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The effect of using flipped learning on student achievement and measuring their attitudes towards learning through it during the corona pandemic period

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A B S T R A C T

The COVID-19 pandemic has led to the end of in-person classes at universities and schools and the beginning of digital advancements in higher education. Flipped learning is very different from traditional teaching methods and necessitates some shifts in the roles of the teacher and the student. The purpose of this study is to investigate the effect of using flipped learning on students' achievement and measure their attitudes towards learning through it during the Corona pandemic period. A quasi-experimental study design was adopted through the pretest and posttest measurements. Two groups were randomly assigned one to be experimental, and the other a control. The present study showed that there was no statistically significant difference between the mean of the pre-measurement and post-measurement tests of the experimental group's motivation towards learning using the flipped learning strategy. The findings from the quantitative data revealed that flipped learning contributed to the academic success of students and their attitudes toward learning during the corona pandemic period. Hence, further studies with more extended periods are recommended to examine the effect of Flipped learning on self-directed learning and other related variables.

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1. Introduction

New trends in the design and implementation of learning-teaching procedures that are more effective and efficient have emerged as a result of the rapid development of information and education technologies in the modern world. New learning environments that provide students with new web-based learning opportunities and resources are made possible by the expanding development of digital technologies and their application in education (Ahmady et al., 2020). Innovative approaches to collaborative learning, exploration, and research in online networked learning environments have benefited from the rapid spread of interactive technologies in higher education. In this setting, tertiary education has seen a breakthrough in alternative approaches to teacher-centered instruction (Karadag & Keskin, 2017). The COVID-19 pandemic has led to the end of in-person classes at universities and schools and the beginning of digital advancements in higher education. The need to revitalize virtual learning opportunities was brought to light by the ongoing crisis. To lessen disruptions in the learning process, UNESCO recommended open-access platforms and distance learning and training programs. Consequently, during the COVID-19 pandemic, online learning methods were implemented as appropriate educational strategies (Mulyanti et al., 2020). Some difficulties resulted from the abrupt shift from traditional to online education without sufficient time to prepare and design virtual classes. Even though all theoretical classes were moved online, many teachers and students were accustomed

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to taking classes in person (Karadag & Keskin, 2017). As online learning managers, most teachers must rapidly advance their IT literacy and employ novel teaching strategies to increase learners' willingness. Students who are self-motivated and independent are also necessary for distance education. Mentality and inspiration are viewed as the primary indicators of the longing to proceed with the training for innovation-based instruction (Al-Rahmi et al., 2020).

In this vein, the emergence of novel approaches centered on the needs of students that has prompted educators to reevaluate educational procedures in order to shift the focus away from them and toward the students, encourage student participation, foster practical thinking, and enhance digital skills (Cheng, Congbin et al., 2023). The flipped classroom (FC), which gives students direct access to video lectures, slides, and other teaching resources on online educational platforms, is one technology-driven model that has gradually gained visibility and relevance. Flipped learning is very different from traditional teaching methods and necessitates some shifts in the roles of the teacher and the student (Campillo-Ferrer & Miralles-Martínez, 2021). As opposed to customary educating, Flipped Learning is an educational methodology that expects to have students gain data outside the homeroom; improve and reinforce their education in the classroom. This strategy is based on the idea of replacing homework with classwork. In flipped study halls, learning is done outside the homeroom and individualized through innovation (Campillo-Ferrer & Miralles-Martínez, 2021). Through asynchronous systems, it provides students with opportunities to access content suitable for individualized learning for the following class. To put it another way, flipped learning can be defined as the substitution of in-class activities for homework. According to Zownorega (2013) and Bergmann and Sams (2012), flipped learning is a method that, as opposed to traditional methods, allows students to learn theoretical information at home and practice it in the classroom. As a result, flipped learning basically entails doing homework in the classroom and distributing classwork online.

2. Theoretical framework

Recent studies have looked at the intrinsic and extrinsic effects of these teaching innovations. They found that these methods can help students learn in fully online or blended academic environments, even when the current pandemic forces students to switch modes. Chick et al. (2020) stated that participants were pleased with the format and were interested in continuing to learn without regularly attending face-to-face lectures, indicating that the FC model, teleconferencing, and online practice were effective means of reducing the risk of virus spread. Latorre-Cosculluela et al. (2021) conducted comparative research and concluded that, rather than passively listening to direct instruction, participants preferred to develop 21st-century skills (such as critical thinking or creativity) under the FC model. In this regard, other studies emphasized the importance of digital resources like videos, recorded lectures, and group discussions to foster discussions, encourage student learning, and divert attention away from the pandemic's current disruption (Bączek et al., 2021; Guraya, 2020).

