm SD
1 Flipped classroom session provides better understanding of subject and learning skills	3.57 \pm 1.06
2 Flipped classroom session enhance students' intellectual curiosity	3.63 \pm 1.04
3 Flipped classroom session give knowledge and skills that are helpful in field practice	3.61 \pm 1.13
4 Flipped classroom session help in better retaining of the subject	3.61 \pm 1.04
5 Flipped classroom session is preferred over traditional teaching	3.33 \pm 0.99
6 Flipped classroom session should include laboratory exercises	3.50 \pm 1.10
7 Flipped classroom session should have allotted more time for each topic	3.11 \pm 1.07
8 Flipped classroom session topics related to same semester is preferred	3.61 \pm 0.95
9 Flipped classroom session should be in the form of case discussions	3.41 \pm 1.06
10 Flipped classroom session reduces the amount of time needed for study when compared to lectures	3.26 \pm 1.07
11 Flipped classroom session improves the application of knowledge	3.64 \pm 1.04
12 Flipped classroom session develops logical thinking	3.77 \pm 0.99
13 Flipped classroom session provides extra information	3.68 \pm 1.02
14 Flipped classroom session requires a long time for preparation and conduction	3.23 \pm 1.04
Overall mean score for the scale	3.49 \pm 0.69

of the participants reported that their level of English proficiency is intermediate, and they were enrolled in the nursing program. Half of the students had previous courses that used flipped teaching strategy. About one-third of the students indicated that they spent less than 15 min each week preparing for lectures. Around 65% of the students stated that they spent more than 120 min preparing for the course exam. Half of the students gave their recommendation for applying flipped teaching strategy in other courses. The mean score of the students' performance in Therapeutic Communication course who enrolled in the intervention group is 83.34 ($SD=9.81$) and for those who were enrolled in the control group is 75.57 ($SD=9.82$).

The students perceived a moderate level of effectiveness of the flipped teaching classroom as a teaching strategy ($M=3.49$, $SD=0.69$) (Table 2). The three highest items that improved students' perception about the flipped teaching strategy were: flipped classroom session develops logical thinking ($M=3.77$, $SD=0.99$), followed by flipped classroom session provides extra information ($M=3.68$, $SD=1.02$), then flipped classroom session improves the application of knowledge ($M=3.64$, $SD=1.04$). The three lowest items perceived by the students were: Flipped classroom session should have

allotted more time for each topic ($M=3.11$, $SD=1.07$), flipped classroom session requires a long time for preparation and conduction ($M=3.23$, $SD=1.04$), and flipped classroom session reduces the amount of time needed for study when compared to lectures ($M=3.26$, $SD=1.07$).

An independent sample T-test was implemented to compare the mean scores of the students' academic performance between the intervention group ($n=182$) and control group ($n=173$) (Table 3). The results of Levene's test for equality of variances ($p=0.801$) indicated that equal variances assumed, and the assumption of equal variances has not been violated. The significant level value (2-tailed) is $p \leq 0.001$, indicating that there is a statistically significant difference in the mean scores of students' academic performance for the intervention group ($M=83.34$, $SD=9.81$) and control group ($M=75.57$, $SD=9.82$). The magnitude of the differences in the means (Mean difference = -7.77% , CI: -10.02 to -5.52) is very small (Eta squared = 0.00035).

Discussion

Flipped teaching is a learning strategy that engages students in the learning process allowing them to improve their academic performance and develop cognitive skills [20]. This study investigated the effect of implementing flipped teaching as an interactive learning strategy on nursing students' performance. Also, the study examined students' perceptions of integrating flipped teaching into their learning process. Flipped teaching is identified as an interactive teaching strategy that provides an engaging learning environment with immediate feedback allowing students to master the learning content [4, 5]. Improvement in the student's academic performance and development of learning competencies were expected outcomes. The flipped classroom approach aligns with the constructivist theory of education, which posits that students actively construct their own knowledge and understanding through engaging with the content and applying it in meaningful contexts. By providing pre-class materials (e.g., videos, readings) for students to engage with independently, the flipped classroom allows them to build a foundational understanding of the concepts before class, enabling them to actively participate in discussions, problem-solving, and collaborative activities during the class. By shifting the passive acquisition of

knowledge to the pre-class phase and dedicating in-class time to active, collaborative, and problem-based learning, the flipped classroom approach creates an environment that fosters deeper understanding, the development of critical thinking and clinical reasoning skills as well as the ability to apply knowledge in clinical practice [21].

