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**TECHNOLOGY OF TRAINING TECHNICAL UNIVERSITY
INSTRUCTORS TO USE ICT IN BLENDED LEARNING**

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Abstract

Blended learning (B-learning or combined learning, BL) is widely used in universities. Its rational organization makes it possible to optimally combine the elements of classical academic education and e-learning resources (ELR). As the world, national and regional experience shows, many instructors during the pandemic were not ready to conduct this kind of learning. A significant part of the instructors experienced difficulties and could not organize the educational process in the BL mode in a quality manner. The low level of design skills in the use of information and communication technologies (ICT) did not allow some instructors to create the curriculum of disciplines holistically. Typically, lectures, seminars, practical and laboratory classes are conducted during the academic study process in full-time format. In turn, modern e-learning involves the use of electronic learning environments (ELE), which are aimed at the development and delivery of educational content, collaboration of all participants in the educational process, collection and analysis of control results. We demonstrate theoretical and practical experience of training instructors to organize BL on the basis of ICT tools at Novosibirsk State Technical University. The authors have developed and implemented a technology aimed at improving the design skills of instructors. The work is valuable in terms of fundamental and practical research in the field of educational design.

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1. Introduction

To meet the requirements of adult learning modern education should acquire the following features when retraining high school instructors and reformulating requirements for their activities. It should be:

- humanistic (oriented towards a person, towards his goals, needs and interests);
- technological (thanks to the use of new technologies);
- variable (providing a choice of tools and training trajectories);
- humanitarian (having value and meaning).

In our work, we concretized and supplemented the structure model of a modern instructor (specialist) activity within BL based on ICT. It reflects both world and national trends (Arroyo Gonzalez et al., 2020; Noskova et al., 2018). Using its structure, we proceeded from classical approaches to formation of a competitive specialist who can apply in his/her practice:

- qualimetric approach (input control of students' readiness to master a professional program; management of a professional educational program);
- innovative approach (diversification, specialization, individualization, humanization, virtualization);
- professional approach (the skill to think systemically, to communicate, to learn and self-study, to adapt to changing conditions, to do research and be creative, to evaluate one's own practice and knowledge);
- implementation of lifelong learning (additional qualifications and competencies, formed skills);
- acmeological approach (a person is the highest value, worthy of a quality life; the image of the final result; professional training as a factor of management, interaction and spiritual communication; value orientations as the goal of transitions in transforming the needs, interests, ideals, goals of the individual);
- motivational support (encouraging students to expand their horizons in accordance with their learning style; focus on needs, motives, means, operations and results; humanistic approach - self-guided structuring of personal experience in order to self-development and self-realization of the individual);
- androgical approach (development of educational needs, priority of independent learning, context, consistency, awareness of learning);
- synergetic approach (homeostaticity, hierarchy, instability, openness, observability, nonlinearity, dynamism).

In BL, by combining the elements of classical academic education and e-learning resources (ELR) (Maslova et al., 2020), an instructor performs many different functions: of a scientific expert; instructor (development and implementation of educational strategies, motivation support); social worker (creation of a comfortable educational environment, organization of inclusive education, collaboration of participants); external controller (monitoring of learning outcomes); manager (process management, moderation of educational activities, facilitation); system administrator (implementation of access to information resources); tutor (giving recommendations on work, assistance in choosing an individual

educational trajectory, coordinating students' questions and answers); researcher (research in the field of pedagogical design and their own professional activities).

When organizing BL, a modern instructor is guided by the requirements of the new educational paradigm.

2. Problem Statement

In the process of training high school instructors, we encounter a number of contradictions:

- between the goals of the educational community to improve the quality of educational and methodological support of the educational process and the lack of clear requirements to its structure and quality assessment;
- between the need for teaching staff at a professional level and low design skills of instructors, who are not interested in working in a new way in modern conditions;
- between a high level of generality of recommendations on PD and the unpreparedness on behalf of instructors to use them in their work, because there is no integral system for training teachers for this type of activity.

3. Research Questions

To solve the contradictions, we proposed and implemented in practice the technology of teaching the teaching staff of a technical university how to use ICT in the organization of BL. According to this technology, instructors were trained at the Faculty of Advanced Training and Staff Retraining of Novosibirsk State Technical University (NSTU)

In this article, educational technology is understood as a model of joint activities of all participants in the educational process in planning, organizing and conducting classes of an academic discipline by means of ICT within the BL framework.

4. Purpose of the Study

The purpose of the study is the development of the model of instructors' activity in the conditions of BL, then development of the technology of instructor training in the use of ICT in their work and practical implementation of technology.

5. Research Methods

The main research methods are modelling the process of education, method of expert assessment and statistical methods.

6. Findings

6.1. Technological model of teaching teachers of technical universities

In classical education, the following components are distinguished in the structure of educational activity: constructive, organizational, communicative and gnostic. For most instructors who begin their teaching activity after defending their Ph. degree without basic pedagogical education (typically, they have a course on general methodology and short educational practice during postgraduate program), this structure is difficult to understand due to its complex semantic structure. Proposing this model, shown in figure 1, we are guided by the results of many years of research on the quality of instructors' activities. The model consists of six components: introspection and reflection; search and exchange of information, construction of personal knowledge; personal; general cultural; research; psychological and educational (pedagogic) components.