According to the studies, it is essential for educators to make strategic decisions in order to cultivate a culture of engagement among students in order to increase student satisfaction and engagement in the unusual circumstance of COVID-19. Accordingly, Collado-Valero et al. (2021) distinguished a critical expansion in the utilization of various web-based computerized assets under the FC approach in a Spanish advanced education setting, chiefly those connected with video and sound assets, which gave a more noteworthy number of chances for students to share their opportunities for growth through a virtual space. Due to the wide range of opportunities for sharing opinions and ideas provided by these virtual scenarios, other research studies also confirm the distinctive rise of flipped learning, in which students access information and have more opportunities to interact with one another (Singh & Thurman, 2019). Specifically, Colomo-Magaña et al. (2020), during the 19/20 academic year, 123 trainee teachers who had been learning under the flipped-top classroom model were surveyed. They concluded that using this adaptable approach helped students improve their ability to learn and improve their oral communication skills. Additionally, they emphasized time optimization as one of the benefits cited by survey respondents. Smith and Boscak (2021) investigated standard flipped classroom pedagogy, in which students were provided with self-learning educational resources such as pre-class videos or case studies in addition to interactive online lectures in which learning topics were revisited and discussed, with the same goal of contributing to the promotion of student learning achievement and engagement despite the constraints imposed by the pandemic. They noticed that the students were happy with the way the flexible and engaging material was used and that they were confident in their skills from the course. Parallel to this, Monzonis et al. (2021) inspected the view of teaching method which followed a flipped technique during the Coronavirus outbreak and saw that most of them had worked on their computerized abilities and expanded their inspiration because of this procedure. Even though there are undeniable advantages for students' skill development and active participation, there are still a few obstacles that need to be addressed in greater depth. These obstacles may primarily be related to teachers, students, or technological requirements. Writers like Agung et al. (2020) featured some innovation-based issues when they found that most students overviewed were not energetic about web-based advancing fundamentally because of an absence of admittance to the web and other mechanical assets, which might be uncovering the issue of the computerized partition. Similar studies indicate that the abrupt shift toward e-learning since spring 2020 has had other tangible web-based limitations, such as an excessive reliance on technology's proper operation or a lack of personal contact in video conferences due to the stark contrast caused by the switching of the teaching-learning environment (Clark-Wilson et al., 2020; Goksu & Duran, 2020).

Teachers may face difficulties because of having to deal with new technology in such a short amount of time. In this regard, ElSaheli-Elhage (2021) noted that some educators acknowledged not being sufficiently digitally literate to handle routine online teaching activities during the pandemic. In this regard, Cevikbas and Kaiser (2020) noted a further disadvantage of digital teaching that is closely related to the subject-specific content required for effective flipped instruction. They talked

about the challenges teachers face when they try to create their own online lecture videos, slides, infographics, and other learning resources or find adapted learning materials that meet the specific needs of their students. Concerning related difficulties during the ongoing emergency, a few creators have distinguished students' burdensome side effects, and that indications of nervousness take off in web-based learning programs because of the impression of lingering behind scholastically under these uncommon circumstances (Islam et al., 2020). Other factors that may contribute to these feelings of psychological unease include the influence of physical distance or an increase in response time when answering questions and providing academic assistance in asynchronous lessons (Ardan et al., 2020).

The primary objective of flipped learning is to prepare students for classroom learning practices (Bristol, 2014; Erol Şahin, 2020). Students use multimedia tools like online videos and presentations to deliver the theoretical portion of a lesson at home. Additionally, according to Seaman and Gaines (2013), in addition to the fundamental course materials provided by the instructor, students take responsibility for their own learning and conduct additional research to comprehend the content. According to Talbert (2012), flipped learning promotes learner autonomy by allowing students to access information at any time and from any location through lesson videos. The ability to deliver content outside of the classroom is another advantage of flipped learning; it improves learning and gives students more chances to practice, which usually takes a lot of time in a short amount of time (Kong, 2014). According to Wang et al. (2023), it also enriches the learning environment, which makes learning and teaching more communicative and improves the effectiveness of lessons. Individualized learning in terms of pace and style, as well as the ability to learn the material before practicing, are additional benefits of flipped learning. Permitting understudies to assume the greater liability of their own learning; and fostering a more open learning environment that extends learning beyond the classroom (Miller, 2012). To better understand and adapt these web-based approaches to the ever-changing demands and requirements of students, additional research and reflection are required on how these innovative models and strategies are used in these new learning scenarios.