Effectiveness of the flipped teaching on students' academic performance

The influence of flipped teaching on students' academic performance was identified by evaluating students' examination scores. The results of this study indicated that flipped teaching had a significant influence on students' academic performance ($p=0.000$). This significant influence implies the positive effectiveness of flipped teaching on students' academic performance ($M=83.34$, $SD=9.81$) compared to traditional classroom ($M=75.57$, $SD=9.82$). These results are in line with other researchers regarding improving students' academic performance [7–10]. Qutob's [8] study shows that flipped teaching positively influences students' performance. Preparation for class positively influenced students' academic performance. The flipped classroom approach is underpinned by the principles of constructivism. These principles emphasize the active role of students in constructing their own understanding of concepts and ideas, rather than passively receiving information [21].

In a traditional classroom, the teacher typically delivers content through lectures, and students are tasked with applying that knowledge through homework or in-class activities. However, this model often fails to engage students actively in the learning process. In contrast,

Flipped classroom requires students to prepare for the class which allows them to be exposed to the learning material before the class. During class time, students are giving opportunities to interact with their classmates and instructors to discuss the learning topic which can positively influencing their academic performance later [7, 9]. Furthermore, the flipped classroom approach aligns perfectly with the core tenets of constructivism. Its adherence to the constructivist 5E Instructional Model further demonstrates its grounding in this learning theory. The 5E model, which includes the phases of engagement, exploration, explanation, elaboration, and evaluation, provides a framework for facilitating the active construction of knowledge [22].

It first sparks student interest and curiosity about the concepts (engagement), then enables students to investigate and experiment with the ideas through hands-on activities and investigations (exploration). This is followed by opportunities for students to make sense of their explorations and construct their own explanations (explanation). The flipped classroom then allows students to apply their knowledge in new contexts, deepening

Table 3 Differences in the mean scores of students' academic performance between the intervention group ($n=182$) and control group ($n=173$)

Sig. (2-tailed)	Mean Differences (Standard Error Difference)	95% Confidence Interval of the Difference	
		Lower	Upper
<0.001*	-77.77(1.14)	-10.02	-5.52

*Significant level is $p \leq 0.05$

their understanding (elaboration). Finally, the evaluation phase assesses student learning and provides feedback, completing the cycle of constructivist learning [22]. This alignment with the 5E model, along with the flipped classroom's emphasis on active learning and create environment that nurtures deeper understanding, the development of higher-order thinking skills, and the ability to transfer learning to real-world contexts.

In this study, one third of the students indicated that the preparation time was less than fifteen minutes a week. According to Vazquez and Chiang [10], preparation time for classroom should be about 15 to 20 min for each topic. Preparation for class did not take much time but positively influenced students' academic performance. Furthermore, preparation for class allows students to develop the skills to be independent learners [8]. Independence in learning develops continuous learning skills, such as long-life learning which is a required competency for nursing. Garcia et al. [22] found out that focusing on shifting teachers' practices towards active learning approaches, such as the 5E Instructional Model, can have lasting, positive impacts on students' conceptual understanding and learning.

Students' perception of flipped teaching as a teaching strategy

Students' perception of flipped teaching as a learning strategy was examined using a survey developed by Neeli et al. [19]. Students recognize flipped teaching as an effective teaching strategy ($M=3.49$, $SD=0.69$) that had a positive influence on their learning processes and outcomes. Several studies identified the positive influence of flipped teaching on students' learning process and learning outcomes [8, 19]. Flipped teaching provides a problem-based learning environment allowing students to develop clinical reasoning, critical thinking, and a deeper understanding of the subject [5, 8, 19, 23]. The flipped teaching approach introduces students to the learning materials before class. Class time is then utilized for discussion, hands-on, and problem-solving activities to foster a deeper understanding of the studied subject [5]. Consequently, flipped teaching provides a problem-based learning environment as it encourages students to be actively engaged in the learning process, work collaboratively with their classmates, and apply previously learned knowledge and skills to solve a problem. The result of this study is consistent with the results from a systematic review conducted by Youhasan et al. [5]. Implementing flipped teaching in undergraduate nursing education provides positive outcomes on students' learning experiences and outcomes and prepares them to deal with future challenges in their academic and professional activities [5].

