The organization of students’ project practice based on cloud technologies

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Abstract. The organization of project activities of students is discussed. Main stages of the project creation are highlighted and the activities of students at stage are presented. Main advantages of using cloud-based software in the educational environment over traditional educational software are considered. The selection of cloud services for their use at various stages of the project activity in accordance with the requirements of the educational process is presented. The proposed algorithm for organizing the project activities of students is illustrated by the description of the work on the project on the topic "Parabola in Physics and Practical Human Activity. The presented materials were tested by the authors at the Faculty of Physics and Mathematics of Moscow Region State University during training sessions.

Introduction
Modern society is characterized by the development of information technologies that are being introduced into all spheres of human activity. They make the life of modern society more comfortable, contribute to improving the quality and efficiency of work. The study of information technologies is especially important now, they not only change the surrounding life, but also affect the forms and content of education. Such technologies make it possible to interest students, intensify the process of studying educational material, and also improve the quality of training. The issue of using information technologies in the professional activity of a teacher remains relevant, especially with the advent of cloud technologies.

Cloud technologies are a good alternative to the classical educational model. Cloud technologies allow the studying field to raise the educational process to a new level. Nowadays, there are a large number of different Internet services that a teacher can use in the classroom, including services based on cloud computing technology (e-mail, office programs, data storage services, etc.). They can be used for educational purposes not only as a fundamentally new tool, but also as an alternative to traditional software, allowing the studying field to build an educational process taking into account the strengthening of the activity component in training. Cloud technologies provide personal orientation of students, involving the development of the abilities of each of them; create conditions for the individualization of their education, taking into account their interests, abilities and inclinations; they provide an opportunity for the development of students’ creativity, through the use of the educational content formed by the students themselves in the form of creative educational products.

The conducted research shows that cloud technologies have a great didactic potential in the organization of project activities of students, which is an integral part of training, and the use
of cloud services makes it more successful. Project activity encourages students to show the ability to comprehend their activities, goal-setting, self-education and self-organization, forms the ability to synthesize, integrate and summarize information from various sources, make the right choice and make informed decisions.

The implementation of project activities in practice leads to a change in the position of the teacher and is determined by the principle of pedagogical support for the development of the student during the project work. From a carrier of ready-made knowledge, he turns into an organizer of the student’s cognitive activity. In the conditions of the modern educational space, information technologies, in particular, cloud technologies, open up new opportunities for preparing students for project activities, and during the implementation of creative projects, they allow them to activate their cognitive activity, contribute to increasing interest in classes, which creates favorable conditions for the consolidation of subject skills and the formation of universal educational actions.

1. Methods

The analysis of scientific and methodological literature was carried out, the experience of teachers on the organization of project activities of students was systematized and generalized. The results obtained showed that it is advisable to divide the work on the project into four stages:

- the problem-target stage;
- the stage of development of the script and the technical task;
- the stage of direct execution of the project task;
- the stage of public protection of the project.

Each stage has its own goals, tasks, and features. To increase the success of passing each stage, it is important to choose the right cloud technologies necessary for this stage. The selection of cloud services should be carried out on the basis of their functionality, as well as in accordance with the requirements of the educational process, the logic of building project activities and taking into account the individual characteristics and needs of the student. At all stages of work on the project, the following services will be in demand:

- Yandex Teleconference (Google Meet or Zoom) – will allow you to organize working meetings to discuss the progress of the project phases. Link to the service: https://telemost.yandex.ru/
- Trello (Evernote or Nimbus Note) – will help you effectively solve work tasks and coordinate actions, track tasks, share information with project participants. Link to the service: https://trello.com/
- Yandex. Disk (Google Docs or OneDrive) - will allow you to store the data necessary for the implementation of the project. Link to the service: https://disk.yandex.ru/
- Word Online (Google Documents or Zoho Documents) - can be used to create reports during the work on the project. Link to the service: https://office.live.com/start/word.aspx?ui=ru-ru

During the implementation of the project, students need to briefly record a report on their actions in electronic form and back it up with "screenshots" made, which should reflect the key points of the project. They can be made using the browser extension Lightshot or Nimbus Capture. The report on the progress of the project in electronic form should be provided to the teacher in the form of organizing access to view the relevant document and notification by e-mail.