3. Problem statement

Given the need to support learners' participation and strengthen their self-directed learning skills, especially in distance education, the lack of an effective teaching method during the COVID-19 pandemic, and the insufficiency of studies on the effectiveness of various online education methods, including flipped classrooms, especially online courses during the COVID-19 pandemic, and the supportive role of social media, the present study was conducted to determine the effect of the flipped classroom on students' achievement and measure their attitudes towards learning through it during the Corona pandemic period.

3.1 Research Questions

In view of the given context, the current study seeks to answer the following research questions:

- What is the effect of using flipped learning on students' achievement in the e-learning course?
- What is the effect of using flipped learning on the student's attitude towards learning through it in the e-learning course?

3.2 Research Objectives

The aim of this research is to investigate the effect of using flipped learning on students' achievement and measure their attitudes towards learning through it during the Corona pandemic period. To achieve this aim, the following research objectives were defined:

- To identify the effect of using flipped learning on students' achievement in the e-learning course.
- To identify the effect of using flipped learning towards learning through it in increasing the learning motivation of the students of the e-learning course.

3.3 Research Hypothesis

The following hypothesis were formulated for this study:

H_1: *There is no statistically significant difference between the degrees of the experimental group in the pre and posttests*.

H_2: *There is no statistically significant difference in the post-test between the degrees of the experimental group that was taught using flipped learning and the control group that was taught in the usual way.*

H_3: *There is a statistically significant difference in the measure of motivation towards learning using the flipped learning strategy of the students of the experimental group.*

4. Methodology

4.1 Study Design

A quantitative methodology was applied to examine the effect of using flipped learning on students' achievement and measure their attitudes towards learning through it during the Corona pandemic period. The research emphasized studying the impact of the independent variable (flipped learning) on the two dependent variables (achievement and attitude). A quasi-

experimental study design was adopted through the pretest and posttest measurements. Two groups were randomly assigned, one to be experimental, and the other a control. Applying the achievement test (pre-post) on the experimental and control groups and applying the independent variable to the experimental group, and teaching to the control group in the usual way was carried out.

4.2 Study Instruments

The researchers worked on preparing the study instruments and then arbitrating them and making the necessary modifications to them in order to implement the experiment. These consisted of the following:

- Achievement test in (6) semesters of the course. They are (types and tools of e-learning/e-learning environments / virtual and augmented reality / hyper-media and multimedia / digital repositories and libraries/knowledge journeys).
- The measure of motivation towards learning using the flipped learning strategy, which consisted of (37) items; distributed in five axes.

4.3 Limitations

The limitations of the current research are as follows:

- Temporal limits: The study was applied in the second semester of the academic year 2020/2021.
- Spatial limits: The study was limited to Taibah University in Madinah.
- Human Limits: The study was limited to a sample of female students in the Faculty of Education at Taibah University in Madinah

5. Results

To facilitate the interpretation of the results, the researcher used the following method to determine the level of response to the items of the tool. Where weight was given to the alternatives: (agree = 3, neutral = 2, disagree = 1), then those answers were classified into three levels of equal range through the following equation:

Class length = (largest value - lowest value) ÷ number of tool substitutions = (3-1) ÷ 3 = 0.67

Table 1 shows the following distribution of categories according to the gradation used in the research tool

Table 1
Distribution of categories according to the gradation used in the search tool

Description	Average range
Agree	2.34-3.00
Neutral	1.68-2.33
Disagree	1.00-1.67

5.1 Motivational Trends towards Learning using the Flipped Learning Strategy

To answer the study questions about motivational trends towards learning using the flipped learning strategy, which has been focused on in this study. Table 2 depicts the motivation to engage in activities and the pleasure of learning. The study sample included phrases that measure the motivation of interest in activities and the pleasure of learning. Frequencies, percentages, and arithmetic means are arranged in descending order for answers.

