

Effect of Flipped Classroom on Academic Performance and Students' Satisfaction Regarding Nasogastric Tube Insertion

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Abstract: Background: Flipped classroom has generated significant concern in nursing education in recent years, particularly in higher education. It provides an innovative solution to the unmet challenges of traditional classroom. **Purpose:** To evaluate the effect of flipped classroom on academic performance and students' satisfaction regarding nasogastric tube insertion **Design:** A quasi experimental research design (pretest - posttest) was utilized to conduct this study. **Setting:** The current study was carried out at Technical Institute of Nursing in Shebin El-Kom, Menoufia Governorate, Egypt. **Sampling:** A consecutive sample of 160 first year nursing students were selected and divided randomly and alternatively into two equal groups (80 students for each of the significant study and control groups). **Instruments:** Three instruments were used for data collection (Structured interview questionnaire, Nasogastric tube insertion checklist, and the student outcomes survey). **Results:** More than half of study group (52.5%) versus 10 % of control group had very good level competency in performing nasogastric tube insertion. There was highly significance difference between study and control groups according to their competency level of performing nasogastric tube insertion showed. The majority of students in Students in the study group showed higher statistical competency in inserting nasogastric tube than students in the control group. **Conclusion:** Based on the current study results, it was concluded that: flipped classroom was more effective method that improve academic performance as well as student's satisfaction regarding nasogastric tube insertion compared to traditional method. **Recommendation:** Nursing students' awareness about the importance of using flipped classroom needs to be improved through the utilization of flipped classroom to improve academic performance as well as student's satisfaction. Future research is recommended to assess using flipped classroom at various educational stages and extended to other nursing disciplines to determine its effectiveness on students' skill achievements and development and increase the generalizability of the study.

Key words: academic performance, flipped classroom, nasogastric tube insertion, student satisfaction.

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Introduction

Flipped classroom (FCs) is an instructional approach that puts students at the center of their learning. It involves learning the material before class and then applying it in the class (Wang et al., 2023). Moreover Cevikbas & Kaiser, (2020) reported that flipped classroom composed of two parts, namely, computer-based instruction out of the classroom, including lecture videos, and interactive group work in the classroom.

Flipped classroom can reduce the amount of time spent lecturing, provide hands-on experience, and help students become more prepared and motivated for their studies. As a result, it can also enhance critical thinking abilities, engagement with the material, and comprehension, as well as their self-assurance and students' academic performance (Baig & Yadegaridehkordi., 2023). Academic performance is known as the extent to which students reach or achieve their education goals as a result of ongoing classroom tasks, exams, or standardized tests (Camacho-Morles et al., 2021).

Moreover, numerous studies have demonstrated that students in flipped classrooms reported higher level of satisfaction and maintain more positive attitudes toward their learning experiences. Research indicated that flipped classrooms contribute to greater academic achievement, an accelerated learning process, and increased motivation among students. Wang et al. (2022) found that the flipped classroom model was more effective than

traditional instructional methods for both active and passive learners (Sarker et al., 2023). A key factor in this increased satisfaction is the model's emphasis on promoting self-regulated learning. Students are required to develop strong time management and organizational skills to engage with preparatory materials prior to class sessions. Additionally, the student-centered activities conducted during class foster the development of self-efficacy, particularly in relation to problem-solving abilities. Self-regulated learning, in turn, has been strongly associated with enhanced student's satisfaction (Strelan et al., 2020).

Recently, the flipped classroom approach has been increasingly integrated into undergraduate nursing curricula, covering subjects such as pharmacology, anatomy, physiology, patient's safety, community health, and medical-surgical nursing procedures, including nasogastric (NG) tube insertion. Nasogastric tube insertion is a blind technique in which the tube is introduced through the nasal passage, navigates the posterior oropharynx and esophagus, and ultimately reaches the stomach. The standard method for measuring the appropriate tube length involves measuring from the tip of the nose to the earlobe and then to the xiphoid process of the sternum, or alternatively, from the forehead to the xiphoid process (Sharma et al., 2023). It is widely used in medical settings for several therapeutic indications including nutritional support, medication administration, stomach

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decompression and the administration of contrast agents for diagnostic procedures (Janiszewska et al., 2021). The position of the NGT is verified through different techniques such as auscultation of an air bolus, observation of abdominal content by aspiration, and pH measurement of aspirated fluids. Also x-ray and computed tomography are considered the gold standard method to confirm its final position (Kebede et al., 2024).

