

**ICEST 2022****III International Conference on Economic and Social Trends for Sustainability of Modern Society****UNIVERSAL ACCESS TO CYBERSPACE THROUGH MASTER'S  
DEGREE PROGRAMME DEVELOPMENT**

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**Abstract**

The paper considers the issues of universal access to cyberspace through the development of new online courses and new master's degree programs. Universal access to cyberspace implies that the development and provision of software should preferably be carried out in an environment of open-source technologies. There is a problem nowadays in innovative courses and methods to prepare qualified specialists in such spheres as IT and cybernetics. The aim of the study is to develop a new online course "Modern Problems of Cybernetics in English" aimed at deepening students' knowledge of the history of the development of cybernetics, the state and importance of cybernetics in the modern world, the formation of skills in applying classical cybernetics methods to software engineering problems, as well as improving English skills language in the professional field. The paper gives the overview of the new course, its structure, risk analysis and the ways to overcome the obstacles in designing the course.

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## 1. Introduction

Considering issues related to ensuring universal access to cyberspace, one should start with the point that the development of new information technologies opens great opportunities for improving the processes of free circulation of ideas by word and image, but at the same time creates the danger of widening the gap between the information rich and the information poor, which may hinder universal participation in the life of the global information society.

It is obvious that linguistic diversity in global information networks and the ubiquitous use of cyberspace are central to today's discussions and can be critical to the development of a knowledge-based economy. At the same time there is an urgent need for international treaties and agreements on intellectual property issues to be considered when promoting the development of universal access to information.

The Resolution of the General Conference of UNESCO noted the most important aspects of this problem (Recommendation concerning the promotion and use of multilingualism and universal access to cyberspace, 1996):

- basic education and literacy are needed to ensure universal access to cyberspace;
- different levels of economic development affect the possibilities of access to cyberspace;
- specific policies and international solidarity are now needed to eliminate the current imbalance in the world with access to cyberspace.

In addressing the issues raised the role of the public and private sectors at the local, national, regional and international levels is invaluable in providing and providing the necessary resources to reduce language barriers and enhance interactive communication between people via the Internet. This is done by facilitating the creation and access to educational, cultural and scientific content in digital format, so that all cultures have the opportunity to express themselves and access cyberspace in all languages, including indigenous languages.

States providing universal access to cyberspace should pursue an active national policy aimed at promoting the development of native languages and the study of foreign languages in cyberspace. Only the strengthening and expansion of international support and assistance to developing countries can really contribute to the development of freely accessible materials for learning languages in electronic form and the improvement of basic human skills in this area.

Within software engineering and the information and communication technology (ICT) industry, universal access to cyberspace is being promoted through collaborative research and development on operating systems, search engines and Internet browsers with great potential for multilingualism, online dictionaries and terminology guides, along with their localization. One of the important challenges in this line of action is the need to support international collaborative initiatives regarding publicly available automated translation services, provided free of charge or at a nominal cost, as well as such intelligent linguistic systems that perform multilingual information search, summarization/abstracting and speech recognition. Universal access to cyberspace implies that the development and provision of software

should preferably be carried out in an environment of open-source technologies (Voroshilova & Kuznetsov, 2021; Zenutkin et al., 2021).

## **2. Problem Statement**

There is a problem nowadays in innovative courses and methods to prepare qualified specialists in such spheres as IT and cybernetics. There are no examples of teaching such discipline as “Cybernetics” in Russia, especially in English. However, for undergraduates of such popular programs as "Software Engineering and Cybernetics" this course is important, both in terms of subject knowledge and in terms of a foreign language, which is simply necessary for information technology specialists to work on the Internet, for programming.

Our task is to develop the course with new content combining the study of the subject and the improvement of English language skills. Tasks should be built on authentic sources, unique, developed by the authors. The innovativeness of the approach lies in the fact that independent work (lectures, tests, assignments) of students to study the material is combined with group work (wiki, polls, discussions, webinars, assignments). At the same time, while studying the subject, students will perform a number of tasks, master the material in interactive H5P tasks, which are very convenient for learning a foreign language, replenishing vocabulary. The course will be in demand at the university, since at the moment, primarily due to the pandemic, but also due to the fact that most masters are working, attendance at master's programs is quite low. At the same time, it is necessary to create such courses that would provide the educational process with effective teaching materials and stimulate students to real learning.

