



## Effects of the Flipped Classroom in Teaching Computer Graphics

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### ABSTRACT

In the development of the modern education system, the teaching of various subjects creates the ability to apply new methods in practice. The implementation of flipped classroom technology in general secondary schools shows that the emergence of the flipped classroom links pedagogy and learning outcomes, and at the same time, may change future teaching and assessment. identifies gaps in the literature. In this technology, visualization is very important to better understand the structure of 2D and 3D objects with their projection. Thus, the flipped classroom is introduced and the students' activities are monitored. The results showed that using a flipped classroom in a computer graphics course enhances student learning in an interesting way.

### Keywords:

Pedagogy, Teaching methodology, Bloom's taxonomy, Flipped Classroom, Computer graphics, Visualization.

**Access.** Chapter 4 of the concept of the development of the youth policy of the Republic of Uzbekistan until 2025 also touched on the issue of wide use of electronic media products (electronic textbooks) in the educational process. Therefore, students' knowledge of the basics of computer graphics is useful in mastering the science of informatics and information technologies, in performing theoretical and independent work, as well as in conducting professional practices at a high level. With the help of computer graphics tools, it is possible to improve the quality and efficiency of labor-intensive graphic operations while saving time. Computer graphics allows you to quickly and qualitatively prepare pictures, diagrams, drawings and other images.

Flipped classroom is a pedagogical approach focused on student engagement, in which the school helps students apply concepts and approach the subject creatively. Traditional education is an instructional strategy and a type of blended learning that is modified

through the flipped classroom, which is used to deliver learning content outside the (online) classroom. This is one such learning strategy that creates learning through online video lessons created by the National Education Resources channel of the Ministry of Public Education or obtained from any media, reducing theoretical lessons and freeing up time for classroom activities. helps to increase. It helps students learn collaboratively through practice. Using class time, problem solving, group discussion, or debate to help students learn new material outside of class, relevant videos can be used to do more challenging work on mastering that knowledge. The increasing accessibility and improvement of educational technologies open up a wide range of opportunities for students to learn, exchange ideas and create. Computer graphics is a very active field, knowledge is updated every time. A skill is developed to regularly review our educational content and adapt it accordingly. Among students, "Computer Graphics" is an

exciting field that includes new animation techniques, 2D and 3D cropping and visualization and projections. If science is taught in a traditional way, it creates difficulties for students. The purpose of this study is to apply an innovative pedagogy called Flipped classroom to provide a student-centered learning environment in a computer graphics course.

**Materials and methods.** Four Columns of Flipped Class (FLIP). 1. Flexible environment: The learning environment is designed to allow students to be flexible enough to choose when and where to learn. 2. Learning culture: In a learner-centered approach, the flipped learning model helps students learn more about topics during class time, creating deepening and rich learning opportunities. Thus, students can actively participate in the construction of knowledge. 3.

**Targeted Content:** Targeted content is used by teachers to maximize classroom time for student-centered, active learning strategies based on grade level and subject matter. 4. Professional Educator: Professional educators create their own videos using open source video recording software and communicate with each other to improve their instruction. They remain an important component during the training sessions between teachers and students. The six easy steps to implementing a flipped classroom are planning, recording, brainstorming, modifying, grouping, regrouping.

In the process of research, we relied on modern theoretical studies in the process of organizing flipped education. In order to achieve these goals, theoretical analysis and synthesis, teaching experience, question-and-answer, content analysis, Internet resources, and mathematical methods were used. The basis for the research was the personal experience of forming the independence of students in the process of education. The research was conducted among students of the 1st general secondary school of Fergana region, Uzbekistan district. The main objective of this study is to apply flipped classroom pedagogy to

facilitate a student-centered learning environment in a computer graphics course. This study developed an intelligent learning diagnostic system to support the flipped classroom to help students learn and diagnose computer graphics concepts and to help teachers manage students' learning situations.

**Results.** Bloom's Taxonomy was created by educational psychologist Dr. Benjamin Bloom in 1956 to promote higher order thinking in education. Rather than memorizing facts, this taxonomy focuses on analyzing and evaluating concepts, processes, procedures, and principles. In traditional learning, recall and understanding (lower levels of learning - Revised Blooms Taxonomy) occur in the classroom, while students typically engage in activities that involve higher levels of learning outside of the classroom. they have to work. In the flipped classroom model, learning is flipped. Students are obliged to finish the lower level of cognitive work before the lesson. When they come to the classroom, they engage in high-level cognitive learning with their peers and teachers.

The six easy steps to implementing a flipped classroom are planning, recording, brainstorming, modifying, grouping, regrouping. 1. Plan : Plan the lesson you want to use in a self-paced classroom 2. Record : Use open source video recording software such as Screen O Cast, OBS, ShareX to record your content. Video should not exceed 10 minutes. Only then will it be easy for students to listen and understand the concept. 3. Targeted content: Targeted content is used by teachers to maximize classroom time for student-centered, active learning strategies based on grade level and subject matter. 3Share: Send the video to students before class begins . They should watch the video before coming to class. 4. Change: Now students know the new topic before coming to class. 5. Group : An effective way to discuss a topic is to divide the students into groups that are given tasks to complete. 6. Regroup: Share the group's work with everyone and ask questions to deepen the topic. After these six steps, review, revise, and repeat must be done.