Despite all the benefits of NG tubes, their inappropriate placement could endanger the safety of patients. Most insertions are unsafe and lead to the accidental entry of NG tubes into airways and routes other than the gastrointestinal tract. Airway misplacement of NG tubes is the most common issue in this regard. With the incorrect placement of NGs, about 3600–8400 cases of lung injuries and 1200–3600 deaths occur in the United States on an annual basis. Misplacement of NG tubes causes serious problems, including aspiration, pneumothorax, pneumonia, bronchopleural fistula, emphysema, pulmonary hemorrhage, mediastinal inflammation, esophageal perforation, atelectasis, and mortality (Heidarzadi et al., 2020).

Significance of the study

A key scoping review on flipped classroom instruction in higher education indicated that very little researches have demonstrated robust evidence to support that the flipped learning approach is more effective than conventional teaching methods. Furthermore, many studies have shown

that the flipped classroom does not lead to significant differences in students' learning outcomes, or even found negative influence toward college students' cognitive learning outcomes (Shi et al., 2020). Because there is a conflict of the result's about the effectiveness of flipped classroom on the previous researches, this motivates the researcher to study and perform a research about this topic.

So it is hoped that the current study will evaluate the effect of flipped class room on academic performance and satisfaction of nursing student regarding nasogastric tube insertion.

Purpose:

To determine the effect of flipped classroom on academic performance and satisfaction of nursing students regarding nasogastric tube insertion

Research Hypotheses

- Students in the study group (group I) who participate in flipped classroom are expected to have a higher level of academic performance than students in the control group (Group II).
- Students in the study group (group I) who participate in flipped classroom are expected to experience a higher level of satisfaction toward flipped classroom than students in the control group (Group II).

Methods

Research design:

A quasi experimental research design (pretest and posttest) was utilized to conduct this study.

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Setting:

The current study was carried out at Technical Institute of Nursing in Shebin El-Kom, Menoufia Governorate, Egypt.

Sampling

A consecutive sample of 160 first year nursing students was selected. The researcher used the sample size calculator with a confidence level of 95%, power 80. The sample size was determined to be 152 students, but the investigator decided to increase it to 160 participants to compensate the attrition rate and increase the power of study. Students were divided randomly and alternatively into two equal groups (80 for each of study and control groups). Students in the study group (study group I) participated in flipped classroom. Meanwhile, students in the control group (II) only participated in traditional classroom.

Students were chosen according to the following criteria:

- Students should have smart phones.
- Students should not have previous training about nasogastric tube insertion.
- Students should be graduated from secondary school.

Instruments:

Instrument one: Knowledge of students structured interview questionnaire

It was developed by the researcher after a review of related literatures (Oliván-Blázquez et al., 2023) to assess social

data and students' knowledge. It included two parts:

- **Part one:** - Social data: It included questions about student's age, sex and marital status.
- **Part two:** - Student's knowledge: It included two sections:

A. **Nasogastric tube insertion:** It included 8 questions about definition, types, purposes, indications, contraindications, complications, methods of examining nasogastric tube placement, and situations that nurse should notify the physician.

B. **Flipped classroom:** It included 9 questions about definition, advantages, disadvantages, principles, types, challenges, instructions for effective flipped classroom, as well as the main teacher's roles and the student's roles in flipped classroom. The students' answers were scored as follows: each complete answer was given two score, correct and incomplete answer was given one score while no answer, did not know or incorrect answer was given zero. The maximum score for student's knowledge about nasogastric tube insertion was 16 and zero was for the minimum score, while the maximum score for student's knowledge about flipped classroom score was 18 and zero was the minimum score. So the total score ranged from zero to 34.

All scores were summed then converted into a percentage score as the following:

- Poor was < 50%.
- Fair was 50% to 75 %.
- Good was >75% (Baig et al., 2020).

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Instrument two: Nasogastric tube insertion checklist

This checklist was adapted from Medical Surgical Nursing staff members (2022) to assess competency acquisition in performing nasogastric tube insertion. The scoring of each step was checked on a way that each criterion in the checklist was evaluated on a 2 response likert scale (done correctly and not done or done incorrectly), done correctly represented one score, while not done or done incorrectly represented zero. The total score of the checklist was ranged from zero (minimum score) to 17 (maximum score).

