Journal of Personalized Learning, 2(1) 2016, 73-85.

EFFECTIVENESS OF FLIPPED LEARNING IN PHYSICS EDUCATION ON PALESTINIAN HIGH SCHOOL STUDENTS' ACHIEVEMENT

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ABSTRACT

Flipped learning (FL) is a new trend in ICT that can improve the teaching and learning process. Learning Physics is difficult for some students and this caused low academic achievement and estrangement to learn it. Thus, there is a need to use suitable learning methods to personalize the learning and make it students-centered approach. It is important to use FL in Physics education to make it fun and attractive for students. There is shortage in Physics studies that conducted in Palestinian secondary schools concerning the effectiveness FL. The main objective of this study is to investigate the effectiveness of FL on Palestinian Secondary Students' Physics achievement. The quasi-experimental method was used. One hundred seventeen male and female students from grade 11 scientific stream were selected purposively from two schools in Palestine. Physics achievement test was prepared and administered twice for the same students as pretest and posttest. Both quantitative and qualitative data were collected by using the Physics achievement test; in addition to the personal interviews. The descriptive and inferential analysis was used for the quantitative data (T-test for two independent variables, T-test for two dependent variables, and ANCOVA test). In terms of the students' achievement score, it is found that FL students score is better than that of the traditional one; the pretest score was not statistically significant for both groups; while it is significant for posttest score in benefit of FL students This means that there were positive effects of the students' achievement in favor of FL.

Key Words: Flipped Learning, ICT Integration, Physics Education, Personalized Learning

INTRODUCTION

As educational technology is developing and evolving very fast, teachers face the challenges for learning and accessing them in order to present the content in a smarter, faster and better way (Prensky, 2010). The increased use of educational technologies offered new opportunities for educators to engage and motivate learners. This technology was harnessed in implementing flipped learning model which in turn may increase students' motivation and comprehension (Bathker, 2011). The Flipped Learning is not just using technology, it is a technology-enabled teaching technique (Walsh, 2012). Toppo (2011) considered the Flipped Learning as the latest technology that changed teachers' task; it inverted their school day upside-down, in which it offered more control of material and more face-to-face time with students. The Flipped Learning is using digital technology for shifting the direct instruction outside of the group learning space to the individual learning space. This helps teachers to maximize individual face-to-face time with students (Jon Bergmann & Sams, 2014b). The extra freed time can be used by students to collaborate with peers, engage more deeply with content, practice skills, and receive feedback on their progress. In addition to that, teachers can use the extra freed time to give students more control over their own learning by coaching, inspiring and assisting

To cite this document:
Atwa, Z., Din, R. & Hussin, M. (2016). Effectiveness of flipped learning in physics education on palestinian high school students' achievement. *Journal of Personalized Learning, 2*(1): 73-85.

them with challenging projects (Hamdan, McKnight, McKnight, & Arfstrom, 2013). The Flipped Learning attracts the attention of educators as well as funders such as Bill Gates who is a main backer of the famous Khan Academy (Toppo, 2011).

Flipped or inverted classroom model can use technology to free class time from lecture to expand the learning activities during class time (Bishop, 2013; Brunsell & Horejsi, 2013). Active learning strategies can be used inside the class to provide opportunities for greater teacher-to-student mentoring, peer-to-peer collaboration and cross-disciplinary engagement. This will challenge and engage today's students in the "flipped classroom" model (Roehl, Reddy, & Shannon, 2013). Sams and Bergmann (2013) illustrated that flipping classrooms is, instead of listening to the teachers lecture inside the classroom and going home for homework to practice what they learned, students watch the lecture at home and come to class for homework to practice what they've learned. Many scholars agreed and asserted that Flipped classroom enabled teachers to shift the teaching/ learning process from the teacher-centered approach to students-centered approach to maximize time use (Jonathan Bergmann & Sams, 2012; Jon Bergmann & Sams, 2014b; Gilboy, Heinerichs, & Pazzaglia, 2015; Hamdan et al., 2013; Miller, 2012; Roehl et al., 2013; Sams & Bergmann, 2013). The classroom time of the face-to-face sessions can be utilized for the application of the online materials and to be used for deep understanding, problem solving and developing skills of the subject matter (Jonathan Bergmann & Sams, 2012; Riendeau, 2012). There is a possibility to engage Millennial students by introducing the learner-centered opportunities inside class for greater teacher-to-student mentoring and peer-to-peer collaboration (Prensky, 2010).

In order to maximize the value of the face-to-face time inside the classroom, teachers can use flipped learning to remove the one way communications such as lecturing and direct instruction from the classroom time and shift it to home by using the suitable technology. Other activities can be shifted outside classroom by creating videos or other materials such as providing overview for new topics, posing questions for developing answers by the students and for prerequisite contents (Jon Bergmann & Sams, 2014b; Sams & Bergmann, 2013).

