

## **Formation of Digital Literacy of Undergraduate Students in the Context of Sustainable Development Goals**

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*The paper aims to develop a model of a training course aimed at forming undergraduate students' digital literacy, considering the goals of sustainable development and the implementation of a competency-based approach. The tasks were to analyze digital literacy frameworks in the context of sustainable development goals, analysis of educational standards of higher education at the bachelor's level, and modeling on this basis the content of the academic discipline, determining the methodological conditions of the learning process, and choosing instrumental solutions for designing the course and implementing academic discipline. In the process of identifying and analyzing the existing framework of digital competencies, international frameworks, and practical experience, we proposed a way to correlate these models with the tasks of implementing a competency-based approach and adapting these models to the national conditions for the implementation of educational programs at the higher education level. We developed a scientific concept and modeled the "Digital Culture" training course, aimed at developing digital literacy of students in all areas of training at the bachelor's level.*

*Keywords: digital literacy, challenges in education, competency frameworks, digital competencies, student digital culture*

### **INTRODUCTION**

Achieving UN sustainable development goals is relevant in the context of the tasks of the socio-economic development of Russia. Effective work in this direction should be comprehensive and systemic, considering the interrelation of ensuring sustainability. The fourth goal of sustainable development, "Ensuring inclusive and equitable quality education and encouraging lifelong learning opportunities for all" is currently being revealed, considering the digital transformation trends of the world economy, digitalization processes, and the development of information technology.

Thematic indicator 4.4.2 “Percentage of youth/adults who have achieved at least a minimum level of proficiency in digital literacy skills,” related to the fourth sustainable development goal, definitely links its achievement with the development of digital literacy.

The digital transformation processes and the penetration of digital technologies into all aspects of human life are constantly expanding the range of skills that can be considered essential in the use of information and communication technologies. At the same time, in the course of the work of international organizations, national projects, individual educational institutions, and research teams, experience has been accumulated in modeling the concept of digital literacy in determining the necessary basic digital skills of a modern person. Several UNESCO publications define the digital literacy model (United Nations, 2018), as well as proposing methodological solutions for its development (United Nations, 2019) and publications of the International Bank for Reconstruction and Development (Bashir & Miyamoto 2020), prepared within the framework of the European program, the DigComp 2.1 framework (The European Digital Competence Framework,” a framework for the digital competence of EU citizens).

This framework describes twenty-one digital competencies in five areas: information and data skills, communication and collaboration, digital content creation, security, and problem solving. The framework has become the basis for developing instrumental solutions and projects (Carretero, Vuorikari & Punie, 2017). A separate project was the DigCompEdu framework, which describes teaching competencies in information and communication technologies, in general, digital skills in demand in the field of education (Redecker & Punie, 2017).

The IC3 Global Standard 6 [GS6] digital literacy certification program identifies the critical areas in which qualification exams must be taken: technical fundamentals, digital citizenship, information management, content creation, communication, collaboration, and digital security (CERTIPOR, 2020).

The development of digital literacy is becoming an essential goal of implementing the national program “Digital Economic of the Russian Federation,” the federal project “Human Resources for the Digital Economic.” Educational projects, programs of additional education, including the concept of lifelong learning, and the annual all-Russian action “Digital Dictation,” aim to solve this problem.

The list of critical competencies of the digital economy is defined in the appendix to the methodology for calculating the indicator “Number of graduates of the vocational education system with key competencies of the digital economy, Thousand people,” approved by the Ministry of Economic Development of Russia dated January 24, 2020, No. 41 (Ministry of Economic Development of the Russian Federation, 2020). The list includes five key competencies: communication and cooperation in the digital environment, self-development in the face of uncertainty, creative thinking, information and data management, and critical thinking in the digital environment.

Competencies in digital literacy and skills in the use of information and communication technologies are included in the results of the development of educational programs at all levels. The Federal State Educational Standards of Higher Education Generation 3 ++ for the undergraduate level define several universal competencies that are substantively most related to the development of digital literacy. “UK-1. A graduate can search, critically analyze and synthesize information, apply a systematic approach to solving the assigned tasks.” “UK-3. A graduate can carry out social interaction and fulfill their role in the team,” “UK-4. A graduate can carry out business communication in oral and written forms in the state language of the Russian Federation and foreign language (s),” “UK-6. A graduate can manage their time, build and implement a trajectory of self-development based on the principles of lifelong education.”

