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The possibilities of an interactive multifunctional cloud portfolio for the individualization of education in primary school

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Abstract. *Problem statement.* One of the priorities of the modern school is informatization and individualization of education. The implementation of these tasks can be facilitated by an electronic portfolio as a means for evaluating the individual educational results of students, optimizing work with information, and supporting the design of a non-linear structure for presenting materials in different formats. The research is aimed at studying the possibilities of an interactive multifunctional cloud portfolio for the individualization of education in a primary school. *Methodology.* Theoretical and methodological analysis and generalization of legal acts, literature on the application of information and communication technologies in education, processing of test results and electronic content of the portfolio are applied. Experimental work was carried out on the basis of Gymnasium No. 1 in Kirovo-Chepetsk. The experiment involved 52 students from grades 5–10 (girls – 52%, boys – 48%). Pearson's chi-squared test for statistical data processing was used. *Results.* A model of an interactive multifunctional cloud portfolio has been developed for the individualization of education in a primary school. This model determines the structure of an interactive multifunctional cloud portfolio, including the sections "My individual educational route" (personal development of the student), "My lessons" (class activities), "My studios" (extracurricular activities), "My affairs" (educational work). The Google Classroom service was used to implement the model. Statistically significant differences in qualitative changes in the pedagogical system were revealed. *Conclusion.* The possibilities of an interactive multifunctional cloud portfolio for the individualization of education in a primary school are summarized: changing the nature of interaction between participants in educational relations; formation of universal educational activities, communication skills; personal development of students, etc.

Keywords: digitalization of education, electronic portfolio, individual educational route, cloud technology, interaction interactivity, Google Classroom

Возможности интерактивного полифункционального облачного портфолио для индивидуализации обучения в основной школе

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Аннотация. *Постановка проблемы.* Одной из приоритетных задач современной школы является информатизация и индивидуализация образования. Ее реализации может способствовать электронное портфолио как средство для оценивания индивидуальных образовательных результатов обучающихся, оптимизации работы с информацией, поддержки проектирования нелинейной структуры предъявления материалов разных форматов. Цель исследования – изучение возможностей интерактивного полифункционального облачного портфолио для индивидуализации обучения в основной школе. *Методология.* Применялись теоретико-методологический анализ и обобщение нормативно-правовых актов, литературы в области использования средств ИКТ в сфере образовании, обработка результатов тестирования и электронного контента портфолио. Опытно-поисковая работа проводилась на базе КОГОАУ «Гимназия № 1 г. Кирово-Чепецка». В эксперименте принимали участие 52 ученика 5–10 классов (девушки – 52 %, юноши – 48 %). При статистической обработке данных использован критерий хи-квадрат Пирсона. *Результаты.* Разработана модель интерактивного полифункционального облачного портфолио для индивидуализации обучения в основной школе, определяющая его структуру, включающую разделы «Мой индивидуальный образовательный маршрут» (личностное развитие обучающегося), «Мои уроки» (урочная деятельность), «Мои студии» (внеурочная деятельность), «Мои дела» (воспитательная работа). Для реализации модели использован сервис Google Classroom. Выявлены статистически достоверные различия в качественных изменениях, произошедших в педагогической системе. *Заключение.* Обобщены возможности интерактивного полифункционального облачного портфолио для индивидуализации обучения в основной школе: изменение характера взаимодействия между участниками образовательных отношений; формирование универсальных учебных действий, коммуникативных умений; личностное развитие обучающихся и т. п.

Ключевые слова: цифровизация образования, электронный портфолио, индивидуальный образовательный маршрут, облачная технология, интерактивность взаимодействия, Google Classroom

Problem statement. According to UNESCO research, presented in the materials of the World Education Monitoring Report, education plays a key role in this century. Not only the fate of an individual, but also the life of the planet as a whole depends on its level, quality, and availability.[1]

One of the priority tasks of the modern school, according to A. Hase, L. Kahnbach, P. Kuhl, D. Lehr, is informatization and individualization of education [1]. The fundamental documents of Russia such as the Federal Law "On Education in the Russian Federation",[2] the Federal State Educational Standard for General Education,[3] the state program "Development of Education" (2018–2025)[4] and other programs determine the directions and priorities for the development of a modern school. These regulations and documents focus on building the educational process, taking into account the individual, age, psychological, physiological and health characteristics of students. According to the conclusions of Y.A. Shirokov, V.G. Tikhnenko, these universal principles should become fundamental in the education throughout the world [2].

