Effects of Flipped Classroom Strategy on Students' Achievements in the Computer and Information Technology Course and Their Attitudes Towards It

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Summary
This endeavor is an attempt to explore the effect of flipped classroom strategy (FCS) on (a) academic achievement in the computer and information technology course and (b) students' attitudes towards this strategy. The sample of the study consisted of 64 students, divided into two groups: experimental and control groups. Two instruments were used to collect the data: a test and a questionnaire. The test was used to measure the students' achievement and the questionnaire to measure their attitudes towards the FCS. The results show statistically significant differences at the level of 0.05 in support of the experimental group at all Bloom's levels. Similarly, students' positive attitude towards the FCS was evident. Therefore, expanding this strategy in different courses is highly recommended because it positively impacts students' achievements. Organizing workshops and designing courses that encourage teachers to implement the strategy in the classroom and develop their technical skills are also recommended.
Keywords: *blended learning, modern teaching strategies, educational videos, computer teaching, flipped classroom (FC)*

1. Introduction

Drawing on education and learning theories, educators usually attempt to develop classroom teaching strategies that effectively promote teaching practices. Historically, a diversity of principles and foundations govern the relationship between the two components of the educational process: teacher and learner. Such theoretical background also determines the roles assigned to each of these two elements. Earlier, teachers dominated the learning process and played the role of dictator, but now they tend to be facilitators and guides. The learners' needs and capabilities, which were ignored, have become the focus of the educational process. Today the curricula and programs are built around learners' needs and abilities.

One of the elements the curricula endures is teaching methods and strategies that teachers use as a bridge to deliver the content to the learners. That is why educators are keen to take advantage of the new technologies and innovations that make learning fun and motivate learners to be active rather than passive participants in the learning process. Arguably, active learning stimulates the learner's motivation to acquire knowledge and the learning effect remaining for a more extended period.

Since the beginning of technology, educational institutions have invested in educational practices. The beginning of such investment included the programmed teaching method advocated by Skinner. It encourages self-learning and takes individual differences into account, making learners proceed according to their abilities and preparation [1]. Based on this method, many software and multimedia emerged and developed and gradually became more effective and attractive to learners. Also, teaching aids were used in the classroom to bridge the gap between the abstract knowledge conveyed by the teacher and the reality of this knowledge.

With the development of communications and information technology during the new millennium, the Internet appeared and linked the vast world, making it look like a small village. It also facilitated the exchange of information and knowledge among users through many services: e-mail, postal groups, forums, webs, and other services that led to a great information revolution [1-2]. As a result of the effectiveness of these services in different sectors, those interested in education have begun to benefit from them in the educational sector by creating websites for academic institutions and activating electronic correspondence.

Integrating various computer and communication applications into education has brought about new educational systems. The foundation of such systems is built on this technology—this comprised e-learning system, defined as a modern method of education. Current communication mechanisms are employed from a computer, networks, and multimedia, e.g., sound and image, graphics and search mechanisms, electronic libraries, and Internet portals, whether remotely or in the classroom [3].

Noticeably, this definition includes online education, a term that has increased dramatically in this decade [4], and many programs have become based on this type of education. Still, more than that, virtual universities are spread around the world and offer their programs Completed by advanced technologies in communication and networks, such as Jones International University and Phoenix Online [5].

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Undoubtedly, this type of education and its flexibility in time and place is ideal for numerous learners who were unable to continue their education in traditional conditions. It also supports self-learning, takes individual differences, and reduces the financial cost [4]., 6, 7].

Despite the advantages of online learning, some educators have pointed out to social dangers of this type of education [8]. Young learners' focus on the virtual environment may affect their ability to interact with others and form genuine social relationships, besides other issues, such as the difficulty of conducting evaluation processes and ensuring authenticity and inappropriateness for primary education stages [9].

This gave rise to a new method of education that aims to blend the virtual environment with the real one [8], which enables learners to juxtapose online education and traditional education– it has been termed as blended learning. With the spread of this method of instruction, multiple models have emerged, including the Rotation Model, which includes more than one model, including the Flipped Classroom Model [7].