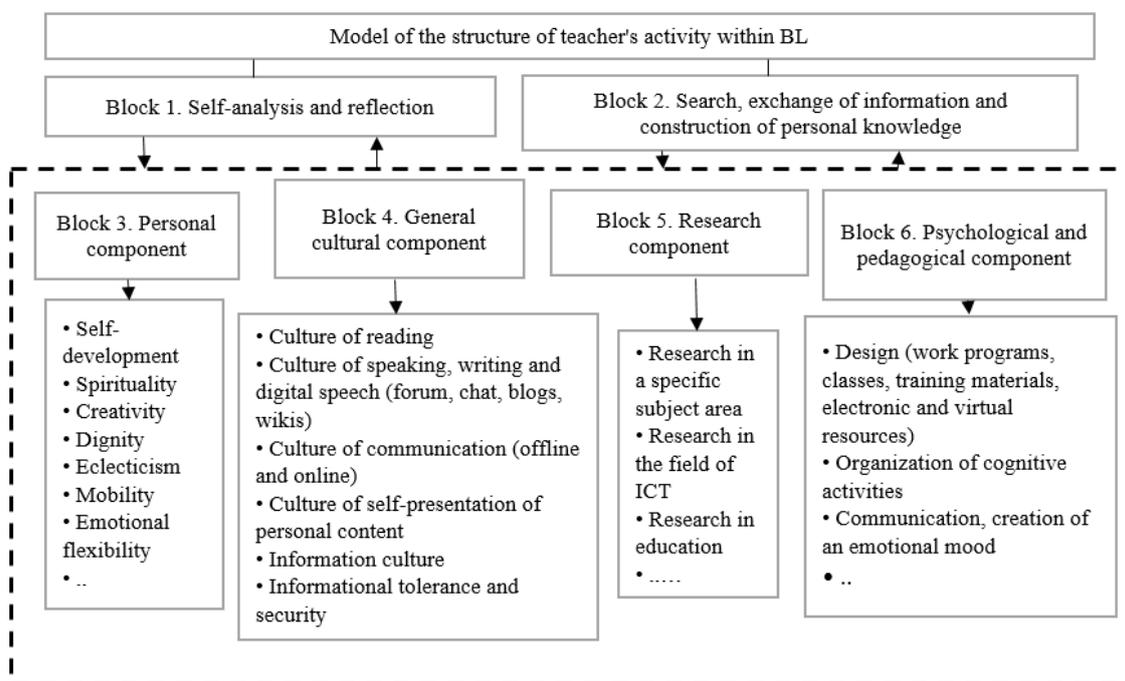


Figure 1. Model of the structure of instructor (high school teachers) activity while using BL

When organizing BL, the skills of introspection and reflection should be especially developed. Rapidly changing pedagogical conditions with a high degree of uncertainty (software learning environments, external resources, online boards) and the target group of students assume that an instructor has this component. Reflection, introspection and self-assessment allow one to study and adequately assess oneself in activity, to make the necessary changes in work. The ability for professional reflection and introspection can be considered both a necessary condition for the development of a person's creative potential and one of the requirements for modern professional activity. The presence of introspection in professional educational activity can be considered one of the indicators of the quality of the instructor's activity. It makes it possible to analyze, adequately evaluate, correct one's own activity, focus on the norms and identify one's strengths and weaknesses in order to outline the paths of self-development and self-improvement.

The personal component presupposes the presence of many value qualities in an instructor. The inner need to learn throughout life initiates formation of many personal qualities: interest in the

personality of others, educational authority, responsiveness, justice, tolerance, humanism, honesty, moral stability, hard work, sense of humor, stress resistance, volitional qualities, intelligence, creative imagination, good memory, charm, resourcefulness. When organizing BL, an instructor involves students in the educational process with the content of the educational material, the nature of the activity, and, first of all, with his/her own personality. Students want to see the instructor, communicate with him/her and want to work under his/her leadership. The instructor's inner tact is not less important.

The general cultural component, the search and exchange of information, the formation of personal knowledge in the organization of BL is becoming more and more relevant. The second component is directly and indirectly related to other components of the structure of instructor's activity; in this study, it is jointly considered with the general cultural one. The instructor actively and interactively communicates with students, works with material from a variety of software environments and services. Reading a large amount of information, the instructors expands his/her vocabulary and active vocabulary. At the initial stage, the instructors uses services in the Web 1.0 mode, and then works in the Web 2.0 mode, entering his/her own information, supplementing the existing information content. The instructor can actively interact with the blog network and contribute to it. Web 2.0 services such as Flickr, eZineArticles, Twitter, YouTube and Facebook are used to publish content. Inevitably, the educator is drawn into the professional realm and participates in Web 3.0. Web 3.0 refers to the development of high quality content and services by professionals using Web 2.0 technologies as a productive platform (Asari et al., 2020). The instructor, like a professional, takes part in a "social search" aimed at what is necessary for a particular user. In doing so, members of the information community can influence search results (Azarov & Mayboroda, 2020).