Instrument three: the Student Outcomes Survey

This survey was designed by Bontempo & Morgan (2003) and was adopted by the researcher to assess the student's satisfaction with the class implementation (flipped or traditional). It contained 20 questions (19 individual questions as well as one summary question). The 19 questions were grouped under three main subscales a) Teaching subscale, that included 6 items such as instructor's knowledge about the content, instructor provide opportunities to ask questions,.....etc, b) Assessment subscale which included 5 items regarding the knowledge insight of the students about the way to be assessed such as the way to be assessed was fair for the student, the assessment was at suitable intervals.....etc, while c) Generic skills and learning experiences subscale, it included 8 items such as

training developed student's problem-solving skills, training developed ability to work as a team member, training developed the ability to plan the work for the students....etc.

Scoring system:

According to Fraenkel et al., (2012) who reported that the scores were based on three points Likert scale from dissatisfy (1), neutral (2), satisfy (3). The scores of each subscale were summed up and were converted into percentage score as if score was less than 60%, it indicated low satisfaction level, if score was ranged from 60% to 75%, it indicated moderate satisfaction level and if score was more than 75%, it indicated high satisfaction level.

Ethical considerations:

An approval was obtained from Ethical and Research Committee of the Faculty of Nursing, Menoufia University code number (ERCNMA 1000/12/6/15/23). All participants were informed about purpose, procedure, and benefits of the study, then a written consent was obtained from all of them. Also all participants were informed that participation in the study would be voluntary and they could withdraw from the study at any time without penalty. Confidentiality and anonymity of participants were assured through coding all data and put all papers in a closed cabinet.

Validity:

All instruments were tested for face validity by five (4 professors and one assisting professor) in the field of Medical Surgical Nursing, Faculty of

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Nursing, Menoufia University to ascertain relevance and completeness for all instruments.

Reliability:

The first and second instruments were tested for reliability through Alpha Cronbach reliability analysis. The value of the first instrument was 0.92, while for the second instrument was 0.70. Value of Cronbach's raw alpha for the third instrument scores was around 0.99.

Pilot study

A pilot study was conducted on 10 % (16 students) of the study sample to evaluate the constructed instruments for feasibility, clarity and applicability, then the necessary modifications were carried out. The participants of the pilot study was excluded from the study sample.

Procedure:

Data collection period was extended from beginning to the end of the second semester for 2023\2024. An approval was obtained from the Dean of the Faculty of Nursing, Menoufia University and from the head of Technical Institute of Nursing at Shebin El-Kom, Menoufia Governorate, Egypt after explaining the purpose of the study. Students who fulfill the inclusion criteria were assigned randomly and divided alternatively into two equal groups (study and control groups, 80 students in each). The study was conducted into four phases: assessment, planning, implementation and evaluation phases as the following:

Assessment phase

The aim of this phase was to collect subjects' baseline data about the students' knowledge related to nasogastric tube insertion and flipped class room using instrument one. Students of each group were interviewed on 4 groups on the WhatsApp program to assess students' personnel data and students' knowledge related to nasogastric tube insertion and flipped classroom using instrument one.

Planning phase:

Based on the obtained baseline data, the researcher prepared 2 videos in English language containing nasogastric tube insertion each video about 12 minutes and another 2 videos about flipped classroom one was 3 minutes and the other was 9 minutes for the study group. These videos were available at https://drive.google.com/drive/folders/1Bcc4K9LKjaRbEYkhnzKPpd5BFh9Uxx_

Implementation phase:

Students in the study group (group 1) were personally notified in the lab and through WhatsApp program to watch the videos to prepare themselves for clinical simulation in the nursing laboratory. Videos were be accessible to the participating students one week before the lecture. To encourage pre-class preparation, announced written quiz was given at the beginning of each class for about 10 to 15 minutes. Participant students were undergone a 3-hours simulation training session on nasogastric tube insertion plus a break for 30 minutes at the middle of this

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duration. The students engaged with researcher in a circle. The classes were proceeded with active learning exercises, which included redemonstration, case studies, applying learning, guiding, and problem-solving. The researcher recognized any misunderstandings or vague points among the students, and supplied with detailed explanations to all these students.

Students in the control group participated in traditional classroom (Group II). The pre-recorded videos on the nasogastric tube insertion procedure were hidden from them. Students were notified regarding the clinical date and time for nasogastric tube simulation at the clinical laboratories. No preparation for this group was done before their clinical simulation day. Students initially watched their researcher's performance of nasogastric tube insertion, then redemonstrated on the nasogastric tube insertion for 3 hours plus a break for 30 minutes at the middle of this duration.