Table 2
Motivation to engage in activities and the pleasure of learning

N	Phrases		agree	neutral	disagree	Mean	SD	arrangement	degree of approval
1	I enjoy learning new information in the course.	T	13	1		2.93	0.27	1	agree
		%	92.9	7.1					
2	I feel satisfied when I correctly perform the tasks assigned to me in the course.	T	5	8	1	2.29	0.61	7	neutral
		%	35.7	57.1	7.1				
3	I feel satisfied when I correctly perform the tasks assigned to me in the course.	T	12	1	1	2.79	0.58	3	agree
		%	85.7	7.1	7.1				
4	The activities made learning more interesting.	T	11	2	1	2.71	0.61	4	agree
		%	78.6	14.3	7.1				
5	Activities motivate me to interact and participate while studying the course.	T	13	1		2.93	0.27	1	agree
		%	92.9	7.1					
6	The course activities make me accept the academic content better.	T	10	4		2.71	0.47	4	agree
		%	71.4	28.6					
7	Watching the educational video motivates me to understand the educational content well.	T	4	8	2	2.14	0.66	8	neutral
		%	28.6	57.1	14.3				
8	In pre-activities, I make sure to have prior knowledge of the content of the lecture.	T	7	7		2.5	0.52	6	agree
		%	50	50					
	The overall mean* of the axis					2.62	0.21		agree

* Arithmetic means of 3 degrees

A study on phrases that measure the desire to search and investigate (curiosity) is given in Table 3. Frequencies, percentages, and arithmetic means are arranged in descending order for sample answers.

Table 3
The desire for research and investigation (curiosity)

N	Phrases		agree	neutral	disagree	Mean	SD	arrangement	degree of
9	Educational activities spark my curiosity and satisfy my curiosity.	T	6	7	1	2.36	0.63	5	agree
		%	42.9	50	7.1				
10	I would like to ask and inquire about points that I do not understand.	T	4	9	1	2.21	0.58	6	neutral
		%	28.6	64.3	7.1				
11	Didactic activities help to understand new information in the course.	T	10	4		2.71	0.47	1	agree
		%	71.4	28.6					
12	makes me search for The flipped learning strategy .information on my own	T	10	2	2	2.57	0.76	4	agree
		%	71.4	14.3	14.3				
13	pushes me to learn The flipped learning strategy .search skills in information sources	T	11	2	1	2.71	0.61	1	agree
		%	78.6	14.3	7.1				
14	increased my The flipped learning strategy .information search experience	T	11	2	1	2.71	0.61	1	agree
		%	78.6	14.3	7.1				
	The overall mean* of the axis					2.55	0.42		agree

* Arithmetic means of 3 degrees

Studies on statements that measure individual learning support and responsibility (preference for the challenge) are given in Table 4. Frequencies, percentages, and arithmetic means are arranged in descending order for sample answers.

Table 4
Individual learning and taking responsibility (preferring the challenge)

N	Phrases		agree	neutral	disagree	Mean	SD	arrangement	degree of
15	in the course I like to learn as much as I can	T	5	7	2	2.21	0.7	7	neutral
		%	35.7	50	14.3				
16	encouraged me to The flipped learning strategy compete and challenge my classmates	T	10	4		2.71	0.47	2	agree
		%	71.4	28.6					
17	strategy by trying I developed the flipped learning to learn what I didn't understand	T	10	4		2.71	0.47	2	agree
		%	71.4	28.6					
18	motivated me to The flipped learning strategy independently master the tasks assigned to me	T	11	2	1	2.71	0.61	2	agree
		%	78.6	14.3	7.1				
19	the spirit of The course activities supported teamwork with my female colleagues	T	13	1		2.93	0.27	1	agree
		%	92.9	7.1					
20	work on my own, no I prefer to continue doing the matter how difficult it is	T	7	3	4	2.21	0.89	7	neutral
		%	50	21.4	28.6				
21	made me more eager The flipped learning strategy to attend lectures	T	9	2	3	2.43	0.85	6	agree
		%	64.3	14.3	21.4				
22	grew out of my The flipped learning strategy personal relationship with my classmates and	T	11	1	2	2.64	0.74	5	agree
		%	78.6	7.1	14.3				
The overall mean* of the axis						2.57	0.37		agree

* Arithmetic means of 3 degrees

The answers of the study sample to the statements that measure the attainment of achievement and mastery of learning are given in Table 5. Frequencies, percentages, and arithmetic means are arranged in descending order.

