

# IMPLEMENTING EDUSCRUM METHODOLOGY IN ONLINE PROJECT-BASED LEARNING

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## ABSTRACT

Design activity is one of the most important components of the professional image of a modern engineer. This type of activity significantly increases the effectiveness of educational programs. The participation of students in the implementation of complex projects on real topics contributes to the rapid acquisition of professional competencies. The EduScrum methodology allows students to participate in real project team activities and effective interpersonal interaction. The most serious challenge of our time is the COVID-19 pandemic. Forced restrictions on personal contacts damage business processes. However, the correct process control mechanism ensures their stability. The functionality of the EduScrum methodology allows the project activities to continue. The efficiency of project activities in the field of IT projects has even increased in some cases. The restrictions helped to optimize the project activities of the team. It was revealed that the high efficiency of the CDIO methodology implementation is ensured by the involvement of students in the implementation of socially-oriented IT projects. The impact of project activities on increasing motivation and academic performance was assessed.

## KEYWORDS

Team project activities, Distant learning, EduScrum, Standards: 3,5,7.

## INTRODUCTION

Engineering students need the competencies of practical project activities in a team. One way to do this is through the CDIO initiative. The success of the initiative is largely based on the use of Project-Based Learning (PBL) in the educational process (Crawley E. F., Malmqvist J., Östlund S., Brodeur D. R., &Edström K., 2014).

In accordance with standards 3, 5, 7 of the CDIO initiative, Surgut State University implements project-based learning. The main focus is on the project activities of students in teams.

Due to the limitations of the COVID-19 pandemic, most students are now studying online. Face-to-face interaction is minimized. However, team project activities can be effectively carried out in accordance with the EduScrum methodology. This methodology can be successfully adapted for organizing project activities online. It can be most effectively applied in IT projects. The Conceive and Design stages can be efficiently implemented online. There are many free and paid services for organizing video conferencing and teamwork. In student IT projects, most often, the implementation of the Implement and Operate stages does not

require complex implementation at the hardware level. Often, the functionality provided by existing IT services and platforms is sufficient.

## **ARRANGE OF PROJECT ACTIVITIES ONLINE**

In practice, it has been proven that the intensive use of project activities throughout the entire period of study at the university contributes to the effectiveness of the educational program (Standards 3, 5, 7). Education with a systematic, intensive use of project activities ensures the formation of fundamental engineering competencies of students (Grishmanovskiy P., Grishmanovskaya O. & Zapevalov A., 2020), (Rebrin O, Sholina I., & Berestova S., 2014). The experience of colleagues proves that the use of project activities motivates students to a deeper study of the professional field (Siong, G., & Thow, V. S., 2017), (Nguyen-Xuan, H., & Sato, K., 2018).

At Surgut State University, the project activities of students enrolled in the "Software Engineering" program are organized according to the EduScrum methodology (Zapevalov A., Kuzin D. & Grishmanovskiy P., 2020). EduScrum methodology is detailed in publications (Delhij, A., van Solingen, R., & Wijnands, W., 2015), (Wijnands W., & Stolze A., 2019). This methodology is a further development of Scrum (Sutherland, 2014), adapted for the education system. There is a successful experience of using Scrum and EduScrum in a number of universities - members of the CDIO initiative. (Ferreira, E. P, & Martins, A., 2016), (Paul, R., & Behjat, L., 2019).

The eduScrum team consists of a curator who is assigned the Product Owner role and student teams of 3 to 5 people. Typically, the role of Product Owner is assigned to a teacher. In each team, one of the students is assigned the role of EduScrum Master. The student performing this role is not a leader, he optimizes the work of the team and is engaged in inter-team interaction. The project is divided into several stages called Sprints. In each sprint, one or more project tasks are solved. Sprints can last from 1 week to 1.5 months.

In 2020, the use of the EduScrum methodology has been expanded. Due to the covid-19 quarantine, students studied online. The functionality of the EduScrum methodology has ensured the efficiency of project activities using IT.

### ***Information support for online project-based learning***

To manage the team project activities of students at the Surgut University, a specialized automated information system "AIS Student" has been implemented (<http://student.surgu.ru>). The home page of the system is shown in Figure 1.

The system helps to create interdisciplinary project teams. It works as an exchange of available vacancies in projects for students, and helps the curator (Product Owner) find participants with the required skills. Any registered user can apply for participation in the project with the chosen role and become a member of the project team.