The Flipped Classroom Model inverted the teaching/ learning process. The direct instruction of lower levels of understanding and remembering of Bloom's Taxonomy move to outside class; while the upper levels of application, analysis and creation take place inside class (Marshall & DeCapua, 2014). Therefore, there is no need for the students to consume their energy inside the classroom in the lower levels of Bloom's Taxonomy. They can go through them for understanding and mastering the concepts outside the classroom due to their time and pace. They can view the video lessons as many times as they want. This method allows low level students better preparation and lesson understanding before going to class. This will help them with their teacher to focus on the upper levels the Bloom's Taxonomy inside the classroom (Marshall & DeCapua, 2014).

The flipped learning researches are limited until now; although the existed researches concentrate on the shift from teacher to student-centered approach which leads to the active learning. Implementing flipping classroom can use teachers' time and expertise in appropriate way, use facilities efficiently and students get better learning outcomes (Berrett, 2012). In this method, the conceptual questions were discussed and answered by the students in small groups during the lecture. The results show that the non-majors Physics students in his class outperform the Physics major's students who learn in traditional method of the force concept inventory (Mazur, 2013).

Flipped Learning Benefits

There are many benefits resulting from the use of Flipped Learning Model (FLM). It is suitable for all learners because it has positive effects and can focus on all of the students (Sams & Bergmann, 2013). Better questions and deep thinking from students are the results of using the FLM as the year progressed (Tucker, 2012). Green (2012) listed some benefits of using FLM such as: increasing students engagement time in doing homework inside class, enabling them to learn in a safe atmosphere, getting immediate feedback, increasing collaboration, increasing access to the necessary technology and more parents engagement and support in the teaching/learning process. Flipped learning can be considered as a good example for personalizing learning.

Palestine participated in the "Trends in International Mathematics and Science Study" (TIMSS) of grade 8 for the first time in year 2003, and then continued to the following years 2007 and 2011. The TIMSS scores provide data about national and international trends in science and math achievement. It gives the decision makers the opportunities to know their level and status in math and science teaching scores compared to other participated countries in order to take the suitable decisions for the educational improvements. The Palestinian results were behind and under the international average scores for both math and science. The international average score for the science and math test is 500. The following Table 1. illustrates the Palestinian results (MOE, 2013).

Table 1. TIMSS Scores in Palestine

Subject	2003 Score	2007 Score	2011 Score
Math	390	367	404
Science	435	404	420

Although the use of ICT in education is still limited in Palestinian schools and there isn't a comprehensive ICT policy in the MOE until now, the integration of ICT in the teaching/learning process remains a significant challenge for MOE (MOEHE, 2014). The MOE has implemented several separated well-known ICT projects since its establishment in collaboration with foreign donors and countries.

One of the strategic options and anticipated results for the MOE is "activating and applying ICT in education" (MOEHE, 2014:60). According to (Leask, 2005a:41) "There is research evidence which indicates that when ICT is effectively deployed, pupil motivation and achievement are raised in a number of respects." In their literature review of flipped learning, Hamdan et al. (2013) assured that the existed researches are limited and suggest conducting more researches about its effectiveness and to maximize its potential. There is a need for conducting more researches on effects of FLM on high school student achievements as there is little rigorous empirical research on the effects of Flipped Learning on student achievement (Hamdan et al., 2013).

Physics is an important subject for all students not only in Palestine, but also all over the world. It is a fundamental science which is one of the core sciences subjects. It is important for understanding this world and the beyond one around us. It challenges imagination with new concepts and theories which leads to great discoveries and technologies that change the people's lives (Agommuoh & Ifeanacho, 2012). So, it is an urgent and important need to develop and improve the performance of Physics teachers in using and utilizing ICT which corresponds to the accommodation of students need and diverse learning methods. In addition to that, the use of ICT in teaching is a relevant and functional way of providing education to learners that will assist in imbibing in them the required capacity for the worth of work (Adeyemo, 2010). This will help in making the teaching/ learning process fun and interesting for both teachers and students.

Studies have shown lack of effective teaching strategies leads to poor performance of physics students in secondary schools (Agommuoh & Ifeanacho, 2012). Other researchers support this claim by stating that learning physics creates boredom because it only adopts the teacher-centered approach and students do not participate (Rodrigues & Oliveira, 2008; Zakaria & Iksan, 2007). However, Aina (2013) and Adeyemo (2010) believe that physics is also classified as a difficult subject in Kenyan schools and other countries.