Instructor's activities as a peer to Web 3.0 will be associated with personalized, contextual and relevant search processes. Cultural development of an instructor will be correlated with the evolution of 3D network and will be accompanied by deductive reasoning. Some of the instructors have already entered this mode of operation, the active use of cloud technologies is an evidence of this (Doronkina et al., 2019).

The educational space should be safe for any participant in the educational process, regardless of his/her subculture. The instructor is responsible for doing this. The organized educational process within BL preserves general cultural traditions, avoiding profanity and slang vocabulary.

When constructing copyright texts, the author must also have a scientific style of speech, avoiding slang clichés.

The research component is inextricably linked with the activities of the university instructor. The instructor is a researcher in his/her subject area and is engaged in fundamental or applied research. Students are involved in this activity, mastering the methodology of science. But in order to work effectively at a university for many instructors, the educational process and their own educational activity (EA) should become the object of research. This is directly related to introspection and personal reflection. Many instructors are not aware of the difficulties in their EA, they often associate problems with the quality of the organized educational process with the personality of the students. The intensive development of ICT cannot pass by the instructors without leaving a trace. As it was mentioned earlier, BL assumes the active use of ELE, which should be mastered, navigated in and chosen correctly to

achieve educational goals. A variety of ELR tools ensure the development and prompt delivery of educational content, the interaction of subjects of the educational process, as well as regular collection and analysis of the results of intermediate and final certification. The broad knowledge of ICT presupposes their inclusion in the object of instructor's own research as they are potential participants in Web 3.0.

The final component in the structure of EA is the psychological and educational one. Methodologically, this research is based on the philosophical interpretation of a person as an active subject, cognizing and transforming the world around him/her and himself/herself in the process of activity. Man is the highest value and an end in itself for social development (Herodotou et al., 2019). In accordance with this, the process of educational design is aimed at creating conditions for a student within the framework of a given educational course for his/her self-determination in relation to the course. This is the basis for building one's own educational trajectory. On the other hand, in the course of educational design (ED), the instructor has the opportunity to rethink the educational process of the course, reflect on it and present it as an integral system. ED is innovative in nature and is an important feature of EA, it is implemented in the course of solving emerging problems, critical attitude to standards and openness to the external environment, thanks to the desire for self-realization and to translating one's intentions into innovative activities (Alyabeva & Turlo, 2020).

The most important result of ED is not only the project itself (for example, teaching materials on an academic discipline), but also the instructor's ability to accept changes, determine his/her own position in relation to them, the ability to critically evaluate his/her project and make educational design an obligatory component of his/her activities.

At the present stage, ED is defined as a complex and cyclical process of developing a "concise", concentrated image of an academic discipline, based on the achievements (theoretical and practical) of education, on the basis of historically established traditions and on new goals, values, development trends and requirements of the education system and modern computer technology. ED is characterized as cyclical, because work on teaching materials is a phased one, the result of each previous stage is the beginning of the next one and proceeds according to the scheme: reflection of the social and personal need to transform the current educational situation → goal setting → choice of means and methods of organization → assessment of the quality of the completed project (Alyabeva & Turlo, 2016). ED is continuous and has fundamental incompleteness (work on educational materials almost never stops, it is associated with the continuous change in the relevance of the course material, the change in the goals and values of various participants in the educational process and the development of ICT).

An instructor, designing the educational process, develops a work program for the discipline, makes up scenarios for face-to-face and distance learning, selects the content of the material and plans the educational activities of students in accordance with the goals and uses a variety of ELE and ELR. He/she selects the appropriate educational technology to develop the model of interaction with students.

Within BL framework, the organization of educational and cognitive activities of students is the most important. It should be no less effective than with full-time traditional education (Hooda, 2020). The results of such training should be durable (knowledge is conscious, and skills are aimed at solving certain problems within the professional context).

An important role is played by communication and creating the right emotional mood. For a large number of instructors, organization of active and interactive communication in the BL mode is difficult. It must work for the future, creating the basis of motives and goal-setting for its own activities (Talyшева, 2021). Unfortunately, most instructors underestimate the importance of this element in the structure of instructor's activities. By creating communication within the framework of certain educational technologies, the instructor uses resources of communication technologies (Kubina et al., 2020). A variety of tools are used for this: a forum, chat, e-mail, blogs, wikis, tele- and video conferencing, hypertext and others. In this case, various base programs and platforms can be used.

6.2. Features of educational materials in modern conditions

An instructor develops new teaching materials in accordance with the modern humanistic paradigm of education (Sabirova et al., 2019). It is these materials that make it possible to successfully support BL implementation. The features of these materials are presented in Table 1.

