# The Concept of Using Electronic Information Space in the Process of Forming Digital Competencies of University Students

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**Abstract.** The purpose of the article is to present the results of a study on the use of electronic information space in the process of forming digital competencies of university students conducted by its authors. The study used the concepts of «digital literacy» and «digital competencies», consistent with existing international approaches. The authors gave a definition to the concept of «electronic information space», showing its differences from the «information-educational environment». It is concluded that there is a need to change the structure of students' activity with digital information resources, from using ready-made resources laid out by teachers and staff to organize the educational process in the electronic information and educational environment of the university, to joint formation by teachers, students and representatives of the professional community of electronic information space. The subspaces of electronic information space used by students are highlighted, namely: global; professional community; university; academic discipline; student groups; learner's personal space. The pedagogical goals of the use of electronic information space in the formation of digital competencies of university students are determined, the choice of software products, including cloud application, for creating electronic information space is made. The authors determined the internal and external structure of digital information resources placed in the electronic information space, and also proposed forms of organization of educational work on the formation of digital competencies of university students. The authors of the article conducted an experiment confirming the reliability of the proposed approaches.

**Keywords:** higher education system, electronic information space, pedagogical goals of the use of electronic information space, digital competencies, digital information and data, cloud applications.



## 1 Introduction

Currently, the process of digitalization of the economy is actively ongoing in the Russian Federation, within the framework of which a system of economic, social and cultural relations based on the use of digital technologies is being built. This process

requires training of personnel with digital literacy, who can solve educational and professional problems, both individually and in collaboration with other people

In accordance with international approaches, the structure of digital literacy includes five sections, namely, digital information and data, communication and cooperation, digital content creation, security, problem solving [1]. Each section includes a set of digital competencies. For example, the digital information and data section includes the following digital competencies: viewing, searching and filtering data, information and digital content; evaluation of data, information and digital content; data, information and digital content management. The communication and cooperation section involves the following digital competencies: interaction using digital technologies; sharing of digital technologies; digital inclusion in the community; digital collaboration; network etiquette; digital identity management. The next section, the creation of digital content, includes such digital competencies as the development of digital content, the integration and processing of digital content, copyrights and licenses, and programming. The security section contains the following competencies: device protection; protection of personal data and privacy; protecting health and well-being; environmental protection. And the last section solving problems involves the following competencies: solving technical problems; identification of needs and technological answers; creative use of digital technologies; identifying gaps in digital competency.

Digital competencies are formed at all levels of education. At the preschool age, children communicate, have fun and learn with the help of gadgets. This process continues at school, both in the framework of the special subject “Informatics” and in the framework of other subjects and extracurricular activities, students search the Internet for the necessary information, process it, present the results of digital work in digital form, use an electronic diary, electronic educational content, interact with classmates and teachers using digital communication technologies, etc. Thus, a first-year student entering a university has a good base for the further development of digital competence related to his future profession, searching and analyzing critically important information specific collaboration using digital collaboration, the creation and deployment of digital content using software, including cloud applications.

## 2 The concept of electronic information space

To create digital competencies of university students, we consider it necessary to restructure the educational process using electronic information space, expanding the capabilities of the university’s electronic information and educational environment.

The structure of the electronic educational information environment is defined in the Federal Law “On Education in the Russian Federation” (article 16, part 3) and includes the following components: 1) electronic information resources; 2) electronic educational resources; 3) a set of information technologies, telecommunication technologies, relevant technological means. At the same time, electronic information resources are understood as separate documents and separate arrays of documents, documents and arrays of documents in information systems (libraries, archives, funds, data banks, other

information systems) made in electronic execution. An electronic educational resource is understood as “an educational resource presented in electronic digital form and including the structure, subject content and metadata about them” [4].

In addition to the concept of "electronic information and educational environment" in scientific and pedagogical research and practice-oriented approaches, the concepts of "information space", "electronic information space" are increasingly found. Moreover, the authors of the studies note the difference between the concept of “environment” and the concept of “space”. So, Tolypina Y.A. writes: "The environment is given, space is always held by the volitional effort of man" [3].

Considering the "space" in the context of the philosophical category, Robert I.V. notes that “space manifests itself, on the one hand, as the internal organization of the substantive essence of a certain material subject, object or ongoing process, and, on the other hand, as a form of existence of a subject, object or process” [2].

Following Frolov I.T., defining space as a form of the existence of matter, expressing the order of arrangement of simultaneously existing objects [5] and Robert I.V., we give the following definition: electronic information space is an objective form of existence of digital information resources, expressing the arrangement of simultaneously coexisting digital information resources and determining their internal and external structure.

Depending on the scale, we highlight the intersecting subspaces of the electronic information space: global; professional community; university; academic discipline; student groups; the student’s personal space.

We consider it necessary to change the structure of students' activities with digital information resources, to switch from the use of ready-made resources laid out by teachers and staff to organize the educational process in the electronic information and educational environment of a university, to the joint formation by teachers, students and representatives of a professional communities of the electronic information space of academic discipline and a group of students.

