Effect of the Application of Flipped Classroom on Technical Nursing Students' Academic Engagement and Knowledge Retention.

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Abstract:

*Background: Flipped classroom as a method of teaching is one of the recent innovative methods of teaching where traditional classroom activities take place before class while class time is devoted to discussion, problem-solving, and interaction among students. Flipped learning is a learner-centered and technology-driven approach. **Objective:** The study aimed to determine the effect of application of flipped classroom on nursing students' academic engagement and knowledge retention. **Setting**: A quasi-experimental study was conducted in the El Kabary Institute of Nursing, affiliated to the Ministry of Health in Alexandria which provides a program graduating technical nurse; this program is covered in 5 years. **Subjects:** The study included all students enrolled in the fourth year in the first semester of the academic year 2017-2018 (61students). **Tools:** Two tools were used for data collection. **Tool I** Technical Nursing Students' Knowledge test. **Tool II:** Student's Academic Engagement Scale. **Results**: The result of this study revealed that there was a statistical significant difference between students' level of knowledge before and after intervention and there was a high level of engagement after conducting the study **Conclusion:** Flipped classroom strategy had a significant positive outcomes, including an increase in students' knowledge, an increase in their academic achievement, an increase in their participation and interaction, and increasing collaboration. Additionally, it found that students were more engaged in the flipped classroom than in the traditional classroom. **Recommendation:** The study recommends that Flipped classroom strategy should be incorporated into the nursing curriculua at the Technical Institutes of Nursing and Internet services should be provided to motivate the students becoming more academically engaged and develop innovative ideas.*

Introduction

As the demands of society have changed, the educational scope must be changed by developing new strategies and methodologies that are used by educational institutions. The educational institution is a "scenario of social life"; that is, there is a direct relationship between society and education and therefore what happens in one area affects and regulates the other (Sevillano-Monje, et al., 2022). Innovative teaching strategies are needed to optimize nursing education pedagogy to prepare future nurses for practice (Lopez, 2022). Educational institutions around the world are witnessing a huge trend in integrating technology into their education and learning methods (Halasa, et al., 2020), (Harahap, et al. 2021). Flipped learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space; teachers are able to incorporate new or different methodologies into their classrooms, freeing up class time for more individualized and small group instruction, classroom is considered "flipped" when lectures are viewed by students outside of the classroom usually on their personal devices; class

time is then used for activities and discussion (Bhavsar et al., 2022).

More researches are focusing on flipped classroom (FC) design. Although the concept has appeared many years ago, some authors such as Aidoo et al. (2022) emphasized how flipped classrooms promote student engagement, leading to better learning outcomes. In higher education, class time becomes a time for in-depth discussion on a topic that students learned through pre-recorded video lectures at home to spend time dealing with more complex clinical case scenarios. Flipped learning is one of the most important educational topics in the world. It has generated growing interest in health sciences, and is considered an appropriate educational strategy to prepare healthcare workers as it enhances learning, encourages engagement, and enhances clinical reasoning skills (Huang et al., 2023).

According to Darling-Hammond (2019), there is a growing need for educators to combine "content with engaging, experiential, and innovative learning experiences." However, flipped classroom combines traditional in-person instruction with online resources to help students complete assignments, solve issues, and take part in discussions and activities.

The term "Inverted Classroom" was coined by Lage et al. (2000); Baker (2000) created a teaching strategy that involved giving homework based on lecture material and utilizing class time to absorb the knowledge and called it "Classroom Flip". Also, the Strayer (2007) reported that the goal of the flipped classroom is to create a positive learning environment during class meetings. The flipped Learning Network has recognized Bergmann & Sams (2012) as the pioneers of the modern flipped class approach; they wrote the book "Flip your classroom: Reach every student in every class every day," which is a valuable teaching tool. They recorded his lectures and shared them on YouTube to improve learning,

Multimedia learning is a cognitive theory of learning that explains why a flipped classroom can be beneficial for students. Some of the flipped classroom's design principles were implemented; the flipped classroom can incorporate *the following principles:* the *modality principle*, which states that students learn better from narration rather than on-screen text; the *individual differences principle*, which states that all design principles have a stronger

effect on low-knowledge learners; and *the multimedia principle,* which states that students learn better from words and pictures than words alone (Park, 2022). The Flipped Classroom uses both learning theories: the behaviorist approach outside the classroom and the constructivist approach within the classroom (Xu & Shi, 2018).