A. Gani, S. Zulaikhah use sociodrama to individualize learning. The authors of the experimental data are convinced of its effectiveness [3]. According to their conclusions, this method is more than just a technology: it encourages students to explore deeper and become aware of significant personal situations and problems, motivates them to greater role, behavioural flexibility. In the process of improvised dramatization, the creative components of the psyche are actualized, the spontaneity and creativity necessary for the assimilation of new knowledge grow.

Y. Huang is developing algorithms for the formation of recommender services [4]. The author concludes that a personalized recommender system is a complex of algorithms, programs and services. Its task is to predict, based on information about the user's profile and activity, what may be of interest to him. In the process of recommender systems, explicit and implicit methods of collecting information are used. The end result of this approach is a latent factor model that helps educators uncover learners' "implicit" motivations and cognitive interests using parameter estimation techniques.

V.M. Savvinov, P.P. Ivanov, V.N. Strekalovsky note that the modernization of the education system is aimed at achieving "digital maturity" and solving the key tasks of education [5]:

– introduction at all levels of general education of new teaching methods, technologies that ensure the development of basic skills and abilities by students, increasing their motivation for learning and involvement in the educational process;

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[1] UNESCO. *Building peace in the minds of men and women*. (In Russ.) Available from: https://ru.unesco.org/futuresofeducation/news/launch (accessed: 06.11.2022).

[2] *Federal Law No. 273-FZ of December 29, 2012 (as amended on October 7, 2022) "On Education in the Russian Federation" (as amended and supplemented, effective from October 13, 2022)*. (In Russ.) Available from: https://www.consultant.ru/cons/cgi/online.cgi?from=140174-0&req=doc&rnd=e8JNiQ&base=LAW&n=422428#1VfnfMTScRod0lqp1 (accessed: 01.11.2022).

[3] *Federal State Educational Standard for Basic General Education (approved by order of the Ministry of Education and Science of the Russian Federation of December 17, 2010 No. 1897)*. (In Russ.) Available from: https://base.garant.ru/55170507/53f89421bbdaf741eb2d1ecc4ddb4c33/ (accessed: 02.11.2022).

[4] *State Program of the Russian Federation "Development of Education"*. (In Russ.) Available from: https://docs.edu.gov.ru/document/3a928e13b4d292f8f71513a2c02086a3/download/1337/ (accessed: 03.11.2022).

– formation of an effective system for identifying, supporting and developing abilities and talents in children and youth;

– creation of a modern and safe digital educational environment;

– ensuring the unity of the educational space of the Russian Federation.

E.V. Frolova, O.V. Rogach substantiate in their works that in modern conditions digitalization is becoming an integral attribute not only of industrial production, but also of the social sphere [6]. According to S.Y. Stepanov, P.A. Orzhekovskiy, digital products make it possible to ensure the continuity of the educational process in the context of the epidemiological restrictions introduction [7]. An important advantage of online learning is the formation of conditions for building individual learning paths [8]. According to P.V. Derkachev, K.V. Zinkovsky, I.A. Kravchenko and K.A. Semenova, individualization excludes the simplification of the educational product, assuming the introduction of a modular training system and expanding the range of educational offers [9].

To individualize learning, an electronic portfolio can also be used as a way of evaluating individual educational results, adequate to modern educational tasks.

O.G. Smolyaninova, E.A. Bezyzvestnykh in their works show that the electronic portfolio allows you to optimize the work with information (search, processing, updating, reorganization, transfer), create a non-linear structure of materials in different formats, organize quick access to them for students, parents, teachers [10].

A.I. Fedorov, I.P. Sivokhin, N.A. Ogienko, V.N. Avsievich conclude that an electronic portfolio allows you to design and implement an individual learning path for a student, to see progress in learning activities [11].

Modern electronic portfolios can include information about the results of both classroom and extracurricular activities [12]. But they do not pay attention to the upbringing component, which is a priority in school education today, interaction with parents as active participants in the educational process is not sufficiently implemented.

In addition, in the overwhelming majority of cases, the existing e-portfolio developments are focused on performing a single function such as fixing the educational achievements of students, they do not fully implement the property of interactivity and, as a rule, do not use cloud technologies to individualize the education and upbringing of schoolchildren [13].

