# IMPROVING THE INDEPENDENT WORK OF STUDENTS IN THE CONTEXT OF THE USE OF NEW INFORMATION TECHNOLOGIES

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## ABSTRACT

*Currently, due to the radical transformations taking place in all spheres of education, the issue of improving the quality of education and the problems of training and educating specialists who meet all the needs of modern society is acute. The purpose of our research is to establish a theoretical substantiation of the use of new information technologies in the independent work of students and to conduct an experimental test of its effectiveness. We studied and analyzed the research experience of organizing independent work for students using the new information technologies through a pedagogical experiment, observations, a survey, testing, and statistical processing of the data we obtained during the study. The pedagogical experiment was carried out in three stages: a defining experiment, an organizational experiment, and a formative experiment. In total, 306 first-year students of K.I. Skryabin Kyrgyz National Agrarian University, Jusup Balasagyn Kyrgyz National University, and S. Naamatov Naryn State University participated in the study. During the implementation of each of the research stages, we identified the main components, i.e., the organizational, methodological, and controlling conditions, and the methods of developing and implementing web technologies, as well as technologies for developing educational and electronic tools for students' independent work in the conditions of using new information technologies.*

**Keywords:** *innovations in education, web-technology, multimedia, website, pedagogy*

## INTRODUCTION

The current state of the use of new information technologies characterizes the theoretical issues of the application of new information technologies in the independent work of students in higher education institutions of Kyrgyzstan. Thus, we analyzed the concept of the "independent work of students" and determined the pedagogical conditions and structural elements of students' independent work organization for the successful organization of their independent work. In our study of the theoretical and practical issues of the educational process using new information technologies, the following possibilities of their use in students' independent work were determined:

- in the chosen discipline, with the help of new

information technologies, students can get the necessary knowledge and information at a convenient time and in a convenient place;

- when performing independent work, new requirements are formed that differ from the conventional requirements imposed on students, special relationships are created when they are fulfilled, and certain problems are solved; and

- with the help of new information technologies, the teacher can create convenient conditions for students when performing independent work, while at the same time continuously controlling and influencing role of the teacher (Shumeiko & Nypadymka, 2021).

Independent work is understood by Kozyreva (2001), Pidkasisty (1980), Polat (2004), and Yesipov (1961), as a form of organizing students' cognitive activity. Graf et al. (1981) defined independent work as a system of organizing pedagogical conditions. Garunov and Pidkasisty (1978) believed that independent work is a specific pedagogical means of organizing and managing independent activities. Usova and Bobrov (1987) considered independent work as one of the forms of educational activity, for the implementation of which cognitive, practical, organizational, self-controlling, and evaluative skills are required. Pankova (2005) considered the independent work of students to be one of the types of educational activity. Asanaliyev (1993) believed that the independent work of students in higher educational institutions is an important component of educational work. Independent work is multifaceted, diverse, and multiform, and it requires a lot of organizational work. For this reason, independent work can be considered a pedagogical system (Ibraev et al., 2015).

New information technologies are a technical means of collecting, organizing, saving, processing, transmitting, and presenting information that expands people's knowledge and develops their abilities to manage technical and social problems (Cheng, 2020; Xia, 2020). In order to improve the efficiency of students' independent work organization when using the new information technologies (e.g., automated design, creation of educational and methodological websites, automated management, etc.), the methods of their application to the student's independent work should be considered (Ostapchuk & Shcherbakova, 2018; Berdykulova et al., 2021). However, the problem of the effectiveness of using new information technologies in the organization of students' independent work is still not solved. The present study is an attempt to fill this gap. That is why we evaluated the effectiveness of the use of new information technologies in the independent work organization of higher education students of economic and information technologies specializations when studying computer science (Tukhatabaeva, 2021; Parfenova et al., 2018). During the study, the following tasks were performed:

- Determining the relationship between the levels of students' independence and identifying the motivational and organizational signs of independence.

- Experimental examination of independent work organization for students of economic and information technologies specializations through the creation of organizational, methodological, and controlling conditions.