In order for the students to understand the Physics concepts well, they need effective teaching strategies inside the classrooms (Agommuoh & Ifeanacho, 2012). Utilizing effective strategies in teaching Physics by ICT integration is important in order to provide students with the necessary mental tools to examine, understand and criticize the Physics issues involved. The researcher didn't find any study about the ICT integration in Physics education or flipping Physics classroom in Palestinian secondary schools and students'motivation towards ICT. The findings of this study may minimize the gap in literature and be an added value to the knowledge. By reviewing some of the references used about ICT integration in Physics education or flipping Physics classrooms in different countries, it is clear that there isn't any reference about Palestine or even Arabic countries.

Introducing FLM in Physics education can play a vital role in getting students attention to the Physics topic, engaging and motivating them which will lead to good understanding of the topic. By introducing different styles of ICT in the FLM such as slide show presentations, simulations, videos, spreadsheets, Web 2.0 applications, World Wide Web, etc. will motivate the students to think critically which improves their achievement. The conceptual framework will take in account all the required concepts of this research title to achieve the objective and to answer the questions. The most suitable learning theory for implementing FLM for the high school Physics students is the constructivist (constructivism) theory that supports active learning which leads to the student-center learning approach (Lobdell, 2013).

Journal of Personalized Learning, *2*(1) 2016, 73-85.

Teachers can easily integrate the constructive theory in the FLM. They can utilize technology to remove lecture parts from the classroom session to have more time for collaborative activities. The flipped learning known as the “inverted method” that “combines the benefits of direct instruction and active learning to engage students in the educational process” (Bates & Galloway, 2012; Tan, 2012) Constructivism introduces the framework for the FLM. It is based on how learners acquire knowledge (Clark, 2013). In the FLM, students prepare the lessons by viewing the videos at home by themselves. They can build and relate the new information to what they already have by making meaning of the learning. If they face problem in doing that, they can improve their understanding inside the class with help of the teacher and their peers. The FLM support the active learning and the student center approach, which in turn students can acquire their knowledge by the constructivism theory, hence the personalized learning can be achieved easily. The required conceptual frame work is shown in Figure 1.

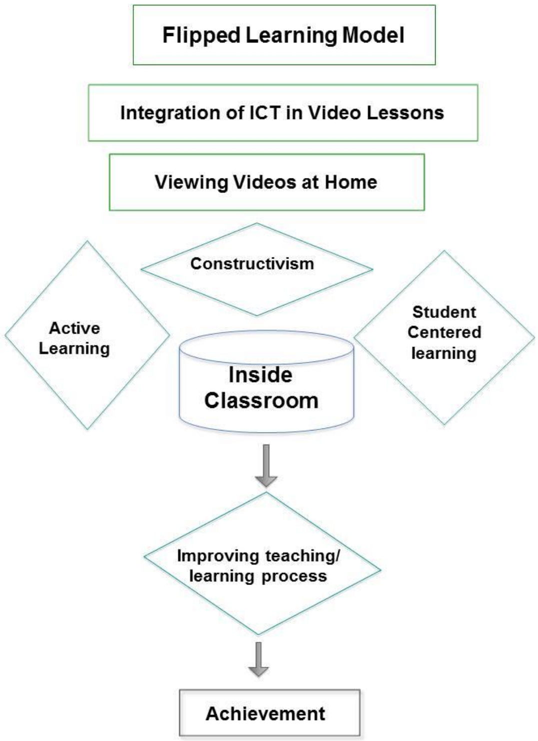

Figure 1. Conceptual Framework

Objective

The main objective of this study is to investigate the effects of flipped learning in Physics education on the Palestinian secondary school students’ achievement.

METHODOLOGY

The various ICT educational researches are complementary to each other and their natural procedures are multidisciplinary and multi method; i.e., no single method of inquiry should be used in educational research (Din, 2010). The quantitative and qualitative approaches were used in this research design to collect, analyze, and interpret the required data (Creswell, 2012). The quantitative research approach is the dominant in this study. It is to collect data in order to analyze if the new flipped learning method affects students’ achievement. Also, if there are contributions, that is, which variable contributes most. The Physics Achievement Test (PAT) tool was used. Meanwhile, the qualitative approach was adopted in the final phases of the research by asking the two Physics teachers in the treatment group two open questions about the advantages and challenges of the FLM.

This research study including the video lessons is significant for the following reasons:

- This is a contribution to the ICT theory and FLM. It is the first study in Palestine to integrate ICT and use FLM in Physics education in secondary stage. The integration of ICT in teaching/ learning process remains a significant challenge for MOE (MOEHE, 2014).
- This is a contribution to the research and an added knowledge for ICT and FLM.