Table 5
Attainment of achievement and mastery of learning

N	Phrases		agree	neutral	disagree	Mean	SD	arrangement	degree of
23	I think I have the skill to answer questions.	T	9	4	1	2.57	0.65	4	agree
		%	64.3	28.6	7.1				
24	I feel the growth of confidence in my abilities as a college student.	T	11	3		2.79	0.43	1	agree
		%	78.6	21.4					
25	I can construct information scientifically and linguistically.	T	9	5		2.64	0.5	2	agree
		%	64.3	35.7					
26	I am satisfied with the development of my skills and knowledge through studying the course.	T	8	5	1	2.5	0.65	5	agree
		%	57.1	35.7	7.1				
27	I participate with interest in the lectures of the course more than the rest of the courses.	T	4	7	3	2.07	0.73	7	neutral
		%	28.6	50	21.4				
28	The assessment and feedback method motivates me to improve my academic level	T	9	5		2.64	0.5	2	agree
		%	64.3	35.7					
29	I feel that not being committed to a specific time and place helped me to study the lecture at a time	T	8	2	4	2.29	0.91	6	neutral
		%	57.1	14.3	28.6				
The overall mean* of the axis						2.5	0.39		agree

* Arithmetic means of 3 degrees

The study sample's answers to the statements that measure learning preferences are presented in Table 6. Frequencies, percentages, and arithmetic means are arranged in descending order.

Table 6
Learning Preferences

N	Phrases		agree	neutral	disagree	Mean	SD	arrangement	degree of
30	I think the flipped learning strategy is a new and good way to learn	T	7	4	3	2.29	0.83	2	neutral
		%	50	28.6	21.4				
31	I benefited from the flipped learning strategy experience in the rest of the courses	T	1	5	8	1.5	0.65	8	disagree
		%	7.1	35.7	57.1				
32	I would prefer it if you taught the course in the traditional way (the professor explained the content)	T	4	2	8	1.71	0.91	5	neutral
		%	28.6	14.3	57.1				
33	I get bored by studying the course through flipped learning strategy	T	3	2	9	1.57	0.85	7	disagree
		%	21.4	14.3	64.3				
34	I like to study with flipped learning because it makes me think and work in a different way	T	9	3	2	2.5	0.76	1	agree
		%	64.3	21.4	14.3				
35	I feel inferior to my classmates because of the flipped learning strategy	T	1	7	6	1.64	0.63	6	disagree
		%	7.1	50	42.9				
36	I would prefer if I studied through the flipped learning strategy face to face (with the teacher in the	T	4	6	4	2	0.78	4	neutral
		%	28.6	42.9	28.6				
37	I would prefer if I studied through the flipped learning strategy with blended learning (the	T	6	4	4	2.14	0.86	3	neutral
		%	42.9	28.6	28.6				
	The overall mean* of the axis					1.92	0.25		neutral

* Arithmetic means of 3 degrees

Table 7 includes a summary of all the arithmetic means of the motivational trends towards learning using the flipped learning strategy in descending order.

Table 7
Summary of motivational trends arithmetic means towards learning using the flipped learning strategy

Interlocutors	Mean	SD	arrangement	degree of approval
Motivation to engage in activities and enjoy learning	2.62	0.21	1	agree
Desire to search and investigate (curiosity)	2.55	0.42	3	agree
Support individual learning and take responsibility (challenge preference)	2.57	0.37	2	agree
Achievement and mastery of learning	2.5	0.39	4	agree
learning preferences	1.92	0.25	5	neutral
using the flipped learning strategy The total degree of the measure motivation towards learning	2.42	0.25		agree

* Arithmetic means of 3 degrees

5.2 Validity and Reliability of a Test on the Types and Tools of E-Learning

Checking the validity and reliability of a test on the types and tools of e-learning is presented in this section. Table 8 depicts the ease coefficients for test questions about the types and tools of e-learning, and Table 9 shows correlation coefficients to measure the relationship between test questions about the types and tools of e-learning and the total score of the test. Transactions distinguish test questions about the types and tools of e-learning is given in Table 10. It depicts discrimination coefficients for test questions about the types and tools of e-learning.

Table 8
Ease coefficients (exploratory sample: n = 61)

Question number	Ease factor	Question number	Ease factor	Question number	Ease factor
1	0.51	11	0.36	21	0.69
2	0.62	12	0.51	22	0.51
3	0.48	13	0.89	23	0.44
4	0.56	14	0.46	24	0.16
5	0.69	15	0.43	25	0.36
6	0.66	16	0.75	26	0.77
7	0.49	17	0.59	27	0.3
8	0.48	18	0.21	28	0.43
9	0.72	19	0.43	29	0.41
10	0.46	20	0.54	30	0.57

Table 9
Correlation coefficients (exploratory sample: n = 61)