Evaluation phase:

The students' competency in performing nasogastric tube insertion was assessed for each group based on nasogastric tube insertion evaluation checklist using instrument two after 2 weeks from explanation the procedure. The students' knowledge about flipped classroom and nasogastric tube insertion were evaluated for both control and study group linked at <https://forms.gle/cbQcHgLk7aTs2NSR7> and <https://forms.gle/PYQDTdzWLFUHBnAh9> respectively. Finally, students' satisfaction with nasogastric tube

insertion simulation experience were evaluated for both groups using instrument three after 2 weeks from explanation the procedure that was available at <https://forms.gle/LmYTDsVnRZPtX1G9> for control group, while for study group available at <https://forms.gle/r2j84RcrRFLtjS1B9>.

Statistical Analysis

The data collected were tabulated & analyzed by SPSS (statistical package for the social science software) statistical package version 25 on IBM compatible computer.

Descriptive statistics were applied and presented as the mean for quantitative data, while qualitative data were expressed as number and percentage (No & %). For analytic statistics, the Pearson Chi-square test (χ^2) was used to study association between two qualitative variables, and the Pearson correlation coefficient test was used for quantitative variables. In addition, the reliability of the study tools was assessed using Cronbach's Alpha.

Results

Table 1: This table shows that the highest percentage of study and control group had equal or more than 18 years old (75% and 81.3% respectively). About three fourth of study and control groups (81.3% and 73.8% respectively) were female. According to marital status, the majority of study and control groups (97.5% and 96.3 % respectively) were Single. There were no statistical significant differences between both groups regarding all social data.

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Figure 1: This figure reports that majority of both study and control groups (86.3% and 87.5% respectively) had poor total knowledge level pre classroom implementation that was highly decreased to 3.7% among study group versus 15% among control group post flipped or traditional classrooms implementation.

Table 2: This table reveals that there were highly significance better performance among study group than control group in almost all steps of the procedure except for washing hands and putting gloves, lubrication the coiled portion of the tube, managing the obstruction, and checking tube position with gaging

Figure 2: This figure illustrates that more than half of study group (52.5%) versus 10 % of control group had very good level competency in performing nasogastric tube insertion post

implementation of flipped or traditional classrooms. There was highly significance difference between study and control groups according to their competency level in performing nasogastric tube insertion.

Figure 3: This figure illustrates that the majority of students in the study group and less than three fourths of control group (70%) had high total level of satisfaction after implementation of flipped or traditional classrooms. There were highly significant differences between study and control groups regarding to their total satisfaction with their teaching methods after implementation of flipped classroom.

Table 4: This table shows that there were highly statistical significance positive correlations between knowledge score with competency and satisfaction scores among study and control groups.

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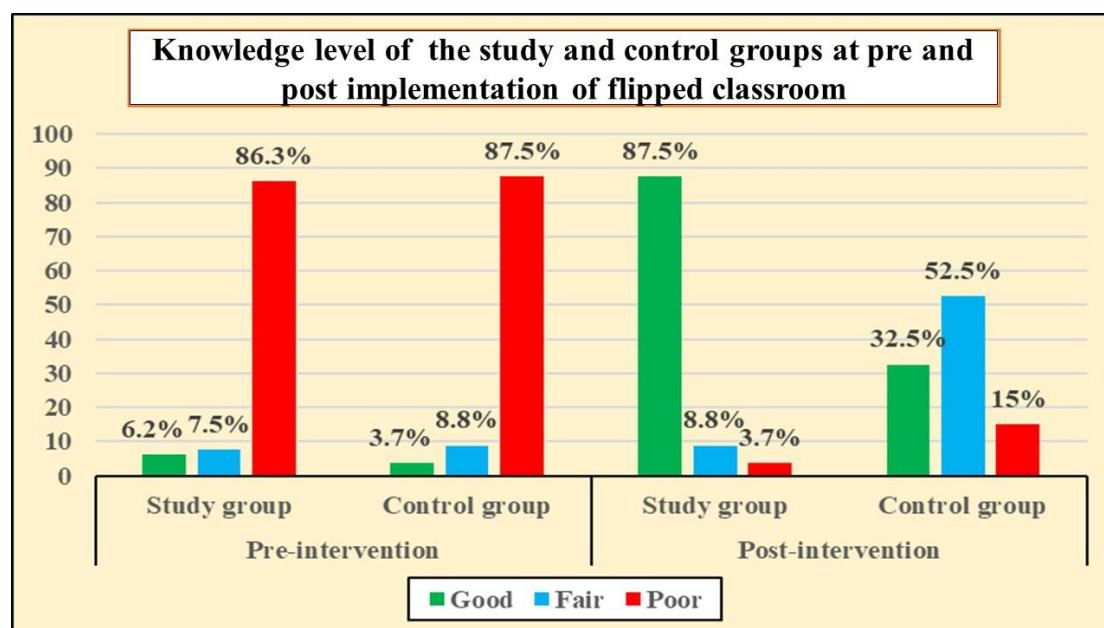
Table (1): Distribution of study and control groups according to their social data (n=160).