The flipped classroom (hereafter FC) is a form of blended learning that has gained researchers' attention recently. In FC, the educational content is sent via various technologies, from videos and other media to the learners before and during class. The role of the learners shifts from passive to active. They participate in the activities on the lesson's topic provided by the teacher [7-10]. In many disciplines, this strategy has been proved to be effective. It enhanced students' academic achievement [13, 11, 12], and it developed higher-order thinking skills [14], assessment competencies and habits of mind [15], alleviate classroom interaction skills [16], and establish self-organized learning skills [17].

Social Constructivism Theory is one of the theories that support the FCS [18]. The founder of the theory (Vygotsky) asserts that the learners' interaction with their surrounding environment, along with their previous experiences, contributes significantly to the success of the learning process [19]. Therefore, the discussions and experiences among students in discussion forums or the classroom about the content sent in the videos they watched at home help them understand what they have been confused about and thus give them new experiences and knowledge. This may contribute to bridging the knowledge gap that may be I was born while watching videos.

The theory also emphasizes the importance of the teacher's role as a guide and facilitator of the educational process through direct or indirect interaction with students. The learner can reach the desired goal, but with the help of others [20].

Flipped class began in 2006 when the chemistry teachers *Bergmann* and *Sams* videotaped lectures their students missed. They uploaded the recordings to YouTube. After a while, they noticed that the absent students watched those videos on YouTube and the students who attended classes, especially the difficult lesson for them. Gradually, the teacher in focus received letters of thanks via e-mail from students and teachers in various states in the USA for their efforts [21]. Having found wide acceptance in the United States, the teachers saw that the students needed the teacher in the classroom not to deliver the content only but also make it available any time to discuss what was difficult for them; So, Bergman and Sams decided in 2007 to record the lectures and publish them to the students before the class time, and to have the class time for activities and answering students' questions. This was the first seed for the flipped class [21].

The FCS consists of two main phases: the first is before the class, and the other is during the class [23,22]. In the first stage, learners watch pre-prepared videos on the subject. Bergmann and Sams [21] mentioned criteria that should be considered when preparing the videos to achieve the desired goal. The most important ones are the following :

1) the videos should not exceed ten minutes.
2) changing the tone of voice from time to time is necessary.
3) It is preferable when preparing the video to have a conversation with another person rather than the same teacher.
4)The video contains a sense of humor to expel boredom from the students and make them enjoy the videos.
5) Do not waste the students' time by talking about your hobbies.
6) The possibility of adding notes on essential points in the topic as is done on the interactive board, and
7) The possibility of adding a box containing an additional explanation about a point in the topic.

In the classroom, students come up with some questions that they could not answer by just watching the videos or that may have arisen after watching those recordings. Through discussions between them or with the teacher and their participation in the activities prepared by the teacher in advance on the topic, answers are reached about These questions [25-24].

2. Features of the flipped classroom strategy (FCS)

Numerous studies have indicated that the FCS in education is advantageous for the two most important components of the educational environment: the teacher and the learner. One of these advantages is enabling the learners to make progress in their learning according to their abilities and capabilities. It is accomplished by reviewing the teacher's digital content more than once until they understand the lesson [21]. The FCS also enables learners to view digital content anywhere before the lesson, thus giving greater flexibility in learning [26]. In a similar vein of research, Du,

Fu and Wang [27] argued that the FC may reduce the frustrations learners face during the lesson due to their lack of understanding of the topic. In addition, the FCS keeps learners in contact, even outside the school environment. It enables them to share opinions and ask questions about the content [28]. It also empowers learners to obtain higher academic achievements better than they traditionally receive lessons [11,13,29,30,31].

FC is beneficial for teachers, too. A salient feature is that it gives more space for the teacher to implement a set of activities around the topic of the lesson [32]. Instead of spending most of the class explaining the topic, the time is invested in enabling learners to apply what they have learned through exercises and activities prepared in advance by the teacher. It turns the role of the teacher from a 'prompter' to a 'guide' and 'facilitator' of the educational process [26]. Moreover, this strategy increases effective communication between the teacher and the learners. It allows the teacher to be closer to (a) closely identify the abilities and potentials of learners and (b) prepare activities that suit them [12].