FLN (2014) also offers additional guidelines for flipped classroom designers, which are ***as follows: i)*** Flexible Environment ***(F), ii)*** Learning Culture ***(L), iii)*** Intentional Content (I), iv) Professional Educator ***(P)*** (Kim et al., 2021) (Dianati et al., 2022), Progressive Networking Activities ***(P),*** *vi*) Engaging and Effective Learning ***(E)***, *vii*) Diversified and Seamless Learning Platforms ***(D)*** (Awidi & Paynter, 2019).

The main benefit of the Flipped Classroom model is that when students are trying to solve problems, answer questions, or work collaboratively as a group (Pang, Aydin& Demirer, Aidoo et al., 2022). Teachers must recognize the opportunities to align technology with teaching goals and know how to enhance learners' critical thinking and increase student participation before, during, and after the flipped classroom period to improve learning outcomes (Darling-Hammond et al., 2020), (Pang, 2022).

According to Hollister et al. (2022), there are three commonly accepted dimensions of student engagement: behavioral, cognitive, and affective, with indicators for each dimension. Behavioral engagement is defined as active responses to learning activities that are characterized by participation, persistence, and/or positive behavior. Cognitive engagement involves mental effort in learning activities and is characterized by deep learning, self-regulation, and comprehension. Affective engagement is defined as an emotional involvement in learning activities, as demonstrated by favorable reactions to the learning environment, peers, and teachers, as well as a sense of belonging.

Flipped classrooms are believed to boost student engagement because they allow students to engage in pre-class activities that help them get ready for class activities (Hava, 2021).According to SteinUtheim and Foldnes (2017), student engagement is seen to be a predictor of learning and academic achievement.

Aim of the study

To determine the effect of flipped classroom on nursing students' academic engagement and knowledge retention.

Research hypotheses:

1- Students who studied by flipped classroom exhibit higher level of academic engagement than those who do not.

2- Students who studied by flipped classroom exhibit higher score of retained knowledge than those who do not.

Materials and Method

Materials

<u>***Research Design:***</u> **A** quasi experimental research design

<u>***Setting:***</u> The study was conducted at El Kabary Institute of Nursing, affiliated to the Ministry of Health in Alexandria which provides a nursing program for graduating technical nurses.

<u>***Subjects:***</u> The study included all technical nursing students enrolled in the fourth year during the first semester of the academic year 2017-2018 (61students). The technical students were randomly divided into two groups; 33 students in the study group and 28 students in the control group.

<u>***Tools:***</u>

Two tools were used in this study as follows:

Tool (1): Technical Nursing Students' level of Knowledge test: It consists of 25 questions divided into four parts, *as follows:*

Parts	No of items	Marks
Part I: True and False questions	5	5
Part II: Multiple choice questions	10	10
Part III: Filling the blanks questions	5	10
Part IV: Matching questions	5	5
Total	25	30

This tool was developed by the researcher after reviewing the course objectives and content outlines related to the following topics: communication and health education, educational materials and methods, and health education evaluation. The questions were developed related to the content of the book assigned to the students by Ministry of Health. It was used to assess knowledge levels of undergraduate technical nursing students. The scoring system of this test was as follow: Grade from 26:30 indicates *excellent* level of knowledge, grade from 23-25 indicate *very good* level of knowledge, grade from 20-22 indicate *good* level of knowledge, grade from 18-19 indicate fair

level of knowledge, and less than 18 indicate fail level of knowledge.

Tool II: **Student's Academic Engagement Scale.** This tool was developed by the researcher after thorough review of the related literature (Callagher L. 2007, Ellis R, Hartley L. 2008, Johnson G. 2013, Gilboy M, Heinerichs S, Pazzaglia G. 2015, Everly MC. 2013), to measure nursing students' engagement. It includes 30 items distributed over 3 dimensions of engagement; emotional engagement (10 items), cognitive engagement (10 items), and behavioral engagement (10 items). Responses on the scale are measured on a 4 points Likert scale ranging from strongly disagree (1) to strongly agree (4). Items are reverse-coded (e.g., strongly disagree (4) to strongly agree (1). The cumulative scores of engagement range from 30-120.

Method

-Permission from the Research Ethics Committee at the Faculty of Nursing was obtained.

-Permission from the responsible authorities at the Faculty of Nursing was obtained and submitted to the responsible authorities of Ministry of Health and population to conduct the study at El-Kabary Institute of Nursing.

