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**FORMATION OF ICT COMPETENCE IN THE PROCESS OF  
IMPLEMENTING ADDITIONAL EDUCATION**

Raziyat Rabadanova (a), Anastasia Evdokimova (b)\*, Vladimir Ponomarev (c),  
Anna Zotova (d), Lyudmila Polezhaeva (e)  
\*Corresponding author

- (a) Moscow State University of Technology and Management named after K. G. Razumovsky (First Cossack University), Moscow, Russia, raziyat@bk.ru  
(b) Saratov State Medical University named after V. I. Razumovsky, Saratov, Russia, doc\_morozov@mail.ru  
(c) Moscow State University of Technology and Management named after K. G. Razumovsky (First Cossack University), Moscow, Russia, v.ponomarev@mgutm.ru  
(d) Moscow State University of Technology and Management named after K. G. Razumovsky (First Cossack University), Moscow, Russia, a.zotova@mgutm.ru  
(e) Russian University of Economics named after G. V. Plekhanov, Moscow, Russia, lnpole@mail.ru

**Abstract**

Distance education programs included in the system of additional education are the most effective methods of forming special competencies and competence related to information and communication technologies (ICT competence). At the same time, a comprehensive study of various areas of ICT can increase the effectiveness of its formation. The purpose of this study is to analyze the results of a comprehensive study of several areas of Web technologies and the creation of modern Websites. The research is based on a pedagogical experiment with the use of distance learning programs on the Moodle and Leader-ID platforms. The results of the study showed that the simultaneous study of several areas in the field of website creation, rarely chosen by participants of educational programs, provides a higher level of ICT competence formation. The novelty of the work is connected with the analysis of the tools of the digital platforms Moodle and Leader-ID to determine the motivational, cognitive and activity criteria for assessing the formation of ICT competence. The study was conducted within the framework of the federal project «New Opportunities for Everyone» and proves the relevance of the integrated application of distance education programs as a tool for the formation of ICT competence.

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*Keywords:* ICT competence, distance education programs, additional education, Web technology learning, Website development, digital platforms



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## 1. Introduction

The issues of using Web technologies in the educational process are considered in the works of domestic and foreign authors. So, the direction of research of the authors in the field learning the basics of Web technologies can be roughly cut in the levels of higher education (Filippov, 2008; Katerzhina, 2009; Kozlova, 2012; Morozov, 2014; Tambieva, 2011; Volkova, 2009). In particular, this occurs in the training of future teachers (Dzamikhov, et al., 2012; Gosudarev, 2004; Mikheeva, 2010; Morozov & Kozlov, 2019; Morozov & Shorina, 2017; Vezirov, 2008); in school education (Dzamikhov, et al., 2012; Gosudarev, 2004; Tikhanov, 2008). Many works (Garcia, et al., 2021; Heerden & Goosen, 2020; Napalkov, 2013; Sanchez & Aleman, 2011; Sasankar, 2020; Shulgina, 2013; Suleiman et al., 2020; Vorobyov, 2003) highlight the creation of educational Web quests for students as the goal of teaching the basics of Web technologies. Despite the depth and scientific significance of these studies, they do not pay enough attention to the formation of ICT competence in the case of students studying several areas in the field of Web technologies, which determines the problems and relevance of this study.

At the same time, the very elements of ICT competence are regularly changed and supplemented, which is associated with the rapid development of information and communication technologies.

In the following sections, the author's research conducted within the framework of the federal project «New Opportunities for Everyone» will be considered in detail and includes testing the hypothesis of improving the formation of ICT competence in the field of Web technologies in the case of a comprehensive study of several areas in modern site construction. A feature of the research design in this case is the use of the Pearson criterion in combination with the modern model «Digital competence profile». The results of the study, which demonstrate the advantages of a comprehensive study of Web technologies as a method of developing ICT competence, allow us to form recommendations for improving distance education courses dedicated to modern information technologies. The critical discussion and the final section reveal the features of the results obtained in comparison with the studies of other authors.