Social data	Study group (n=80)		Control group (n=80)		X ²	P-value
	No.	%	No.	%		
Age					0.914	0.339
< 18 years	20	25.0	15	18.7		
≥ 18 years	60	75.0	65	81.3		
Sex					1.290	0.256
Male	15	18.7	21	26.2		
Female	65	81.3	59	73.8		
Marital status					0.206	0.650
Single	78	97.5	77	96.3		
Married	2	2.5	3	3.7		

X²: Chi-square test.

No Statistically significant at p >0.05.

Figure (1): Distribution of students in the study and control groups according to their knowledge levels about nasogastric tube insertion and flipped classroom pre and post implementation of flipped or traditional classrooms.



Test of significance

X²=0.584
P₁=0.747

X²=50.56
P₂=0.000**

X²: Chi-square test. P: p-value. No significant at p >0.05. **Highly significant at p < 0.01.

P₁: p value for comparing between two groups at pre flipped classroom. P₂: p value for comparing between two groups at post flipped classroom.

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Table (2): Distribution of students in the study and control groups according to their competency in performing nasogastric tube insertion post implementation of flipped or traditional classroom (n=160).

Items	Study group (n=80)				Control group (n=80)				X ²	P-value
	Accurately done		Not done		Accurately done		Not done			
	No.	%	No.	%	No.	%	No.	%		
1) Explain procedure to patient	78	97.5	2	2.5	70	87.5	10	12.5	5.766	0.016*
2) Instruct the patient to raise his index finger during insertion	70	87.5	10	12.5	60	75.0	20	25.0	4.103	0.043*
3) Put patient in the suitable position according their level of consciousness	73	91.3	7	8.7	57	71.3	23	28.7	10.50	0.001**
4) Place towel cross chest and hands him an emesis basin.	62	77.5	18	22.5	49	61.3	31	38.7	4.972	0.026*
5) Wash hands and put on disposable gloves	77	96.3	3	3.7	75	93.8	5	6.2	0.526	0.468
6) Measure patient's NEX, and mark the tube appropriately	73	91.3	7	8.7	24	30.0	56	70.0	62.86	0.000**
7) Coil the first 7-10 cm of the tube around the fingers and lubricate the coiled portion of tube with water-soluble lubricant.	74	92.5	6	7.5	73	91.3	7	7.8	0.084	0.772
8) Tilt back the patient's head, and gently pass tube through nostril into posterior nasopharynx.	75	93.8	5	6.2	56	70.0	24	30.0	15.20	0.000**
9) Directing downward backward, gently rotate the tube 180 degrees.	73	91.3	7	8.7	62	77.5	18	22.5	5.736	0.017*
10)Ask the patient to flex his head toward the chest	59	73.8	21	26.3	24	30.0	56	70.0	30.66	0.000**
11)Allow the patient to take several sips water through straw, if patient gag, advance tube as patient swallows	77	96.3	3	3.7	64	80.0	16	20.0	10.09	0.001**
12)If the obstruction appears, don't use force. Rotating tube gently may help. If unsuccessful, remove tube& try another nostril.	78	97.5	2	2.5	77	96.3	3	3.7	0.206	0.650
13)Continue to advance the tube until the tap mark reaches the patient's nostril.	77	96.3	3	3.7	77	96.3	3	3.7	0.000	1.000
14) If gagging continues, use a tongue blade to check tube position in the back of the throat.	68	86.1	11	13.9	74	92.5	6	7.5	1.718	0.190
15)15-Check the tube is in the stomach	70	87.5	10	12.5	41	51.2	39	48.8	24.74	0.000**
16)Attach the tube to suction or clamp the tube.	68	85.0	12	15.0	54	67.5	26	32.5	6.764	0.009**
17)Secure tube with hypoallergic tape	68	85.0	12	15.0	27	33.7	53	66.3	43.55	0.000**

X²: Chi-square test.