Table 1. Comparison of old and new paradigms of education

Old paradigm of education	New paradigm of education	Nature and features of educational materials in line with the new paradigm of education
A teacher takes responsibility	Responsibility is assumed by teaching materials and students themselves	Learning guides, teaching manuals and instructions, ELR and EEE become valuable besides textbooks and monographs
The main thing is the provision of information by the instructor and its "reproduction" by students (provision of information for future use, answers to unasked questions)	The main thing is to jointly obtain information necessary for solving specific situations, searching for it to answer the questions that arise	Tasks (questions, situations) precede the "text". Methodological materials with unsolved tasks -problems ("hot spots" of science) are valuable
The main activity of a student is under the guidance of an instructor	The main activity of a student is under the guidance of an instructor	Well-developed course programs and e-educational courses allowing students to plan and carry out their activities are important
Control at all stages is important. Questions are asked by the instructor	Self-control is more important. A student asks. An instructor (or teaching materials) plays a supporting role	Self-test materials preceding the presented information
Standard tasks are familiar to the instructor and there is stability. Students acquire knowledge and methods of activity reproductively. There are many samples of problem solving in the materials	Dynamic phase of the life of society. Non-standard tasks are solved in conditions of lack or excess of conflicting information and the choice of the necessary information	From standard textbooks to collections of situations, problems, cases, information necessary to solve them and links where you can find the answer to your questions
Scientific and pedagogical parallelism (theory is separated from practice and technology)	Theory and practice are inseparable, combined into a single whole	Training materials in which tasks, problems, specific situations are interspersed with the necessary information to solve them or instructions, tips where to find it
Subject-oriented learning	Knowledge about oneself, about the world, about ways of activity and value orientations integrated within the framework of the educational field. Joint development by teachers	Study materials at the intersection of sciences, focused on solving specific problems

	and students of an integrated lesson that has wide application	
Man is a means. University-oriented leaning. State-oriented learning	Man is the goal, the centre of the educational process. Interests of the individual, society and state	Educational and methodological materials are focused on different categories of users (mandatory minimum is the "core", maximum is different)
Separate highly specialized manuals of individual authors are aimed at solving local problems ("everyone is his/her own behalf")	Joint activities of instructors working in one educational program ("all for one"). Students create their own educational content within the framework of Web 2.0, which is the result of personal reflection on the material of the educational course	A set of educational materials is developed in accordance with the objectives of the educational program and personal educational trajectory
The main activity of a student is under the guidance of an instructor	The focus is made on independent work (planning, organization, self-control)	Well-developed course programs, e-educational courses on various platforms, use of EEE and other ELR, which allow students to plan and carry out their activities, are important There is demand for educational materials on the methodology of education, self-education, teaching and learning. Students share their own learning experience and together with teachers create such educational materials that are always in demand (productive ways of activity)
Highly specialized (often rapidly aging) knowledge is valued	Focus is made on what remains "when everything learned is forgotten" and on the ability to learn and relearn	References and information literature are important for training to work in new conditions of various consumers, links to ELR portals and information on how to work with them
Focus is on ready-made information	The predominant mind set is to search for information	

The design component in the structure of instructor's activity must be clearly expressed and developed in order to create such teaching materials (TM). Moreover, educational materials are supposed to be used in BL format. In the context of modern humanistic paradigm, the activities of the teacher and the features of the educational process are already changing both in traditional teaching and in BL (Kubina et al., 2020). For this, it is necessary to know the specifics of training, requirements for BL and its tools and teaching methods.

6.3. Technology for training teachers to use ICT when organizing blended learning

To solve the contradictions, we proposed and implemented in practice the technology of teaching instructors of a technical university to use ICT in the organization of BL. According to this technology, instructors were trained at the Faculty of Advanced Training and Staff Retraining of Novosibirsk State Technical University (NSTU)

In this article, educational technology is understood as a model of joint activities of all participants in the educational process in planning, organizing and conducting classes of an academic discipline by means of ICT within the BL framework.

Any educational technology consists of a conceptual framework, content and procedural components.

The conceptual basis of teaching technology is made up of the following provisions:

- meaningful “core” means “norms” of ED in BL;
- the process of adopting the “norms” of the ED in BL by teachers is associated with a change in personal “norms” of quality and bringing these “norms” in line with the proposed ones;
- teachers' awareness of their own difficulties in the ED is a prerequisite for the development of their competence;
- the possibility of joint training of different teachers is based on the nature of the proposed ED material, which is invariant to the content of specific disciplines;
- the choice of an individual trajectory of training is implemented by a developed system of support for teachers in the course of training;
- in the course of developing and evaluating BL elements by means of ICT, each teacher gains ED experience in real conditions;
- the previous experience of teachers is taken into account;
- the vector of the educational process is the contradiction between the tasks that the teacher needs to perform when designing his discipline, and his level of training;
- teaching technology is based on taking into account personal characteristics, joint cooperation, learning in dialogue, organic communication of a group and individual activities, a significant proportion of independent work, each teacher develops his/her own project, evaluates its quality, as well as the quality of colleagues' projects.

The teaching technology is based on the competence-qualification approach. After successful training, the teacher can form and develop competencies in the field of ED of BL, learn to develop a variety of educational elements and assess their quality.