## **3. Research Questions**

The research questions are as follows:

- i. How to develop the concept of a new course.
- ii. How to create a modern interactive online course.
- iii. How to apply up to date H5P technologies.
- iv. How to develop the tasks for teamwork and live communication in English on the subject through online services.
- v. To assess the risks of the project.

## **4. Purpose of the Study**

The aim of the study is to develop a new online course “Modern Problems of Cybernetics in English” aimed at deepening students' knowledge of the history of the development of cybernetics, the state and importance of cybernetics in the modern world, the formation of skills in applying classical cybernetics methods to software engineering problems, as well as improving English skills language in the professional field.

## 5. Research Methods

The research methods include literature analysis, systems analysis, generalization, risk analysis, new methodological methods and modules, new trends in online and IT education.

## 6. Findings

Only universal access to cyberspace will provide equal conditions for the educational activities of the population, which can be in the nature of continuous self-learning. There are three types of educational activities:

- formal education culminating in the issuance of a generally recognized diploma or certificate;
- non-formal education taking place in educational institutions or public organizations is usually not accompanied by the issuance of a document;
- informal education, individual cognitive activity that accompanies our daily life and is not necessarily purposeful.

The continuum of lifelong learning makes non-formal and informal education equal participants in the learning process. The term “lifelong learning” highlights the time factor of continuous education. Recently, the term “lifewide learning” has appeared, which emphasizes not only the constancy of the learning process, but also the variety of its forms - formal, informal and informal.

One of the key factors contributing to the solution of scientific, technical and organizational problems of continuous education is the development and use of learning and self-learning technologies in cyberspace based on information and communication technologies (ICT), which includes:

- development of advanced learning technologies and, above all, flexible distance learning technologies;
- development of information and communication infrastructure for the dissemination of distance learning technologies, creation of intellectual information and educational environments;
- development and mass use of national educational portals;
- training of personnel to ensure the dissemination of distance learning technologies;
- development and use of didactic technologies to support distance learning;
- creation of educational information resources and services.

Modern experience shows that the core of ICT is information and educational resources. All over the world, the question of technical support for the spread of distance learning technologies no longer arises - the issue of changing the mentality of teaching, managerial and administrative personnel in the use of such technologies in education is being discussed.

The global trend in the development of education in the third millennium is the introduction of information technology in the educational process. The Internet plays a special role in this process, as the

main infrastructure of open cyberspace, which provides an interactive exchange of information in modern society (Gilfanova & Petunina, 2021; Kovalev et al., 2020).

Many educators do not understand the benefits that can be derived from the use of advanced educational technologies, and do not know how they can affect developers. Educational system designers and artificial intelligence (AI) researchers are also often unaware of the needs and demands of the typical educator. It is necessary to help these groups to better understand each other's role in all educational processes and show them ways of mutual support.

One of the examples of introduction such an approach is a new course for the master's degree students.

The new online course "Modern Problems of Cybernetics (in English)" is intended for undergraduates in the direction 09.04.04 - Software Engineering, a new master's program "Software Engineering and Cybernetics" enrollment for which began in 2021 in Siberian Federal University. The course is designed for 2 semesters, with a volume of 144 hours, including 36 hours of contact work with a teacher and 108 hours of independent work. The aim of the course is to develop the skills of applying the methods of classical cybernetics to the problems of software engineering. The study of the discipline will allow the masters to develop the competencies necessary for the successful solution of current problems related to the creation and operation of complex self-adaptable and scalable software systems. Teaching the course in English will improve the skills of undergraduates in English in the professional field to communicate with foreign colleagues, speak at international scientific conferences and seminars, publish articles in foreign journals. Studying the course involves reading and analyzing sources on cybernetics in the original, many of which are written by foreign authors - the founders of cybernetics. Independent work of students in the developed course will be based on interactive tasks, which will stimulate interest in their passage. Interactive lectures with questions for understanding the material, surveys, test tasks will allow students to receive feedback in real time, take the course at a convenient and free time from work. The Wiki element in the course will allow students to create group pages in English like website development, which is especially important for undergraduates in software engineering. Live online communication in Zoom, Microsoft Teams, on the one hand, will allow you to improve your spoken English skills, and, on the other hand, will provide an opportunity to prepare for online speeches in English, master modern ways of online communication (Kovalev et al., 2021).

