

The Effect of the Flipped Classroom Strategy on Eleventh Grade Students' Understanding of Physics and Their Attitudes Towards Physics in Tonnb Secondary School in the UAE

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Abstract

This study investigated the impact of employing the flipped classroom strategy in teaching “Laws of Motion” on eleventh grade students’ understanding of physics concepts and their attitudes towards physics. A total of 59 grade eleven students at Tonnb secondary school in UAE participated in the study, (30 in experimental group, and 29 in control group). A pre-post scientific concepts test and attitudes towards physics scale were administered. The results revealed that there were statistically significant differences between the study groups in favor of students in the experimental group on both study variables. The study recommended the importance of employing flipped classroom strategy in teaching scientific concepts.

Keywords: flipped classroom strategy, understanding of physics concepts, attitudes towards physics.

1. Introduction and literature review

Needless to say, that technology has affect every facet of modern societies; education is no different. New technologies become often embraced in almost educational innovations in an attempt to enhance instruction (Jensen, J.; Kummer, T.& Godoy, P., 2015). In this context, many educators have a great demand to find the most appropriate method of teaching science. What is commonly used in our schools today requires teachers to find a flexible way of teaching in order to meet all the students’ needs (Orlich, 2013). Flipped Classroom (FC) approach is one of the new methods of teaching which can be used in teaching different subjects.

Trigwell (2005) defines FC as “the mixed combination of traditional learning with web-based online approaches”. In addition to that, FC is known as an educational transformation which is illustrated as a chance to allow students to give direction to their learning process, building on their strengths and interests and making use of the face-to-face instructional time (Bergmann& Sams, 2014).Lage, Platt, & Treglia (2000) defined FC as “Inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa”. Whereas, in 2013, Bishop and Verleger, pointed out that the FC just represents a re-ordering of “in-class” and “out-of-classroom” activities. As such, Bishop and Verleger defined the FC as “...an educational technique that consists of two parts: interactive group learning activities inside the classroom, and direct computer-based individual instruction outside the classroom” [2]. FC could be an effective method to help students acquire new information (Hattie, 2008; Schwerdt & Wupperman, 2010).

The FC supports class time for constructivist approaches and encourages collaboration with the student-centered approach and active learning (Salmon, 2000). Constructivism is a theory of learning which puts learners at the center of their learning process where they actively “construct” their knowledge instead of passively getting information (Thornbury, 2006). Moreover, FC steers to intensify levels of student performance and involvement (Fulton, 2012). The FC had been defined by many researchers as it supports the role of team work and helps students to build their own theories without any change of the pedagogic concept. Moreover, increasing the time for giving feedback which enrich student learning, as it has the most important effects of any instructional activities (Beesley & Apthorp, 2010; Hattie, 2008).

Researchers had studied FC from many facets. Nouri (2016) investigated the attitudes of 240 undergraduate students at Stockholm University in Sweden towards learning with FC method. The findings of the study showed that most students have a positive attitude towards learning by FC. The study conducted by Rae (2017) was aimed at examining the relationship between students' perceptions of FC and their self-regulated learning, and the impact of these variables on achievement. Seventy-six students who were studying introductory biology course were participated in this study. The results revealed that students' perceptions of the flipped model positively predict their use of several types of self-regulated learning strategies. Moreover, results suggest that FC demonstrate students’ successes in the active learning sessions through constructivist teaching methods.

Eyitayo’s (2017) study investigated the effects of a flipped instruction model on academic performance and attitudes of 66 first-year secondary school students towards chemistry. The results revealed that the students in the flipped classroom got better conceptual understanding of scientific concepts more than the students control condition. Positive significant differences were found on all assessments with the flipped class students performing higher on average.

In a research study conducted by Attaran and Zainuddin (2015), the results revealed that most students had positive perceptions towards the use of FC and most of them would recommend flipped learning for other

courses and other students. Moreover, flipped classroom generated positive impacts for quiet and shy students.

The study conducted by Jin Su, Darvid, & Florintina (2016) revealed that the students have positive perceptions to a flipped classroom. Majority of the students considered FC as a valuable learning experience, more interactive, and were willing to have more courses following a flipped model.