-A written permission to conduct the study was obtained from manager of El-Kabary Institute of Nursing, affiliated to Ministry of Health.

-Tool I and II were developed by the researcher after reviewing the related literature and submitted to a jury of 5 experts in the related fields to determine their applicability and content validity and necessary modifications were done.

- Reliability of the study tools was tested using Cronbach's Alpha test. Tools I & II were reliable and their coefficient values were (0.834, 0.885) respectively.

- A pilot study was conducted on 6 students (10%) of total subjects to ensure the clarity and feasibility of the tools, and the necessary modifications were done accor**ion:**

Th**dingly.**

-Data collecte study was conducted through three phases: preparation, implementation, and evaluation.

Phase (I): Preparation phase:

-This phase included three parts as preparation of teaching materials, preparation of learning environment, and preparation of students.

- Pretest was done for all the students in both groups using tools I and II.

Phase (II): Implementation phase:
For the study group:
- The study followed the routine schedule of teaching covering three topics: communication and health education, educational materials and methods, and health education evaluation using the flipped classroom method of teaching
- This phase lasted for four weeks (one day/ week, 2 hours/ day); during this phase, the students watched pre-recorded video lectures every week and answered the questions of quiz prior to classroom to listen to each group answers and interact cooperatively through effective discussion and students' participation.
- At the end of each session, the researcher evaluated the activities of each group of students and summarized the content, corrected the mistakes and gave them feedback related their activities. Then, the researcher provided them with reading assignments, power point presentation and the next questions of quiz related to next topic.

For the control group:
- The control group followed the routine schedule of teaching covering three topics: communication and health education, educational materials and methods, and health education evaluation using the traditional method of teaching.

Phase (III): Evaluation phase:
•Post-test was done immediately for all students in both groups using tools I and II after completion of the module, students were asked to fill in the engagement scale and knowledge test.
•Follow up was done after one month after posttest implementation of the FC strategy for both to measure their knowledge retention using tool I.
•Data was collected within four weeks during the first semester of academic year 2017- 2018.

Ethical consideration
•A written informed consent was obtained from technical nursing students after explaining the aim of the study.
•Confidentiality of the collected data was maintained
•The anonymity and the privacy of the study subjects were assured.
•Participation of the nursing students in the study was on voluntary basis.

Results:
The main results revealed that:
- The majority of the students in the study group were from Alexandria and had less than 20 years old, all of them were female and in the first semester of the academic fourth year.
- Table **(1)** shows a statistically significant difference was found as $Fr_{(P)} = (32.00^* < 0.001^*)$ regarding the comparison of knowledge levels before and after the study intervention among the study group.
- Also, there was statistical significance between the study and the control groups after the study intervention presented as χ^2 (p2) = χ^2 = $16.920^* (< 0.001^*)$, while no statistical difference of knowledge levels was found between the study and control groups after one month of study intervention (follow up) presented as χ^2 (p3) $\chi^2 =$ 0.262 (0.715).
- Table **(2)** presents a statistically significant difference among both groups expressed as Fr(p) = (109.610* (<0.001*) 43,506* <0.001*)) respectively.
- Also, the comparison of knowledge levels study and control groups after the study intervention, there was a statistically significant difference expressed as χ2 (p2) = χ2= (6,242* (< 0.001) *)) of the total knowledge level between study and control groups.
- Table **(3)** shows a statistically significant difference expressed as ((p2) 3.261* 0.002*) regarding the emotional engagement score for comparing between the studied groups after intervention. Also, there was a statistically significant difference expressed as ((p3) 0.002*) regarding the emotional engagement score of the study group before and after intervention.
- Although, there was no statistically significant difference between the studied groups regarding cognitive and behavioral engagement presented as ((p3) 0.810), (0.0144) respectively. There was a statistical significance difference between the studied groups regarding the total scores of overall engagement, which is expressed as (p2), (0.024*).

Table **(4)** shows a high engagement score for both study and control groups after conduction the study indicated (24.2%, 7.1%) respectively.
- While, the comparison between the study group and control groups before and after

regarding total engagement score shows no statistically significant difference presented as p3 (0.344, 1.000) respectively.