After completing the course, the instructor will have an idea of:

- modern trends in education, e-learning and distance learning, cloud technologies, stages of development of the Web 1.0 - 3.0;
- the role of ED in the activities of a university teacher;
- approaches to assessing the quality of the educational process and teaching materials within the BL.

The instructor will know:

- principles of planning, structure and requirements of BL, stages of development of BL in the world;
- distinctive features of new ICT-based teaching materials;
- principles of material structuring;
- peculiarities of students' activities during the process of BL;
- requirements for the formulation of definitions of concepts, generic relations of concepts;
- main components of pedagogical and ICT training;
- leading EEE (platforms) and ELR;
- types and forms of education during the process of BL;

- features of the Dispace platform when organizing classes and exercising control;
- major mistakes and difficulties in conducting BL;
- methodology for assessing the quality of classes and teaching materials during the process of BL.

The instructor will be able to:

- formulate the objectives of the discipline and teaching materials during the process of BL;
- develop the structure of ED products for BL;
- develop and deliver BL classes using ICT tools on various platforms;
- use leading ICTs in the development of a variety of educational materials (for the presentation of information, organization and control of student activities);
- establish communication with students by means of ICT;
- create materials within the framework of Web 3.0 technologies;
- develop propaedeutic materials;
- present the same theoretical information in different forms (video, screencasts, hypertext, text, illustration, diagram, table, diagram, formula);
- develop elements of open online courses using the Jalinga Premium software and hardware complex;
- use leading graphic editors, online boards when organizing classes;
- highlight and describe productive ways of performing tasks in BL mode;
- identify possible difficulties of students and choose ways to eliminate them;
- formulate frequently asked questions of students and answers to them;
- make recommendations for students on how to work with TM;
- evaluate the quality of a certain type of TM;
- plan the procedure for using TM in the educational process.

The goals of the learning technology determine its content and procedural parts.

The features of teaching technology of ED are associated, first of all, with the change in the personal position of an instructor (an active developer) in the learning process:

- focus of instructor's activity not only at the satisfaction of cognitive needs, but also at the self-development of the individual: self-affirmation, self-determination, creativity, self-actualization;
- stability and maintenance of the instructor's individual style of educational activity;
- dualism of educational forms: group training in the development and assessment of the quality of prepared materials and a dialogue between an instructor (a developer) and a consultant;
- taking into account and overcoming the unawareness of instructors in the process of designing their own difficulties;
- implementation of "positive" learning, during which students (teachers) do not have mistakes but there are difficulties (growth points), which can be removed after having been understood; the mistake becomes a new vector in the development of an instructors. The main types of educational activities are presented in Table 2.

Table 2. Stages of educational design

Stages	Activity of a instructor-consultant)	Activity of a instructor-developer
<ul style="list-style-type: none"> • agreement and acceptance of modern values and goals of education; • awareness of personal difficulties with ED; • modelling activities for the design of TM; • creation of TM; evaluation of ED results 	<ul style="list-style-type: none"> • creation of situations in which an instructor sees mismatch between previous experience and modern requirements for the quality of educational institutions; • collaboration, the implementation of polemics aimed at achieving the desired goals, the organization of generalizing conclusions of the discussion, highlighting important and valuable points and students' recommendations; • organization of work with EEE and ELR; • conducting screening control in the form of a questionnaire at all stages of training and developing materials for subsequent discussion; • emotional support of students, creating trust-based relationships and professional openness; • removing hidden resistance of instructors 	<ul style="list-style-type: none"> • building and understanding modern ideas about the organization of the educational process in the discipline within the BL; • comparison of the structure of traditional electronic and open online courses; • comparison and assessment of the qualities of the TM fragments for BL in various disciplines; • highlighting the functions, characteristics and features of the training in BL; • conducting a comparative analysis of instructor's activities in the traditional learning and BL

The activity of an instructor-developer is much wider. It includes the following stages as well:

- comparison of educational technologies and ICT;
- comparison and collation, highlighting strengths and weaknesses, advantages, various EEE and ELR, identifying their functional significance in BL;
- presentation of the main EEE, ELR and Dispace in the educational space;
- analysis of the main components of TM;
- establishing links between the main components of TM in BL;
- presentation of one's own position on the issues discussed;
- participation in polemics with colleagues;
- development of TM of a certain type or their fragments for BL;
- self-assessment;
- evaluation of the quality of TM and the rationality of their use in BL;
- preparation of an expert opinion based on the results of the expertise.

Instructors are selective about everything related to design issues. Most of the information is perceived by the listeners in a metered manner and not immediately. It is easier to adopt the information that is part of personal experience, therefore, at the beginning of training, conditions are created for actualization of the subjective experience of instructors.

When organizing classes, both individual and collective ways of learning take place - brainstorming, case solving, collective search. This allows us to consider educational problems as a whole, within the framework of many disciplines, and creates conditions for instructors' awareness of the ED of TM in the structure of their activities. Problem-based teaching of ED causes a mismatch with the personal experience of teachers. Artificial creation of problematic situations makes it possible to dramatically activate instructors and to reveal their creative potential. A preliminary analysis of the experience of other students from the position of an expert enables the instructor to correlate his/her own experience with the experience of others and introduce new things into his/her own practice.