The analysis of the scientific works listed above allows us to identify the problem associated with the need for additional study of the use of an interactive multifunctional cloud portfolio for the individualization of education in primary school.

The aim of the study is to investigate the possibilities of an interactive multifunctional cloud portfolio for the individualization of education in a primary school.

Methodology. Methods for studying the aspects of using an interactive multifunctional cloud portfolio for individualizing education in a primary school are the analysis of legal acts, teaching aids, and literature on the use of ICT tools in the education. Methods of theoretical analysis are used (comparative method, generalization of experience); study and analysis of the experience of using an electronic portfolio.

In the course of the pedagogical experiment, the analysis and generalization of the experience of students with an interactive multifunctional cloud portfolio aimed at individualizing education in the main school was carried out.

To process the results, questionnaire and diagnostic methods were used (observation, conversation, generalization, questioning, testing, evaluation).

Experimental work was carried out on the basis of the Kirov Regional State Educational Autonomous Institution "Gymnasium No. 1 in Kirovo-Chepetsk". The experiment involved 52 students from grades 5–10 (girls – 52%, boys – 48%). The use of an interactive multifunctional cloud portfolio for the individualization of learning is implemented in the Google Classroom environment.

At the first stage of the study, the analysis of scientific and pedagogical, educational and methodological literature was carried out in order to determine the state of problem development; studying the degree of problem elaboration of education and upbringing individualization in the primary school, the use of interactive and cloud technologies in the educational process, including the use of an electronic portfolio.

At the second stage of the study, the theoretical and accumulated empirical experience was systematized, the structure, content, and model of an interactive multifunctional cloud portfolio were developed to individualize the education and upbringing of primary school students, systematization and selection of cloud technology tools were done, a pedagogical experiment was carried out, the interactive multifunctional cloud portfolio was introduced in practice.

At the third stage of the study, the main conclusions and recommendations on the methodological support of the process of individualization of primary school education were formulated, and the prospects for further research of the problem were identified.

Statistical processing of the obtained data was carried out using Pearson's χ^2-test.

Results and discussion. When analysing federal legal documents, the key tasks of applying an individual approach to teaching basic school students were identified: formation of readiness for self-development and continuous education; design and construction of the social development environment; the inclusion of students in active educational and cognitive activities; building educational activities based on the individual characteristics of schoolchildren. An analysis of the works of O.G. Smolyaninova, E.A. Bezyzvestnykh and others made it possible to identify the features of the tools for implementing the process of individualization of education: an individual educational route, an individual educational trajectory, an individual educational program [10]. At the same time, one of the most effective modern tools for implementing the individualization of learning processes is an individual educational route. Its design is a kind of educational activity, first, by the student himself, in order to study some (chosen by the student) subjects at a deeper level.

The following features of the implementation of individual educational routes were identified: internal differentiation, expressed in the choice of tasks in the lesson from the proposed set based on the personal experience of students; training according to individual programs, associated with individualization in the choice of courses, the level of their development; ensuring the possibility of working in temporary groups [14].

At the first stage of the experiment, the didactic potential of interactive and cloud technologies was analysed for the implementation of the individualization of learning at school.

Based on the analysis of domestic and foreign studies, the advantages of using information technologies in the educational process were identified: expanding the possibilities for presenting educational material, expanding the list of educational tasks to be solved, and the tools used, the possibility of variable transformations of the content of the material, the use of different forms of work (individual, group), individualization learning, increasing motivation, self-control, ability to reflect, communication skills.

When analysing the term "interactivity", its concept was clarified both in the pedagogical sense and in the technical one [15]. Interactive methods in pedagogy are focused on the interaction of students not only with the teacher, but also with each other and technical devices, as well as the dominance of the activity of students in the learning process, they imply targeted intersubjective interaction between the teacher and students to create optimal conditions for the development of the student. In a technical sense, interactive is understood as electronic content in which operations with its elements are possible: manipulations with objects, interference in processes.

Currently, Internet resources have been developed that can be used to create a digital educational environment and implement e-learning. Among them are the Russian Electronic School, Uchi.ru, YaKlass, etc., on the platform of which interactive lessons for students from grades 1 to 11 were developed and posted. It should be noted that the listed platforms are mainly focused on the implementation of the learning function, while supporting the targeted interaction of participants in educational relations, aimed at planning and analysing joint affairs and events, almost no attention is paid.