- Useful to policy makers for future strategic planning for improving the teaching/ learning process. It may enlighten curriculum designers to improve the Physics textbooks and the methods of teaching.
- This is a response to the Palestinian Teacher Education Strategy to use modern and promising methods including video recording of different teaching practices, using educational technology and using interactive cases in teaching (UNESCO, 2008).
- Developing Physics video lessons to be used by teachers can be an added value. It can help teachers to develop similar video lessons for other Physics topics and may be other subjects like science, math, English…etc. It can be an added value to the teaching/ learning process when using the suitable resources purposefully (NCCA, 2007).
- Due to the researcher work experience in educational process (about 25 years), he does feel that this study is very important to light the way well for the educators and decision makers to use ICT effectively in FLM and in their work for supporting teachers to do their job in better ways. He is sure that this study will help his organization MOE in implementing and utilizing ICT in better way in the education system since they are in the process of evaluating and reforming the curriculum in light of the 21st century skills and the educational technology (MOEHE, 2014). In addition to that, the researcher found no study that exclusively has explored the ICT integration or the FLM in Physics education for the secondary school students in Palestine. The results from this study may contribute to the body of knowledge and minimize the gap in literature.

Research Method and Design

The quasi-experimental research design is used in this research study which is a suitable method for answering the research questions (Black, 2002; Creswell, 2012; Pitts, Prost, & Winters, 2005). The pretest – posttest design (PPD) is used in this study to experiment the effect of video lessons of the FLM on the students' achievement. The PPD is a common way of determining change caused by the treatment group (Dimitrov & Rumrill, 2003). The experimental research is a situation in which the independent variable -the intervention- is carefully manipulated by the researcher under known and controlled conditions. It consists of an experimental group which is exposed to the intervention under investigation; and a control group which is not exposed. Both groups are equivalent, and investigated systematically under conditions that are identical in order to minimize variation between them (Blaxter, Hughes, & Tight, 2010).

To have comprehensive data, both gender groups were included in each category. The majority of the Palestinian governmental secondary schools was separate, i.e. schools for boys only and schools for girls only. This is why two schools were selected. The experimental groups were go under the FLM treatment. This requires that students prepare their lessons at home, and use the classroom time in active learning activities. Physics teachers were trained to implement the FLM, and the students oriented and prepared. Individual meetings were held with the Physics teachers for discussing and clarifying the FLM in order to be used in the experimental groups. In addition to that, one session of 40 minutes was held for each experimental group by the researcher, physics teacher and school principal. In that session, the flipped learning concepts, the methodology, the required procedures and the orientations were discussed and clarified. A pamphlet of two pages was distributed to each student in order to let his/her parents know about this new method and to obtain consent for participation.

The control group went under the conventional normal method. The conventional method in general can be summarized by the following steps: teacher discusses the lesson concepts by solving examples on the blackboard for the first half of the session, then questions the students by asking them to solve other problems by applying what they have learned for the second half of the session directly. Problems from the textbook or extra problems will be given for the students as homework to be solved at home. At the beginning of the next session, the teacher will be sure that students solve their homework, and if needed, teacher will solve them on the blackboard or let one of the students solve them.

Population and Sample

The secondary scientific stage contains two grades only: Grade 11 and Grade 12 (1st & 2nd secondary grade). Grade 12 is the final grade in general education system, and students are preparing for the high school general exam certificate (Tawjihi) during June-July of each year which is not easy or suitable to test the FLM. They are concentrating on tests and exams for achieving and getting high scores which is important for them to determine the university and their study fields. Grade 11 (1st secondary scientific stream) students of the governmental schools were selected to be the population for this research study during the second semester of year 2015. The purposive sampling was used in this study (Creswell, 2012). Ramallah and Al-Bireh Educational Directorate in Palestine is chosen to be the target for the research study. This selection is aimed to have approximately the same background for the students, and due to the fact that the researcher lives and works near and for easy meeting and communication with teachers and students. Two secondary schools were selected purposively to be the target group of the study because it is not easy to find one governmental school that contains both male and female students of 1st scientific secondary grade. Both male and female students were distributed approximately equally to the two schools.

The students were distributed in the classes by the school administration. It is not easy or allowed to choose random students for implanting the FLM. Just all the class students can be selected randomly as a unit. The classes are categorized in each school as (A, B and C). So, the researcher assigned the groups randomly. Class B from each school was selected randomly to be the experimental group for implementing the FLM, while class A to be the control group. The total number of the selected students was 113 students distributed to 57 for the FLM and 56 students for the normal teaching method NTM. The following Table 2 summarizes the students' distribution in both schools due to the treatment and control groups.

Table 2. Students distribution due to the Treatment groups

School Name	Class	No. of Students	Gender	Treatment
Al-Hashemiyyeh Secondary Boys School	A	27	Male	NTM
Al-Bireh Secondary Girls School	A	29	Female	NTM
Al-Hashemiyyeh Secondary Boys School	B	26	Male	FLM
Al-Bireh Secondary Girls School	B	31	Female	FLM

This research contains two independent variables (Flipped Learning Method FLM and Normal Teaching Method NTM) and one dependent variable the Physics Achievement Test PAT tool. Each independent and dependent variable contains male and female students. All the students in experimental and control groups took the pretest and posttest of PAT. For triangulations, the two Physics teachers of the experimental group were asked two open questions about the advantages and challenges of the FLM.