Discussion

Flipped classroom provides students with opportunities to learn current and accurate content in an interesting manner and allows them to access the materials, such as recorded videos, powerpoint presentations, and reading, reviewing, and well-prepared materials, at any time (Noori et al., 2022; Kazu and Yalçın, 2022). In the current study, the researcher has chosen the communication topic was specifically chosen because of its important value in community nursing, which considered one of the most important specialties in nursing education to apply the flipped classroom.

The effectiveness of Flipped classroom model of instruction has been proved in many studies as an active learning strategy (Kim, Jin, & Lim, 2015; Park & Park, 2018; Wilson, 2020). These studies have discussed flipped classroom as an important part of the paradigm shift from teacher centered to student-centered learning, in which students actively and extensively interact with teachers and peers through collaborative work.

The recent results showed that knowledge levels were better when the flipped classroom is introduced to the study group, and there is a significant difference between the study and control groups regarding knowledge levels. These findings indicate that flipped classrooms are an excellent way to minimize the amount of face-to-face instruction in classroom practice while maximizing one-on-one interactions and a more collaborative and supportive contribution to classroom processes. In addition, flipped classrooms integrate technology and active learning activities to promote student academic success, improve critical thinking skills, and provide opportunities for student participation (Zidan et al., 2020).

Furthermore, it has been noted that students are adaptable, capable, and able to repeat lectures in addition to playing back video segments that were not clear on the first screen. Zuraidah & Osman, (2014) and Jensen et al., (2018) also proposed that students who receive audio podcasts are more likely to listen to lectures more than once and that they are able to retain information while focusing on the prepared activities in class. Students who achieved

higher scores on all assignments and exams, resulting in a higher overall course grade (Awad & Ahmed El-Adham, 2019).

This result also aligned with the findings of Awidi and Paynter (2019), who found that pre-recorded lectures, online quizzes, and in-class group activities were all part of the flipped sessions that had an impact on undergraduate biology students' learning experiences; where the students expressed high levels of satisfaction with some aspects of the flipped approach. Halasa et al., (2020) suggested that when students prepare the material at home using a flipped learning design, such as watching a pre-recorded lecture video, they are inspired to search the Internet for more information on the topic before coming to class, and teachers only serve as guides in the field.

Though most researchers think that using the FC model improves student learning, one study's results by Cabı, (2018) revealed that there was no statistically significant difference between the scores of each group, indicating that the use of the model does not significantly improve student achievement. Moreover, many studies failed to uncover any of the anticipated benefits; for instance, Smallhorn (2017) discovered that student achievement had not increased significantly. Also, Kim et al. (2014) asserted that there was no evidence connecting the FC model to the increase in student scores.

According to the recent study, there is a statistically significant difference between the studied groups, indicating that students are more emotionally engaged with the materials delivered in the flipped classroom. Also, the study group's emotional engagement scores varied statistically significantly before and after the intervention. Similarly, in mainland China, Jiao et al. (2017) studied the effect of flipped classrooms on students attending a college; by comparing the flipped and non-flipped classes, they found that students in the flipped course had higher levels of emotional engagement; specifically, learners reported less emotional anxiety, more learning interest, and higher confidence levels than those in the traditional classroom.

This current study's findings is congruent with many studies conducted by Amir yousefi (2019), Hung, (2015), and Lee & Wallace (2017); which discovered that the students in flipped classroom were more engaged with the material and activities

in class and gave the process more time and effort. On the other hand, Li, Z., and Li, J. (2022) found no significant difference in emotional engagement between flipped and non-flipped results.

Although, this study shows that there is no statistically significant difference when comparing the two studied groups in before and after periods related to cognitive engagement. This finding may be explained by the fact that the development of students' critical thinking, problem-solving, autonomy, and decision-making skills is important for promoting cognitive engagement, which is a process that takes time to mature, in addition to the duration of the study, which spanned four weeks, was deemed insufficient to facilitate the development of cognitive engagement. Conversely, Kurt (2017) demonstrated that using the flipped classroom model shown a greater degree of thinking skills than the traditional lecture method.

This study's findings revealed a statistically significant difference in the behavioral engagement of the control group, which was given the standard lecture approach, between the pre- and post-study periods. This result could be explained by the fact that the control group students were taught using the traditional lecture style by their teacher, who pushed them to participate actively and interact effectively with their peers, as opposed to the researcher, who they viewed as a new teacher and this could also account for considering their teacher's evaluation.

