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An Adaptive Teaching Model For Flipped Classroom

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Abstract—Individual differences are important for the learning environments so that it can be said that learning environments that are designed by using adaptation techniques are effective in improving the performance level of students. In this study a flipped classroom model was developed for elementary school students by using adaptivetechniques in English lectures. In this way advantageous and strong aspects of adaptive and flipped learning complete each other. In the research, two different flipped learning environments were developed. The flipped learning environment was designed without adaptations and with adaptations. The students worked for a period of ten weeks in the designed environments. The aim of the study is to show the benefits of adaptive technologies for flipped learning environments. In total 60 students from Libya were selected randomly then placed in adaptive flipped learning and Flipped learning environments. T-test was used in the substance analysis performed for knowledge test. Based on the findings obtained from the success rates of the students displayed on tests, administered as a pre and post test, it was demonstrated that adaptability of the flipped learning environment and levels of the adaptability have a positive effect on the academic achievement rates of the English lecture students.

Keywords-adaptive technologies; flipped learning; flipped class; adaptive learning environment

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I. INTRODUCTION

Today, the development of the web based technologies, computer based education and online media, as they influence every other area also change and affect the educational platforms. It has been emphasized that the rapid development of the innovator models and information technologies using for education, change the student preferences from traditional to the newest models like online or blended [1]. In Flipped Classroom model which is a good example of these newest models, contrary to the traditional model, online course videos are prepared by the teacher to transfer the information. Students can study the course materials, working on problem sets, experimental activities before coming to the class so that they have more time for interaction in the class instead of lecturing [2,3]. Although the online assist may be an important supplement for a traditional learning, there are still question marks surrounding this model. The same page content and link structure on the standard web based platforms, may cause individual differences of the students to be ignored. However, using adaptation techniques supply personalized learning for the students. Adaptive learning adapts teaching strategies by taking individual characteristics and needs of the students into consideration and is able to achieve effective learning for them[4,22]. Koumi (1994) provided personalized learning for web based learning, implemented multimedia-based adaptive learning management system in which computer offers individualized control and interactivity [5,6]. It is pointed that more advanced tools need to be employed in order to adapt students' out of class behaviors into the content of the courses [7]. Research indicated that the learning styles vary among learners and the students prefer using different types of

learning methods in order to suit their abilities [8]. In Flipped learning there are still personalized differences like learning styles and preknowledge of students. Individual differences and student model are important factors that influence student-centered webbased learning [9]. The use of videos or other digital technologies to deliver content outside class can not be sufficient for the kind of education which gives priority to personal differences. However, due to the emphasis on students becoming the agents of their own learning rather than the object of instruction, the Flipped Learning model can enable educators to make the shift from teacher-driven instruction to student-centered learning[10].

A. Adaptive Technique in Flipped Learning

Kakosimos (2015) compare the effect of the micro-adaptive instruction (mAI) with the traditional style of education, on the education outcomes of the Chemical Engineering (CHEN 304) course at Texas A & M academy at Qatar. The researcher has implemented the process for two sequential terms that is (2013 and 2014) on CHEN 304 which was divided into group A and group B and comparable to a course, (PETE 314) which serves as the control group. 17 students Falls in 2013 and 20 Falls in 2014. The quantitative results show a slight improvement, within the groups (A & B) of the same course, there was no clear change with and without mAI.

According to the study carried out by Daniel Szafir, Bilge Mutlu (2013), the design space which is called Adaptive Review Technology for Flipped Learning: ARTFuL afforded by these new educational models are explored for improving teaching [15]. There were 24 female students and 24 male students in the program. All students were native English speakers from the University of Wisconsin. To explore the

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effects of adaptive content review on educational results, they implemented three alternative education systems designed around different methods of providing a content review.The first styling provides no content review, the second provides maladaptive content review established for reviewing notion to which students initially paid the most interest, and the third provided a full review of all lesson concepts.

The results confirmed the following:

1. An adaptive review significantly increased reminiscence and knowledge gains compared with the no review baseline, while students who received maladaptive review did not get cognitive performance gains over the baseline in these measures.

2. Their results showed no variance in learning or recall between the full and adaptive conditions, while a significant difference was found between the full review and the maladaptive review in terms of recall. However, their results indicated only a marginally significant difference between a full review and maladaptive review in terms of learning.