The project is aimed directly at students of the master's program "Software Engineering and Cybernetics" of the Siberian Federal University, and these are mostly young people from 21 to 30 years old. A feature of the course is its teaching in English, which can attract older people to study it, including teachers of disciplines in computer science, software engineering and other computer sciences who want to improve their knowledge of English, English language skills in the professional field. Thus, indirectly, the course is aimed at an adult audience. The main participants of the course should be university students and teachers; however, the course may be of interest to specialists working in the field of information technology and wishing to improve their professional English skills and expand their knowledge of the history of cybernetics. The course will be able to be taken as a discipline of choice by foreign students of the university of all specialties, including students of postgraduate and doctoral studies. The online format of the course will allow people with disabilities to take it without visiting classrooms. The general format

of the course allows improving the digital literacy of students, the ability to use online services, and create websites.

The course is part of the curriculum for the master's program "Software Engineering and Cybernetics" implemented in the 2nd and 3rd semester of study. The work program was compiled in accordance with the Federal State Educational Standard of Higher Education for Major "Informatics and Computer Engineering" approved by the head of the Department of Informatics. The transfer of the course to distance learning was carried out on the basis of the Regulations on the implementation of e-learning and distance learning technologies in the university. The new course will fully comply with the requirements for the transfer of disciplines to the electronic form of education. This course can become a universal discipline of choice for master's programs in the field of Informatics and Computer Engineering, and will be in demand for inclusion in the programs of foreign students enrolled in inclusive education in English at the university. Today, more than 700 foreign students studying at the university, while the attractiveness of the university for foreign students directly depends on the number of subjects sold in foreign languages.

In Russian universities there are no analogues of this course in a foreign language. Lectures are given in Russian on the history of the development of cybernetics, and a number of manuals on cybernetics have been developed in printed form. In foreign universities, this course is taught, but does not include the study of the development of cybernetics in Russia. It is planned to include video lectures by Professor of the University of George Washington Umpleby (1990) on the history of the development of cybernetics (in English), lectures by Novikov from the Institute of Control Problems of the Russian Academy of Sciences on problems of cybernetics and other scientists (Mayer, 2021; Novikov, 2016; Suyatinov, 2020). In general, online courses in special disciplines are widely used today in universities, but there are not so many non-linguistic courses implemented in English. It is planned to use the general methodological approaches of successful online courses of the Siberian Federal University, examples of which are given in the training and methodological materials. It is also planned to adapt the successful practices of using such elements of online courses as a lecture with questions to test understanding, a wiki, and surveys. A feature of the developed course is that it will be taught in English. Therefore, it is planned in a number of elements of the course to adapt some exercises for the development of listening and speaking skills, writing, grammar to its content. But these skills will be developed on the materials of texts and audio resources on the specifics of the subject. That is, authentic materials on cybernetics will be used. All exercises will be authored, based on the experience of teaching and developing methodological materials of the author of this course (Gubanov et al., 2014).

Siberian Federal University has an e-learning system - E courses, Moodle - an electronic course management system for online courses. The Moodle version of the university allows one to apply for the creation of new courses, add all modern course elements, including the creation of interactive lectures, polls, tests, folders with materials, glossaries, assignments, wiki, feedback, gradebook, hyperlinks, forums, chats, etc. One of the newest features introduced is the ability to use H5P content, which is used to create interactive elements of the course, allowing you to take the course in a playful interactive form. The eLearning Server provides step-by-step instructions for using and implementing all of the content forms in an eLearning course. In the new course, it will be necessary to develop assignments in

all elements and forms that will help diversify the course, stimulate students' interest in taking the course from beginning to end. Using H5P elements, interactive training videos will be developed, games for memorizing a new vocabulary on the topic of the course, answer elements with pronunciation of answers will be built into the tests, which is especially important for the development of speaking skills, since the course will be implemented in English and the development of speaking skills is very important in this case. You will need to purchase a Zoom subscription as this service will be used for online classes and webinar recording. Conducting online classes will help develop speaking and communication skills in English on the subject of the discipline.

The new course will consist of 5 main sections: A review of existing work in the field of software cybernetics, the history of the creation and development of cybernetics; Definition and study of the structure, main directions and current achievements of cybernetics; Modern research in the field of cybernetics; Analysis of modern projects for the creation and operation of complex self-adaptive and scalable software systems; Cybernetics 2.0: main trends and development prospects. 2 first topics are studied in the 2nd semester; 3 topics are studied in the 3rd semester. The topics are interconnected and lead students from the history of the birth of cybernetics to the study of its foundations, subject, tasks, etc., consider its interdisciplinary nature, relationship with other sciences, importance in the modern world, as well as its failures, the course ends with a study of modern trends development of cybernetics in the world and in various directions, as well as the prospects for its further application. Each section will include elements such as interactive lectures with quizzes, self-study materials, assignments, tests, quizzes, videos. The sections will be interconnected by a glossary, the creation of a wiki (websites on the material covered), video lectures. A number of sections will include interactive H5P activities: collages, columns, interactive presentations, conversation cards, interactive videos, memory games, etc.

