UDC 371.133.2

FLIPPED CLASSROOM IN MIDDLE SCHOOL CHEMISTRY TEACHING

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Education systems around the world are being reformed. However, modern advances in information technology and the large-scale development of Internet technologies have opened up completely new areas of research in the field of education. To meet the demands of this changing world, innovative ways of learning are being developed. Students can successfully perceive information not only inside the classroom, but also outside the classroom, using various information devices. In addition, it is necessary to take into account the individual speed of perception of each student. In order to shape the experience of school students in acquiring and applying new information and skills, to improve educational outcomes, the education process is constantly being reviewed. One of the modern learning models is the flipped classroom.

Key words: flipped classroom; middle school; modern technology; chemistry; education

The flipped classroom technology is one of the components of the blended learning technology, which combines face-to-face and distance learning. The essence of the flipped classroom technology lies in the fact that students receive theoretical training on their own by working with electronic resources provided by the teacher.

The originators of the flipped classroom model are Jonathan Bergman and Aaron Sams, high school chemistry teachers from Colorado, who in 2006 first figured out how to provide their lectures to athletes who often skip classes, and then developed this idea into a new educational direction.

Flipped classroom (or flipped learning) has two defining components: moving the lecture out of the classroom, usually delivered by electronic means, and moving practical assignments for application, formerly homework, into the classroom [1, p. 10]. Currently, there is no single flipped class model. This term is widely used to describe any structure of the pedagogical process, which involves the provision of recorded lectures to students, followed by practical and laboratory work in the classroom, while traditional lectures are not given. Typically, teaching material is provided in the form of slides and short videos that include teacher commentary. Instead of video, in many cases, audio recordings can be used, containing an explanation of the material posted on the slides. The flipped classroom technology has a range of advantages over traditional teaching, which includes classroom lectures, and is now increasingly used in the educational process in various countries, including the teaching of chemical disciplines [2, p. 85].

During the implementation of this model, students independently, in the course of doing homework, master the theoretical material, and the work in the classroom is as follows: students actively discuss the problems of the educational topic, clarifying key issues, and perform practical tasks in order to develop skills in applying the studied material. Thus, it allows you to reverse the learning process. At the same time, the teacher acts as a consultant and organizes joint activities on the topic studied: discussion in groups, solving problems, creating mini-projects, conducting laboratory experiments.

To implement the flipped classroom model in the process of studying chemistry, the following platforms can be used:

1) Screencasts with an explanation of theoretical material (Screencast-O-Matic service). A screencast video tutorial created with a screen capture program. The peculiarity of this format is that the use of sounding of the material makes it possible to include not only the visual, but also the auditory memory of students.
2) Use of Google services. Google Forms provide the ability to create self-validating questionnaires and tests. For flipped learning, it is important that the test can be supplemented with a video, illustrations, texts.
3) YouTube provides video hosting services. Users can add, view, rate and comment on various videos [3, p. 40].

S. B. Veledinskaya singles out the following components of the structure of the flipped classroom model in secondary school: pre-school, which ensures independent work of schoolchildren in mastering theoretical material, solving a problem task (preparation for a lesson) in an electronic environment (electronic course); lesson – practical work in the lesson, which is a continuation of the independent work of students, and post-work, aimed at consolidating the material of the discipline in the electronic environment [4, p. 8].

However, taking into account the specifics of chemistry, the process of teaching chemical disciplines includes not only the development of theoretical foundations, but also the disclosure, illustration of the main provisions of the theory in the framework of a laboratory workshop, instills skills in handling substances, chemical glassware, and forms research skills. Therefore, the “flipped classroom” model in the process of teaching chemistry includes pre-class work, which involves independent work in preparation for classes. Lesson work consists of students' activities in analyzing the main provisions of the discipline, solving chemical calculation problems, acquiring skills in performing a chemical experiment in laboratory work. Subsequent post-work work is aimed at consolidating the material of the discipline by completing assignments, preparing a report on laboratory work and its subsequent defense.