We will describe the actions of students at each stage of work on the project and the cloud services used. At the problem-target stage, the project topic is selected, its goals and objectives
are determined, a short summary of the project is written (why, for whom and what is this project aimed at). At this stage, it is assumed that the students and the teacher will work together. The following services can be used to ensure collaborations:

- Services for video conferencing: Yandex Teleconference, Google Meet or Zoom can be used to discuss the topics of the project, the stages of its implementation, monitoring the activities of students.
- Services for creating and sharing notes and tasks: Trello, Evernote or Nimbus Note can be used to discuss project ideas, exchange views on the implementation of project stages, and distribute project management responsibilities.
- A text editor included in one of the integrated Office Online software packages, Google Docs or Zoho Office can be used to write a project annotation and conduct its discussions, using the means of document sharing and built-in chat. The service allows several users to simultaneously work in a document, leave comments in the text, discuss important points in a chat.

At the stage of developing the scenario and the technical task, the content of the educational material is selected in accordance with the project objectives; the funds necessary for the implementation of the project are selected, namely, the resources on the basis of which the project will be implemented and the corresponding Internet services based on cloud technologies are determined. The result of the activity at this stage will be a work plan, with a detailed description of all the intermediate results and an indication of the resources needed at each stage.

At this stage of the project activity, joint work is still being carried out, during which it is advisable to use the cloud services described at the previous stage. At each stage, it is necessary to make adjustments to the project and for this you can use the note and task services Trello, Evernote or Nimbus Note.

An important role in the project activity is assigned to the third stage, the stage of direct execution of the project task. At this stage, the project implementation stages are discussed in the team and the distribution of responsibilities, the creation of references, and then the direct construction of drawings and the creation of a three-dimensional model of the object based on the scenarios thought out at the previous stages and using the services selected at the previous stage.

This stage can be presented at two levels: theoretical and practical. At the first level, there is a theoretical study of the problem under consideration and the construction of a theoretical model of the product that is supposed to be obtained as a result of the design, as well as a description of the algorithm or scenario for obtaining it. At the second level, there is a direct production of the necessary product provided for by the task. The project activity at this stage is accompanied by the use of additional cloud services.

- Photoshop Online (Pixlr Editor or Fotor) - for creating collages with references (auxiliary images) on the topic of the project in order to more effectively display the conceived idea. Link to the service: https://online-fotoshop.ru/
- WolframAlpha (Excel Online or GeoGebra) - for the implementation of a design project in the form of a mathematical model of a graph. Link to the service https://www.wolframalpha.com/
- Sketch Up (Tinkercad or 3D Slash) - for the implementation of a design project in the form of a three-dimensional model for the subsequent implementation of the project in real life. Link to the service: https://www.sketchup.com/ru

Let’s consider the functionality of the selected services. The WolframAlpha cloud service allows you to plot a function using a knowledge base and a set of computational algorithms,
allows you to combine calculations, graphics, interactive examples and notes in a single document in the working environment; can perform interactive manipulations, i.e. turn static examples into dynamic models in real time to easily visualize complex concepts; make a presentation in the form of a slide show with interactive elements that can also be edited in real time.

Creating collages with references (auxiliary images) on the project topic, which allows you to more effectively display the conceived idea of the project based on previously existing projects, can be implemented in the services Photoshop Online, Pixlr Editor or Fotor. These services allow you to create collages, perform color correction of finished images, use retouching, apply effects, draw images from scratch to create a sketch of the project in the format of a two-dimensional image.