The results which are planned to be achieved through the introduction of the proposed product and the new competencies it will allow to form in students, teachers, and other participants in the educational process are shown in Table 1 below.

**Table 1.** The results of the course

<b>Result</b>	<b>Index description</b>	<b>Data source (validation method)</b>
A special course in cybernetics in English for teaching foreign students, which can be used in master's programs in English	1 online course developed on the E-course platform	Course URL
Growth in the number of students who speak English	1 course in a special discipline in English	Course URL
Increasing student participation in international conferences and programs	The number of students who speak English at the Intermediate and Upper-Intermediate levels will grow by 15-20 people every semester	Certificate of Proficiency in English
The growth of students who successfully completed the course and passed the final certification for the course	The number of students who presented papers in English and took part in international programs will grow to 5-10 people per year	Results of competitions and conferences
Growth of students' publication activity	The number of students who successfully complete the course will grow to 90%	Record sheet
A special course in cybernetics in English	The number of students who have mastered	Articles published by

for teaching foreign students, which can be used in master's programs in English the skills of presenting the results of their research, including in English, will grow by 5-10 people per year students, including in English

The course created is planned to be presented at a meeting of the Department of Informatics of the university. New interactive forms of the H5P course are planned to be presented to teachers at the methodological workshop. It is also planned to present the experience of translating a non-linguistic (special) discipline into English at a meeting of the Presidium of the Russian Union of Scientific and Engineering Associations, which unites regional unions of the R&D of the Russian Federation. This experience will promote the use of online courses for engineering education, which is important at the moment when many training programs are moving online. the student environment, the course will be promoted by creating groups on social networks and Telegram.

The course will be delivered online. However, the real communication between the teacher and the students will take place during the Zoom seminars, which will replace the real communication in English and the discussion of the problems of the development of cybernetics. In addition, the developed tasks can also be used in traditional offline learning, if the classes are transferred to the traditional learning format for some reason, or the developed course is used to teach students of other programs in the traditional form. All tasks can be demonstrated through presentation equipment (projector and screen) in the classroom, in addition, it is planned to develop a teaching aid for the course, which will include educational material, tests and assignments. This textbook can be used in traditional lessons in the discipline.

There are the main risks that may hinder the implementation of the project. They were analyzed in order to propose measures to reduce or prevent each risk (Drukarenko et al., 2020). The full analysis is given in Table 2.

**Table 2.** Risk analysis

<b>Risk</b>	<b>Obstacle</b>	<b>Measures to reduce or prevent each risk</b>
Problems with the purchase of equipment	The sale does not include the equipment necessary for the implementation of the project	Installing a local version of Moodle on a computer, which will allow you to continue developing course elements with the subsequent transfer of the developed material to the E-courses server
Server failure	Server of E-courses not working	Transition to domestic software with characteristics that satisfy the project
Lack of software required for course development	Foreign software is not available for purchase due to sanctions and the inability to pay abroad by card	The structure of the course is being revised in accordance with changes in curricula
Change in the internal rules of the university	Changes have been made to the curricula of the magistracy by hours and semesters of the implementation of the discipline	Exercises and assignments should be designed in such a way that students with different levels of English proficiency can complete the course, assignments should be included to teach how to use modern translation

Level of knowledge of a foreign language	At the stage of course development, it is difficult to predict the level of foreign language proficiency of masters	programs Constant monitoring of the implementation of project stages, filling out the project implementation diary, timely making changes to the project implementation plan aimed at fulfilling the project result on time
Mistakes in planning the stages of project execution	When planning the stages, mistakes were made in the sequence of stages, the timing of the project	Regular meetings with team members, timely reminders and control over the fulfillment of commitments, if necessary, search and involvement of other specialists
Failure to complete tasks by team members	Due to the workload of other projects and work, team members do not fulfill their obligations	Timely conduct of test checks created during the development of tasks, involvement of students and teachers of the department in test checks of tasks, adjustment of tasks based on the results of test checks
Conflict of expectation results	Designed assignments in a course do not work as intended	Elaboration of the possibility of using domestic services (Rutube, VK and others)