## LITERATURE REVIEW

When considering the independent work of students using new information technologies as an educational activity, Simonov (2007) noted that such activity pursues the following two goals: the development of students' independence and the development of subject knowledge, skills, and abilities of students in independent actions with the use of new information technologies. The content of the independent work of students is an important component of the system of students' independent work, which includes the principles and methods of teaching and the educational and material base (Sarsekeyeva et al., 2019). It is in a subordinate position in relation to the purposes set. According to Kaldybaev (2009), the content of students' independent work on an academic subject is implemented based on the prevailing principles of scientificity, clarity, activation, and individuality.

Bespalko (1989) considered that the methods of performing independent work are provided by the choice of teaching methods for mastering the content and achieving the goals of the pedagogical system. The following training tools are considered to be close in nature to the applied methods: material, i.e., demonstrational pedagogical software tools, automated training systems, computer

simulators, information, and reference systems; and ideal, i.e., telecommunications and hypertext tools (Kalimova et al., 2022). Individual, frontal, group, and collective forms are used as a form of training.

According to Kalsoom and Qureshi (2021), when using new information technologies, students develop multilevel animations and automate processes. When performing, they used mainly internet sources and tools. Dalvi-Esfahani et al. (2020) were convinced that new information technologies have a great influence on students in the development of internal motivation, and the development of motivation allows students to develop as professional specialists. In accordance with the set purpose, the system of students' independent work using new information technologies is designed to form the skills of self-organization. This is because the student independently searches for the sources of information they need. In this regard, it becomes possible to evaluate the materials obtained and the products developed (Scheel et al., 2022). In the context of the use of new information technologies, the result of students' independent work is computer-generated animations, models, automated processes, computer presentations, and so forth.

For the organization of students' independent work, there are three main components of the methodological conditions: websites created for educational purposes, multimedia and graphic information, and electronic teaching materials (Lemieux, 2021; Komilova et al., 2023). According to Casino et al. (2019), the conditions for the effective organization of independent work are not limited only to organizational and methodological ones. The complete fulfillment of these conditions and the organization of the process must be controlled. Controlling the stages, starting from planning independent work to summarizing the results, ensures the correct and successful implementation of the process. Perifanou and Economides (2022) asserted that the statement of the following three conditions is important: planning of independent work, requirements and criteria, and reporting. In accordance with the considered components of the system of independent work of students, there are three main criteria that can be used to characterize the result: motivational (emotional-volitional), content-operational, and self-organizational (Durkaya & Lokumcu, 2022). The motivational (emotional-volitional) criterion

evaluates the appearance of emotional-volitional efforts in independent cognitive activity. The content-operational criterion determines the completeness of knowledge and actions. These include the subject completeness of students' knowledge, the student's ability to link theoretical and practical material, the logical methods of conclusions, and the implementation of a certain number of educational activities in a given period (Kozhasheva et al., 2022). The self-organizing criterion identifies the ability for self-organization (Du et al., 2021). This criterion characterizes the ability to carry out planning, self-assessment, self-control, and adjustment of their activities.

This article examines in detail the importance and effectiveness of such an educational process as independent work of students. We believe that this topic has become even more relevant due to the introduction of distance learning during the COVID-19 pandemic. It was this factor that showed the importance of independent work of students, and it also added more autonomy during training. In the article, in contrast to the above, the practical part of the study of the effectiveness of independent work is considered, and not its theoretical concept. Thanks to the experiment, which is the basis of this study, the influence of new information technologies on the process of independent work of students, and, as a result, further vectors of its functional development, became clearer.

## METHODOLOGY

### Participants

In total, the experimental work covered 306 first-year students in the specializations of Banking and Finance, Accounting and Auditing, Marketing, Applied Information Science in Fields, Economics and Management, and Computer Studies, at such higher education institutions as K.I. Skryabin Kyrgyz National Agrarian University (KNAU), Jusup Balasagyn Kyrgyz National University (KNU), and S. Naamatov Naryn State University (NSU). For the experiment, we selected only students of economics and information majors who started to study the computer science course. All participants independently agreed and gave verbal consent to the experiment.

