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Devising New CLA Methodology in Teaching Programming Using Flipped Learning with Counterpart Learner Assistant - CLA

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Abstract

The focus of the research study is to devise a new CLA methodology in teaching programming using flipped learning using a counterpart learner assistant -CLA from the learner side. Investigated the benefits of the flipped learning pedagogy focusing on assessment of learners on their attitudes, motivation, and effectiveness when using flipped learning compared with traditional classroom learning has been realized. There is a difference between a Flipped Classroom and Flipped Learning. These terms are not interchangeable. Flipping a class can, but does not necessarily, lead to Flipped Learning. Four broad categories of instructional approaches for use in an flipped learning have been identified: (a) individual activities, (b) paired activities, (c) informal small groups, and (d) cooperative student projects. The research study is based on the theory of Bloom's revised taxonomy of cognitive domain. This taxonomy provides six levels of learning discussed in the research methodology section. In order to analyse all this, a case study experiment was realized and insights as well as recommendations are presented.

Keywords: flipped classroom, programming robotics, effectiveness of learning, flipped learning paradigm
JEL classification: A23

Introduction

The flipped classroom is a new pedagogical model where lectures and lab and practical elements of a course are given to students prior to their class. Short video lectures are required to be viewed by students at home before the class session, while in-class time learners have to do exercises, projects, or discussions. It is kind of a reverse classical classroom.

As a relatively new model of instruction, educators understandably desire evidence that the Flipped Learning model has a positive impact on important student outcomes, including achievement and engagement.

The technological innovations and different collaboration tools have changed the face of education (Alimisis et al, 2007). Using new technologies students can organize their learning process independently and become an active learner instead of the passive learner (Holmbom, 2015). This situation forces the education

paradigm (EDUCAUSE Learning Initiative, 2012) to change from traditional instructor-centered to student-centered classroom. Therefore, technology plays a big role in this change by using its various online/offline tools and devices. We have been evidencing that the modern technology plays a significant role in our education system.

Besides, exploitation of robotics in educational processes (Moeller and Reitzes, 2011) has dramatically increased recently. According to Alimisis et al., 2009 what makes robotics studies attractive for educationists is that it's trans-disciplinary and project-based nature which offers "major new benefits in education at all levels." (Martin el al., 2000) "Robotics uses 21st century technologies and can foster problem solving skills, communication skills, teamwork skills, independence, imagination and creativity".

According to Mataric, 2004 using robotics in education as a tool enhances student learning and motivation (Martin el al., 2000). Moreover, providing robots for students and schools is easier than before. Many schools in the world have started to implement brick-based robotics classes to develop constructionist learning and student thinking (Mataric, 2000).

This allows children to add computation to traditional construction method (Muntner, 2008). "Robotics is an excellent tool for teaching science and engineering, and it is a compelling topic for students of all ages. However, the art, science, and pedagogy of teaching hands-on robotics is still in its infancy."

Literature review

In recent years, the flipped classroom has become one of emerging technologies in education and it can be a standard of teaching-learning practice to foster students' active learning in higher education (Bergmann et al., 2013; Bishop et al., 2013). The flipped classroom is an approach to teaching and learning activities where students watch a video lesson outside the class through distance learning and have hands-on activities in the class. According to Estes et al., 2014 note that the flipped classroom or reverse classroom is an element of blended learning, integrating both face-to-face learning in the class through group discussion and distance learning outside the class by watching asynchronous video lessons and online collaboration. Flipped classroom is also known as a student-centred approach to learning where the students are more active than the instructor in the classroom activity. In this case, the instructor acts as a facilitator to motivate, guide, and give feedback on students' performance (EDUCAUSE Learning Initiative, 2012). Hence, by applying the flipped classroom approach to teaching and learning activities, the instructor can move the traditional lecturer's talk to video and the students can listen to the lectures anywhere outside of class. The flipped classroom allows students to watch the video according to their preferred time and need, and they can study at their own pace; this type of activity also increases students' collaborative learning in distance education outside the class. Thus, by flipping the class, the students will not spend so much time listening to long lectures in the classroom, but will have more time to solve problems individually or collaboratively through distance learning with peers.