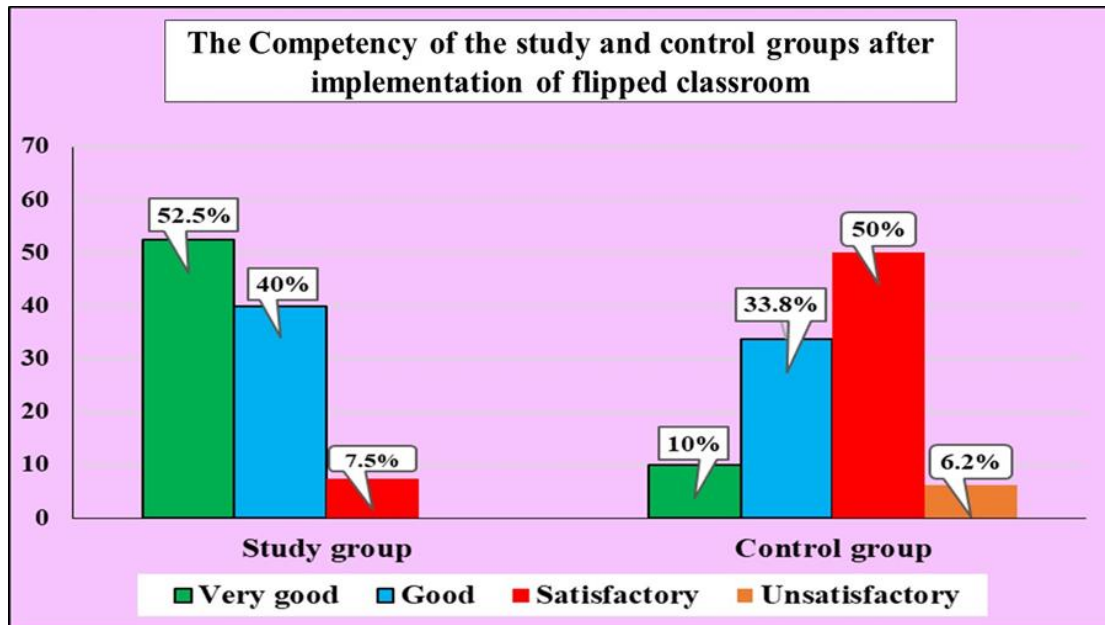
No significant at p >0.05.

* Significant at p < 0.05.

**Highly significant at p < 0.01.

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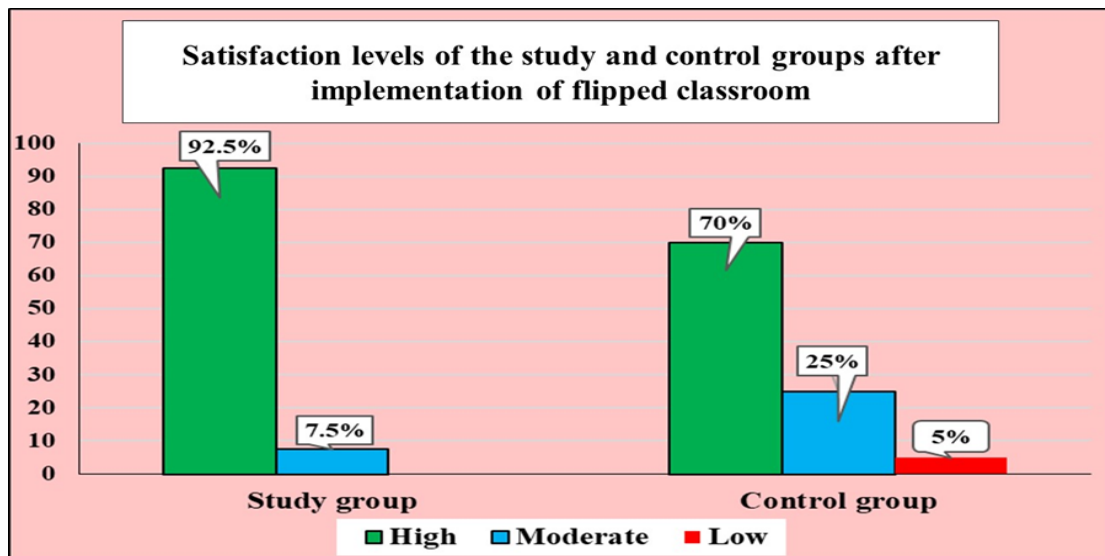
Figure (2): Distribution of students in the study and control groups according to their total competency level in performing nasogastric tube insertion post implementation of flipped or traditional classrooms.