### Data Analysis

The formative experiment was carried out in two stages. During the first stage, experimental

and control groups were created to test the effectiveness of the impact of methodological conditions in the development of students' independence. The first group, specified as E1, involved first-year students of KNU, the Institute of Information and Communication Technologies, in which we tested the above methodological conditions for presenting information in the format of hypertext structures in a tree-like form and the use of websites prepared for educational purposes. To test the second methodological condition, first-year students of KNAU, the Faculty of Innovative Technologies, were involved. In the second group, E2, we examined the condition for presenting educational material in the form of an optimal combination of text and graphic and multimedia forms of information presentation. The effectiveness of the use of an electronic educational and methodological complex was carried out in the E3 group, with the participation of first-year students of NSU, the Faculty of Economics and Management. To compare the results of the experimental group, we created control groups in each university (C1, C2, and C3).

At the first stage of the experiment, the total number of students in the control groups was 88 people and in the experimental groups 81 people. The results of the experimental study made it possible to test and evaluate the methodological conditions. Each level was evaluated using the above criteria of content-operational, motivational, and self-organizational. To determine the average indicator of the level of independence in the group, the following formula was obtained based on the research of Simonov (2007) and Kaldybaev (2009):

$$, \quad (1)$$

where:$,,,$ are indicators of the levels of independence (reproducing, reproductive, partially-searching, creative) and N is the number of students in the group.

*Statistical Analysis*

Statistical analysis was performed using the Statistica 8.0 software suite (StatSoft.Inc.). Intergroup differences were evaluated by the nonparametric criterion Mann-Whitney U-test. For pairwise connected groups, the nonparametric Wilcoxon test will be applied.

## FINDINGS

The results of the formative experiment have shown that the use of new information technologies in the independent work of students in computer science gives effective results. At the second stage of the experiment, based on the logic of the study, we tested the effectiveness of the selected methodological conditions in the complex. In the experimental groups, web technologies, educational sites, and electronic textbooks were used to implement the independent work of students in computer science in a complex form. At the same time, when performing independent work, students were offered tasks ranging from simple to complex, and requirements for the use of hypertexts were set. In the second stage of the experiment, 69 people participated in the control groups (C4), and 68 people participated in the experimental groups (E4). At all stages of the experiment, seven teachers were involved. The results of the average indicator of the level of independence of the initial, intermediate, and control assessment during the experiment are shown in the following tables and diagrams (Tables 1–3; Figures 1–3).

Analyzing the results of the second stage of the experiment, we noted that there is a noticeable increase in the level of students' independence in

*Table 1.*
*Results of the Levels of Independence of the Diagnostic Testing*

| | Group number | | | | | | Quantity | |
|---|---|---|---|---|---|---|---|---|
| Control | (C4) | 28 | 21 | 11 | 9 | 22% | 69 | |
| | | 41% | 30% | 16% | 13% | | | |
| Experimental | (E4) | 30 | 24 | 6 | 8 | 21% | 68 | 1.82 |
| | | 44% | 35% | 9% | 12% | | | |

*Figure 1.*
*Diagram of the Initial State of Students' Independence Levels*



| | α1 | α2 | α3 | α4 | α- av. |
|---|---|---|---|---|---|
| C4 | 41% | 30% | 16% | 13% | 22% |
| E4 | 44% | 35% | 9% | 12% | 21% |
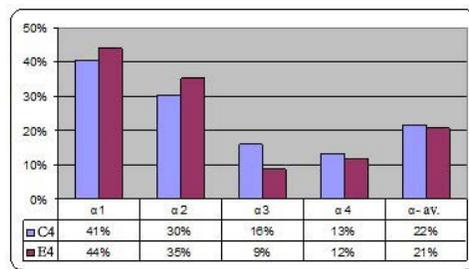
*Table 2.*
*Results of the Levels of Independence of the Intermediate Assessment*

| | Group number | | | | | | Quantity | |
|---|---|---|---|---|---|---|---|---|
| Control | (C4) | 15 | 21 | 23 | 10 | 24% | 69 | |
| | | 22% | 30% | 33% | 15% | | | |
| Experimental | (E4) | 8 | 25 | 22 | 13 | 25% | 68 | 2.91 |
| | | 12% | 37% | 32% | 19% | | | |

