

## USING DISTANCE EDUCATION TECHNOLOGY IN DEVELOPING STUDENTS' PROGRAMMING COMPETENCE

**Yarashov Shokhrukh Tolmas ugli**

Independent researcher at the Department of  
"Digital Technologies" of Navoi State University

**Abstract.** This article presents proposals and recommendations for using distance learning technologies in developing the programming competence of students in higher educational institutions.

**Keywords:** distance learning, information and communication technology programming, competence, project, platform.

In the country's higher educational institutions, research is being conducted on the active use of modern scientific and technological achievements in computer technology and their integration into the educational process, management, and educational activities. If we consider information and communication technologies as a set of various solutions (computer programs, the latest versions of software created by manufacturers, high-speed internet access), it can be said that the use of distance learning technologies in developing students' programming competence is effective [1]. It has the following advantages:

- simultaneous engagement of a wide audience;
- teaching students to program as a team;
- online programming training based on attracting students from other regions;
- programming training for students with disabilities.

It should be noted that if an educational organization implements curricula in programming disciplines using distance learning technologies, it is important to ensure an appropriate level of training for faculty, management, and support staff, as well as to conduct advanced training to develop their programming competence.

In the practice of programming, distance learning is an interactive interaction between the faculty and the student; programming reflects all components (goals, content, methods, organizational forms, teaching aids) inherent in the educational process, and the capabilities of information and communication technologies are realized (operational communication between the user and the educational tool, collective project preparation, program code analysis, archiving, transmission, and processing of large volumes of information, automation of computational processes, information retrieval activities, processing of educational experiment results, automation of information and methodological support, organizational management of educational activities, and monitoring of learning material mastery results).

Given the aforementioned advantages of distance learning in teaching programming, it is advisable to use it in today's conditions of globalization. The potential of distance learning technologies is directly linked to the positive aspects of integrating information and communication technologies into programming education in educational institutions, including higher education institutions:

- the ability to create an individual distance learning trajectory for each student, allowing for the adaptation of the programming learning process to the developmental needs of the individual;
- each student can follow an individual schedule when learning programming (for example, studying at night), which allows them to improve their skills or study without interrupting their professional activities;
- the economic efficiency of distance learning is ensured by the affordability of such education;



- mobility, openness, and accessibility, i.e., access to the distance learning website, lecture materials, and practical assignments from any internet-connected device (computer, tablet, laptop, phone, smartphone, PDA, etc.), and the development of logical, algorithmic, and creative thinking related to listening and programming for students with disabilities.

It should also be noted that distance learning technologies allow participants in the programming educational process to quickly exchange information on problems arising during the learning process and to create various practical projects as a team. In this case, students can quickly receive advice from the faculty regarding various aspects covered in theoretical materials and the quality of completed practical assignments, receive comprehensive information about intermediate or final grades, and have additional opportunities to correct intermediate results, etc. This aspect of distance learning technologies involves interactivity and feedback.

At the same time, distance learning technologies allow for the visualization of information on a computer using various multimedia technologies, the graphical representation of information, and the use of video and audio materials.

The potential of distance learning technologies lies in the ability to create and use hypertext-structured educational materials related to programming. In computer terminology, hypertext is text formed using a markup language and potentially containing hyperlinks. A hyperlink is a part of a document with hypertext that points to another element or another object within the same document. Organizing a hypertext structure during the creation or online placement of educational materials allows distance learning professors and instructors to create an individual programming learning path for each student (suggesting more difficult or simpler tasks, setting different deadlines for completing practical assignments, etc.), use group learning, and include or exclude educational materials from the educational process.

Distance learning technologies allow professors, teachers, and students to store theoretical materials and various practical tasks related to programming on their personal computers for future use in their professional activities. You can also archive information about students' progress in a course or subject for further processing.

At the same time, distance learning technologies allow teachers to respond quickly to technological advancements: adding or removing theoretical material due to changes in legislation or the adoption of new regulatory documents, including newly developed practical tasks or laboratory work in the curriculum, including developed tests in a course or subject, etc.

Based on the aforementioned opportunities and positive aspects, it can be said that distance learning technologies play an important role in developing students' programming competence.

Therefore, it is proposed to use the following distance learning tools in developing students' programming competence:

Atutor is an open-source, web-based LMS for managing the educational process, featuring training modules such as Forums, Materials, Messenger, Chat, Exercises, Group work, and Student tracking [2]. This system serves as an important pedagogical tool for teaching programming to students with disabilities. That is, blind students will be able to listen to the words in the educational content by transferring them to audio format based on integration into the system through special web applications.

Claroline is a Web-based software package that allows for the formation of open-source distance learning courses. The Claroline software package is currently widely used in the educational process of developed countries. The Claroline software package has the following capabilities: user registration; setting user tasks in the system by the administrator; creating and editing programming training courses, assessing and monitoring student knowledge, monitoring, chat, forums, and sending short messages.

The Dokeos software package possesses the same capabilities as the Claroline platform; unlike Claroline, which was created for educational institutions, it is intended to be adapted for employees of state enterprises and is considered effective for implementation. At the same time,



this system can also be used in the training process. Like the aforementioned LMS systems, the Dokeos software package supports the SCORM standard [3]. Various didactic tools for programming through the platform serve as an important tool for placing and organizing the educational process.

The LAMS software package allows professors and teachers to systematize the educational process based on visual learning tools. From this, the formation of electronic educational resources in the educational process ensures online communication. This software package is an application that allows for the formation of electronic educational resources. The system has training modules such as Forums, Materials, Messenger, Chat, Exercises, Group work, Student tracking. This module is effective in teaching programming languages and developing students' algorithmic thinking in programming.

OLAT (Online Learning And Training) is an open-source learning system that includes training modules such as Content management, Forums, File discussions, Quizzes with different kinds of questions, Wikis, Blogs, Podcast, Surveys, and Chat. This is effective in teaching students to program as a team through modules.

Sakai is an open source software package distributed under the GNU GPL license. The difference between the LMS and other systems is that the system is written entirely in JAVA. Therefore, the system is cross-platform. One of its advantages is the availability of a database. Sakai is considered effective in teaching programming within the software package and features the following modules: Drop Box (File Exchange) - ensures data exchange between the teacher and the students; Resources - the ability of users within the system to store their educational resources and provide them to users in the system; Chat Room - the availability of an online communication environment with system users; Forums - you can create a discussion on any topic. Unlike online communication, it is possible to analyze problem situations in offline mode; Message Center (Message Center) - the ability to exchange internal data with system users; Poll tool - the ability to conduct various types of surveys within the system [3].

Ilias is an open-source LMS system for managing distance learning processes, featuring modules such as Forums, Materials, Messenger, Chat, Exercises, Student tracking, Calendar, Glossary, and Wiki. One of the advantages of this system compared to other systems is that it has electronic control types such as single choice, multiple choice, matching, fill-in-the-blanks, hot spots, flash, and java applet. It is also possible to analyze and certify the results obtained in programming.

The ATutor system is considered one of the open-source systems designed for asynchronous learning, and its composition includes modules such as Forum, Glossary, File Storage, Site map, My tests and surveys, My tracker, Directory, Export content, Chat, Links, Polls, Blogs, and Web search [2]. This module serves as an effective tool for teaching distance programming to students.

In conclusion, it is advisable to use the aforementioned systems designed for distance learning to develop students' programming competence.

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