However, the current study's results reveal that there is a statistically significant difference between the study and control groups regarding the total engagement score. This result might be from the students' enthusiastic involvement in group projects, students can hear what they have to say, listen to what other students have to say, advance, expand their own knowledge, and integrate new ideas and experiences.

According to Crawford (2020), the impact of implementing the flipped classroom instructional method on student engagement, academic success, and overall course satisfaction of students; student engagement displayed high levels of consistency throughout the length of the study as evidenced by the student responses that indicated high response rates to activity completion, content relevance, and peer interaction, and a meaningful learning

experience where they are challenged, can solve real-world problems, and are able learn from others.

Additionally, Amerstorfer et.al (2021) concluded that there is a significant increase in students' knowledge level in study group as compared to the control group, might be due to active engagement of students in teamwork, this enables students to both be heard and to hear their peers, which helped them learn through building their own knowledge, connecting new ideas and experiences.

Finally, Hollister et al., (2022) believed that the student is at the heart of the educational process and the basis of much research, exploring effective ways to foster an environment conducive to learning and using modern technologies for the benefit of both students and instructors. Many strategies can be used to develop active student engagement and lifelong learning skills; the process of flipped class becomes more satisfying for both instructor and teachers. Flipped classroom techniques are increasingly understood to be an important aspect of modern nursing education.

Conclusion:
It can be concluded from the current study that:
the use of a flipped learning approach may result in a number of positive outcomes, including an increase in students' knowledge, an increase in their academic achievement, an increase in their participation and interaction, in addition to increasing their collaboration, it improved their academic engagement especially emotional engagement.

Recommendations
In the light of the study findings, the researcher recommends the following:

Recommendations for Technical Institutes administrators:

- Technical Institutes administrators should use flipped classroom strategy as a student-centered teaching strategies to maximize students' academic engagement.
- Internet services should be provided to motivate the students becoming more academically engaged
- Educational workshop conducted to nursing educators to increase their knowledge and competencies about designing and applying Flipped classroom strategy.

Recommendations for further studies:

1- A study to determine the effect of Flipped classroom strategy on nursing students' critical thinking.

Table 1: Comparison between the study and control groups in relation to their level of knowledge before, after immediately and after one month of intervention (follow up).

Level of Knowledge	Study (n = 33)						Control(n = 28)						$\chi^2(p_1)$	$\chi^2(p_2)$	$\chi^2(p_3)$
	Before		After		Follow–up		Before		After		Follow–up				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Fail	33	100.0	14	42.4	28	84.8	28	100.0	26	92.9	25	89.3	–	$\chi^2=$ 16.920* (<0.001*)	$\chi^2=$ 0.262 (0.715)
Fair	0	0.0	8	24.2	5	15.2	0	0.0	1	3.6	3	10.7			
Good	0	0.0	5	15.2	0	0.0	0	0.0	1	3.6	0	0.0			
Very good	0	0.0	5	15.2	0	0.0	0	0.0	0	0.0	0	0.0			
Excellent	0	0.0	1	3.0	0	0.0	0	0.0	0	0.0	0	0.0			
Fr(p)	32.00*(<0.001*)						2.923(0.232)								
Sig. bet. Periods	p_4<0.001* ,p_5= 0.025*,p_6<0.001*						–								

χ^2: **Chi square test**
p: p value for comparing between the studied periods in each group
p_1: p value for comparing between the studied groups in pre
p_2: p value for comparing between the studied groups in post
p_3: p value for comparing between the studied groups in follow–up
p_4: p value for comparing between pre and post in each group
p_5: p value for comparing between pre and follow up in each group
p_6: p value for comparing between post and follow up in each group

Table (2): Comparison between the study and control groups according to total their level of knowledge

Knowledge	Study (n = 33)			Control (n=28)			$t(p_1)$	$t(p_2)$	$t(p_3)$
	Before	After	Follow up	Before	After	Follow up			
Total score Mix.–Min.	13.0–3.0	27.0–7.0	7.0 – 18.0	11.0–1.0	20.0–5.0	19.0–6.0	0.535 (0.595)	6.242* (<0.001*)	0.145 (0.885)
SD.±Mean	2.60±6.85	4.05±18.61	13.0 ± 3.0	2.46±6.50	3.52±12.48	3.53±12.88			
% score Mix.–Min.	43.33–10.0	90.0–23.33	23.33 – 60.0	36.67–3.33	66.67–16.67	63.33–20.0			
SD.±Mean	8.67±22.83	13.51±62.02	43.33±0.68	8.19±21.67	11.74±41.61	11.76±42.92			
F(p)	109.610* (<0.001*)			43.506* (<0.001*)					
Sig. bet. periods	P4<0.001* ,p5<0.001* ,p6<0.001*			P4<0.001* ,p5<0.001* ,p6= 0.583					

p: p value for comparing between the studied periods in each group
p1: p value for comparing between the studied groups in pre
p2: p value for comparing between the studied groups in post
p3: p value for comparing between the studied groups in follow–up
p4: p value for comparing between pre and post in each group
p5: p value for comparing between pre and follow up in each group
p6: p value for comparing between post and follow up in each group