Implications

The results from this study identified that flipped teaching has a significant influence on students' academic performance. The results also indicated that students have positive perception of flipped teaching as an interactive learning strategy. Flipped teaching pedagogy could be integrated in nursing curriculum to improve the quality of education process and outcomes which will result in improving the students' performance. Flipped teaching provides an interactive learning environment that enhances the development of essential nursing competencies, such as communication, teamwork, collaboration, life-long learning, clinical reasoning, and critical thinking. For example, flipped teaching allows students to develop communication skills throughout discussion in the classroom, and collaboration skills by working with their classmate and instructor. In this study, flipped teaching was implemented in a theoretical course (therapeutic communication course). This interactive learning strategy could also be applied in clinical and practice setting for effective and meaningful learning process and outcomes.

Strengths and limitations

This research study reveals the effectiveness of flipped teaching on students' academic performance. This study used a quasi-experimental design with control and intervention groups to investigate the influence of flipped teaching on nursing education. Nevertheless, this study has limitations. One of the study's limitations is the lack of randomization, thus causal association between the variables cannot be investigated. In addition, this study used a self-administered survey which may include respondents' bias; thus, it may affect the results. Also, this study investigated students' perceptions of flipped teaching as a learning strategy. The results from examining students' perceptions indicated that students had a positive perception of flipped teaching as it allowed them to develop essential nursing competencies. This study did not focus on identifying and measuring competencies. Therefore, future studies must consider measuring the influence of flipped teaching on students' ability to acquire nursing competencies, such as critical thinking and clinical reasoning.

Conclusion

Flipped teaching is an interactive learning strategy that depends on students' preparation of the topic to be interactive learners in the learning environment. Interactive learning environment improves learning process and outcomes. This study indicated that flipped teaching has significant influence on students' academic performance. Students perceived flipped teaching as a learning strategy that allowed them to acquire learning skills, such

as logical thinking and application of knowledge. These skills allow students to have meaningful learning experience. Also, students could apply these skills in other learning content and/or environments, for example, in clinical. Thus, we believe that flipped teaching is an effective learning approach to be integrated in the nursing curriculum to enhance students' learning experience.

Abbreviations

IRB	Institutional Review Board
M	Mean
SD	Standard deviation
P	The level of marginal significance within a statistical test
CI	Confidence Interval of the Difference

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Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to data privacy but are available from the corresponding author on reasonable request.

Declarations

Institutional review board

Institutional Review Board (IRB) in Princess Nourah bint Abdulrahman University, approval No. (22-0860).

Informed consent

Informed consents were obtained from all study participants.

Competing interests

The authors declare no competing interests.

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References

1. Figueiredo AR, Potra TS. Effective communication transitions in nursing care: a scoping review. *Ann Med*. 2019;51(sup1):201–201. <https://doi.org/10.1080/07853890.2018.1560159>.
2. O'Rae A, Ferreira C, Hnatyshyn T, Krut B. Family nursing telesimulation: teaching therapeutic communication in an authentic way. *Teach Learn Nurs*. 2021;16(4):404–9. <https://doi.org/10.1016/j.teln.2021.06.013>.
3. Thai NTT, De Wever B, Valcke M. The impact of a flipped classroom design on learning performance in higher education: looking for the best blend