Start Flipping Classroom

Flipped classroom can be a start step to change the role inside the classroom from teacher-centered to student-centered approach. It supports students' engagements by using the constructivist theory. This requires that teachers improving and mastering the instruction before using the flipped classroom concept (Miller, 2012). ICT integration in teaching/ learning process requires teachers to expand their knowledge of pedagogical practices across multiple aspects of planning, implementation and evaluation processes (Mndzebele, 2013).

Creating video did not mean recording the teacher inside the classroom while lecturing by using the video camera only. Majority of teachers creating videos by making a screen cast utility which is capturing the computer screen such as slide show of Power Points presentation, recording voices; include a small webcam of the teachers faces, using digital pen for solving problems or highlighting main issues and so on. The suitable average video time is about 10–15 minutes long (Sams & Bergmann, 2013). Many online internet sites contain good quality of video lessons such as TED Organization http://www.TED.com , Khan Academy http://www.Khanacademy.org , and so on.

Students Preparation for the FLM

Now days, the internet access is available all the time in almost every home in Palestine. Students can view the online flipped classroom materials any time they want according to their own pace (Roehl et al., 2013).This will help the students to view the lessons many times, or to go through them once. In addition to that, they can get help from their parents or colleagues for more comprehending the materials. Uploading video lessons to the internet to be viewed by students will not be enough to guarantee that they are learning by themselves. Students need preparation and training on using the flipped learning methodology in order to be comfortable with the new video lecture style, and to be responsible for their learning. Students can use any suitable device such as PCs, laptops, tablets, and smart phones to access the videos on the internet during their convenient time and from any place they want such as schools, buses, parks… etc. They can prepare the lessons well before going to class by viewing the videos many times according to their pace (Sams & Bergmann, 2013). There is a need for informing parents about implementing the FLM. The rational for such change is the required preparation which is different than the traditional one. Parents were informed through written information before implementing the FLM.

Inside the Flipping Classroom
Learning become student-centered and teachers can use the active learning strategies inside the classroom. Teachers can use the freed time for integrating and applying the students prepared knowledge via conducting research or working on projects with classmates. Also, teachers have the time to check student's individual understanding, help them develop procedural fluency if needed (Hamdan et al., 2013). Sams and Bergmann (2013) required students to watch videos outside classroom and come up with interesting questions that they don't know the answers and other notes about the videos as a verification of watching the video lectures. Inside the classroom, they might open the class with questions or clicker poll to check for students understanding instead of begin lecturing. Teachers can also check students understanding before coming to classroom by collect their responses and reactions about the video material by using online tools. The flipped classroom management is easier than the traditional one and more challengeable. The teachers' energy was consumed in managing students in the traditional classroom to keep them sitting, listening and quiet without noisy. While managing the flipped classroom requires different perspectives that it is filled with activity, engagement, inquiry, and learning. The teacher needs to be within and among the students, working with them, guiding and helping them for better and deeper learning which means not to be in front of the students and sage on the stage (Jon Bergmann & Sams, 2014a).

Facebook is one of the most popular applications. At the same time, it is a Web 2.0 software, open source, cloud computing and social media application. According to Wang, Woo, Quek, Yang, and Liu (2012), Facebook groups can be used as LMS software because it has the pedagogical, social and technological affordances, which allow putting up announcements, sharing ideas and resources, and implementing online discussions. In addition to that, it enables students to communicate and interact with peers and teacher. Embi (2011) introduces twenty Web 2.0 software tools in education in his book. He discussed the applications in details. In general, each application contains the following six headings: (i) what is the application?, (ii) advantages of the application, (iii) ways of using application in education, (iv) usage in teaching and learning, (v) get started with the application and (vi) references. The majority of Web 2.0 applications support collaboration and social interactions between users by encouraging active user participation in creating, sharing and structuring data (Safran, Helic, & Gütl, 2007).Web 2.0 is participative, convenient to include many concepts, and it is comprising equal parts of evolution and revolution. It challenges outdated attitudes towards the rights of the user, customer choice and empowerment (P. Miller, 2005)."Web 1.0 took people to information; Web 2.0 will take information to the people" (P. Miller, 2005).