As homework, the teacher offers a task in the form of a training video (created independently using the Screencast-OMatic service or already available, taken from the YouTube service), giving detailed instructions for working with it. In the process of watching the video, students get acquainted with the topic, having previously completed the tasks necessary for further work in the class. Further, directly during the lesson in the classroom, the study time is devoted to discussing the content of the theoretical material, testing and practicing knowledge. The teacher may offer a mini-test with a self-examination on the topic studied and, based on the results of the passed test, tasks are given individually to each student. For example, students who passed the test without errors prepare a mini-lecture for classmates who made one mistake – they perform additional practical tasks, and students who did not cope with the test work with the conceptual apparatus. At the end of the lesson, each group presents the result of their work.

Among other things, students have the opportunity to enter into a discussion, during which particularly difficult issues are resolved. The teacher in the classroom advises students, encouraging their independent actions and teamwork. It organizes, supports, directs and provides feedback. At the same time, the role of the student also changes: he becomes an active participant in the educational process.

Let's consider the stages of the flipped classroom model using the example of studying the topic 'Metals' in high school.

The first stage is pre-class work, which involves independent preparation of students to master the theoretical material. Schoolchildren are given the task to independently compose a basic lecture notes on the topic using electronic educational resources: lecture notes, presentations, video lectures, and online lectures. Thus, by the lesson, students already have basic knowledge of the topic and are ready to perceive more complex issues.

The second stage is lesson work, which involves obligatory feedback, through a mini-survey, commenting on the mistakes made by students when completing assignments, and the teacher's answers to questions that have arisen. Then the main provisions that need to be mastered when studying the topic 'Metals' are discussed. Students receive individual tasks aimed at developing the ability to write equations for chemical reactions occurring in electrochemical systems.

The third stage is post-work, which involves consolidating the material covered, finalizing the basic abstract on the topic 'Metals', developing the skills to use it when describing the operation of a galvanic cell in the course of an individual task. To this end, students independently work with computer training programs, simulator programs 'Galvanic cell', 'Corrosion of metals', 'Electrolysis', finalize the reference notes.

The fourth stage is pre-class work, which involves the independent preparation of students to perform laboratory work. Students get acquainted with the methodical instructions for laboratory work posted in electronic access, perform virtual laboratory work, prepare a template for a report on laboratory work, and finalize an individual task.

The fifth stage is lesson work, which involves the implementation of laboratory work. The admission to the performance of the work is an individual task completed by the student, a test placed in the electronic environment for mastering the methodology for performing a chemical experiment, safety precautions when performing it, the features of its conduct, formulating a hypothesis in accordance with the purpose of the experiments, predicting the results.

The sixth stage – post-work – involves the finalization of individual tasks, correction of errors, preparation of a report on the completed laboratory work and its placement in an electronic environment for verification by the teacher.

The seventh stage – pre-school work – is preparation for a practical lesson includes writing an essay on the topic 'Metals in everyday life' (each student is offered his / her own metal) with its placement in an electronic environment, evaluating the essay in accordance with pre-discussed criteria.

The eighth stage – lesson work – is a practical lesson, students solve calculation problems. The essay is being analyzed. Further, using an interactive whiteboard or a multimedia projector, a collective defense of reports on laboratory work is carried out. During the defense, the activity of students, their participation in evaluating the design of a classmate's report, and the level of assimilation of the material are assessed. Particular attention is paid to the interpretation of the results, the literacy and validity of the conclusions.

Then comes post-lesson work, which completes and includes the revision of the report, if errors are found in it in the process of defending, checking the level of assimilation of the material by performing tests.

The introduction of the flipped classroom model in the organization of a chemistry lesson provides students with the opportunity to effectively organize their own educational and cognitive activities using the electronic environment, in particular, create a glossary on the topic, write essays, build logical and semantic models, perform test tasks, conduct group research, which increases the activity and meaningfulness of their activities in the classroom. Independent preparation of students to perform a chemical experiment in a laboratory workshop frees up time for laboratory work, which is important in the context of the formation of professional competencies of future metallurgical bachelors [5, p. 143].

Thus, this technology can be recommended to teachers for organizing the educational process, since it is a form of learning that stands between offline learning and distance learning. A student in the modern view is an independent subject, ready and able to constantly learn new things, independently obtain and apply the necessary information, and the "flipped classroom" model becomes a fairly effective tool for solving these problems. This technology allows creating conditions for self-development of students, gives them the opportunity to demonstrate their level of education. Motivation for learning increases and, in connection with this, the quality of education is increased.

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