Despite the advantages of FCS, previous studies illuminated some challenges that may arise when applying the strategy in question. A major challenge is the students' attitudes towards this strategy and their belief in its effectiveness [33]. Hence, the teachers should pay attention to this aspect. Because students are not accustomed to DCS, teachers should explain the reason for adopting it. The explanation may motivate them and reduce their resistance to it [27]. Since this type of education is learner-centered, the characteristics of learners should be taken into consideration when applying it [34]. Moreover, the time devoted to FC may be another challenge that hinders its implementation. Alzahrani [30] asserted that having enough time to watch the videos presented in advance is challenging. The availability of technical infrastructure necessary to implement this strategy is an additional difficulty for learners who live in remote areas with limited internet access. Watching videos and communicating with classmates or the teacher requires a good Internet connection and some specific software [27, 30].

In terms of attitudes, previous studies have reported positive attitudes of students and teachers towards FCS. For instance, Alharbi and Alshumaimeri [31] identified the tendency of secondary school students towards the FC in teaching English (Grammar). The study showed positive results towards the FCS. Likewise, Alyan and Abed [13] measured the students' tendency towards using this strategy in the Arabic language, and the results showed that the students preferred this strategy. These positive trends included teachers, too. Al-Subaiy [35] identified the attitudes of computer teachers towards the FCS, and the results showed teachers' acceptance. They believe that this strategy enhances their students' self-confidence and allows students to discuss and exchange opinions. Additionally, the FCS may contribute to creating a positive attitude towards the course. Abanami [11] ascertained that the use of the FC in teaching the Tafsir course improved students' attitudes towards that course.

3. Questions

The following central question surfaced based on the problem statement, and this study intends to address it. What is the effect of using the FCS on students' academic achievement in the Computer and Information Technology Course and their attitudes towards it?

This central question can be made of two sub-questions:

1. What is the effect of FCS on students' academic achievement in the computer and information technology course?
2. What are the students' attitudes towards using the flipped classroom strategy?

4. Hypotheses

The following hypotheses can be proposed to answer the first question of the study, namely:

1. There are no statistically significant differences at (0.05) between the experimental and control groups in the pre-achievement test.
2. There are no statistically significant differences at (0.05) between the experimental and control groups in the post achievement test.

5. Method

As in previous studies, the quantitative research design was adopted in the present study. The quasi-experimental design was used to measure the effectiveness of the FCS on students' achievements, and the descriptive design was used to measure students' attitudes towards the strategy under inquiry. The quasi-experimental study was designed according to Creswell [36], as displayed in the following figure.

6. Population & Sampling

The sample of the study consisted of 64 students chosen randomly. They were divided into two groups; each group had 32 students. A pre-test was conducted to ensure the equality of the two groups. The researcher used a t-test to

measure the differences between them. The results showed no statistically significant differences at the level of 0.05 between the two groups in the total or each level of Bloom's taxonomy (see Table 1).

Table1: *Pre-Test Result and Significance level between the Control and Experimental Groups*

Bloom levels	groups	Means	SD	Mean differences	t	DF	Sig.	level
Remember	control	3.84	1.19	0.16	0.56	62	0.57	Not Sig.
	experimental	4	1.02					
Comprehension	control	2.84	1.19	0.25	0.91		0.37	Not Sig.
	experimental	3.09	0.99					
Analysis	control	1.84	0.81	0.06	0.34		0.73	Not Sig.
	experimental	1.91	0.64					
Synthesis	control	1.25	0.44	0.12	0.85		0.4	Not Sig.
	experimental	1.37	0.71					
Evaluation	control	3.78	1.18	0.16	0.56		0.58	Not Sig.
	experimental	3.94	1.04					
Total	control	13.56	1.86	0.75	1.55		0.13	Not Sig.
	experimental	14.31	2.0					

7. Instruments

The following instruments were prepared to address the research questions.

- **An achievement test**

This tool was used to measure the impact of FCS on the students' achievements. In its initial form, the test consisted of thirty multiple-choice items built around the two selected units and identifying all the cognitive goals they contained.