Research Tool
The research tool was the Physics Achievement Test (PAT). The PAT tool contains general information about the students' demographic factors. The achievement test is to measure what has been learned by the students as individuals and as a whole class. The PAT for Grade 11 Scientific Stream is constructed by the researcher due to his experience in Physics education. The PAT construction is based on the TIMSS Advanced 2015 Physics Framework (Jones, Wheeler, & Centurino, 2014) that organized according to two dimensions: content and cognitive dimensions; instead of using the six domains based on Bloom's Taxonomy: knowledge, comprehension, application, analysis, synthesis and evaluation. The content dimension specifies the Physics subject matter to be assessed which is the Static Electricity topic that consists of four subtopics: Static Charge & Coulomb Law, Electric Field, Potential Field, Capacitance and Capacitors. The cognitive dimension specifies the three domains: knowing, applying and reasoning. These three cognitive domains describe the students thinking while they are engaging with the Physics content. The rationale behind this is to measure the students' abilities to demonstrate their knowledge, apply what they have learned, solve problems, and reason through analysis and logical thinking. Take in account that the content validity evidence for the achievement test is important because its aim is to measure how well the content taught has been mastered (Kubiszyn & Borich, 2013). All the guidelines for writing the PAT items mentioned by (De Vaus, 2002); Kubiszyn and Borich (2013) were taken into account. The content analysis was done for this unit; the percentages of the four subtopics and the question numbers in the unit are shown in the following Table 3.

Table 3. PAT Content Subtopics Percentages

No.	Content Domain	Percentages	No. Questions	Questions No
1-	Static Charge & Coulomb Law	22%	5	1, 2, 6, 17, 18,
2-	Electric Field	29%	7	4, 8, 9, 12, 14, 17, 20,
3-	Potential Field	23%	5	3, 5, 10, 13, 16,
4-	Capacitance and Capacitors	26%	5	7, 11, 15, 19, 21, 22

Journal of Personalized Learning, *2*(1) 2016, 73-85.

Also, the percentage of the cognitive domain in the unit is as follows: knowing 10%, applying 46% and reasoning 17%. But the PAT was prepared based on the TIMSS 2015 Assessment Frameworks for Science Cognitive Domains. The percentage of each domain is shown in the following Table 4:

Table 4. PAT Domain Percentages

TIMSS 2015 Assessment Frameworks for Science Cognitive Domains				
No.	Cognitive Domain	Percentages	No. Questions	Questions No
1-	Knowing	30%	6	3, 5, 9, 10, 13, 19
2-	Applying	40%	9	1, 2, 4, 7, 8, 11, 14, 15, 17
3-	Reasoning	30%	7	6, 12, 16, 18, 20, 21, 22

PAT Validity

For the validity purposes, the PAT is gone through a successive series of assessment. The assessment was to be sure that the PAT contains the exact content and cognitive percentage domain, easy to understand by the students and well prepared. The PAT was prepared in Arabic language and sent to eight educational experts in the Ministry of Education, Universities, Educational Districts and schools. All of the experts were asked to go through each question and its answer to be sure that it is clear, has no grammatical or scientific errors or misconception. Also, they asked to categorize the questions based on the content and cognitive domains and to go through the instructions for the students to be sure that they are clear, the students know what to do and how to fill in it. Their feedback was accepted; three questions were deleted, the copy was improved and modified. The final copy was revised by an Arabic expert to be free of any grammatical or printing errors. Also, the PAT was translated into English for the research purposes. The final copy of the PAT consists of 22 multiple choice questions while the original one consists of 25 multiple questions. Each question has four alternatives in which only one choice is correct. The score will be “0” or “1” per question. The minimum score is “0” and the maximum score will be “22”.

PAT Reliability

The final version of the PAT was piloted and tested by 26 students (13 male and 13 female) of Grade 11 in the Scientific Stream in both targeted schools and checked for reliability. The Cronbach's Alpha reliability coefficient for the tests of dichotomous data is weak; instead the Kuder-Richardson 20 (KR-20) coefficient can be used which is equivalent to the Cronbach’s one (Elliott, Kettler, Beddow, & Kurz, 2011). The KR-20 reliability coefficient for the PAT was calculated and it is 0.894 which is acceptable that is more than 0.70. In addition to the KR-20 reliability test, the same PAT was retested again for the same students after 2 weeks of time. The Pearson correlation Coefficient between the 2 PAT scores is shown in Table 5., and the result is accepted for the research purposes (Muijs, 2004; Pallant, 2011).