The purpose of this study is to use an innovative pedagogy called the flipped classroom to provide a student-centered learning environment in the computer graphics department. Some techniques that can be used in classroom activities are:

Active learning. Allow students to apply the concepts in class, and they can ask teachers for feedback.

- Peer instruction. Students can teach each other by explaining concepts or working on small problems.

- Collaborative learning. Cooperative learning activities can increase student engagement, increase understanding, and develop collective intelligence.

- Problem-based education. Class time can be spent working on problems that can last for an hour.

- Opinions or discussions. Give students the opportunity to express themselves on the spot and develop their own arguments to support their opinions or arguments.

According to Thomas Suselo (2017), teaching computer graphics can be challenging because it requires different skills such as mathematics, physics, programming, spatial thinking, problem solving, art and design. This problem was solved by a systematic literature review that identified the problems, methodologies and approaches reported in teaching computer graphics. The problems listed are: mathematics (Glvez et al., 2008; Hui et al., 2012; Zhou et al., 2010) and core programming (Lowther et al., 2000; Papagiannakis et al., 2014) are lacking. Difficulties in understanding transformations, projections and 3D geometric modeling (Elyan, 2012), Difficulties in solving logical problems (Hitchner and Sowizral, 2000; Talton and Fitzpatrick, 2007) and measuring the connection between theory, programming, application and visual effects installation (Stevenson) and Taube-Schock. 2009). Students have become passive learners and do not interact much with peers and teachers (Peternier et al., 2010, Marti et al. 2006). Traditional methods of education and the teacher the concept of the flipped classroom to modify focused teaching methods was introduced by Bergmann and Sams in 2007

(Bergmann & Sams, 2012). The flipped classroom is a student-centered pedagogy that changes the in-classroom and out-of-classroom learning activities in traditional classrooms (Chen, Wang, Kinshuk, & Chen, 2014). In the flipped classroom, theoretical problems in the classroom are converted into pre-class learning through videos or other media to allow more time in class to discuss, practice, or apply knowledge (Bergmann and Sams, 2014). ). Therefore, the flipped classroom can increase the interaction between teachers and students, give teachers the opportunity to solve the problems of individual students, and give students more time to apply knowledge. enables a successful experience (Lin & Hwang, 2018b). To date, the flipped classroom has been applied to various educational levels and courses (Slomanson, 2014; Teo, Tan, Yan, Teo, & Yeo, 2014).

- Partners listen to the process and offer suggestions if there are difficulties or express confusion if there are parts that are difficult to understand. After the first problem is solved, ask the students to switch roles and start again. In this study, the treatment group consists of 30 students. The pre-test was conducted with multiple choice questions. Data were collected using a questionnaire to determine the perceptions of this group of students about the usefulness of the proposed system.

**Debate.** Various data sources, including prior knowledge test, academic achievement test and questionnaire results were analyzed to evaluate the impact of the proposed approach on student learning performance. The prior knowledge test is designed to assess the students' knowledge of computer graphics before participating in the course: The learning achievement test is designed to evaluate the learning results of the students after the completion of the course. In this study, two tests included 10 multiple-choice test items, and the maximum score of the tests was 100 points. In addition, one questionnaire was designed to obtain the treatment group's perceptions of the usefulness of the proposed system. Students in the treatment group and the control group were asked to take a pre-test

before teaching the computer graphics course. This will be used to determine the initial learning motivation, learning attitude and problem solving skills of the two groups. The students of the control group were taught computer graphics in the traditional way using the chalk and blackboard strategy. As for the treatment group, students were asked to participate in a flipped classroom. Outside of class, students were encouraged to self-study to learn the theoretical concepts of computer graphics by watching video clips sent by the teacher via Google Classroom. Readers can watch the video whenever and however they want. In addition, students completed specific diagnostic assessments to assess their understanding of the proposed system. In the classroom, the teacher helped the students get involved in the activities. After completing all training sessions, all students of both groups were given a post-test. The post-test consisted of 20 multiple-choice questions to assess students' knowledge of animation techniques, geometric modeling, 2D and 3D cropping, and visualization and projections. Statistical software was used for this.

Students in the treatment group and the control group were asked to take a pre-test before taking the computer graphics course. This will be used to determine the initial learning motivation, learning attitude and problem solving skills of the two groups.

This study proposed a flipped classroom through Smart Flipped Management System (SFMS) to support the teaching of computer graphics in a general secondary school. An experimental study was conducted to evaluate the effectiveness of the proposed study. The result showed that computer graphics with the proposed system benefited students more than the traditional classroom in terms of academic achievement. The students of the experimental group had a higher perception of using the flipped class on computer graphics. Conducting the class process in the form of discussions using such modern technologies will support students to have their own opinion, psychological development, and be a leader in the team in the future.

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