Didactic opportunities were highlighted, confirming the feasibility of using cloud technologies in teaching based on the cooperation of a teacher and a student: sharing and publishing documents of various types and purposes; organization of group, pair and individual work not only in the classroom, but also outside of school hours; organization of interactive classes and collective teaching.

Interactivity between the teacher and students using cloud technologies is rational to use not only for organizing joint activities when working with documents, but also for evaluating educational results. One of the effective forms of evaluating learning outcomes in a modern digital school is an electronic portfolio.

An analysis of a number of existing electronic portfolios according to the criteria (structure of an electronic portfolio, organization of storage of an electronic portfolio, features of use in a primary school) revealed the following shortcomings:

1. Not all portfolios have interaction with parents, and some authors try to protect the joint activities of the teacher and students from the influence of parents in order to provide children with the opportunity to independently evaluate their results.

2. Electronic portfolios developed using cloud technologies do not provide such an important aspect of these technologies as collaboration on documents that could be used to organize group work in the classroom, when doing homework and projects, and joint planning of educational work.

Therefore, one of the objectives of the study was to develop and test a model of an interactive multifunctional cloud portfolio to individualize the learning process in a primary school.

At the preparatory stage of the experiment, a general progress assessment of 52 students was carried out.

As part of the control event, schoolchildren were asked to complete 50 tasks. Correct performance was scored one point. The examples of tasks are presented below.

1. Two runners start from one point of the stadium ring track, and the third athlete starts simultaneously with them in the same direction from a diametrically opposite point. After running 3 laps, the third runner caught up with the second for the first time after the start. 150 seconds after that, the first runner caught up with the third for the first time. How many laps per minute does the second athlete run if the first overtakes him once every 6 minutes? Answer options (half a circle per minute; one circle per minute; a quarter circle per minute; one and a half circles per minute).

2. Continue the sequence: $a + b + 2$; $a + c + 3$; $b + a + 8$; $b + c + 9$; $c + a + 8$; $c + b + 9$; $a + b + 8$; $a + c + 9$. Answer options: $a + c + 8$; $b + a + 8$; $a + c + 9$; $b + a + 9$.

3. They sell three bags of potatoes. Half of the first one was sold, 2/3 of the second one, and the third bag, which contained 1/3 of all potatoes, was sold all. How many percent of the potatoes were sold if there were two times less potatoes left than it was in the second sack? Answer options: 75, 70, 65, 55%.

4. In fantasy land N, all computers have wires, all laptops are computers, and some laptops have a screen. What conclusion can be drawn from this?

Answer options: "Some computers in country N have wires, and some laptops have screens"; "In country N, most laptops don't have wires, and some don't have a screen"; "All laptops in country N have wires and some have a screen"; "In country N, all laptops that have wires have a screen".

Each student scored from 0 to 50 points. The grade was determined as follows: "excellent" for the students received 45 or more points; "good" for the range from 34 to 44 (inclusive); "satisfactory" for the range from 23 to 33 (inclusive); "unsatisfactory" in all other cases.

At the second stage, a model of an interactive multifunctional portfolio was developed, systematization and selection of cloud technologies were made, an experimental part of the study was carried out, a set of materials was formed and recommendations were developed for teachers on the use of an interactive multifunctional cloud portfolio, as well as joint activities based on cloud technologies.

To implement the developed model, the Google Classroom service was chosen, which allows you to differentiate access rights, organize your own educational space for both teachers and students, organize joint access to documents. The activities of students, teachers, parents related to maintaining an interactive multifunctional cloud portfolio in Google Classroom are divided into sections "My individual educational route" (personal development of the student), "My lessons" (class activities), "My studios" (extracurricular activities), "My affairs" (educational work).

For example, in the "My Lessons" section, the student analyses his progress. At the beginning of the study period, he puts down the expected grades, every week enters the average scores for subjects, monitors the dynamics of changes in the average score, at the end of the study period enters the final marks in the table and compares them with the expected ones.

During the implementation of the project (section "My Studios"), the student fills in the "progress table", and the teacher checks the work of the student and makes marks in the table corresponding to the level of completion of the stages of work. An example of filling is shown in Table 1.