With the flipped model (Fetaji et al, 2016), the lower levels are presented before class through recorded lectures and video. Readings, simulations, and other materials also provide this foundational support for learning so that in-class time can be spent working on higher levels of learning from application to evaluation. In flipped classrooms, students go from the lowest level (remembering) to achieve the highest level (creating). (Ivanova et al.,2009) mentioned that the flipped classroom focuses on how to support the learners in achieving a higher level of the taxonomy

domain. Additionally, EDUCAUSE Learning Initiative, 2012 added that in flipped learning, classroom activity is spent on application and higher-level of learning rather than listening to lectures and other lower-level thinking tasks. As shown in Table 1, implementing flipped learning allows the students to spend more time supporting higher-level learning tasks such as a group discussion, while lower-level tasks such as knowledge and comprehension are completed independently outside the class.

Research methodology

The research study methodology used was action research and empirical research. Used quantitative and qualitative methods at the same time using triangulation to determine the results. Participants of this research are divided in three groups of the first grade students. One of the classes are assigned as a control group, and other two are assigned as the experimental groups. Initially it was taken a preliminary survey from all groups. This survey questions will aim to realize the student's background knowledge of the topics, usage of the internet and other technological devices. Have utilized the learning management system called Schoology. Each group register to their own online group called "Robotics Course" on Schoology. After registering, students could access the online posted materials in this course. The main materials are high quality recorded topical videos, presentation files, and worksheets. Also required some physical tools like flash drives, CDs, tablets, smartphones and computers.

Students watched short tutorial videos which will cover the main lesson topics at home. This videos are published on the YouTube. The video lengths are less than 10 min. Students are able to follow the instructor's lecture along with the video by re-playing or pausing. To be sure that the video is watched by the students, they will have to take some notes on the video contents to present the teacher. Additionally, at the end of each video lecture there are a small quiz to review the student comprehension.

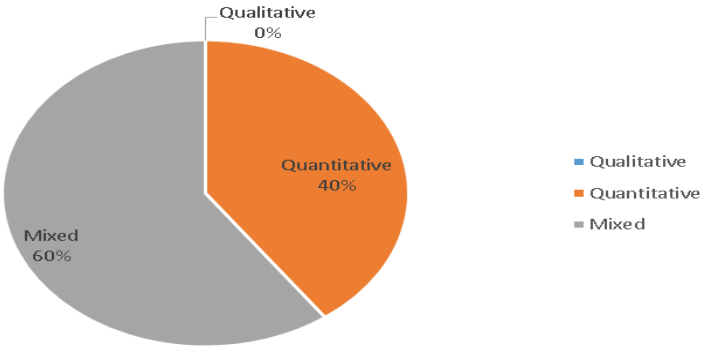
The study of flipped classrooms was based on the theory of Bloom's revised taxonomy of cognitive domain. This taxonomy provides six levels of learning. The explanation is arranged from the lowest level to the highest level:

1. Remembering: in this stage, the students try to recognize and recall the information they receive; they also try to understand the basic concepts and principles of the content they have learned.
2. Understanding: the students try to demonstrate their understanding, interpret the information and summarize what they have learned.
3. Applying: the students practice what they have learned or apply knowledge to the actual situation.
4. Analysing: the students use their critical thinking in solving the problem, debate with friends, compare the answer with peers, and produce a summary. The students obtain new knowledge and ideas after implementing critical thinking or a debate in group activities. In this level of learning, the students also produce creative thinking.
5. Evaluating: assessment or established peer-review knowledge, judge in relational terms; in this stage, students are evaluating the whole learning concepts and they could evaluate or make judgment on how far they successfully learned.
6. Creating: the students are able to design, construct and produce something new from what they have learned (Bishop et al., 2013).

In implementing flipped classroom, remembering and understanding as the lowest levels of cognitive domain are practiced outside the class hour (Fetaji et al, 2016). While in the classroom, the learners focused on higher forms of cognitive work, including applying, analysing, evaluating, and creating. The following Figure 1

illustrates the level of students' learning in the flipped learning according to Bloom's revised taxonomy.

Figure 1
Analyses of research methods applied in investigating flipped learning



Results

Used SPSS to analyse the data. In this questionnaire there are 11 questions cross-checking students' perception of flipped classroom. Since question 6 is a reverse question (asking the same thing from the reverse direction). It should be "recode into the Same Variables" using the Transform menu.