## 2. Problem Statement

Currently, an increasing share of research in the field of pedagogy is devoted to the formation of competence related to information and communication technologies (hereinafter referred to as ICT competence). One of the important trends in this area is the widespread use of distance learning technologies and teaching the basics of Web technologies, which is associated with the general acceleration of the processes of digitalization of education.

## 3. Research Questions

Starting the research, we identified the following main issues: the choice of key areas for the creation of one-page websites (landing pages) and the preparation of educational materials on this topic; the choice of an educational platform for distance learning. These also include the selection of a control and experimental group among students for conducting a pedagogical experiment; the choice of tools and the

assessment of the formation of individual components of ICT competence in the participants of the control and experimental group.

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

The purpose of this study is to test the hypothesis of increasing the effectiveness of the formation of ICT competence in such components as digital design and the creation of an IT product in the case of complex development of several areas of creating single-page websites (landing pages).

#### **5. Research Methods**

A special feature of the methodological apparatus of the study is the use of the Pearson criterion in combination with the modern model «Digital Competence Profile». The Pearson test is used to compare the results of the control group and the experimental group. When assessing the formation of ICT competence, motivational, cognitive and activity criteria were evaluated. To assess the formation of various criteria, the following tools were used: conversations in the WhatsApp chat of the educational course and students writing reviews in the case of a motivational criterion; students pass the test in the case of the cognitive criterion; students complete the final task in the case of the activity criterion.

#### **6. Findings**

An important feature of the study was the application of the modern model «Digital Competence Profile» (Digital Competence Profile, 2021). This model is used in the projects of the University «20.35», the Agency for Strategic Initiatives and the Autonomous Non-Profit Organization (ANO) «National Technology Initiative». This model was one of the central elements of the educational intensive courses «Island 10-21» and «Island 10-22».

As part of the distance course on creating modern single-page Websites (landing pages), we will consider in detail such elements as creating an IT product and digital design. Each of the elements has a set of levels of development, combined into three groups, following the growth of the formation of indicators of ICT competence: the possession of specific tools related to this area; the possession of specific tools related to this area; the ability to perform productive activities in this area.

For data collection and analysis, the tools of the administrative interface of the Internet portal «Leader ID» and LMS (Learning Management System) Moodle were used.

The Internet portal «Leader ID», supervised by the Agency for Strategic Initiatives and the ANO «National Technology Initiative», allows you to create events (including remote ones) on your platform, connect links to YouTube broadcasts, Zoom or Microsoft Teams conferences displayed after the user registers for the event. It also allows one to upload a list of participants after the event, indicating their place of work or study, city and region of residence. The Internet portal has a built-in analytical system that informs the portal users about the event, whose list of interests intersects with the list of topics of the event chosen by the organizer. The number of users registered on the portal, which exceeds 1.6 million people, together with its technological and IT orientation, determines the choice of this Internet portal as a platform for launching a distance education course on creating modern single-page websites (landing pages).

The free Moodle platform is the most popular among the first-generation LMS educational organizations. It provides access to the source code of the platform and allows you to modify the platform in accordance with the needs of the educational organization, which largely determines its popularity. From the point of view of this research work, its important features are the possibility of conducting test and boundary control in the form of testing and practical tasks, uploading the results of passing tests and practical works by students for their further analysis and comparison.

In this study, the test implementation of a distance learning course on the creation of modern one-page Websites (landing pages) on the Internet portal «Leader ID» allowed us to identify the target audience of the educational course by the level of education/professional interests, to determine the potential regional coverage.

Conducting a distance learning course on the LMS Moodle platform within the framework of the federal project «New Opportunities for Everyone» for a previously defined target audience allowed us to conduct a pedagogical experiment. This proves the hypothesis of increasing the effectiveness of the formation of ICT competence in the case of complex development of several areas of creating single-page websites (landing pages).