*Figure 2.*
*Diagram of the Levels of Independence of the Intermediate Assessment*



*Table 3.*
*Results of the Levels of Independence in the Control Assessment*

| | Group number | | | | | | Quantity | |
|---|---|---|---|---|---|---|---|---|
| Control | (C4) | 10 | 17 | 27 | 15 | 26% | 69 | |
| | | 15% | 25% | 39% | 22% | | | |
| Experimental | (E4) | 6 | 13 | 24 | 25 | 28% | 68 | 4.23 |
| | | 9% | 19% | 35% | 37% | | | |
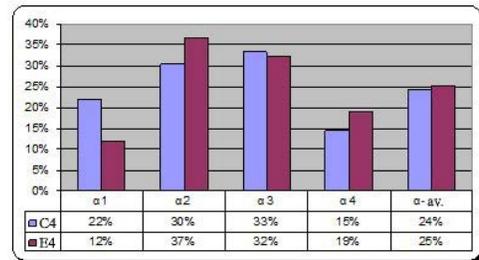
*Figure 3.*
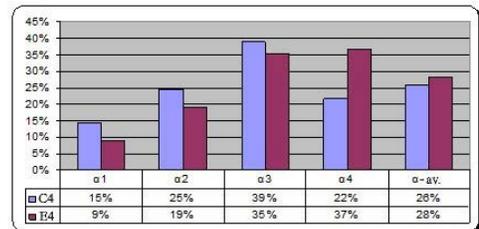*Diagram of the Levels of Independence in the Control Assessment*



both experimental and control groups. This means that within the framework of the conventional system of students' independent work, independence develops as they accumulate professional knowledge and experience in its organization. However, this process proceeds less intensively than in the experimental groups, where special conditions were introduced that promote the development of students' independence (Wekerle & Kollar, 2022). At the second stage of the experiment, the results of the initial diagnostic test in the control group C4 have shown that 22% of students had an average level of independence, and at the reproducing level the result was 24%, having increased by 2%, at the creative level, compared with the results of the initial diagnostic test, the number of students increased by 4%. And in the experimental groups, E4 averaged 21% in the initial diagnostic tests, but at the reproducing level, it was 25%, where an increase of 4% can be noticed. The creative level is 28%, while 7% of students in the experimental group rose from a low to a high level.

Questions of test tasks were prepared that check the levels of students' independence: = low (reproducing); = medium (reproductive); = high (partially searching); and = very high (creative). Furthermore, to test students' independence, we used the following methods: interviews, monitoring of their activities during the independent performance of tasks (a student's request to the teacher for a consultation in the classroom), reports when submitting independent work (presentation, report, etc.), a survey, and questionnaires of students.

## IMPLICATIONS

The use of web technologies in the organization and improvement of the independent work of students creates favorable conditions for teachers. Using web technologies, the teacher has the opportunity to develop and offer students educational and targeted websites, portals, and syllabuses. In addition, for the organization of student's independent work, the teacher has the opportunity to prepare auxiliary sheets by creating a group of links (web-quests) on internet sources.

## CONCLUSION

Appropriate conditions should be created for the organization of students' independent work using the didactic opportunities of new information technologies since providing students with new knowledge and developing their independent mental actions is an important task of education.

The place and role of new information technologies in the organization of students' independent work follow from the identification of their didactic capabilities in the educational process. The use of new information technologies in independent work allows students to gain new knowledge, provides a search for different information, and opens the way for the development of cognitive activity, creativity, independence, and skills.

It should be considered an important task to train teachers of higher education institutions to use the opportunities of information technologies. The purpose can be the creation of a special environment and pedagogical conditions for the use of new information technologies in the independent work of students. In this study, depending on the features of the appropriate tools, the content of the work performed and the organizational, methodological, and controlling conditions have been determined.

The experiment confirms that the pedagogical conditions we proposed for the use of new information technologies in the independent work of students, the methodology of using web technologies, and the technology of developing and applying electronic courses allow for developing students' independence. The creation of pedagogical conditions and their purposeful use in the educational process give positive results. Therefore, the creation of such conditions and their implementation provides an opportunity to achieve goals in the independent work of students and to form and develop the qualities of independence.

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