Table 2
Item Distribution of the Achievement Test Items at Bloom's levels

Bloom Levels	Remember	Comprehension	Analysis	Synthesis	Evaluation	Total
#Q	6	6	5	4	5	26

The test, in its initial version, was given to arbitrators in the relevant domain. The arbitrators thought that some items were unsuitable or caused difficulty in measuring them on the selected units and were thus omitted. The test ended up with twenty-six items. Determining the appropriate time for the test required taking the time of the first and last two students who completed the test. The average between them was decided, and the results were respectively 30 minutes and 50 minutes, and accordingly, the test time was determined to be fifty minutes. The reliability of the test was also measured by the re-test method, and the reliability score was 0.83, which is considered an acceptable score.

- **Questionnaire**

This tool was used to measure students' attitudes towards the FCS. It consisted of twenty items in its initial form. After some experts in the field validated it, it was modified to be seventeen items, five of which are negative statements. The reliability of the tool was also measured using Cronbach's alpha, and its value was 0.86, which indicates the reliability of the tool used to measure the trend.

- **Technical Tools**

The technical tools included educational videos and a platform. The videos were sent to students before the time of the class. The researcher used the Screen O Matic program, which is free to record the lecture as a video and then save it in mp4 format to send to students through one of the educational platforms. After completing the preparation, they were checked by professors specialized in technology Education and computer teaching methods. The researcher chose the Easy Class platform for it supports the Arabic language and is easy to use.

8. Results and Discussions

Research question #1:
What is the effect of FCS on the academic achievement of second year secondary school students in computer and information technology?

Before the experiment, the nonexistent statistical differences between the experimental and control groups at the level of 0.05 were ascertained (Table 1). The research question was answered through the following null hypothesis test: There are no statistically significant differences at (0.05) between the experimental group and the control group in the post-achievement difficulty. The researcher used a t-test to ensure no statistically significant differences at the 0.05 level between the two groups in the post-test to test this hypothesis.

Table 3: *Post-Test Result and the Significance Level between the Control and Experimental Groups*

Bloom levels	groups	Means	SD	Mean differences	t	DF	Sig.	level
Remember	control	4.69	1.06	0.81	3.91	62	0.0002	Sig.
	experimental	5.50	0.51					
Comprehension	control	3.56	0.5	0.31	2.92		0.0049	Sig.
	experimental	3.87	0.33					
Analysis	control	1.91	0.64	1.09	5.04		<.0001	Sig.
	experimental	3.0	1.05					
Synthesis	control	1.44	0.62	2.41	10.3		<.0001	Sig.
	experimental	3.84	1.17					
Evaluation	control	3.78	1.21	0.66	2.38		0.0203	Sig.
	experimental	4.44	0.98					
Total	control	15.37	2.09	5.28	9.09		<0.001	Sig.
	experimental	20.66	2.53					

As data in the Table shows, there are statistically significant differences at the level of 0.05 between the experimental and control groups in the total and at all Bloom's levels: remembering, understanding, analysis, synthesis, and evaluation, and therefore the null hypothesis was rejected.

The effect size of FCS on students' achievement was measured using the Eta square, and the effect size was more significant than the average (see Table 4). This means that the FCS affects students' achievement, which largely encourages using it. This result is consistent with the study of Shalabi [15] that indicated its impact on the development of assessment competencies and habits of mind. It is also in line with Alsowat [14] who confirmed the effectiveness of its application in developing higher-order thinking skills among students.

Table 4: *Effect of Using* FCS *on Students' Achievement (Using the Eta square)*

	t-value	**eta. square) η2(**	**Impact size**
Total score	9.09	0.61	more than average

This result could be attributed to the FCS's opportunity to integrate traditional and online learning. The learners' access to the content before the lecture allows them to prepare for the lesson thoroughly and identify the questionable points and problems. This helps to invest the full use of the lecture time. Additionally, the strategy allows the learner to access the scientific content without being restricted to time. This allows frequent access to it and displays it more than once to review some of the lecture points. Similarly, it is a learner-centered strategy. It enables the learners to build their own experiences, and at the same time, communicate with the teacher or students to form a virtual knowledge community through which experiences and knowledge are exchanged among them.