## 3 Pedagogical purposes of using electronic information space

We formulate the pedagogical goals of using electronic information space in the formation of digital competencies of university students: identifying the level of formation of digital competencies and exercising control in the process of forming digital competencies; development of the student’s digital competencies in the process of searching, selecting, analyzing, evaluating and managing data, information and digital content; the development of digital competencies in the organization of interaction and cooperation of students with each other, the teacher, representatives of the professional community, the sharing of digital technologies based on digital identification in compliance with the rules of network etiquette; development of digital competencies in the development of digital content, its integration and processing, taking into account copyright and licenses; development of digital competencies for device protection, personal data and privacy; development of digital competencies in determining needs and technological answers, as well as the creative use of digital technologies.

## 4 The choice of software products for the formation of electronic information space

Let us formulate the criteria for choosing a software product for creating, supporting and developing electronic information space: ensuring the possibility of placing digital information resources or links to them both for the teacher and the student, as well as for representatives of the professional community; sharing and editing digital information resources; supporting information security of digital information resources located in the electronic information space; coordination of work, namely, time management, online verification, etc .; in case the participants of the educational process are located remotely from each other, the environment should provide the opportunity for interaction in real time; free licenses.

Based on the above criteria, software products for creating educational information portals (Sakai, Moodle, etc.) and software products for organizing user collaboration (MicrosoftTeams, Trello, etc.) are considered. As a result of the comparison of opportunities, software was selected for the creation, support and development of the electronic information space - Trello, because it fully complies with the selection criteria listed above, and also does not require material costs for use.

As software products for working with digital content, cloud application were selected that allow you to jointly create, use and edit content, for example, GoogleDocs and Mindmeister.

Means of information infrastructure used to create, support and develop electronic information space were also selected: information networks; search engines; electronic libraries; educational platforms.

## 5 The structure of digital information resources hosted in the electronic information space

Depending on the pedagogical goals of using electronic information space, the internal and external structure of the digital information resources placed in it is determined.

So, the resources allocated by the teacher or representatives of the professional community (the input and final test on the discipline / module, goals and objectives of the discipline / module, the structure of the material studied, the time frame for studying the discipline / module, assessment criteria are included in the internal structure of the electronic information space of the discipline results of work on the discipline / module, lecture materials, materials for preparing for practical and laboratory work, etc.) and students (mental maps, glossary, performance of practical and laboratory work, the results of the decision of cases, the results of training projects, links to digital electronic resources in a personal space or files placed in the electronic information environment groups and others.).

The external structure of digital information resources placed in the electronic information space is determined by a system of links to these resources from the outside and a system of links to external digital information resources.

## 6 The forms of organization of educational work

Let's consider the forms of organization of educational work using the electronic information space in the framework of the academic discipline, aimed at the formation of digital competencies of university students.

In order to identify the level of formation of digital competencies and exercise control in the process of forming digital competencies, the teacher offers students to perform work in the electronic information space presented below.

To develop the student's digital competencies in the process of searching, selecting, analyzing, evaluating and managing data, information and digital content, students are invited to: organize the search for the necessary information using search services; select the necessary materials in electronic libraries; choose an online course that matches your educational needs; assess the compliance of the found electronic resources with the set goal; place found resources or links to them in the electronic information space of the discipline.

In order to develop digital competencies in the organization of interaction and cooperation of students with each other, the teacher, representatives of the professional community, the sharing of digital technologies based on digital identification in compliance with the rules of network etiquette, students are invited to: form the internal and external structure of electronic information space using software products for organizing user collaboration; give access to digital information resources located in the created space; jointly perform the task set by the teacher, in compliance with the rules of network etiquette.

To develop digital competencies in the development of digital content, its integration and processing taking into account copyright and licenses, students are invited to use a cloud application or software product for which there is a valid license.

In order to develop digital competencies for protecting devices, personal data and privacy, students are invited to set up password protection, go through the authentication and identification procedure, and perform a security check on digital information resources.

For the formation of digital competencies in determining needs and technological answers, as well as the creative use of digital technologies, students are invited to develop an intelligence card and place it in the electronic information space.

## 7 Conclusions

In order to verify the effectiveness of the proposed approaches, the authors of the article conducted an experiment on the formation of digital competencies of university students using electronic information space in the framework of the discipline "Introduction to Digital Culture". The experiment was attended by first-year students of the Cherepovets State University in the amount of 500 people.

At the beginning of the experiment, input control of the formation of digital competencies was carried out using a system of tasks, including: search, selection, analysis, evaluation and management of data, information and digital content; organization of

interaction and cooperation of students with each other and the teacher, the sharing of digital technologies based on digital identification in compliance with the rules of network etiquette development of digital content, its integration and processing taking into account copyright and licenses; development of digital competencies for device protection, personal data and privacy; identification of needs and technological answers, as well as the creative use of digital technology. At the end of the discipline, the output control of the formation of digital competencies was carried out using a system of similar tasks. The output control showed an increase in the average number of correctly completed tasks by 35%.

On the basis of which, we believe that the organization of training university students using the electronic information space, realizing the pedagogical goals of its application, will allow to develop digital competencies of students.

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