Question number	Correlation coefficient	Question number	Correlation coefficient	Question number	Correlation coefficient
1	0.06	11	**0.4653	21	**0.3976
2	0.2512	12	**0.5539	22	**0.4150
3	0.2187-	13	**0.5837	23	*0.2766
4	**0.4148	14	0.2179	24	0.171
5	0.006	15	0.1722	25	**0.3608
6	**0.5493	16	**0.3395	26	**0.5269
7	**0.4108	17	0.1449	27	0.1924
8	0.2217	18	0.1787-	28	**0.5233
9	**0.4544	19	**0.3906	29	*0.2552
10	**0.4115	20	*0.2544	30	**0.4208

* significance of 0.05 ** significance of 0.01
The blue color indicates that the question is acceptable. The researcher may not delete it.
The red color: indicates that the question is weak. The researcher is supposed to delete it

Table 10
Discrimination coefficient (exploratory sample: n = 61)

Question number	Discrimination coefficient	Question number	coefficient Discrimination	Question number	coefficient Discrimination
1	0.12	11	0.48	21	0.5
2	0.36	12	0.61	22	0.45
3	0.22-	13	0.37	23	0.42
4	0.36	14	0.17	24	0.07
5	0.1	15	0.14	25	0.38
6	0.56	16	0.38	26	0.58
7	0.43	17	0.11	27	0.19
8	0.09	18	0.13-	28	0.62
9	0.44	19	0.33	29	0.16
10	0.42	20	0.31	30	٦0.46

The red color: indicates that the question is weak. The researcher is supposed to delete it.
For questions whose coefficient of discrimination was negative, the researcher should review the key to correct them
Question No. 3 The key to the correct answer is (c).
Question No. 18, the key to the correct answer (c).

The significance of testing and distinguishment factors test questions about the types and tools of e-learning to measure the relationship between ease factor, correlation coefficients and discrimination coefficients are presented in Table 11.

Table 11
Ease factor, Correlation coefficients and Discrimination coefficients (combined) (exploratory sample: n = 61)

Question Number	Ease factor	Correlation coefficient	Coefficient discrimination
1	0.51	0.06	0.12
2	0.62	0.2512	0.36
3	0.48	0.2187-	0.22-
4	0.56	**0.4148	0.36
5	0.69	0.006	0.1
6	0.66	**0.5493	0.56
7	0.49	**0.4108	0.43
8	0.48	0.2217	0.09
9	0.72	**0.4544	0.44
10	0.46	**0.4115	0.42
11	0.36	**0.4653	0.48
12	0.51	**0.5539	0.61
13	0.89	**0.5837	0.37
14	0.46	0.2179	0.17
15	0.43	0.1722	0.14
16	0.75	**0.3395	0.38
17	0.59	0.1449	0.11
18	0.21	0.1787-	0.13-
19	0.43	**0.3906	0.33
20	0.54	*0.2544	0.31
21	0.69	**0.3976	0.5
22	0.51	**0.4150	0.45
23	0.44	*0.2766	0.42
24	0.16	0.171	0.07
25	0.36	**0.3608	0.38
26	0.77	**0.5269	0.58
27	0.3	0.1924	0.19
28	0.43	**0.5233	0.62
29	0.41	*0.2552	0.16
30	0.57	**0.4208	0.46

* significance of 0.05
** significance of 0.01
The blue color: indicates that the question is acceptable. The researcher may not delete it.
The red color: indicates that the question is weak, the researcher is supposed to delete it.

Table 12 and Table 13 depict test stability coefficients on the types and tools of e-learning.

Table 12
Test stability coefficients (exploratory sample: n = 61)

Variable	Number of questions	Kuder-Richardson constancy	Split-half reliability
The overall stability of the test	30	50.6	10.4

Table 13
Test stability coefficients (exploratory sample: n = 61) After deleting question No. (1 - 3 - 5 - 8 - 14 - 15 - 17 - 18 - 20 - 23 - 24 - 27 – 29)

Variable	Number of Questions	Kuder-Richardson Constancy	Split-half reliability
The overall stability of the test	17	- ٠,٧٧	-0.61

5.3 Equivalence of the Two Study groups

To verify the equivalence of the two groups (experimental and control), the researcher used the T-test to indicate the differences between two independent groups in order to identify the differences between the mean scores of the experimental and control groups in the pre-measurement of e-learning types and tools. Table 14 shows the following results.