3. Only reviewing the material is not enough to improve student learning. They found no difference between the no review and maladaptive review conditions. The outcomes confirm that simply reviewing the material is not sufficient to develop student learning. They found no variation between the no review and maladaptive review conditions.

Problem of Research

Students' level varies from student to student; that mean there are individual differences between students' educational levels, so these differences must be taken into account and from previous studies, note that there is no initial assessment of student levels in order to be guiding each student to the appropriate level of educational abilities, while it was found in the currentstudy, when the student enters the required data, student will be evaluated, and directed to the appropriate level by an evaluation test.There are many studies about adaptive learning and about flipped learning. However, there are few studies about adaptive technique in flipped learning.

In a traditional classroom, students would be asked to stand idly by while the teacher delivers a lecture. Students' focus will be limited to taking notes without absorbing modern concepts and this will make them to lack the ability to develop their skills, and lack practice in the classroom because their focus is on presentation rather than practice. Adaptive Flipped Learning enables students to prepare for the lesson according to their personal qualities outside class so that they can participate the class activities more effectively.

B. Research Focus

This study was used to determine the impacts of Adaptive Flipped Learningand Flipped Learning in a collectable third-grade elementary students studying English. During the research, students can study the educational content at home before coming to class and their learning platform can be configured according to the student model. When considering the previous studies, there were few studies about adaptive technique in flipped learning within the limits of researcher's knowledge and this forms the importance of this study. This study attempts to answer whether:

1.The differences between the pre test and post test of adaptive+flipped learning environment of beginning and advanced levels are significant.

2. There are any differences between flipped learning, and adaptive flipped learning for understudies in the third grade students.

II. METHODOLOGY

A. General Background of Research

The purpose of this study is to determine the effects of Adaptivetechnologies on aflipped learning environment model and to develop a flipped learning environment including adaptive technologiesfor elementary school students. In the adaptive flipped learning environment, the educational content contains two main levels. The beginning which includes the introduction content and the advanced level whichcontains the more advanced content.

Adaptive Technologies that were used in the study:

Adaptive learning environment is formed according to students' relevant information and attempt to establish a new structure based on their interests and needs, then the system individualized for every student [11]. These environments enrich learning processes and present alternative means for the students in their learning process. According to Brusilovsky (2001), there are two fundamental techniques for putting adaptation into practice: Adaptive presentation and adaptive navigation[12].

Adaptive presentation

The aim of this technique is to adapt the content presented in each hypermedia according to student goals

The information is presented in different ways such as text, images,video etc.

In this study, Fragment Variants technique was used as adaptive presentation. In this technique the same contents were prepared by different materials like text, images and videos.

Adaptive navigation

The aim of this method is to support the student to find an effective way during navigation [13].

In this study, the adaptive navigation that was used in the design include direct guidance. Direct guidance directly tells the student in what sequence the section links should be learnt [14]. Also, Link generation technique was used in the quiz module.

B. Sample of Research

In total 60 students from Libya were selected randomly then placed in adaptive flipped learning and Flipped learning environments (N = 30 in each group). Both groups were taught

by the same teacher and used the same syllabus. The control group was taught via flipped learning and experimental group which was divided to beginning and advanced level taught by adaptive technique in flipped learning (flipped+adaptive). A placement test was given to experimental and control groups to assess whether all groups show a similar English language level .The results of the placement test did not statistically significant variance between the experimental and control groups in terms of their levels in English.

C. Instrument and Procedures

Tests: The pre-test that consisted of 20 multiple-choice questions was conducted before starting the experiment, it was observed that there is no difference between the students' levels ($\alpha > 0.05$). The Post-test was conducted for all the Control and Experimental Groups. Then ten weeks after starting the experiment, and it was observed that there was a difference between the students' levels in favor of the experimental group ($\alpha < 0.05$) .

D. Data Analysis

The data obtained in the research was analyzed using SPSS (The Statistical Package for The Social Sciences) software. Descriptive statistics such as %, arithmetic mean and standard deviation were used in data analysis. T-test was used in the substance analysis performed for knowledge test. In testing of all hypothesis of the research, .05 significance level was based on and the differences which are significant at .01 were also highlighted.

III. RESULTS AND DISCUSSION

The hypothesis for the first question is:

The differences between the pre test and post test of adaptive+flipped learning environment of beginning and advanced levels are significant.