The result of this study confirms several previous findings, e.g., Abdul Ghani [37] and Abanmi [11]. The former indicated differences in favor of the experimental group in the achievement of female students, and the latter showed the effectiveness of using FCS with the lower levels of Bloom's classification. Some studies indicated the positive use, with most of the higher skills of the rating [12,13,38].

Research question #2:

What are the students' attitudes towards the flipped classroom strategy?

To answer this question, the researcher used frequencies, mean values, and standard deviations (see table 5).

Table 5: *Students' Attitudes Towards using the* FCS

No.	**Items**	**Mean**	**SD**
1	Flipped class helped me build a strong relationship with my teachers	4.37	0.61
2	Flipped Class Help me share my opinions with classmates on unit topics.	4.27	0.74
3	Watching read and visual files at home is easy for me to understand during the lecture.	4.3	0.65
4	I prefer the traditional method of presenting the material over the flipped class strategy.	2.73	0.91
5	I prefer doing homework in class instead of at home, because we can ask the teacher or students	3.3	1.37

	about the points that are difficult for us.		
6	Watching the various topic files (videos, pictures, guided readings) before the lecture time encouraged me to research the topic in the various resources available on the Internet.	4	0.79
7	The flipped class motivated me to use the self-learning method.	4.23	0.63
8	I get bored watching the lesson topic videos at home.	3.27	0.91
9	The availability of video files contributed to my understanding of the lesson points by watching them more than once.	4.37	0.89
10	The Flipped Class Contribute to investing the lecture time by solving activities and asking questions about the topic.	3.93	0.78
11	The flipped class contributed to the formation of positive relationships with my classmates.	4.2	0.8
12	I feel that the flipped class strategy has reduced my cooperation with my classmates.	3.4	0.89
13	The flipped row made the lecture more enjoyable.	4.2	0.61
14	I prefer the teacher to implement the flipped classroom strategy over the rest of the course topics.	3.6	1.04
15	I'm not used to learning at home before going to school, so I prefer to learn in class	3.03	0.76
16	Learning content through educational videos is better than learning it through textbooks	3.9	1.03
17	Watching videos is time consuming and takes up most of my time at home	3.17	0.87
	Total	3.78	0.44

As data in Table 5 indicates, the two items, No. 1 and 9, got the highest mean score (M= 4.37). It means that the participants agree on the two statements to such a very great extent. This may be because the FCS and its advantages that allow communication outside the classroom contributed to strengthening human relations between students and their teachers. This result is consistent with Al-Daribi's study [34], which found that 82% of the respondents believe the FCS helps form a good relationship between them. It also confirms Al-Subaiy's [35] that about 78% of the respondents agree on the strategy's effectiveness in promoting communication between them. As for item 9, which obtained the same mean value for the previous item, it resulted from the educational environment, including the unsuitable environment or mind wandering during the classes. Such distractions cause the loss of some important points in the lesson. Thus, the availability of these videos can support the learning process by reviewing what the students missed from the lesson points. Ultimately, that would contribute to the educational process enhancements. This is consistent with Al-Daribi [34], who reported that watching the parts deemed difficult during the lesson gives an additional advantage to applying the FCS.

Although the results in Table 5 show that the participants had significant positive attitudes towards FCS in general, some respondents still believe that the traditional method is more appropriate for them than using the strategy at hand. This may stem from students' negative attitudes towards technology or the wrong application of the strategy [35-34]. Generally, Table 3 indicates that the general mean score of the participants' responses was 3.78, with a standard deviation of 0.44. This means that the students have significant positive attitudes towards using the FCS [13-31].

9. Recommendations

Based on the results outlined above, the researcher recommends the following:

- Expanding the application of FCS in different courses; it positively impacts students' achievements.
- Conducting meetings with learners before applying the FCS to clarify its mechanism and the necessary procedures and tools for its implementation.
- Urging education administrations to organize courses and workshops that encourage teachers to implement FCS in the classroom.
- Organizing training courses for teachers and students to develop their technical skills to benefit from the strategy.

Based on the outcomes of the present study, the researcher suggests advancing research by using the FCS in the computer course to measure other aspects related to the computer, such as students' software skills and computational thinking.

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