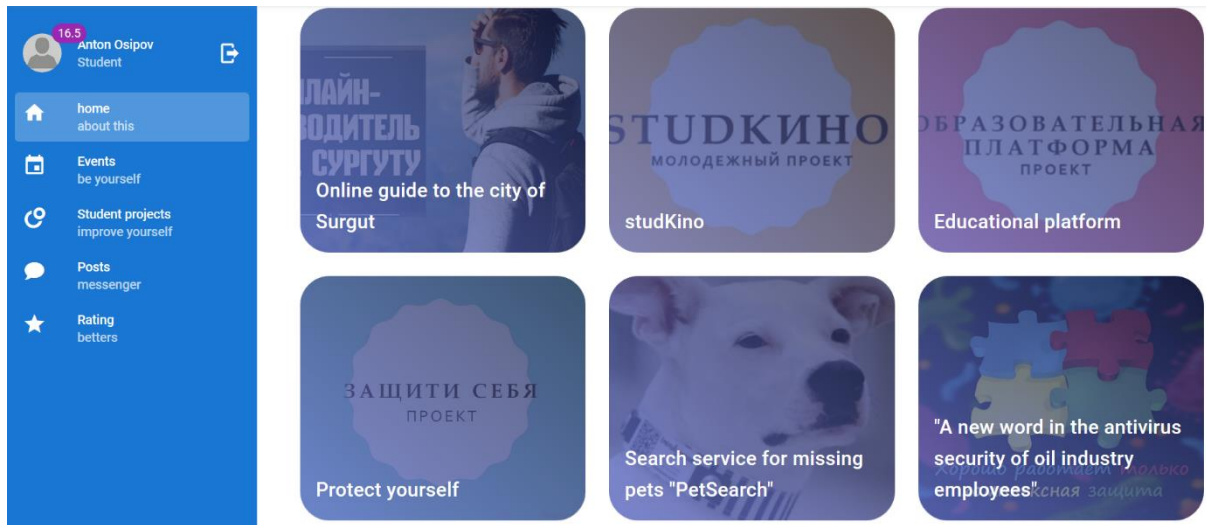


Figure 1. The home page of the specialized information system "AIS Student" (<http://student.surgu.ru>)

Product Owner creates a project in the system, defines its theme, goals, required resources and vacancies for participants. All information about the project is displayed on the project card. Sample project cards are shown in Figure 2.

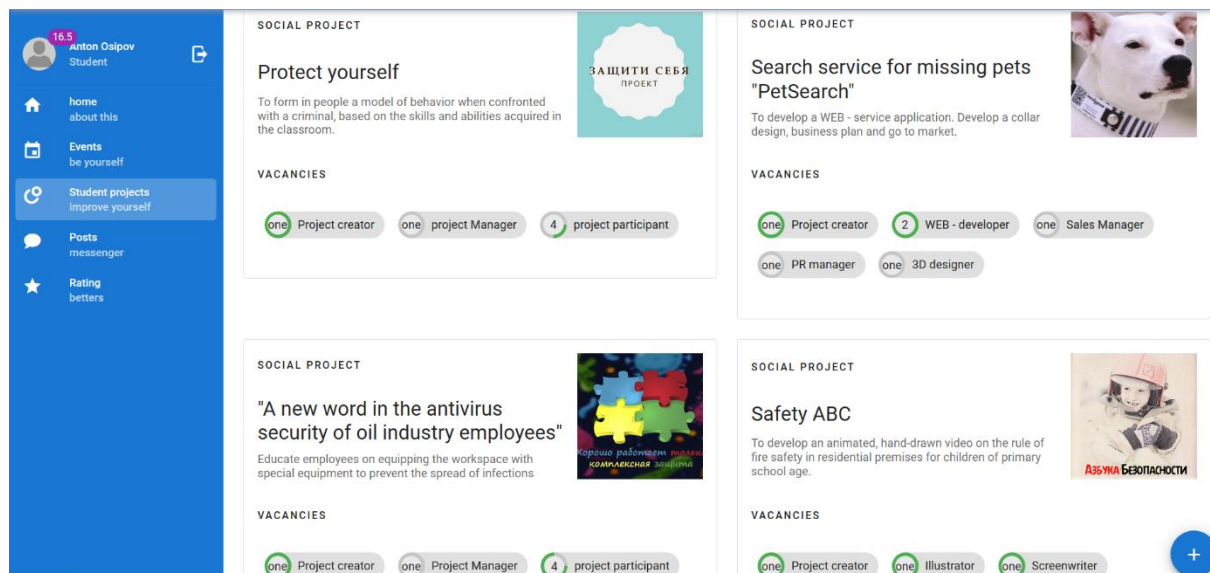


Figure 2. Cards of projects in information system "AIS Student"

### Stage "Conceive"

This stage lasts 2-4 weeks. At the conceive stage of project a team is formed. Typically, students sign up for teams on their own, but the Product Owner can send personal invitations to potential team members. Project cards contain only minimal information. Detailed information on team members, project goals and objectives, planned results and required

resources is contained on the corresponding project page. An example of a project page is shown in Figure 3.