Marlowe (2012) examined the effect of the flipped classroom on students' performance and stress levels. 19 students in the second year of the International Baccalaureate Standard Level Environmental Systems and Societies (ESS) program in Dubai were the participants of the study. The results of the study showed that students in the flipped classroom recorded lower stress levels but there were no significant differences of their achievement.

Zheng, Becker, and Ding (2014) at University of Wisconsin-Stout compared teaching with flipping the classes with the traditional method. Twenty-five students enrolled to a program of "Fundamentals of Plastics Materials and Processing" were participated in this study. The results showed that teaching with the FC method saved time and added more functional use of the class time as well.

Baki Mohammed Diab and Khaled Mohammed Abdel (2016) examined the effect of the FC on students' performance in the new SAT 2016 mathematics skills for 11th grade Emirate students at Al-Ain. Results showed that students' performance had been improved more significantly compared to their colleagues.

As it can be seen from the aforementioned studies, many advantages of employing FC at many facets, in students' academic performance, class time management, and lowering students' stress levels.

The current study come to investigate if any of the advantages of using FC are applicable in the United Arab Emirates.

2. Significance of the study

The recent study applies a quantitative method to investigate the influence of flipping the classroom instruction on students' achievement in physics. The significant of this study is in how to encourage the physics teachers to use a wide range of teaching methods and implement the teaching methodology that motivates students and support the individual needs.

3. Statement of the research problem

This study examines the effect of implementing the flipped classroom instruction in teaching physics on eleventh grade students' achievement and their attitudes towards learning physics comparing with the traditional teaching method. Specifically, this study aims to answer the following two questions:

- 1- Are there significant differences in students' understanding of physics concepts related to using FC teaching strategy?
- 2- Are there significant differences in students' attitudes towards physics' related to using FC teaching strategy?

4. Methodology

4.1 Participants of the study

The present study examines the impact of the FC strategy on eleventh grade students' achievement in physics and their attitudes towards learning physics. Fifty-nine of 11th grade students were randomly selected and assigned to be the participants of the study. The participants were divided into two groups, experimental group (n=30) and control group (n= 29). Both groups were taught by the same physics teacher.

4.2 Study Instruments

This study utilized two instruments, scientific concepts test and attitudes towards physics scale.

4.2.1 Scientific concepts test

To answer the questions of the study, the scientific concepts test was assigned to eleventh grade students. This test was designed per a certain analysis of unit nine which is about the work, the energy, and machines. The test was 25 objective questions; the multiple-choice questions had only one correct answer for each question.

To keep the validity of the test, it had been rechecked by three instructors who work in different universities and they recommended reducing the number of the questions to be 16 instead of 25. All the questions were objective ones and were corrected by the teacher. Cronbach's Alpha Equation was used to measure the exam stability. And the result was equal to 0.83 which is suitable for the scientific research.

4.2.2 Students' attitudes towards Physics scale

Accordingly, the researcher used a survey to measure the attitudes of students towards physics as the related literature mentioned (Gamze, Mehmet & Kamielm 2011). The survey consisted of thirty items classified as follow: sentimental side (17 points) and behavioral side (13 points). Respondents specify their answers on a 5-point Likert scale (strongly not applied 1, not applied 2, don't know 3, applied 4, and strongly applied 5). A panel of specialized educators were validated the scale, moreover the scale was pilot- tested with 30 students.

4.3 Data Collection

This study follows the quasi-experimental method. The researcher followed a quantitative approach to collect the data of the study by designing a test of scientific concepts and a survey to determine the students' attitudes towards learning Physics. The researcher applied both the test and the survey before and after the experiment then a period of treatment lasted three weeks and included 15 lessons. The researcher designed the determined unit for grade eleven as some instructional videos and online lessons were posted to students on WhatsApp on the day before the lesson at school, then students were asked to watch them and discuss them with their teacher the next day in the classroom. After the experiment, the researcher applied the two instruments again and compared the results of students through both scientific test of the concepts and the survey. The Analysis of Variance was used to answer the questions of the study.