## 7. Conclusion

The result of the project will include a new author's course on cybernetics in English which will be developed for teaching Russian and foreign students. It can be used in master's programs implemented both in Russian and in English. The course will be designed using the latest interactive forms that will stimulate interest and motivation to study it. The course will be universal for use in master's programs in information technology, can be used for a research seminar and research practice for undergraduates. As a result of the course, the number of undergraduates who speak English will increase, including those who have improved their competence in reading authentic literature in their specialty, speaking and listening, as well as scientific and academic writing. The number of graduates and students of the master's program prepared for oral presentations with the presentation of special topics in a foreign language, participating in international conferences on IT technologies, big data, cybernetics, and programming, will increase. The course will prepare undergraduates for writing articles on scientific issues in the Russian and foreign scientific sphere, the publication activity of undergraduates in publications indexed in citation and analytical databases will increase. The number of students who have successfully passed the final certification in the discipline implemented in the new course, as well as in courses directly related to this discipline, will increase.

The new course will show one of the ways to solve the tasks set to ensure universal access to cyberspace as it will teach new specialists in this field.

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## References

- Drukarenko, S. P., Kovalev, I. V., Testoyedov, N. A., Voroshilova, A. A., & Efa, S. G. (2020). Integration of educational and industrial organizations in the implementation of the roadmap in the field of engineering and industrial design. *Journal of Physics: Conference Series*, 1691, 012177. <https://doi.org/10.1088/1742-6596/1691/1/012177>
- Gilfanova, G. T., & Petunina, A. R. (2021). Digital educational resources in teaching to foreign students at language universities. *European Proceedings of Social and Behavioural Sciences EpSBS*, 116, 514-521. <https://doi.org/10.15405/epsbs.2021.09.02.57>
- Gubanov, D., Korgin, N., Novikov, D., & Raikov, A. (2014). *E-Expertise: Modern Collective Intelligence*. Springer. <https://doi.org/10.1007/978-3-319-06770-4>
- Kovalev I., Voroshilova, A., & Pivovarov, G. (2021). Social Importance of Scientific And Educational Projects In The Modern Youth Environment. *European Proceedings of Social and Behavioural Sciences EpSBS*, 116, 1-8. <https://doi.org/10.15405/epsbs.2021.09.02.1>
- Kovalev, I. V., Voroshilova, A. A., & Testoyedov, N. A. (2020). Civil Society Project Initiative In Formation Of University 3.0. *European Proceedings of Social and Behavioural Sciences EpSBS*, 90, 1114-1121. <https://doi.org/10.15405/epsbs.2020.10.03.128>
- Mayer, R. (2021). On the formation of students' information-cybernetic thinking at pedagogical universities. *Review of Omsk State Pedagogical University. Humanitarian research*.
- Novikov, D. (2016). *Cybernetics: from Past to Future*. Springer.
- Recommendation concerning the promotion and use of multilingualism and universal access to cyberspace. (1996). Retrieved on 30 April, 2022 from [https://en.unesco.org/sites/default/files/eng\\_-\\_recommendation\\_concerning\\_the\\_promotion\\_and\\_use\\_of\\_multilingualism\\_and\\_universal\\_access\\_to\\_cyberspace.pdf](https://en.unesco.org/sites/default/files/eng_-_recommendation_concerning_the_promotion_and_use_of_multilingualism_and_universal_access_to_cyberspace.pdf)
- Suyatinov, S. (2020). Educational Laboratory Complex for the Study of Complicated Systems. *ITM Web of Conferences*, 35, 01018. <https://doi.org/10.1051/itmconf/20203501018>
- Umpleby, S. A. (1990). The Science of Cybernetics and the Cybernetics of Science. *Cybernetics and Systems*, 21(1), 109-121. <https://doi.org/10.1080/01969729008902227>
- Voroshilova, A., & Kuznetsov, A. (2021). Overview of the III International Workshop on Modeling, Information Processing and Computing (MIP: Computing-2021). *Modern Innovations, Systems and Technologies*, 1(2), 1-21. <https://doi.org/10.47813/2782-2818-2021-1-2-1-21>
- Zenutkin, N., Kovalev, D., Tuev, E., & Tueva, E. (2021). On the ways of forming information structures for modeling objects, environments and processes. *Modern Innovations, Systems and Technologies*, 1(1), 10-22. <https://doi.org/10.47813/2782-2818-2021-1-1-10-22>