Table 1

Filling out the project along the "promotion" route

Last name, first name	Worked out reference material	Completed the interactive task "Stages of creating a game"	Invented heroes, drew sketches	Wrote the game script	Made a reflection	Wrote scripts
Mark the completion of a work step in the required column with a "+" sign. After validation, the cell will be colored						
Student 1	+	+				
Student 2	+	+				
Student 3	+	+				
Student 4	+	+	+	+	+	+

The activities of all participants of education, supported by Google Classroom, are described in chronological order, starting from grade 5. In each class, the features of working with an interactive multifunctional cloud portfolio are highlighted, and an approximate list of activities by months during the academic year is given. So, for example, the 5th grade is characterized by the transition of students to the main school, the way of their school life is changing, and there is a process of adaptation to new learning conditions. During this period, students need to adapt to the new conditions of school reality, ranging from external (office system) to internal (establishing contacts with different teachers, mastering new subjects), therefore, a psychologist does a lot of work along with the class teacher, serious help from parents is required. In grades 6 and 7, much attention is paid to project activities (implementation of different projects). In grades 8–9, the main emphasis is on career guidance for students: providing career guidance support to students in the process of choosing a profile of study and the scope of future professional activity, developing a conscious attitude towards work among students, professional self-determination in conditions of freedom to choose a field of activity in accordance with their capabilities, abilities and taking into account the requirements of the labour market. Psychologists are involved in working with an interactive multifunctional cloud portfolio in the Google Classroom environment, who uses it to diagnose the professional orientation of students in grades 8–9 (through electronic forms, individual consultations, etc.). Based on these data, further work with parents and students is carried out by class teachers.

At the third stage, the effectiveness of the proposed model and the set of pedagogical conditions for its implementation using Google Classroom tools were tested. Information about the evaluation results before and after the experiment is presented in Table 2.

Table 2
General assessment of the progress of students in the secondary school

Grade assessment	Experimental group (26 students)		Control group (26 students)	
	Before experiment	After experiment	Before experiment	After experiment
Excellent	2	8	2	3
Good	6	11	7	6
Satisfactorily	7	5	7	10
Unsatisfactory	11	2	10	7

The following hypotheses were accepted: H0: the level of results of educational activity of students in the experimental group is statistically equal to the level of students in the control group; H1: The level in the experimental group is higher than the level of the control group. In the online resource (http://medstatistic.ru/calculators/calchit.html) the values of the criterion were calculated before (χ^2 observation 1) and after (χ^2 observation 2) the experiment. For $\alpha = 0.05$, according to the distribution tables, χ^2_{crit} is equal to 7.815. Thus, we get: $\chi^2_{obs.1} < \chi^2_{crit}$ (0.125 < 7.815), and $\chi^2_{obs.2} > \chi^2_{crit}$ (8.188 > 7.815). Therefore, the shift in the direction of increasing the level of progress of students in the basic school can be considered non-random.

The obtained conclusions about the didactic potential of an interactive multi-functional cloud portfolio in relation to the individualization of learning confirm and supplement the results of the works of O.G. Smolyaninova, E.A. Bezyz-vestnykh. A significant result of the study is the description of the basic ideas of the approach, expanding the ideas of T.N. Suvorova, E.A. Mikhlyakova about the possibilities of digital technologies for designing individual educational routes and cognition trajectories [15].

Conclusion. The implementation of the proposed model of an interactive multifunctional cloud portfolio in the Google Classroom environment based on the integrated use of cloud technologies allows to organize individual and joint work of teachers, students and their parents, aimed at individualizing learning. In the course of the study, the following features of an interactive multifunctional cloud portfolio in the Google Classroom environment were identified for individualization of education in the main school:

– change in the nature of interaction between participants in educational relations, which is expressed in their active involvement in the process of development, upbringing, education of students;

– formation of universal educational activities, communication skills, including through the creation of their own educational environment;

– personal development of students, which is manifested in activities not only direct, related to the development of academic subjects, courses of extra-curricular activities, participation in educational activities, but also related to the maintenance of the portfolio itself.

The result of the individualization of learning is expressed in the individual choice, design and implementation of an individual educational route and is achieved through activities that involve:

– planning and analysis of activities, including the design of individual educational routes, setting educational goals for the study period, joint planning of events, summing up the results of educational activities;

– organization of joint work using cloud technologies in a single educational space.

This study confirmed the hypothesis that an interactive multifunctional cloud portfolio is an effective means of individualizing schoolchildren's learning in classroom and extracurricular educational activities and in the implementation of the personal development of students. The use of the proposed model and tools of cloud services makes it possible to determine the best options and solutions that contribute to the personal development of students, their pre-profile preparation and the conscious choice of the profile of education in high school.

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