The screenshot displays the project page for 'Implementation of the City Events Map Web Application'. The page is divided into several sections:

- Header:** 'home / Projects / Implementation of the City Events Map Web Application.'
- Navigation:** 'INFORMATION', 'ROLES IN THE PROJECT', 'PARTICIPANTS' (active), 'FILES', 'CHAT'.
- Project Overview:** A map showing event locations with a 'CHANGE LOGO' button.
- Description:** 'Social project' section describing the 'Events Map' internet service.
- Participant List:** A table with columns for ID, Last name I.O., Role, Credentials, and Participation.
 

#	Last name I.O.	Role	Credentials	Participation
92	Korepanov A.	Project creator	Project administrator	EXCLUDE
1094	Potapov V.A.	Backend developer	Participant	EXCLUDE
1099	Bazhenova A.S.	Frontend developer	Participant	EXCLUDE
1095	A. I. Shevchuk	Frontend developer	Participant	EXCLUDE
1098	Khrustal'ov A.	Backend developer	Participant	EXCLUDE
- Vacancies:** A section showing the number of people assigned to each role: Project creator (1/1 person), Frontend developer (2/2 people), and Backend developer (2/2 people).

Figure 3. Project page example in information system "AIS Student"

At the beginning of the project, at the Conceive stage, students, together with the Product Owner, choose a platform for video conferencing. Then the tasks and timing of the project are determined. A Scrum Board is created, a Scrum Master is elected, a calendar of meetings is assigned. The Project Passport is created as the main project document.

Online participation in project activities forces contractors to more thoroughly document all stages of the project than before. It reduces the risk of making or uncoordinated decisions.

### Stage "Design"

At the Design stage, students explore ways to solve the assigned tasks. Changes in interaction procedures are also noted here. Sprints have become more discrete, shorter and more intense. In some teams, the Scrum Master held operational meetings twice a day - morning and evening. Meetings with the Product Owner are held 1 - 2 times a week (Figure 4). The localization of tasks within sprints has increased. This made it possible to increase the speed of project implementation.

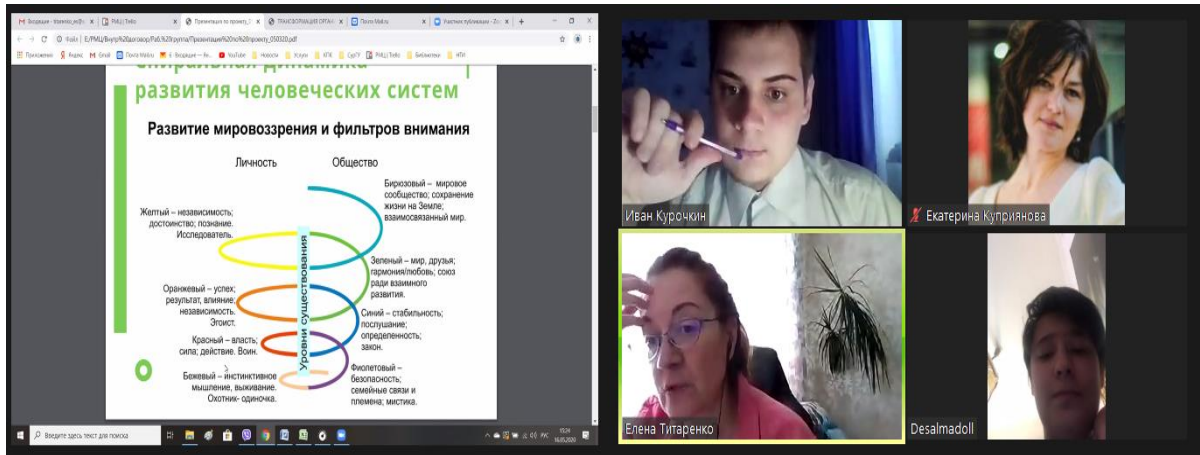


Figure 4. Online meeting of team members

Weekly meetings between one Product Owner and a Scrum Master from different competing teams contribute to a more competitive product. At the meetings, the team leaders present the results of the current stage, talk about project solutions, successes and difficulties.

The analysis of competitor teams allows the Scrum Master to evaluate his team and make adjustments to its work. On the other hand, the team may see some solution or idea that will improve their project. All this has a positive effect on the results of the project.

### **Stage "Implement"**

This sprint implements the concepts developed at the previous stage. The stage lasts 6 to 8 weeks. Software components are being developed. At weekly team meetings, the performance of the work performed is analyzed. The implemented functionality, convenience and friendliness of the interface are evaluated. System components such as client and server are tested together. Much attention is paid to the implementation of human-machine interaction. The result of this sprint is a fully functional prototype of the system.

The EduScrum methodology is most successfully applied in online IT projects. In the spring semester of the 2019/20 academic year, a number of projects have already been completed and implemented. Currently, several competing teams are carrying out a project to create a 3D-model of the university campus in Minecraft. Examples of 3D models of the university building are shown in Figure 5.