To test the hypothesis of increasing the effectiveness of the formation of ICT competence in such components as digital design and the creation of an IT product in the case of complex development of several areas of creating single-page websites (landing pages), the following two stages of the study were implemented.

At the first stage (October-November 2020), a series of educational events dedicated to the basics of site building and the creation of single-page websites (landing pages) was held on the Internet portal «Leader ID». The total number of participants was 367 people. With a traditionally high share of participants from Moscow for the Internet portal, participants from some of the regions were widely represented. These are the Altai Territory, Amur Region, Arkhangelsk Region, Astrakhan Region, Belgorod Region, Bryansk Region, Vologda Region, Trans-Baikal Territory, Kabardino-Balkar Republic, Kaliningrad Region, Kamchatka Territory, Karachay-Cherkess Republic, Kemerovo Region, Kirov Region, Kostroma Region, Krasnodar Territory, Krasnoyarsk Territory, Kursk Region, Lipetsk Region, Moscow Region.

A total of 53 subjects of the Russian Federation are represented. These are Nizhny Novgorod region, Novgorod Region, Novosibirsk Region, Omsk Region, Orenburg Region, Oryol Region, Penza Region, Perm Region, Primorsky Territory, Republic of Bashkortostan, Republic of Buryatia, Republic of Dagestan, Republic of Crimea, Republic of Sakha (Yakutia). There is also the Republic of North Ossetia-Alania, Republic of Tatarstan (Tatarstan), Republic of Tyva, Rostov Region, Ryazan Region, Samara Region, Saint Petersburg, Saratov Region, Sakhalin Region, Sverdlovsk Region, Sevastopol, Smolensk Region, Stavropol Territory, Tambov Region, Tomsk Region, Tula Region, Tyumen Region.

During the analysis of the age distribution of participants tracking data were obtained: school students aged 12 to 16 years – 6%; university students (17 to 23 years) – 40%; young people from 24 to 35 years – 18%; adults aged 36 to 65 years – 35%; people over 65 years – 1%. At the same time, among the adult population aged 36 to 65 years, 42% of the participants indicated educational organizations as their place of work.

Analysis of the data of the first stage of the study shows that with the expected high for the Internet portal «Leader ID», there is a forty percent share of the student audience of educational events. The main volume of the portal's audience is registered for it through university boiling points and represents university students. 35% of the audience of the educational course was the adult population from 36 to 65 years, 42% of which are employees of educational organizations. The geographical distribution shows a wide regional coverage – more than 50% (53 subjects of the Russian Federation), which, for example, according to the classifications of the Agency for Youth Affairs, corresponds to the level of federal (All-Russian) projects.

The results of the first stage of research and analysis of the target audience of the educational course on creating single-page Websites (landing pages) became the basis for the relevance of the development based on a series of educational events on the Internet portal «Leader ID». This is also based on the digital platform LMS Moodle of the K. G. Razumovsky Moscow State Technical University (FKU), an educational program «Fundamentals of Site Construction: creating single-page Websites (landing pages)», including the means of boundary and final control in the form of tests and practical tasks. In addition to the initially planned use of the educational program for students of the K. G. Razumovsky Moscow State Technical University (FKU), the analysis of the program's target audience at the first stage of the study became the basis for the decision to include this additional education program in the federal project «New Opportunities for Everyone». Its audience traditionally includes a high proportion of the adult population over 35 years old. The target audience includes a significant proportion of employees of educational organizations, for whom it is important to receive a free certificate of advanced training in the framework of one of the educational programs under this federal project.

The second stage of the study (November 2020 – January 2021) included conducting a pedagogical experiment and analyzing its results. To test the hypothesis of the study on improving the effectiveness of the formation of ICT competence in such components as digital design and the creation of an IT product in the case of complex development of several areas for creating single-page Websites (landing pages). Each of the registered participants took part in the educational course «Fundamentals of Site Construction: creating single-page websites (landing pages)». Participants of the federal project «New Opportunities for Everyone» (a total of 103 people registered for this course) had to choose as a final task for the creation of a single-page Website (landing page) based on one of the three approaches considered in the educational course. This implies creating the design and code of a Website using the Adobe Photoshop graphic editor, the Figma Web service or the Russian modern website designer Tilda. Using a complex application of two or more approaches is considered. With the expected high proportion of course participants who chose one direction (in most cases, the Tilda website builder), 37% of students chose a comprehensive application of two or more of the approaches considered. To communicate with the students of the course, a chat in the instant messaging system «WhatsApp» was used.