6.4. Results and their discussion

On the basis of the proposed technology, training of instructors was organized within the framework of the course "Practice of using ICT in the organization of BL" on the basis of NSTU. The course length is 72 hours, of which 36 hours are classes held in a mixed form, 4 hours are individual consultations, 30 hours are proposed for independent work and 2 hours are for the presentation of the final work.

Classes were conducted using the designer platform Dispace. 276 NSTU instructors were enrolled for the course. They were experienced instructors from various departments with more than 5 years of work experience. The training was conducted in small groups of 12-15 people. To support the course, an electronic educational and methodological complex (EEMC) was developed.

Lectures took up one fifth of the classes, the rest of the time were practical classes.

Working with various ELRs, the teachers conducted classes in the BL format, finding analogues to face-to-face training. Table 3 shows comparison of traditional educational technologies and ICT.

Table 3. Comparative analysis of traditional teaching tools and BL ones

Educational technologies	Communication technologies
Learning in collaboration, in small groups	Forum, chat, email, blogs
Forum, chat, email, blogs	Forums, chats, blogs, videoconferences, "seminar" function of ES of NSTU
Role-based and business games of problematic orientation	Forums, chats, videoconferences, system "Skype", "seminar" function of ES of NSTU
Situational analysis	Chat, forum, teleconferences
Method of projects	Forum, email, web quest, blogs, internet resources
Student portfolio	Hypertext, multimedia, email, forum, personal web page, online whiteboard, image editors
Brainstorm	Chat, video conferencing, system "Skype"
Lecture	Hypertext, presentations, multimedia, video conferencing, Skype system, audio lecture, television lecture, podcasts

The instructors used modern instant messaging (IM) in real time. The educational process involved: instant messaging services (IMS), online consultants (OnlineSaler) and client programs (Instant Messenger, IM). All technologies presented in Table 2 were implemented using a variety of messengers, which have not yet been familiar to most teachers. Before training, many teachers used some of them as novice users, poorly using their functionality. Special attention was paid to the most used communication tools: MyChat, IRC, AIM, Skype, MSN, ooVoo, Yahoo !, Gem4me, XMPP, Jitsi.

The instructors explored podcasting – the process of creating and distributing files in audio and video formats. The instructors, working on the material of the disciplines taught by them, used Bandicam program and Movavi software package, as well as choose some of the following programs: Screenshot Capto, Monosnap, Ashampoo Snap, PicPick, Snagit, Screen Capture, ScreenShooter. Working with Movavi software package aroused particular interest. On the basis of these programs for working with multimedia, instructors developed their own TM and used them in the mode of Web 2.0 and Web 3.0 technologies placing them on the Internet.

Many instructors deeply appreciated the capabilities of BL and the need for its widespread use. At the initial stage, a significant part of the instructors did not plan to use BL in their activities because they did not master its tools. During the course, there was a desire to work and delve into this topic.

A special place in the course was given to software for web conferencing, online lectures, teleconferences - BigBlueButton, ZOOM, Dispace. The functionality of these programs also allows individual and group consultations, work of small and large groups by creating rooms or session rooms. In real time, each instructor worked with these programs within discipline they teach. The instructors conducted master classes and shared their experience of conducting open web classes.

Writing in these programs is not convenient enough, therefore, in the learning process, work with online boards is organized. In modern conditions, they can be a place of planning, and a tool for explaining and presenting the content of disciplines (Oi-Lam, 2020). Many interactive teaching methods (brainstorming) are effectively realized with their support. Online whiteboards are well suited for modelling, planning, discussing any ideas, and most importantly, for student collaboration. During the practical lesson, each student worked in parallel in his/her own whiteboard window, and everyone could see his/her work. Familiarity with Google applications and their functionality allowed them to quickly intensify the learning process. The wide functionality of the online boards Idroo, JamBoard has found various fields of application in the educational process. The instructors suggested many new directions in the use of these tools in practice.

In parallel, during the training, part of the time was devoted to the methodological and fundamental issues of BL organization. After all, the development of some kind of EEMCs and their number do not mean quality training. All ICT products must organically "fit" into the process.

Based on BigBlueButton, ZOOM, Dispace and Discord stream chat, teachers learned how to work with online boards, giving students access to work. The main programs for conducting distance learning using a tablet were Notepad and Inkodo.

It was the easiest for the instructors to work with graphic editors, graphic tablets, and the most difficult to get acquainted with the hardware and software complex "Jalinga Premium". This is special software designed for video recording and webinars. With its help, you can record instructions and lectures, conduct classes and conferences, using unique opportunities to interact with the presentation.

This software package makes it possible to:

- film and broadcast video;
- record interactive distance education courses;
- transmit a video stream using software emulation of a webcam;
- record and delete, switch tools for working with the presentation using gestures when you touch the board with a touch frame;
- add gif-files;
- animate change of slide, appearance and disappearance of an object;
- move objects using gestures when you touch the board;
- hide and show the presentation object;
- create active objects: 3D graphics, browser, map, list;
- import presentation from PDF.