Test of significance	
X ²	P-value
53.67	0.000**

X²: Chi-square test. **Highly significant at p < 0.01.

Figure (3): Distribution of students in the study and control groups according to their total satisfaction level post implementing flipped or traditional classrooms.



Test of significance	
X ²	P-value
14.03	0.001**

X²: Chi-square test. **Highly significant at p < 0.01.

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Table (3): Correlation between total knowledge score, total competency score and total satisfaction score with teaching methods post implementation of flipped or traditional classrooms among study and control groups (n=80).

Variables	Study group				Control group			
	Knowledge score		Competency score		Knowledge score		Competency score	
	r	P-value	R	P-value	R	P-value	r	P-value
Competency score	0.466	0.000**			0.704	0.000**		
Satisfaction score	0.598	0.000**	0.393	0.000**	0.503	0.000**	0.430	0.000**

r= Correlation coefficient test. **highly significant at $p < 0.01$. Interpretation of r: Intermediate (0.25-0.74)

Discussion

Flipped classroom is a pedagogical approach which moves the learning contents that were taught by teachers' direct instruction to the time before class in order to increase the chances for the students and teacher to interact. . Therefore, teachers would have more time to guide the learning activities and solve students' problems in order to promote the learning effects (Weiß & Friege 2021).

The current study findings indicate that the majority of both groups had poor level of knowledge level pre implementation of flipped or traditional classrooms; but post teaching, there were highly significant improvements of total and subtotal knowledge level among study group than control group. These improvements may be related to the effect of flipped classroom implementation. These findings are consistent with Chao et al., (2022) in their study about Effectiveness of digital flipped learning evidence-based

practice on nurses' knowledge, attitude, and practice.

Regarding student's competency level in performing nasogastric tube insertion, the present study revealed that more than half of study group had very good level of competency in performing nasogastric tube insertion after implementation of flipped classroom compared to minority of control group after implementing traditional classroom, This could be attributed to the significant effect of flipped classroom on academic performance of NGT.

This finding is supported by the research of Joseph et al., (2021) about "Flipped classroom improves Omani nursing students' performance and satisfaction in anatomy and physiology" in Oman who reported that flipped classroom improve Omani nursing students' performance. Also Lu et al., (2023) studied "Examining the effects of student-centered flipped classroom in physiology education" in

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Harbin Medical University, China and stated that the flipped classroom teaching significantly improved students' learning effectiveness as indicated by final exam score of their performance. Moreover Polat & Karabatak, (2022) carried a study about "Effect of flipped classroom model on academic achievement, academic satisfaction and general belongingness" in Turkey and confirmed that a flipped classroom model that integrates technology into the educational environment improved students' academic achievement, academic satisfaction, and general belongingness. As well as Aksoy & Pasli Gurdogan, (2022) found that the flipped classroom approach was effective for improving urinary system knowledge and skill level. Additionally Hassan & Elsaman, (2023) showed that using the simulation-based flipped classroom method through a pre-recorded video was more effective in accelerating critical care nurses' learning compared to traditional simulation.

During the present study, the researcher gave the course resources to the students before face to face sessions, regardless of time and environment, students study these resources and mostly take advantage of the videos. Also, they have an opportunity to ask the researcher and their group members about the points that they didn't understand in a face-to-face environment which make learning more effective. Naturally, this situation can be interpreted as an essential explanation of why students in the flipped classroom model have higher

academic performance than other classroom models.

In other words simulation-based flipped classroom allows students to review pre-recorded videos before laboratory sessions. Thus, students can be deeply engaged in clinical training during laboratory activities with peers which can improve students' participation in achieving the intended learning outcomes. Moreover, this approach allows students to discuss knowledge and practice skills with confidence. These results supports the first study hypothesis.

But the current findings disagree with Sourg et al. (2023) who studied "Impact of flipped classroom model in increasing the achievement for medical students" at Al-Neelain University in Khartoum and revealed that there were no significant effect of flipped classroom on medical students' academic achievement. From the researcher point of view, this may be related to the traditional lecture group of Sourg et al was given a reading material to study immediately after the lecture and before the post-test, which is not the real practice during the traditional lecture and may be considered a bias. Another explanation for the absence of difference between the both groups may be related to that flipped classroom model was a new experience for the flipped classroom group hence they were facing this new approach for the first time in their education and the very short time that was used for students' preparation.