A control study group was formed out of 30 students who chose one direction, and an experimental group was formed out of 30 students who chose an integrated approach to conduct a pedagogical experiment. To check for differences in the distribution of the level of ICT competence of the control and experimental group participants, the nonparametric criterion  $\chi^2$  (Pearson's criterion) was used. The

composition and structure of the control and experimental groups were chosen so that at the beginning of the experiment there were no significant differences between the groups ( $\alpha = 0.05$ ).

To assess the formation of ICT competence according to various criteria, the following tools were used: conversations in the Whatsapp chat of the educational course (initial state) and writing feedback by students (final state) in the case of the motivational criterion; passing the entrance test (initial state), boundary and final tests (final state) in the case of the cognitive criterion. They also include viewing examples of Web pages previously created by listeners, if they are available and provided (initial state), and performing the final task by listeners (final state) in the case of an activity criterion. The low, medium or high level of ICT competence formation was considered within the framework of the «Digital Competence Profile» model for the elements «IT Product Creation» and «Digital Design» and corresponds to three groups of development levels. The results of the pedagogical experiment are presented in Table 1.

**Table 1.** Levels of ICT competence formation at the beginning and end of the experiment

Criteria	Column header	Control group		Experimental group	
		in the beginning, %	in the end, %	in the beginning, %	in the end, %
Motivational criterion $\chi$ crit. = 5,99, $\chi$ emp.beg.* = 0,05, $\chi$ emp.end.** = 7,92	Low level	55	44	56	28
	Middle level	36	42	35	48
	High Level	9	14	8	24
Cognitive criterion $\chi$ crit. = 5,99, $\chi$ emp.beg. = 0,33, $\chi$ emp.end. = 7,33	Low level	68	50	70	30
	Middle level	29	43	26	51
	High Level	3	7	3	19
Activity criterion $\chi$ crit. = 5,99, $\chi$ emp.beg. = 0,3, $\chi$ emp.end. = 9,8	Low level	53	42	54	25
	Middle level	42	48	37	51
	High Level	4	10	8	23

\* emp.beg. – empirical beginning

\*\* emp.end. – empirical ending

The analysis of the results in Table 1 shows a significantly greater increase in the indicators of motivational, cognitive and activity criteria for the experimental group in comparison with the control group, which proves the hypothesis of the study.

In comparison with previous studies in the field of teaching various types of Web technologies, this study covers the adult population aged 35 to 65 years with a wide regional distribution (including employees of various educational organizations), justifying the interest of this target audience in studying Web technologies using the tools of the Internet portal «Leader ID».

The research of other authors in this field mainly deals with teaching Web technologies to university students, which we have already noted in the introduction to this work.

In contrast to these research papers, this study examines a comprehensive approach to the study of Web technologies, including the development of several areas of creating modern single-page websites (landing pages). An element of the scientific novelty of this study is also the application of the competence model «Digital Profile».

## 7. Conclusion

The results of the study prove the effectiveness of a comprehensive study of several approaches to creating modern single-page websites (landing pages) as an element of the formation of ICT competence, which confirms the hypothesis of the study and justifies the achievement of the research goal. The key stages of the study correspond to the tasks set and confirm their implementation.

The results of the research can be used in the development of distance education programs (both basic and additional education programs) dedicated to Web technologies and the creation of single-page websites (landing pages).

As prospects for further research in the field of ICT competence formation, a comprehensive study of digital technologies such as 3D modeling and cybersecurity is required.

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