- of lectures and guiding questions with feedback. *Computers Educ*. 2017;107:113–26. <https://doi.org/10.1016/j.compedu.2017.01.003>.
4. Özbay Ö, Çınar S. Effectiveness of flipped classroom teaching models in nursing education: a systematic review. *Nurse Educ Today*. 2021;104922–104922. <https://doi.org/10.1016/j.nedt.2021.104922>. 102(n. Issue).
5. Youhasan P, Chen Y, Lyndon M, Henning MA. Exploring the pedagogical design features of the flipped classroom in undergraduate nursing education: a systematic review. *BMC Nurs*. 2021;20(1):50–50. <https://doi.org/10.1186/s12912-021-00555-w>.
6. 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. <https://doi.org/10.1016/j.nepr.2018.11.001>.
7. Jordan C, Magrenan A, Orcos L. Considerations about flip education in the teaching of advanced mathematics. *Educational Sci*. 2019;9(3):227.
8. Qutob H. Effect of flipped classroom approach in the teaching of a hematology course. *PLoS ONE*. 2022;17(4):1–8.
9. Nguyen B, Yu X, Japutra A, Chen C. Reverse teaching: exploring student perceptions of flip teaching. *Act Learn High Educ*. 2016;17(1):51–61.
10. Vazquez J, Chiang E. Flipping out! A case study on how to flip the principles of economics classroom. *Int Adv Econ Res*. 2015;21(4):379–90.
11. Florence E, Kolski T. Investigating the flipped classroom model in a high school writing course: action research to impact student writing achievement and engagement. *TechTrends: Link Res Pract Improve Learn*. 2021;65(6):1042–52.
12. Bahadur G, Akhtar Z. Effect of teaching with flipped classroom model: a meta-analysis. *Adv Social Sci Educ Humanit Res*. 2021;15(3):191–7.
13. Galindo-Dominguez H. Flipped classroom in the educational system: Trend or effective pedagogical model compared to other methodologies? *J Educational Technol Soc*. 2021;24(3):44–60.
14. Webb R, Watson D, Shepherd C, Cook S. Flipping the classroom: is it the type of flipping that adds value? *Stud High Educ*. 2021;46(8):1649–63.
15. Barranquero-Herbosa M, Abajas-Bustillo R, Ortego-Maté C. Effectiveness of flipped classroom in nursing education: a systematic review of systematic and integrative reviews. *Int J Nurs Stud*. 2022;135:104327. <https://doi.org/10.1016/j.ijnurstu.2022.104327>.
16. Lelean H, Edwards F. The impact of flipped classrooms in nurse education. *Waikato J Educ*. 2020;25:145–57.
17. Youhasan P, Chen Y, Lyndon M, Henning MA. Assess the feasibility of flipped classroom pedagogy in undergraduate nursing education in Sri Lanka: a mixed-methods study. *PLoS ONE*. 2021;16(11):e0259003. <https://doi.org/10.1371/journal.pone.0259003>.
18. Harris AD, McGregor JC, Perencevich EN, Furuno JP, Zhu J, Peterson DE, Finkelstein J. The use and interpretation of quasi-experimental studies in medical informatics. *J Am Med Inf Association: JAMIA*. 2006;13(1):16–23. <https://doi.org/10.1197/jamia.M1749>.
19. Neeli D, Prasad U, Atla B, Kukkala SSS, Konuku VBS, Mohammad A. (2019). Integrated teaching in medical education: undergraduate student's perception.
20. Baloch MH, Shahid S, Saeed S, Nasir A, Mansoor S. Does the implementation of flipped Classroom Model improve the Learning Outcomes of Medical College Students? A single centre analysis. *J Coll Physicians Surgeons-pakistan: JCPSP*. 2022;32(12):1544–7.
21. Robertson WH. The Constructivist flipped Classroom. *J Coll Sci Teach*. 2022;52(2):17–22.
22. Garcia I, Grau F, Valls C, Piqué N, Ruiz-Martín H. The long-term effects of introducing the 5E model of instruction on students' conceptual learning. *Int J Sci Educ*. 2021;43(9):1441–58.
23. Chu TL, Wang J, Monrouxe L, Sung YC, Kuo CL, Ho LH, Lin YE. The effects of the flipped classroom in teaching evidence based nursing: a quasi-experimental study. *PLoS ONE*. 2019;14(1):e0210606.

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