Table 5. PAT Correlations of the Test-Retest

		PAT Test	PAT Retest
PAT Test	Pearson Correlation	1	.722**
	Sig. (2-tailed)		.000
	N	26	26
PAT Retest	Pearson Correlation	.722**	1
	Sig. (2-tailed)	.000	
	N	26	26

**. Correlation is significant at the 0.01 level (2-tailed).

Video Lessons Preparation

The selected topic was Static Electricity unit 4 in the Physics text book for the academic year 2014/2015 exactly during the period of March until Mid-May of 2015. This will not affect or alter the teaching / learning process inside the school. It will not be extra load for students or Physics teachers in the school. The video lessons were used the original topics and lessons from the Physics textbook of Grade 11 and re-design them by ICT integration to develop the video lessons. The researcher has a good experience in teaching secondary Physics for seven years during 1990s years -before 17 years. Also, he is a member of the national team for science curriculum guidelines for grades 1-10, and a member of the national team for Physics curriculum guidelines of the secondary stage for grades 11-12. He helped the selected two Physics teachers and encouraged them to participate in preparing the video lessons. The video lessons were uploaded to the

Journal of Personalized Learning, *2*(1) 2016, 73-85.

researcher YouTube channel (Zaher Atweh) (https://www.youtube.com/channel/UCXHCcxpAT0NKHIfUMPdx6nA) at least one week before class session.

One of the physics teachers took the responsibility to prepare the video lessons inside the real class. He arranged his schedule to fit this process. He makes the C class to be one week ahead of the control and experimental classes. So, he discusses the lesson in about 15 minutes at the beginning of the session then continues his normal class. This is because the researchers suggest that the period of the video lesson to not exceed one and half multiplied by the class grade in minutes. So, the video length for grade 11 will be 16.5 minutes or less. The majority of the lessons were done by this way. Few of the lessons were prepared by the researcher himself in his office or home. Smart phone and a stand was used for this purpose, although a high quality cameras and equipment were available in his work, but the researcher used them for the first 2-3 lessons only in order to be sure that anyone with easy available equipment can video the lessons.

This has been first step in the video lessons preparations. The second step is to transfer the video lesson to the laptop to make the required treatment. The treatment aimed at deleting the silent places or the inappropriate ones, and making sure that the sound and light are suitable. Movie Maker package, Screencast-O-Matic package and the Camtasia package were used for this treatment. Sometimes 2-3 videos were compiled in one, or rearranged some shots. The third step is to find suitable and related short videos, animations and simulations from the internet educational websites that provide free educational resources. The most important internet platforms used in this research are Khan Academy https://www.khanacademy.org , TED http://TED.com and SOPIA https://www.sophia.org . In addition to that, to write the objectives of the lesson on one slide and to prepare 1-2 short questions as a quiz on the last slide.

The fourth step is to prepare the complete lesson online using the Blend Space platform https://www.BlendSpace.com . Later its URL was changed to https://www.tes.com . Usually, the lesson includes the title slide, objectives slide, video lesson that prepared inside the class and treated by the suitable packages, the other related short videos and animations, and the quiz questions or other short questions. Through this platform, one can search the related videos and insert them directly to the lesson online. The preparation of this step is directly online. About fifteen completed lessons were prepared by the above procedures. Here is a link for one of the lessons: https://www.tes.com/lessons/KMCjFLMZRqFnxw/edit.

The fifth step is to upload the lessons on Facebook. Three Facebook groups were created for this reason. The first one is for the researcher and the physics teachers for communications and sharing experiences. The second is for the male students and the third is for the female students. The completed lessons uploaded to the first group to be evaluated by the researcher and the physics teachers, after that, uploaded to the second and third groups directly. The researcher and the two Physics teacher are the administrators for the groups. Each one of them invited and added all of his/her students of the experimental group. All the students in the treatment FLM group were added to the appropriate group due to their gender in addition to the researcher and their physics teachers. The students prepare their video lesson before the real class any time and at any place that have internet and device such as smartphone, laptop, tablet or PC desktop. The following Facebook groups are:

- For Physics teachers: Flipped Learning Physics تعلم الفيزياء المعكوس :
  https://www.facebook.com/groups/1415367362109561
- For female students: Flipped Learning Physics for Girls تعلم الفيزياء المعكوس:
  https://www.facebook.com/groups/872233919485678
- For male students: Flipped Learning Physics for Boys تعلم الفيزياء المعكوس
  https://www.facebook.com/groups/1374973089494851
  Blended Space: https://www.tes.com/lessons/YxnYoU4vKK2yfA/edit

Statistical Analysis Technique

All the students in both groups –control and experimental- took the PAT research tool twice: pretest before the FLM implementation around mid-March 2015 and posttest after the FLM implementation around mid-May 2015. The pretest scores are very important to be considered as a baseline data, to compare the homogeneity and to determine the pre- knowledge and skills for students in experimental and control groups (Black, 2002; Butzler, 2014).

The quantitative collected data from the PAT research tool was grouped and analyzed by the suitable methods and tests for comparisons between the different groups and students' demographic factors. The

Statistical Package for Social Science (SPSS) package version 20 was used for the quantitative data analysis (Pallant, 2011). The descriptive statistics –average mean, median, and standard deviation- is needed for describing score results and students' demographic factors such as gender, location, school tests. Moreover, inferential statistics, involving independent samples t-test, One Way Analysis of Variance ANOVA and Multivariate Analysis of Variance MANOVA were used in this research to determine the differences between the groups. Specifically, the statistical MANOVA technique was conducted for each independent and dependent variable (Craker, 2006). Then, ANAVO was conducted for the significant one in order to determine the sources of difference and significance.