Table 14
T-test for the significance of differences between the means of both groups in the pre-measurement to test the types and tools of e-learning

Groups	The Number	*Mean	SD	T Value	Significance Level	Comment
Experimental	12	61.67	10.59	0.41	0.688	non-significant
control	14	63.33	10.29			

* The mean has been converted to 100 degrees

It is clear from Table 14 that the value of (T) is non-significant, which indicates that there are no statistically significant differences between the means of the experimental group and the control group in the pre-measurement scores of the e-learning types and tools test. Thus, the researcher has verified the equivalence of the two groups of the study: (experimental and control), in testing the types and tools of e-learning, before starting the implementation of the experiment using the program on the students of the experimental group.

5.4 Differences Between the Two Study Groups in the Post-Measurement

To verify the differences between the two study groups in the post-measurement, the researcher used the (T) test to indicate the differences between two independent groups, in order to identify the differences between the mean scores of the experimental group and the control group in the post-measurement to test the types and tools of e-learning. Table 15 shows the following results.

Table 15
T-test for the significance of differences between the mean scores of the both groups in the post-measurement test for the types and tools of e-learning

Groups	The Number	*Mean	Standard Deviation	T Value	Significance Level	Comment
Experimental	12	61.94	11.5	0.84	0.415	non-significant
control	14	59.05	3.31			

* The mean has been converted to 100 degrees

It is clear from Table 15 that the value of (T) is non-significant, which indicates that there are no statistically significant differences between the means of the experimental group and the control group in the post-measurement scores of the e-learning types and tools test.

5.5 Differences Between the Pre and Post Measurements of the Experimental Group

To verify the differences between the pre and post measurements of the experimental group, the researcher used the T-test to indicate the differences between two non-independent (correlated) groups, in order to identify the differences between the averages of the pre and post measurements of the experimental group in testing the types and tools of e-learning. Table 16 shows the following results.

Table 16
T-test to indicate the differences between the mean scores of the pre-measurement and the mean scores measurement of the experimental group in testing the types and tools of e-learning

Measurement	*Mean	SD	T Value	Level Significance	Comment
Experimental	61.67	10.59	0.1	0.924	non-significant
Control	61.94	11.5			

Note: As in previous tables

It is clear from Table 16 that the value of (T) is non-significant, which indicates that there are no statistically significant differences between the means of the pre- and post-measurement of the experimental group in the test scores of e-learning types and tools. Due to the small size of the groups, it is preferable to use non-parametric statistical methods. To verify the equivalence of the two groups; (experimental and control), the researcher used the Mann-Whitney test as an alternative to the (T) test to indicate the differences between two independent groups, in order to identify the differences between the scores of the experimental and control groups in the pre-measurement of learning types and tools. Table 17 shows the results reached.

Table 17
Mann-Whitney test for the significance of differences between the scores of the experimental and control group in the pre-measurement test for the types and tools of e-learning

Groups	The Number	Average Rank	Ranks Total	U Value	Level Significance	Comment
Experimental	12	12.79	153.5	75.5	0.667	non significant
Control	14	14.11	197.5			

It is clear from Table 17 that the value of (U) is non-significant, which indicates that there are no statistically significant differences between the experimental group and the control group in the pre-measurement scores for testing the types and tools of e-learning.

Thus, the researcher has verified the equivalence of the two groups of the study: (experimental and control), in testing the types and tools of e-learning, before starting the implementation of the experiment using the program on the students of the experimental group.

Table 18
Mann-Whitney test for the significance of differences between the scores of the experimental and control group in the dimensional measurement to test the types and tools of e-learning

Groups	The Number	Average Rank	Ranks Total	U Value	Level Significance	Comment
Experimental	12	14.71	176.5	69.5	0.462	non-significant
Control	14	12.46	174.5			

It is clear from Table 18 that the value of (U) is non significant, which indicates that there are no statistically significant differences between the experimental group and the control group in the post-measurement scores of the e-learning types and tools test. To verify the differences between the pre and post measurements of the experimental group, the researcher used the Wilcoxon test as an alternative to the (T) test to indicate the differences between two non-independent (correlated) groups, in order to identify the differences between the averages of the pre and post measurements of the experimental group in testing the types and tools of e-learning. Table 19 shows the results.

Table 19
Wilcoxon test for the significance of differences between pre-measurement scores and pre-test scores measurement of the experimental group in testing the types and tools of e-learning

Groups	The	Rank	Total	Z Value	Significance	Comment
Post-measurement	3	5.33	16	0.28	0.778	non-significant
Pre-measurement	5	4	20			
Equality	4					

It is clear from Table 19 that the value of (Z) is non-significant, indicating that there are no statistically significant differences between the pre-measurement and post-measurement of the experimental group in the test scores of e-learning types and tools.