5. Results and Discussions

To answer the first question of the study (i.e. Are there significant differences in students' understanding of scientific concepts related to using flipped classroom teaching strategy) the mean scores (M) and standard deviations (SD of scientific concepts tests were calculated (see Table 1).

Table 1: Mean scores and standard deviations of scientific concepts tests

Group		Pre- test	Post-test
Experimental	N	30	30
	M	5.6667	12.9333
	SD	1.98847	2.55874
Control	N	29	29
	M	4.7931	7.4828
	SD	1.56706	2.16499

As can be seen in Table (1), there are apparent differences in the means between the experimental group and the control group in the results of scientific concepts test. To stand on the significance of these differences, ANOVA test was used (see Table 2).

Table 2: Tests of Between-Subjects effects for students' results in scientific concepts test

Source	Type III Sum of squares	Df	Mean Square	F	Sig.
Corrected Model	461,992	2	230,996	43,526	,000
Intercept	416,793	1	416,793	78,536	,000
Pre-test (concepts)	23,914	1	23,914	4,506	,038
Group	366,367	1	366,367	69,034*	,000
Error	297,194	56	5,307		
Total	6963,000	59			

*Statistically significant difference ($\alpha=0.05$)

As can be seen in Table (2), the differences in the mean scores of students' results in scientific concepts test are statistically significant ($F= 69.034$). Referring to Table (1), it can be seen that differences are in favor of students who learned the target concepts using flipped classroom strategy.

To answer the second question (i.e. Are there significant differences in students' attitudes towards physics' related to using flipped classroom teaching strategy?) the mean scores and standard deviations of students results in Attitude towards physics scale were calculated (see Table 3)

Table 3: Mean scores and standard deviations of students' results in Attitudes towards physics scale

Group		Pre- test	Post-test
Experimental	N	30	30
	M	95.7000	111.3000
	SD	17.77474	21.04535
Control	N	29	29
	M	88.6552	96.1034
	SD	23.98999	21.52796

As can be seen in Table (3), there are apparent differences in the means between the experimental group and the control group in the results of attitudes towards physics scale. To stand on the significance of these differences, ANOVA test was used (see Table 4).

Table 4: Tests of Between-Subjects effects for students' results in Attitudes towards physics scale

Source	Type III Sum of squares	Df	Mean Square	F	Sig.
Corrected Model	13731,275	2	6865,638	24,813	,000
Intercept	5680,581	1	5680,581	20,530	,000
Pre-test (Attitudes)	10325,960	1	10325,960	37,319	,000
Group	1638,851	1	1638,851	5,923*	,018
Error	15495,030	56	276,697		
Total	665292,000	59			

*Statistically significant difference ($\alpha=0.05$)

As can be seen in Table 4, the differences in the mean scores of students' results in attitudes towards physics scale are statistically significant ($F= 5,923$). Referring to Table (3), it can be seen that the differences are in favor of students who learned the target concepts using flipped classroom strategy.

The results of the current study showed that the students who were taught by the flipped classroom strategy achieved better understanding of the scientific concepts and better attitudes towards physics as well. These results come in accordance with the results of other studies (e.g. Eytayo's ,2017; Marlowe,2012; and Baki Mohammed Diab & Khaled Mohammed Abdel, 2016)

These results can be attributed to the flipped classroom strategy, which created untraditional learning context. First of all the flipped classroom had made a difference in students' attitudes and perceptions in teaching and learning process; in the flipped classroom each student has its own academic time which enable him/ her to learn better. Moreover the flipped classroom encourages active learning process where each student actively constructs his/ her knowledge (Salmon, 2000; Thornbury, 2006). The student in the flipped classroom has the opportunity to learn at the time and the place he/ she prefer.

In general, the evidence from this study suggested that flipping the classroom can results in large learning gains and more positive attitudes towards physics learning.

6. Recommendations

According to the current study results, it could be recommended that:

- Teaching physics in the secondary schools using the flipped classroom method of teaching is an effective way.
- Working on applying the flipped classroom method of teaching in different subjects and conducting research on them.

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