FINDINGS AND DISCUSSIONS

The PAT tool was administered twice for the purpose of the pretest and posttest in order to measure the required variables for students for both groups. Techniques in this section make the assumption that samples are obtained from populations of homogeneity of variances. This means that the variability of scores for each of the groups is similar (Pallant, 2011). It is clear from the below Table 6. that there were no statistically significant differences at the level of significance (α <0.05) in the PAT between the two samples experimental and control in the pre-test" .

Table 6. Results between Experimental & Control Groups of the pre-test of the Domain (PAT)

Application	N	Mean	Std. Deviation	t	Df	Sig. (2-tailed)
Experimental	57	0.36	0.110	0.914	111	0.363
Control	56	0.34	0.126			

Using the inferential analysis to answer the research question: What are the effects of flipped learning in Physics education on the Palestinian students' achievement? The researcher test the differences between the two samples (control and experimental) in post-test. The results shown in the below Table 7. that "There were statistically significant differences at the level of significance (α <0.05) between experimental and control groups posttest in (PAT) in favor for the FLM". This means that when using FLM, it increases the academic achievements for the students.

Table 7. Results between Experimental & Control Groups of the post test of the Domain (PAT)

Application	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Experimental	53	0.43	0.154	2.446	107	0.016
Control	56	0.36	0.123			

As a conclusion and in terms of the students' achievement score, it is found that FLM students score is better than that of the traditional one; the pretest score was not statistically significant for both groups; while it is significant for posttest score in benefit of FLM students The main findings of this research is that the flipped learning method is effective and affecting the academic Physics achievement positively. In addition to that, the two physics teachers said that the FLM is a new method for students and they were happy to be part of this study. The female teacher stated that she is planning to use the FLM for her students in the coming year. Also, teachers' relation with students becomes better than before that cause the students to become more active inside the classroom.

This research finding is supported by previous studies for secondary school students. There are other researches about the successful implementation of the FLM in the higher education institutes about students' achievements. Integration of the instructional technology in the teaching/ learning process can make the learning more interesting, engaging and productive for both teachers and students (Hamdan et al., 2013). The FLM significantly affected students' achievement (Strayer, 2012). The math teachers Troy Faulkner agreed on an ambitious plan by developing their own curriculum and flipping their classrooms to solve the students' achievements problem. He leaded the team for improving math learning inside the school and succeeded in that In terms of the students' achievement score, it is found that FLM students score is better than that of the traditional one; the pretest score was not statistically significant for both groups; while it is significant for posttest score in benefit of FLM students (Fulton, 2012). The Flipped Learning Network and the Classroom Window conducted an online survey for 450 teachers in 2012. They found the following results after implementing FLM: the students attitudes and performance were improved; two thirds of the teachers reported that the standardized test scores were increased for their students; the students' attitudes towards learning was improved for eight out of ten teachers; the job satisfaction was improved for about 90% of the surveyed teachers and significantly improved for 46% of them (Hamdan et al., 2013).

Researches indicated that FLM model provides students with opportunity to be active learners who take control of their learning (Strayer, 2012). In the FLM, the interaction time between students and teacher inside the classroom increase because the students prepare their lessons before coming to the classroom session. In this case, teacher can reach and help every student inside the classroom; the student-centered approach and personalized learning will be achieved. So, the FLM can enhance instruction and improve student motivation achievement (Lobdell, 2013).

CONCLUSION

The findings show that the FLM is effective for improving the students' academic Physics achievement. By increasing the interaction time inside the classroom, the personalized learning achieved and the teaching and learning process improved. Although the FLM is not the panacea to solve all educational problems, it can be a way to create better learning environment toward student-centered approach according to the existed researches (Hamdan et al., 2013). In this issue, the question that Gojak (2012) asked about the promising FLM is "not whether to flip or not", it is how to get the best use of its benefits to be effective toward increasing the learners conceptual understanding. The recommendation is to implement the FLM for other subjects and for long periods. It is recommended also that the school make orientation and preparation for the students and implement the FLM step by step. This is because of the well-known saying that any new change is painful. Introducing the FLM as new teaching/ learning methodology is a challenge for students, teachers and schools. It needs shift in the mind of all stakeholders of the educational process (Roehl et al., 2013). Students who are accustomed to the traditional learning style need time to get used to a new one (Tucker, 2012). It may take more than one semester for the students to get accustomed to the FLM and value it. The students become more responsible for their individual learning while using the active learning of FLM (Roehl et al., 2013).

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