6. Discussion

The purpose of this study was to investigate the effect of using flipped learning on students' achievement and measure their attitudes towards learning through it during the Corona pandemic period. The results of the study were presented by making connections with the findings of the quantitative data. According to the first hypothesis of the study which is that “there is no statistically significant difference at the level of <0.05 between the degrees of the experimental group in the pre and post tests”, the present study showed that the total mean of the pre-measurement and post-measurement tests of the experimental groups motivation towards learning using the flipped learning strategy was statistically not significant.

Using online tools, there is evidence that flipped classrooms can increase students' interest in learning and meet their needs. Students in a flipped classroom with a Learning Management System (LMS) can choose how best to learn new information (Ugwoke et al., 2018). By studying the teacher-prepared material asynchronously prior to class, students can develop self-directed and self-paced learning skills. Together with the teacher's supervision, self-management skills can be developed through the use of the material. Mastery of the material improves students' intuitive learning skills and confidence to participate in classroom activities prior to the flipped classroom (Robinson & Persky, 2020; Zainuddin, 2018).

The second speculation of the study is that "there is no statistically significant difference at the level of <0.05 in the post-test between the degrees of the experimental group that was taught using flipped learning and the control group that was taught in the usual way". The results showed that flipped learmimg strategy was not useful as the experimental group showed no significant differences. Flipped classrooms have also been shown to increase student satisfaction and self-directed learning readiness. There is evidence that the flipped classroom method boosts students' self-directed readiness skills and positively influences their motivation (Liu et al., 2018; Zainuddin & Perera, 2018). Stöhr et al. (2020) reported that there was no difference in average performance between the Flipped classroom and campus-based course groups. Flipped classroom was compared to campus-based courses in their study. Additionally, postgraduate students took part in their studies.

According to Slater and Cusick (2017), age and prior education may have a positive impact on self-directed learning readiness. It is worth highlighting the non-statistically significant differences identified in the dimensions of the study. These findings encourage the continued use of online learning in higher education so that students can gain more exposure to flipped learning, increase their motivation, and learn to better manage cognitive knowledge (Abeysekera & Dawson, 2015).

When evaluating the various e-learning methods and tools, non-parametric tests revealed that the experimental group's average pre- and post-measurement differences were not statistically significant. If students are sufficiently e-competent during this learning or in the future as they intensify their acquisition of digital skills, these may provide learners with a more immediate sense of progress. In any case, flipped learning has demonstrated that it makes it simple for students to comprehend where they are in the learning and development of novel methodological proposals.

The third hypothesis of the study states that there is a statistically significant difference in the measure of motivation towards learning using the flipped learning strategy of the students of the experimental group. However, the findings of the study indicated that there are no significant differences between the motivational trends towards learning using the flipped learning strategy. These findings may be due to the fact that flipped learning approach does not improvise the learning methods and does not provide an opportunity to explore and expand the knowledge.

7. Conclusion

With the increasing growth of online learning during the COVID-19 pandemic and the effectiveness of the flipped classroom as a novel method, this study was conducted to determine student achievement and measuring their attitudes towards learning during the corona pandemic period. The findings from the quantitative data revealed that flipped learning contributed to the academic success of students and their attitudes towards learning during the corona pandemic period. This background, combined with the active educational approach used, yielded satisfactory results. Hence, further studies with more extended periods are recommended to examine the effect Flipped learning on self-directed learning and other related variables.

8. Recommendations

The following recommendations are suggested considering the findings of the study:

- Flipped learning can be used to encourage students to have positive attitudes toward academic success.
- In comparison to traditional methods, flipped learning may be more effective than traditional methods at improving students' learning skills and encouraging positive attitudes.
- Pre-service teachers' exposure to and active participation in flipped learning must be ensured by providing them with flipped learning practices in order to provide them with the necessary skills to use flipped learning effectively in the classroom. As a result, prospective teachers would have the abilities to incorporate flipped learning into their instruction.

In addition, there were no statistically significant differences between the means of the experimental group and the control group in the post-measurement scores of the e-learning types and tools test, so the results of this study cannot be considered representative of current teaching and learning practices that foster student motivation.

Due to the restrictions or lockdowns and the complex set of interrelated factors affecting their implementation, further research is required on these newly emerging e-learning scenarios. Likewise, further exploration is expected to break down the lower esteem things inside this way to deal with redo them as per students' particular advantages and needs.

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