Another words, are there statistically significant variance at the standard of significance ($\alpha=0.05$) between the mean scores of the students in the experimental group itself according to Bloom's Taxonomy (remembering, understanding, applying)?

To answer this question, T test was applied to measure the importance of the difference between the pre-test and post-test each of the flipped and adaptive technique in flipped environments. The arithmetic mean, standard deviation and the value of (T) between first achievement and last of experimental group (Beginning level) and experimental group (Advanced Level) were calculated according to Bloom's Taxonomy (remembering, understanding, applying) (Tables 1 and 2).

TABLE 1.PRE-TEST POST-TEST EVALUATION FOR ADAPTIVE+FLIPPED LEARNING ENVIRONMENT (ADVANCED LEVEL)

Tests	Value(t)	df	Standard deviation	Average	Sig.(2-tailed)
Pre	17.992	16	1.468	22.18	0
Post			2.856	9.18	

According to the results, for the Experimental group of advanced level, it was observed that the T value was statistically significant at Bloom's three levels (remembering, understanding and applying).

TABLE 2.PRE-TEST POST-TEST EVALUATION FOR ADAPTIVE+FLIPPED LEARNING ENVIRONMENT (BEGINNING LEVEL)

Tests	Value(t)	df	Standard deviation	Average	Sig.(2-tailed)
Pre	3.277	12	2.431	10.08	0.007
Post			3.14	7.23	

According to the results, for the Experimental group of begining level, it was observed that the T value was statistically significant at Bloom's three levels (remembering,

understanding and applying). It was concluded that for both advanced and begining levels, there were significantly difference between pre and post tests. The first hypothesis: "The differences between the pre test and post test of adaptive+flipped learning environment of beginning and advanced levels are significant" is true.

The hypothesis for the second question is:

There are any differences between flipped learning (control group), and adaptive flipped learning (experimental group) for understudies in the third grade students.

TABLE3.COMPARING BETWEEN ADAPTIVE+FLIPPED (ADVANCED) AND FLIPPED LEARNING ENVIRONMENTS

	Value(t)	df	Standard deviation	Average	Sig.(2-tailed)	The level of achievement
Experimental (Advanced)	4.163	38	0.516	3.6	0	Remembering
Control	4.741	19.9	0.668	2.63	0	
Experimental (Advanced)	5.129	38	0.48	3.7	0	Understanding
Control	6.088	21.9	0.68	2.5	0	
Experimental (Advanced)	5.827	38	0.483	3.7	0	Applying
Control	6.639	19.9	0.626	2.43	0	
Experimental (Advanced)	6.861	38	1.054	11	0	Total
Control	8.056	21.3	1.454	7.56	0	

Results of second question for the comparing between (adaptive+flipped) with flipped learning, from the Table 3 it turns out the following: Value (T) became statistically significant at three levels of Bloom levels (remembering, understanding, applying), meaning there are significant differences in the average achievement test in favor of the experimental group (Advanced Level Group) (Table3).

For the beginning level of adaptive flipped learning environment, the value of t became statisticaly significant at three Bloom's levels. According to the findings, there are significant differences in the average achievement test in favor of the experimental group (begining level)(Table 4).

These results agree with many studies [16,17,18,19,20]. These studies indicated that students in distance learning courses that demand on adaptive e-learning earned higher

evaluations than those in the customary classroom setting. Adaptive technique in flipped learning led to changes on the students'levels and this may be due to several factors positive was observed by the researcher, has directly influenced the student achievements.

1) Adaptive techniques in flipped learning such as sound effects, animated video games, Flash applications contain several interactive elements that influenced the level of understanding.These influences have caused excitement in the mental abilities of the student and reflected a positive manner to increase achievement.

2) Provide a sense of fun to study, prevent boredom and this has led to increased demand for learning, which has had a positive impact on high academic achievement rate.

3) Provide the continuous assessment of students, where each lesson tutorial includes electronic tests and a variety of activities.

4) In addition to the presence of the teacher the student has the ability to exercise self-learning also means that there is an interaction between the student and the adaptive learning materials.