To implement a design project in the form of a three-dimensional model for the subsequent implementation of the project in real life, you can use the services Sketch Up, Tinkercad or 3D Slash. These services are used for three-dimensional design and architectural design.

To create a video clip showing the step-by-step execution of the project in the selected service, you can use such cloud services as Nimbus Capture, Prezi Video or YouTube Studio.

The result of the activity at this stage should be the consistent implementation of all actions for the development and receipt of the desired final product provided for by the project, according to the developed algorithm or scenario for its receipt.

The fourth stage of project activity is the stage of public protection of the project. This is an important stage of presenting the results of the work, proving their compliance with the task. Public defense shows the depth of immersion in the project of students, awareness of its implementation, the ability of students to reveal the main characteristics of the resulting design product. At this stage, students develop the ability to present the products of their own activities, develop communication skills.

The main service that will be used to present the results of the project will be a service for creating, editing and sharing multimedia presentations. You can use the following services based on cloud computing technology: Canva, Power Point Online, Prezi Prezent or Zoho Show. In addition, during the project defense, students can demonstrate videos recorded at the previous stage with step-by-step descriptions of creating a real object provided for by the project.

The conducted research shows the possibility and proves the feasibility of using cloud technologies in the organization of project activities of students. The demand for cloud technologies in the organization of project activities is due to the fact that constant feedback is provided, the full history of the project creation is preserved, it is possible to provide timely assistance to students, and all its participants who are at a distance from each other are given the opportunity to work together on the project. Cloud services are a universal resource that allows you to build graphs, perform mathematical calculations, create tables, presentations, take screenshots of screens, screencasts, mount videos and much more.

2. Results
The proposed algorithm for organizing project activities can be illustrated by describing the work of students on a project on the topic "Parabola in physics and practical human activity". The purpose of this project is to introduce students to the use of the properties of a quadratic function and its graph in physics and practical human activity.

During the project, students understand that parabolas (the graph of a quadratic function) surround us everywhere and are an integral part of our life: physics, technology, ballistics, astronomy, architecture, bridge construction and much more. Cosmic bodies, comets and asteroids, pass near large space objects along a trajectory shaped like a parabola. In everyday life, parabolas are found in various lighting devices, this is due to the optical properties of the parabola associated with focusing and defocusing light rays. In nature, we see it in flowers that bend down to the ground and form a parabola shape. Mountain peaks, rocks and depressions
also have a shape in the form of a parabola. The parabola can be seen in various arches of bridges, suspension bridges, gorges, in ancient windows, fountains of cities, whose jets form the shape of a parabola. This form can be found in famous historical buildings - the Colosseum, the Eiffel Tower.

During the project, students study the movements of a body thrown at an angle to the horizon. They can conduct an experiment with a hose and find out under what conditions the water jet from this hose will have the maximum range, then find a justification for their hypothesis.

Another task in this project may be to consider the shape of the water jet at the fountain. It is advisable to offer students to make a sketch of a fountain invented by them. Students can draw a sketch of the fountain in a raster editor, for example, Photoshop Online or Pixlr Editor, or in a vector editor, for example, Janvas. In the Sketch Up service, students can create a ready-made design project of a fountain, which can be presented as the final product of the result of the project activity of students.

3. Discussion
The described possibilities of students’ project activities using cloud services indicate their great educational capability. The developed algorithm for organizing project activities using cloud technologies was tested in educational practice at Moscow State University, and its implementation led to positive changes in several areas: the level of motivation of students increased by an average of 10%, and the indicator of the quality of knowledge increased by 15%.

4. Conclusion
The results of the research described in the article show the possibilities of cloud services in the organization of project activities of students and the importance of establishing the relationship of the studied theoretical material with practical activities for the development of students’ interest in further studying the subject and the use of cloud services in solving practical problems.

Cloud services have unique functionality that is not typical for the traditional software environment of personal computers and mobile devices, familiarity with which will allow students to form ideas about the popular functions of modern cloud systems.

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