A 3D modeling project for the university campus is currently under construction. The teams have already modeled some of the university buildings and are continuing to model other campus buildings.





Figure 5. 3D models of the university building in the Minecraft environment

**Stage "Operate"**

This is the shortest of all stages, lasting 1–2 weeks. At the Operate stage, the results of the project are presented and evaluated publicly. To increase the effectiveness of personal and interpersonal communication skills, a competition of student teams projects is held. During the competition, project teams present their projects to the jury, receive expert opinions and reviews. The jury is composed of PhDs and industry representatives. According to the competition, a rating of teams and an individual ranking of students are built (Figure 6). The rating is published on the AIS "Student " page and is publicly available. The figure shows a small piece of data arranged from top to bottom. At the top of the rating, many students have the same rating value, due to the large number of participants in project activities and the unification of the content of the corresponding academic disciplines.

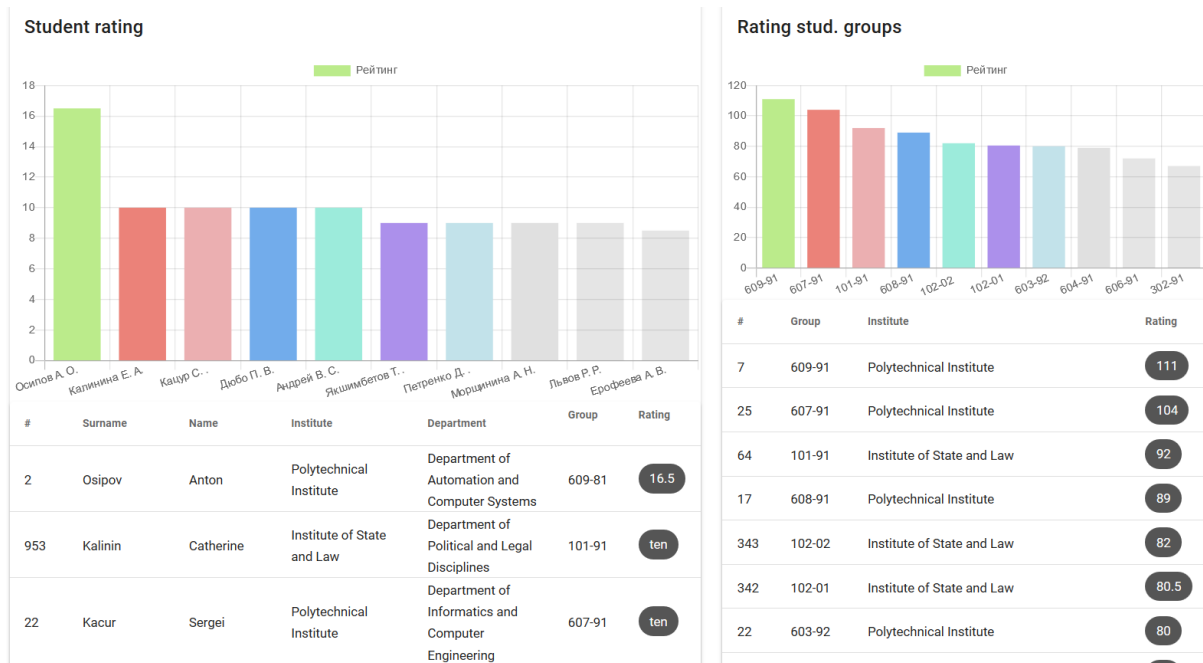


Figure 6. Ranking of students and project teams in information system "AIS Student" in 2020

A significant advantage of socially oriented IT projects is the ability to test them in operation. At the operational stage, the project is at least tested. The project team receives feedback from project users. Based on the feedback received, adjustments are made to the project. In some cases, it is necessary to rethink design solutions or concepts. Maintaining and modernizing the IT system can be a challenge for the next project.

## CONCLUSIONS

This paper presents the practical results of adapting the EduScrum methodology to online learning. The implementation of EduScrum has ensured success in project-based learning. Distance learning experience has shown that the effectiveness of online project activities does not decrease, and sometimes even increases. This conclusion was made based on the results of comparing the assessments of students studying full-time and students studying online. In many disciplines there is a slight decline in student performance, but in project-oriented disciplines, academic performance persists or increases.

EduScrum has proven to be more effective online for IT projects compared to other types of projects. This is due to the high importance of information technology in organizational and communication procedures for online learning. The limitation of personal contacts due to the pandemic has contributed to the modernization and optimization of project activities.

Successful experience of using the EduScrum methodology online together with AIS "Student" contributes to the expansion of the scope of projects.

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## BIOGRAPHICAL INFORMATION

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