TABLE4.COMPARING BETWEEN ADAPTIVE+FLIPPED (BEGINING) AND FLIPPED LEARNING ENVIRONMENTS

Groups	Value(t)	df	Standard deviation	Average	Sig.(2-tailed)	The level of achievement
Experimental (Beginning) Control	9.092 9.097	48 40.9	0.516 0.668	3.25 1.36	0 0	Remembering
Experimental (Beginning) Control	9.016 9.757	48 47.9	0.48 0.68	3.6 1.53	0 0	Understanding
Experimental (Beginning) Control	5.763 6.417	48 46.8	0.483 0.626	2.8 1.23	0 0	Applying
Experimental (Beginning)) Control	9.627 10.862	48 45.4	1.054 1.454	9.7 4.1	0 0	Total

According to post test results, it was observed that the students' scores in experimental group (adaptive flipped) are high for remembering, understanding and applying level (Figure1).
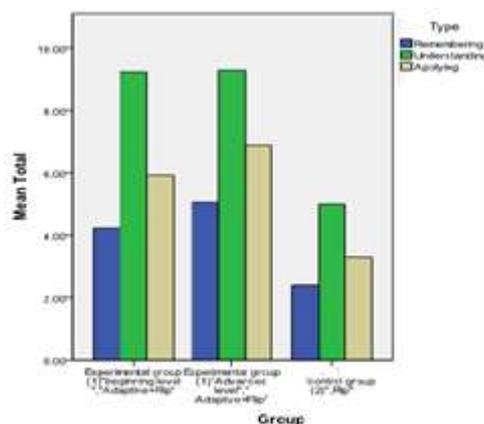

Figure 1. Comparison of post test results in the experimental and control class.

There are measurably huge fluctuation at the standard of hugeness between the mean scores the control, and the trial bunches at the level of ($\alpha=0.05$) in the measurement before the experiment, and measurement after the experiment after the tenth week of the level of achievement according to the classification Bloom (remembering, understanding, applying) for the experimental group of students in the third grade of primary in English.As it turns out there are statistically significant variance at the standard of significance between the mean scores at the level ($\alpha=0.05$) between the mean of the experimental group itself in the measurement before the experiment and after the experiment. Results of second question for the comparing between (adaptive+flipped) with flipped learning it has been observed that value (T) became statistically significant at three levels of Bloom levels (remembering, understanding, applying), meaning there are significant differences in the average achievement test in favor of the experimental group (Advanced Level) (Table3).

IV. CONCLUSIONS

Nowadays, according to scientific and technological developments, the need for ensuring a better education facility for individuals caused using new educational models. Language teaching is very important in early ages. Creativity in teaching techniques can bring effectiveness for learning language. Flipped learning is one of these newest models. Adaptive learning environment which is another innovative model for learning that personalizes teaching for each student by creating a model of the preferences, areas of interest and aims of the students. The adaptive techniques for flipped learning was presented in this paper. Through this model, the student can study before coming to the class and can use his/her own learning style to learn. Pre test was given for determining the prior knowledge levels of the students. According to the results of the test, the students was modelled and they were directed to the appropriate level as beginner or advanced. The sample study was composed of 60 students and it was differentiated into total 2 groups, the number of each class/group = 30 students. The experimental group learned through adaptive technique in flipped learning, the control group learned via Flipped learning . After the experimental process it was observed that there is a difference between the students' levels in favor of the experimental group ($\alpha <0.05$) . The findings derived from the scores of the tests which were given as the pre and post tests indicated that the academic achievements of the students who study in adaptive flipped and non-adaptive flipped learning environments may differ.

As a result of the research, it has been detected that the academic performance of the students studying in the flipped environments with adaptation is significantly different and higher when compared to the flipped environment without any adaptations. It is possible to conduct studies focusing on the

effects of the adaptive environments with different adaptation techniques on the academic performance of students.

From the results obtained from this study, it is clear that adaptive technique in flip learning, which contains several new technologies have an impact on improving the three levels of learning (remembering, understanding, applying) and this led to an increased understanding and comprehension of students. The findings derived from the scores of the tests which were given as pre test and post test indicated that the academic performance of the students who study in adaptive and non-adaptive flipped learning environments may differ.Individual differences are important for the learning environments so it can be said that learning environments designed by using adaptation techniques are effective in improving the performance level of students. For this reason adaptive technique for flipped learning also plays an important role for student centered education. In this way the advantageous and strong aspects of adaptive and flipped learning complete each other.

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