Regarding to student's satisfaction, the finding of the current study revealed that there were highly statistical

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significant differences in all teaching, assessment, generic skills and learning experiences subscales as well as overall satisfaction among study group than control group. These findings are in line with Wang et al. (2024) who studied "The effects of 'small private online course+ flipped classroom' teaching on job competency of nuclear medicine training trainees" in China and confirmed that significant differences were observed between experimental and control groups in the areas of over-all satisfaction, teaching methodologies, and fulfillment of targeted clinical skills.

From the researcher's point of view there are some factors explain why there were highly statistical significant differences in teaching and assessment methods among study group than control group. First, the teacher in the flipped classroom was forced to prepare the lecture in sufficient time and send it as a video Therefore, the method of teaching and conveying information is good. Second, the time in the flipped classroom was not compressed as the teacher is available to facilitate discussion, guide learning, and help students in problem solving. Also the teacher in flipped classroom had enough time to explain in details the evaluation method. Moreover students in flipped classroom had higher level in competency in performing nasogastric tube insertion than students in traditional classroom which gave the teacher the opportunity to give students useful feedbacks on their assessment.

Also there are some factors explain why there were highly statistical

significant differences in generic skills and learning experiences among study group than control group. Flipped classroom empowers students with the autonomy for independent learning, and improves educational outcomes. This model has emerged as a novel concept and teaching model aimed at student's education, particularly in stimulating learning motivation and professional interests, diversifying instructional methods, increasing the attractiveness of teaching, and enhancing interactivity. Furthermore, by deepening the understanding of students' performance in both classroom and online learning evaluations, the flipped classroom method can foster active learning, promote personalized educational experiences, enhance independent learning capabilities, and develop critical thinking skills, thereby facilitating overall students' development.

Also the students watched the prepared videos before class made them able to think for themselves based on the questions asked by the teacher, felt more involved in the process, and knew what they were doing. Second, students could master important and difficult knowledge in class. They distinguished between primary and secondary points, and through discussions between them, researchers could provide targeted explanations of difficult problems so that knowledge can be better internalized, which is conducive to better understanding and application.

The finding of the current study revealed that majority of study group compared to less than half of control

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group had high level of satisfaction about the training after implementation of flipped classroom versus traditional classroom. This finding is parallel to Sourg et al. (2023) who reported that majority of participants were satisfied with using a flipped classroom. Also Mandasari & Wahyudin, (2021) studied "Flipped classroom learning model: Implementation and its impact on EFL learners' satisfaction on grammar class" in Indonesia and stated that students satisfy with the learning process which used flipped classroom because flipped classroom was easy to implement ,promote self-directed learning and improve grammar knowledge. Also Polat & Karabatak, (2022) confirmed that flipped classroom model that integrates technology into the educational environment improved students' academic achievement, academic satisfaction, and general belongingness.

Moreover Lin et al. (2023) stated in a study about "Investigating factors affecting learning satisfaction and perceived learning in flipped classrooms: The mediating effect of interaction" in Changhua City, Taiwan that, a positive and direct link between perceived learning and learning satisfaction with flipped courses was found. Moreover Hassan & Elsaman, (2023) showed that students who underwent simulation-based flipped classroom were more satisfied than those who underwent traditional simulation. These results supports the second study hypothesis.

For correlation between total knowledge score, total competency

score and total satisfaction with teaching methods. The findings of present study reported that there were positive correlation between total competency score and total satisfaction score in both study and control group. This finding agrees with Strelan et al. (2020) who studied "Student satisfaction with courses and instructors in a flipped classroom" in Australia. This explain that students who enjoy course content are more likely to perform better. Student's satisfaction can be associated with motivation to persist. In addition to, the way courses are structured can affect student's retention.

Moreover Aguilera-Manrique et al. (2022) stated that the FC increases knowledge and clinical skills among nursing students in performing urinary catheterization, considering it more effective than traditional teaching that increase student's satisfaction.

These results may be related to previously viewing videos on clinical skills. In addition, the videos enable the repeated viewing of the procedure. A further aspect that may have had an influence is the flexible learning approach, which allows students to access the resources when and where they want, thus satisfying their educational needs at any time.

Conclusion

Flipped classroom was an effective method in improving students' academic performance as well as student's satisfaction regarding nasogastric tube insertion.

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Recommendations

The current study can be replicated on a larger sample at different settings to increase generalizability of results and providing affordable technology solutions and internet access for all students and teachers. Also Future research is recommended to assess using flipped classroom at various educational stages and extended to other nursing disciplines to determine the effectiveness on students' skill achievements and development.

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