Table (3): Comparison between the two studied groups according to their levels of engagement

Engagement dimensions	Study(n = 33)		Control (n = 28)		t (p1)	t (p2)
	Before	**After**	**Before**	**After**		
Emotional Total score Mix.–Min. SD.±Mean	22.0 – 33.0 25.58 ± 2.72	23.0 – 34.0 27.45 ± 2.85	17.0 – 30.0 24.68 ± 3.33	20.0 – 30.0 25.36 ± 2.16	**1.158 (0.251)**	**3.261* (0.002*)**
% score Mix.–Min. SD.±Mean	55.0 – 82.5 63.94 ± 6.79	57.50 – 85.0 68.64 ± 7.13	42.5 – 75.0 61.7 ± 8.33	50.0 – 75.0 63.39 ± 5.41		
p3	**0.002***		**0.397**			
Cognitive Total score Mix.–Min. SD.±Mean	20.0 – 38.0 27.79 ± 3.22	19.0 – 32.0 27.64 ± 3.23	23.0 – 33.0 28 .0± 2.36	20.0 – 33.0 27.93 ± 2.69	**0.289 (0.774)**	**0.380 (0.706)**
% score Mix.–Min. SD.±Mean	50.0 – 95.0 69.47 ± 8.05	47.5 – 80.0 69.09 ± 8.07	57.5 – 82.5 70.0 ± 5.89	50.0 – 82.5 69.82 ± 6.73		
p3	**0.810**		**0.909**			
Behavioral Total score Mix.–Min. SD.±Mean	26.0 – 38.0 30.15 ± 2.59	18.0 – 36.0 29.15 ± 3.55	25.0 – 34.0 29.68 ± 2.58	20.0 – 37.0 27.61 ± 3.55	**0.712 (0.479)**	**1.694 (0.096)**
% score Mix.–Min. SD.±Mean	65.0 – 95.0 75.38 ± 6.47	45.0 – 90.0 72.88 ± 8.86	62.5 – 85.0 74.2 ± 6.46	50.0 – 92.5 69.02 ± 8.88		
p3	**0.144**		**0.021***			
Overall Engagement Total score Mix.–Min. SD.±Mean	75.0 – 109.0 83.48 ± 6.43	75.0 – 97.0 84.24 ± 5.82	67.0 – 92.0 82.36 ± 5.65	69.0 – 96.0 80.89 ± 5.4	**0.721 (0.474)**	**2.315* (0.024*)**
% score Mix.–Min. SD.±Mean	62.5 – 90.83 69.57 ± 5.36	62.50 – 80.83 70.2 ± 4.85	55.83 – 76.67 68.63 ± 4.71	57.5 – 80.0 67.41 ± 4.5		
p3	**0.552**		**0.288**			

t: Student t-test
p1: p value for comparing between the studied groups in pre
p2: p value for comparing between the studied groups in post
p3: p value for Paired t-test for comparing between pre and post in each group

Table (4): Comparison between the two studied groups according to levels of engagement

Engagement scores	Study (n = 33)				Control (n = 28)				$\chi^2(^{FE}p_1)$	$\chi^2(^{FE}p_2)$
	before		after		before		after			
	No.	%	No.	%	No.	%	No.	%		
Moderate	29	87.9	25	75.8	26	92.9	26	92.9	0.423 (0.678)	3.231 (0.092)
High	4	12.1	8	24.2	2	7.1	2	7.1		
p3	**0.344**				**1.000**					

χ^2: Chi square test   FE: Fisher Exact
p1: p value for comparing between the studied groups in pre
p2: p value for comparing between the studied groups in post
p3: p value for McNemar test for comparing between pre and post in each group

Flipped Classroom, Blended Learning, Knowledge Retention, Academic Engagement

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