Practice has shown that mastering the hardware and software complex requires a separate advanced training course. Working with this complex is associated with the activities of a whole team of support personnel and requires significant costs. Some of the teachers agreed to undergo further training in the course "Technologies for creating video materials in the Jalinga software and hardware complex" at the Faculty of Advanced Training and Staff Retraining of NSTU.

During the training, it turned out that 40% of instructors used tests only in printed form and did not know how to use test creation tools. Most of the instructors had experience with the development of online tests, poorly using the capabilities and functionality of these programs. Special attention was paid to the DiTest program on the Dispace and Moodle platforms. Various formats of test preparation were presented - in the online test editor DiTest, as well as with the help of download files.

Each instructor developed a series of various tests with a high degree of variability, got acquainted with the stages of using tests in an online course and mastered the algorithms for the effective use of tests. The tests, in addition to their various types, differed in purpose - tests of entrance control, tests "activators of educational activity", tests of current, intermediate and final assessment and tests for self-control. The wide assimilation of the functionality of the test programs allowed the testing process to be interesting, multilevel, and creative. From now on tests created by the teachers meet validity criteria, and test results can be statistically evaluated. On the basis of these results, instructors modelled the individual trajectory of student learning, for example, to fill gaps in initial training, at the stage of study and consolidation of knowledge and skills.

The instructors liked the work with Myquiz program most. With its help during online classes, you can quickly check the work of students and highlight the most successful ones in a playful way (Suryadi, 2020). All students work simultaneously and do not want to share the results with each other, because only the first ones will receive points. This program allows students to share the answers to the test with others.

When organizing training during the course, the typology of instructors was taken into account (Zakharov et al., 2021). We have identified five groups of instructors differing in their attitude to ED:

- The representatives of "the first group", organically integrate the proposed approach to ED in their activities and make it the subject of their own research, the results of which are of great importance and can be used by other instructors in their own work on TM;
- The representatives of "the second group", accept the proposed approach to ED, its ideology and creatively apply it within their subject area without internal conflict and resistance, regardless of the opinions of others;
- The representatives of "the third group", conscientiously apply a new approach to ED of TM in their discipline, following the "form" rather than the idea of this approach, their work generally meets modern requirements for the quality of this kind of PD products;
- The representatives of "the fourth group", in fact, do not accept the changes taking place in the educational process, at best, they nominally approach the development of educational institutions, observing the external side of the ED process due to mechanical transfer of the form without thoughtful consideration of the peculiarities of academic discipline they teach and the characteristics of a particular educational institution;

- The representatives of “the fifth group”, believe that it was much better before, they live only in the past, various kinds of innovations only interfere with their daily work and overload them, they do not want to change anything in their work and take an active position in denying educational innovations in general.

In the course of the work, the number of students belonging to a certain group was distributed as it is presented in Figure 2. Belonging to a particular group was assessed by the results of the questionnaire and the products of the ED.

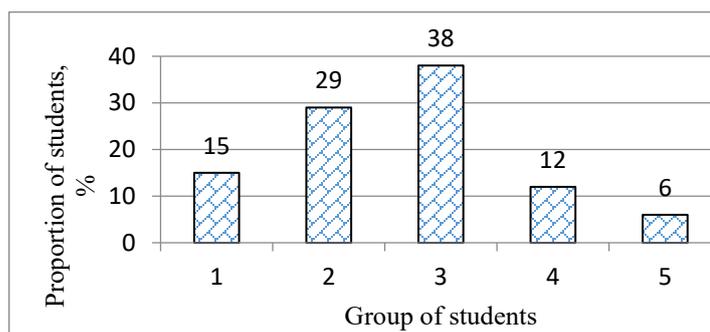


Figure 2. Typology of instructors according to their attitude to ED

ED results statistically differ from each other according to the Student's t-test. Instructors tend to live according to established stereotypes, to follow the usual norms. It takes time to become aware of new trends and values in education.

During the preparation of TM, the quality of the ED product was systematically assessed. On the one hand, it was carried out by instructors themselves, and on the other hand, by an expert (course leader). Figure 3 shows differences in the results of assessment by instructors and the expert at the beginning and at the end of the training.

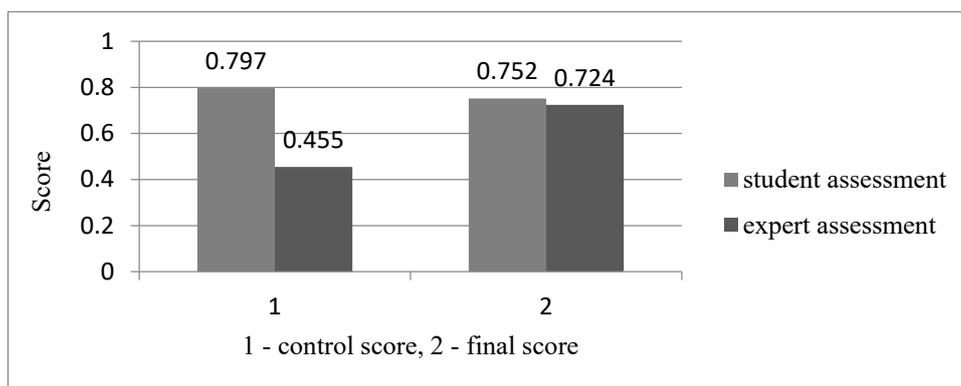


Figure 3. Differences in the results of assessment by instructors and an expert at the beginning and at the end of the training