Second step to analyse the data was to find descriptive statistics. I first found the frequencies of the answers to each question. The analysis show that for instance for the 1st question. In total, there are 52 students who took the questionnaire and 19 of them (36.5%) are from the 6th grade and 33 students (63.5%) are from the 10th grade. All of the answers are valid.(100%). For the second question the frequencies are as below.

Table 1
Data analyses of learners

How would you evaluate the Teaching? (In Flipping classroom you participated)				
HhValid	Frequency	Percent	Valid Percent	Cumulative Percent
2	3	5.8	5.8	5.8
3	8	15.4	15.4	21.2
4	15	28.8	28.8	50.0
5	26	50.0	50.0	100.0
Total	52	100.0	100.0	

According to this table out of 52 valid answers 50% of them is 5, 28.8% of them is 4, 15.4% of them is 3,5 and 8% of them is 2. This shows that majority of the students (4s and 5s=78.8%) approve of the flipped learning.

Table 2
Data analyses of Frequencies

Statistics					
		What grade are you?	How would you evaluate the Teaching? (In Flipping classroom you participated)	How would you evaluate the Learning process? (The Flipped classes you participated)	Flipped Classes are more engaging than traditional Classes?
N	Valid	52	52	52	52
	Missing	0	0	0	0
Mean		8.54	4.23	4.27	4.08
Std. Error of Mean		.270	.128	.120	.164
Median		10.00	4.50	4.00	4.50
Mode		10	5	5	5
Std. Deviation		1.945	.921	.866	1.186
Variance		3.783	.848	.750	1.406

As we can see in the table above the type of answers for each question have consistency. The mean and median values for the questions 1, 2, 3 and 4 are very close to each other. (Means = 4.23, 4.27, 4.08, 4.10, medians = 4.50, .4.00, 4.50, 4.00)

This shows that students produced similar answers and treated these questions in the same way. The mean and median values are relatively close to each other for each question. This shows that data set is close to the normal distribution with a little skewness to the right. This results from high frequency of 4's and 5's in students' answers.

A one-way between groups analysis of variance was conducted to explore the impact of the flipped learning on students' learning in robotics class. Students were divided into two groups. First group (group 1) has robotics lesson with the flipped learning methodology and second group has without flipped learning. So comparing these two data set above, used SPSS to get ANOVA statistics.

Conclusion

The research study aim was to devise a new methodology in flipped learning using a counterpart assistant on the student side and investigate and find out whether there is any benefit of the flipped learning pedagogy on the student learning in the Robotics lessons and whether it has any advantages over the traditional teaching methods in the computer science lessons. The importance of this research study is that it may help educators to realize that teacher-student integration is possible to be improved in class time by class activities. Because, doing homework or class work in class time together provides a teacher with communication opportunities with their students (Moeller et al, 2011).

Based on the evaluation feedback and ANOVA analyses shows higher level of knowledge transfer on student side which means they learn more. Comparing the control and experimental groups who are of different ages help us realize the impact of the flipped learning on student learning. This change does not come from only watching a video out of the class. It comes directly from class activities and increases the teacher-student communication. After changing my lesson's atmosphere into "learning by doing" with hands-on activities, project based

learning, problem solving and critical thinking, my classroom has become deeply learner-centered.

Applying flipped learning methodology approach also contributes to better understanding of technology use in teaching and learning activities; students used various technology media in learning activities independently, and in in their teaching practices. The difficulty on a student side is that they lose and cannot focus on their assignments and subjects adequately after three hours of classes. This pedagogy, with teacher-student interactions, may help students use their precious time properly. The other difficulty for the instructors is to prepare the lessons. Preparing an interactive lesson for flipped learning class needs plenty of time and experience for teachers. Capturing or editing a video, creating class activities and sending explanation/messages to LMS must be done before class time. If a teacher is at a beginner level of technology use, that makes many glitches on the way of this methodology. On the other hand, this approach has a few limitations that require further research. Effective use of the flipped learning in class is bound up with many different parameters. One of the most important things is accessibility and motivation on the student's side.

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