The problems of determining the components of digital literacy, the essence of the concept of digital competence and its significance in the development of the digital economy, modern culture, as well as the problems of achieving sustainable development goals are the subject of research interest of a circle of authors (Grigoriev, 2020; Kullaslahti, Ruhalahti & Brauer, 2019; Shaukhalova, 2020; Spante, Hashemi, Lundin, et al., 2018). An integrated approach is declared as the main methodological solution for implementing sustainable development goals in the Russian Federation in the publication of A.G. Sakharova and O. I. Colmar.

The authors conclude that the effectiveness of this work is associated with the inclusion of social aspects of sustainable development in national strategic planning documents (Sakharov & Kolmar, 2019).

The apparent relevance and practice-orientedness of this research area activate project work aimed at developing citizens' digital competencies, making it difficult to choose specific methodological guidelines. This paper describes the methods and results of project activities aimed at developing the student's digital literacy. The study attempts to develop a model of the training course, considering the requirements of the competence-based approach and federal educational standards and the key provisions of the concept of sustainable development.

## **MATERIALS AND METHODS**

The paper aims to develop a model of a training course aimed at forming undergraduate students' digital literacy, considering the goals of sustainable development and the implementation of a competency-based approach. The objectives of this research are the analysis of digital literacy frameworks in the context of sustainable development goals, the analysis of educational standards of higher education at the bachelor's level, modeling on this basis, the content of the academic discipline, the determination of the methodological conditions of the learning process, and the choice of instrumental solutions for the design of the course and the implementation of the academic discipline.

In the process of modeling the discipline, we used the results of the project work organized as part of the development of the educational program "Advanced technologies in the field of education and educational services" (2020, Tomsk State University [TSU]). The developed structural model of the training course "Digital Environment" included the following modules: "Digital Ethics and Etiquette," "Digital Collaboration," "Digital Safety and Ergonomics," "Digital Education and Self-Development." The selection of content and modules was based on the teaching experience of the project team members, the analysis of solutions - additional education and curricula of academic disciplines of Russian and foreign universities, as well as materials from the questionnaire survey of first-year students of Altai State University.

The training course "Digital Environment" was offered for implementation in additional education - a program of additional professional education addressed to freshmen in the humanitarian areas of training. The course could bridge the difference in the level of digital skills of students focused on professional development in the humanitarian field and those who chose technical and natural science areas of training. The design solution assumed the possibility of scaling the training course, implementing it for students in all training areas, and implementing it in other universities in a network form.

Further design work in this direction was undertaken following the iterative development method. A fundamental change in the structure of curricula implemented at Altai State University since 2021 has determined the need to develop academic disciplines from the "University Core" block. These disciplines are intended primarily to form the universal competencies of the federal state educational standard of higher education [FSES HE] among the 1st and 2nd-year undergraduate students. A unified set of disciplines for junior students contributes to changing the educational track and will become the basis for the individualization of educational paths.

The development of the discipline "Digital Culture" for undergraduate students at Altai State University was undertaken considering the need to form the sixth universal competence "Ability to manage my time, build and implement a trajectory of self-development based on the principles of lifelong learning."

## **RESULTS**

To identify and analyze the existing framework of digital competencies, international frameworks, and practical experience, we proposed a method for correlating these models by implementing a competency-based approach and adapting these models to national conditions to implement educational programs at the higher education level. Table 1 examines the correspondence of digital competence models of international frameworks and universal competencies to higher education federal educational standards in the Russian Federation.

**TABLE 1**  
**MODELS OF COMPETENCIES IN THE FIELD OF DIGITAL LITERACY AND THEIR**  
**CORRESPONDENCE TO THE UNIVERSAL COMPETENCIES OF THE FEDERAL**  
**STATE EDUCATIONAL STANDARD OF HIGHER EDUCATION**