Let us check the significance of the difference between the expert's grades at the beginning and at the end of the instructor training course. To do this, check the hypothesis about the equality of the means:

$$H_0: \mu_{\text{expert}}^{\text{(start date)}} = \mu_{\text{expert}}^{\text{(end of training)}}$$

in two paired samplings using the paired Student's t-criterion and the nonparametric Wilcoxon pairwise comparison criterion. Table 4. shows the results of testing the hypothesis. The descriptive statistics are presented in the Table 4.

Table 4. Results of testing the hypothesis of the equality of mean values between expert assessments at the beginning and at the end of instructor training

Criterion	Difference of the means	Statistics	Significance level
	$\mu_{\text{expert}}^{\text{(start date)}} = \mu_{\text{expert}}^{\text{(end of training)}}$		
T-Criterion	-0,269	-70,274	0,000
T-Criterion		-6,862	0,000

As can be seen from Table 4, the achieved significance level for both criteria is too small and the hypothesis of equality of means is rejected when $\alpha = 5$. Consequently, the expert's assessment of the quality of TM after training is statistically significantly higher than the assessment at the beginning of training.

Let us consider how the instructors' assessment of their TM differs from the objective assessment of the expert. To do this, we will test the hypothesis about the equality of the means:

$$H_0 : \mu_{\text{teacher}} = \mu_{\text{expert}}$$

for two independent samplings using the Mann-Whitney test.

Table 5 shows the results of hypothesis testing.

Table 5. Results of testing the hypothesis of equality of means between the assessments of instructors and the expert

Criterion	Difference of the means	Statistics	Significance level
	$\mu_{\text{instructor}} - \mu_{\text{expert}}$		
At the beginning	0,342	-9,618	0,000
At the end	0,028	-9,618	0,000

The hypothesis of equality of means is rejected, which means that there are significant differences between the assessments of the instructors and the expert. Instructors tend to overestimate the quality of their own work. Comparison of the assessment of the authors of this study with the self-assessment of students showed that:

- students tend to overestimate the quality of the results of their own work; from personal communication it became clear that they put a slightly different meaning in the given characteristics of their TMs;
- in the learning process, there is concretization and acceptance of "norms" of modern TM, which make it possible to qualitatively organize BL by students; awareness and acceptance of the requirements for the TM leads to improvement in the quality of work;
- 82% of students in general identified those characteristics of teaching and learning which correspond to modern requirements for the quality of BL;

- at the end of the training, the instructors' assessment is close to the expert's, which indicates the acceptance of the “norm” of the quality of modern TM;
- all students noted that after working with the questionnaire, they more clearly identify and formulate individual properties of the components of the TM;
- in general, the prepared TMs are developed on the basis of the proposed requirements, however, the characteristics of the TM, assessed by the minimum points, can be improved;
- the quality of the TM prepared by the trainees after training has significantly increased which indicates an increase in their qualifications in the field of ED - the formation of the competence of development and the competence of expert assessment of the quality of educational materials by means of ICT;
- the presented TMs offer students variety of activities that correspond to their chosen learning trajectory and needs (the level of aspirations and motivation, the degree of preparedness and study of the material, the level of theoretical and practical orientation) in the implementation of BL;
- TMs, developed by students, allow for organizing BL in a quality manner, and become an indicator of the quality of educational activity and the educational process.

After the training, the students were surveyed about the quality of the training. Most of the respondents note a high degree of satisfaction with the training. Such high rates of satisfaction are explained by the fact that during the training the opinion of instructors was constantly analysed. The wishes of the instructors were valuable not only for the content of the course, but also for its organization. The course was provided with a large number of copyright handouts. At the beginning of the course, the trainees recorded their expectations of the course in writing. At the end of the training, it was compared to what extent the expectations had been met. 95% of teachers believe that their expectations are met. 76% of the respondents noted that the result they received during the training exceeded their expectations.

7. Conclusion

The authors have proposed the structure of the teacher's activity in the context of BL. The content of the features of ED in the organization of distance learning technologies has been disclosed. The use of information and communication technologies makes it possible to develop the activities of instructors as active users of the Internet, participating in collection, processing, storage, distribution, displaying and using information in the interests of users of the educational community. The proposed model creates a vector of the instructor's professional competence.

The technology of training teachers to use ICT in the organization of BL in a technical university has been described. Its effectiveness in training NSTU teachers has been experimentally proved. Instructors have learned to plan BL based on ICT resources. The instructors have mastered basic ICT, which allow for conducting classes in various formats. Prepared TMs are indicators of the quality of instructors' activities, demonstrate an increase in the competence of instructors in the field of ED (development and expert assessment). The learning experience in the course can be broadcast to other educational institutions.

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