DigComp 2.1 Competency Area and Digital Literacy Global Framework [DLGF]	Key Areas of the IC3 GS6	Competencies of the digital economy	Universal competencies of the Federal State Educational Standard of Higher Education Generation 3 ++ undergraduate level
Devices and Software Operations	Technical Basics	—	—
Information and Data Literacy	Digital citizenship Information management	Information and data management Critical Thinking in the Digital Environment	UK-1. Ability to search, critically analyze, and synthesize information, apply a systematic approach to solving assigned tasks
Communication and Collaboration	Communication Collaboration	Communication and cooperation in the digital environment	UK-4. Ability to carry out business communication in oral and written forms in the state language of the Russian Federation and foreign language (s) UK-3. Ability to carry out social interaction and fulfill their role in the team
Digital Content Creation	Content creation	Creative thinking	UK-1. Ability to search, critically analyze, and synthesize information, apply a systematic approach to solving assigned tasks
Safety	Digital Safety	—	—
Problem Solving	—	Critical Thinking in the Digital Environment	UK-1. Ability to search, critically analyze, and synthesize information, apply a systematic approach to solving assigned tasks
Career-Related Competences	—	Self-development in the face of uncertainty	UK-6. Ability to manage their time, build and implement a trajectory of self-development based on the principles of the lifelong education

*Source:* (CERTIPOR, 2020; Ministry of Economic Development of the Russian Federation, 2020; United Nations, 2018).

The table identifies the overlapping areas and noticeable differences; however, in the comparison process, one should proceed from the complexity of each model: all areas are interrelated, and the missing direct analogies are part of other competence areas. Competencies in the field of working with digital devices and digital security are not directly indicated among the universal competencies of the Federal State Educational Standard of Higher Education. However, their formation should be the basis for other educational results, and several educational standards of higher education include competencies in this area in the group of general professional ones. The inclusion of most of the universal competencies of the Federal State Educational Standard of Higher Education in this table shows that forming skills and competencies in digital literacy seems to be the educational task of many academic disciplines. Several general professional competencies of the Federal State Educational Standard of Higher Education in various training areas also focus on developing students' competence in information and communication technologies.

The problem of modeling the educational discipline "Digital Culture" was solved. It aimed to develop students' digital literacy in all areas of training at the bachelor's level, determine the main modules of the discipline, select its content, and choose methodological and instrumental solutions for its implementation. In the curricula of bachelor's degree programs for this discipline, universal competence "UK-6. A graduate can manage their time, build and implement a trajectory of self-development based on the principles of lifelong learning," which determines the general orientation of the selection of content. Table 2 presents the main modules of the academic discipline.

**TABLE 2**  
**CONTENT OF MODULES OF THE EDUCATIONAL DISCIPLINE "DIGITAL CULTURE"**

Module	Areas of digital competence	The main topics of the module
Digital ethics and safety	Safety  Communication and collaboration  Digital content creation	Features of the development of the modern digital environment. Digital transformation. Digital transparency. Digital ethics and rules of etiquette in Internet communication. Business communication channels. Empathy is the basis for building a communication strategy. Features of business communication on digital platforms. Social accounts and messengers. Security of the information environment. Working with passwords. Password managers. Malware, phishing, and social engineering. Confidentiality of information. Intellectual property issues. Public domain. Public licenses. Free content resources. Protection of personal information.
Self-development in the digital environment	Information and ability to work with data,  Digital content creation  Career-related competencies	Basics of information retrieval. Relevance and reliability of the information. Development of information retrieval and information selection skills. Search for images. Search for scientific information. Curation of professional content as a means of self-development and professional positioning. Tools for working with text documents and spreadsheets. Cloud platforms. Development of a simple website for project presentation tasks based on online website builders. Personal

		knowledge base and note-taking. Tools for storing and organizing information: personal wiki pages, outliners, services for making mind maps. Information technology in the professional development of the individual. Educational opportunities of the Internet. Modern types of digital educational resources. Massive open online courses, their types. Short online courses and video tutorials. Thematic professional communities of social networks as an educational environment. Components of the information environment of the university. Scientific library of the university and electronic library systems.
Self-organization and teamwork	Communication and collaboration  Career-related competencies  Problem solving	Time management concept. Services for working with information resources, planning and organizing professional and educational activities. Electronic calendars. Integration of information from the student's account into the personal information environment. Task management platforms. Collaboration techniques based on cloud-based web technologies. Using digital services for project management. Reflection and awareness in professional and personal self-development.

Source: Compiled by the authors.

As a result of successful development, the student will be able to:

- Develop projects using digital tools and create projects by working in a team using modern tools;
- Maintain a safe working environment and comply with ethical norms and rules of etiquette in the digital environment;
- Build a trajectory of self-development in the digital environment and find the necessary information and opportunities for self-development.

The program aims to develop the ability to search for professionally oriented sources of information and data to use the information received to solve problems effectively. In mastering the program, it is supposed to use online tools and online information resources. Since the e-course is addressed to undergraduate students of Altai State University in all training areas, it is recommended to perform practical tasks considering professional guidelines. Immersion in the professional aspects of the application of information and communication technologies is assumed in a separate workshop and goes beyond the development of this course.

The methodological conditions for the implementation of the discipline were distance learning, the use of an electronic course on the Unified Educational Portal of Altai State University for the delivery of educational content and the organization of all practical work, the development of all educational activities at the threshold or higher levels, and the use of a point-rating system to assess learning outcomes. Distance learning offered to students in the first semester of their programs can be challenging. One of the tasks of developing the course was to design instructional materials and develop forms of methodological support for students. In particular, interactive video instruction and slides were developed to characterize the content of the program modules and include the recommended terms of work for each module. Mastering discipline assumes familiarity with lectures, completing practical tasks, and independent work. The electronic course

is mastered sequentially; it will be possible to proceed to the next educational element after completing work with the previous one. The sequence is organized as follows:

- Study of video lectures;
- Formation of specific applied skills and consolidation of the topics of each section in the form of practical exercises and independent work;
- Practical exercises involve performing tasks according to specific instructions; completing tasks for independent work may require an independent search for the correct solution;
- The study of additional materials (attached links and videos) is optional. Additional materials attached to topics will expand general awareness or set directions for self-study.

An essential task of mastering this discipline should be considered in the study of the foundations of the culture of educational work and rest, self-management, the organization of self-education, self-education, and self-development in the university. This task is consistent with the universal competence of the UK-6, which students must form in mastering the program. Consistent, measured, and systematic work on mastering the discipline should become a learning experience that opens up opportunities for effective lifelong learning.

## **DISCUSSION**

The design of disciplines for the “university core” is a relatively new practice for most Russian universities. The relevant developments of leading universities, including Tyumen State University and Tomsk State University, seem to be valuable experiences. Thus, the design of core disciplines at TSU focuses on the tasks of building the identity of a graduate of a bachelor’s degree from this university. In contrast, identity is “a configuration of the experience received by the student in addition to the narrow professional training formed in the course of educational activities, allowing the student to realize themselves as a member of the university community to become a university person, to accept the university system of ideas and values” (Osachenko, 2019).

The proposed model of the discipline “Digital Culture” combines three interrelated modules, meaningfully revealing aspects of modern digital culture and comprehensively forming undergraduate students’ digital skills and digital competence. Building the identity of a university graduate can undoubtedly be solved, including within the framework of this discipline, since it allows to set the basis for the formation of professional mobility, adaptability to a situation of uncertainty, and rapid technological change. These qualities, which are in demand in the labor market in various socio-cultural contexts, can favorably distinguish university graduates. At the same time, the tasks of developing digital literacy, outlined for sustainable development (United Nations, 2018), determine the need for the formation of these skills not exclusively within the educational programs of leading educational institutions, but in wide educational practice including informal and informal education. Projects, creative solutions that graduates can create, solve problems, and organize project work, which bachelors possess, should rely on a high level of digital competencies, possession of digital tools, and a systemic understanding of trends in the digital economy. Thus, the development of digital literacy of university graduates can be considered, among other things, as a way of digital broadcasting culture, a way to develop the digital environment of professional communities and regional projects.

## **CONCLUSION**

Mastering digital literacy is becoming a key educational goal for students in all areas of study. Knowledge, skills, and abilities in the field of digital literacy allow solving problems of various kinds – professional, educational, communicative, and socio-cultural. The models of digital literacy proposed in the framework of international projects, research teams, and authoring developments show the complex nature of this phenomenon. The multidimensionality of the tasks of its formation, including the formation of digital competencies, is considered an essential task in the context of certain sustainable development

goals. In national educational systems, the solution to this problem should be correlated with established educational practices, basic concepts, and educational approaches. The implementation of the competency-based approach in the educational system of the Russian Federation and strategic national programs fully contributes to the achievement of this goal.

In the process of designing the educational discipline “Digital Culture” for undergraduate students of Altai State University, a model for the formation of digital competencies was proposed based on three training modules – “Digital Ethics and Security,” “Self-Development in the Digital Environment,” “Self-Organization and Teamwork.” Full approval of this project is possible with the start of the implementation of bachelor’s degree programs in September 2021. An iterative approach to development assumes the continuation of work on the training course, considering the approximation results. The proposed model can be scaled up to create a massive open online course or transferred to a different educational context.

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