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The Model of Formation of Functional Literacy of Students in the Conditions of Digital Transformation Taking into Account Regional Specificity

Lyudmila N. Khramova, Olga B. Lobanova*, Natalia V. Basalaeva, Anna V. Firer and Elena V. Kirgizova
Lesosibirsk Pedagogical Institute
Lesosibirsk, Russian Federation

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Annotation. Nowadays, the problem of functional literacy is becoming a key issue in education. Thus, one of the indicators of the national project «Education» is the entry of the Russian Federation into the TOP-10 countries in terms of the quality of general education. That is why the formation of students' functional literacy acquires a national character. The aim of the study is to describe the model of the formation of functional literacy of students in the context of digital transformation based on the analysis of the formation of the components of functional literacy of students of the Priyenisei region. As a result of the study, the authors of the article, based on the results of regional diagnostic work of students studying in grades 6–8, aimed at studying individual components of functional literacy (reading literacy, mathematical literacy, science literacy), have come to the conclusion that it is necessary to increase the level of functional literacy. So, the model has been developed for the formation of functional literacy of students in the context of digital transformation taking into account regional specificity.

Keywords: a model of formation of functional literacy, functional literacy, mathematical literacy, reading literacy, financial literacy, science literacy, creative thinking, regional specificity, regional identity.

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Research area: culturology.

* Corresponding author E-mail address: olga197109@yandex.ru
ORCID: 0000-0003-4146-2079 (Khramova); 0000-0003-3243-7816 (Lobanova); 0000-0002-9357-7313 (Basalaeva); 0000-0002-1779-6725 (Firer); 0000-0002-7571-1224 (Kirgizova)

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Модель формирования функциональной грамотности обучающихся в условиях цифровой трансформации с учетом региональной специфики

Л.Н. Храмова, О.Б. Лобанова, Н.В. Басалаева, А.В. Фирер, Е.В. Киргизова
Лесосибирский педагогический институт – филиал Сибирского федерального университета
Российская Федерация, Лесосибирск

Аннотация. В настоящее время проблема функциональной грамотности становится ключевой в образовании. Так, одним из показателей национального проекта «Образование» является вхождение Российской Федерации в ТОП-10 стран по качеству общего образования. Именно поэтому формирование функциональной грамотности обучающихся приобретает национальный характер. Цель исследования – описание модели формирования функциональной грамотности обучающихся в условиях цифровой трансформации на основе анализа сформированности компонентов функциональной грамотности у обучающихся Приенисейского региона. В итоге исследования авторы статьи, опираясь на результаты краевых диагностических работ учащихся 6–8 классов, направленных на исследование отдельных компонентов функциональной грамотности (читательской грамотности, математической грамотности, естественнонаучной грамотности), пришли к выводу о необходимости повышения уровня функциональной грамотности. В связи с этим была разработана модель формирования функциональной грамотности обучающихся в условиях цифровой трансформации с учетом региональной специфики.

Ключевые слова: модель формирования функциональной грамотности, функциональная грамотность, математическая грамотность, читательская грамотность, финансовая грамотность, естественнонаучная грамотность, креативное мышление, региональная специфика, региональная идентичность.

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Introduction to the research problem

The modern world has become much more complex, the visual-digital world has replaced the analogue-textological world, which requires the expansion and rethinking of the concept of «functional literacy».

The concept of «functional literacy» was introduced by UNESCO in 1957 as a set of skills to read and write to solve everyday problems in everyday life. Functional literacy in education is becoming one of the key issues for discussion at all levels: in the Ministry of Education, in the Council for Science and Education, in educational organizations. So, one of the indicators of the national project «Education» is the entry of the Russian Federation in terms of the quality of general education in the top 10 countries.

In addition, the problem of increasing functional literacy has become actualized today in connection with digital transformation. In the era of universal digitalization, new technologies and services are being created that can be effectively used in the process of education to form functional literacy of students and which will be of interest to representatives of young generations.

At present, the system of measures for the formation of functional literacy is being developed in Russia. So, in 2019, the Ministry of Education of the Russian Federation initiated the project «Monitoring the formation of students' functional literacy», aimed at increasing the level of a person's ability to apply the knowledge gained to solving life problems (Basiuk, Kovaleva, 2019). However, along with the development and implementation of federal-level programs, not enough attention is paid to the formation of functional literacy taking into account the regional specificity.

The relevance of the problem predetermined the aim of this article – to describe the model of the formation of functional literacy of students in the context of digital transformation based on the analysis of the formation of the components of functional literacy of the students of the Priyenisei region.

Conceptological foundations of the study

To achieve the aim, the following methodological approaches were used: a systematic approach, which made it possible to consider the process of forming students' functional literacy as a system of interrelated components; system and activity approach to the organization of the educational process, focusing on the priority of active teaching methods; a cognitive-visual approach that provides wide and purposeful use of the cognitive function of visualization in the process of forming functional literacy.

Within the framework of the study, epistemological principles are of particular importance: the relationship between theory and practice in the process of scientific cognition, the principle of consistency, the principle of objectivity, the principle of creative activity of the subject of cognition.

The problem of increasing functional literacy is currently being actualized in connection with digital transformation. Digital transformation is a current trend in the social, economic, industrial, and educational systems. The digital transformation of education is one of the leading components of the fourth industrial revolution.

A. Yu. Uvarov believes that «digital transformation (or the transition to a digital school) is a systematic and synergistic renewal of the basic components of the educational process (Fig. 1), including:

- results of educational work,
- educational content,
- organization of the educational process,
- evaluation of results» (Uvarov, 2019).

O.I. Popova in her article notes that «the essence of digital transformation (DT) of education is the achievement of the necessary educational results by each student through the personalization of the educational process based on the use of the growing potential of DT, including the use of artificial intelligence methods, virtual reality tools; development of the digital educational environment in educational institutions; providing public broadband access to the Internet, working with big data» (Popova, 2018).

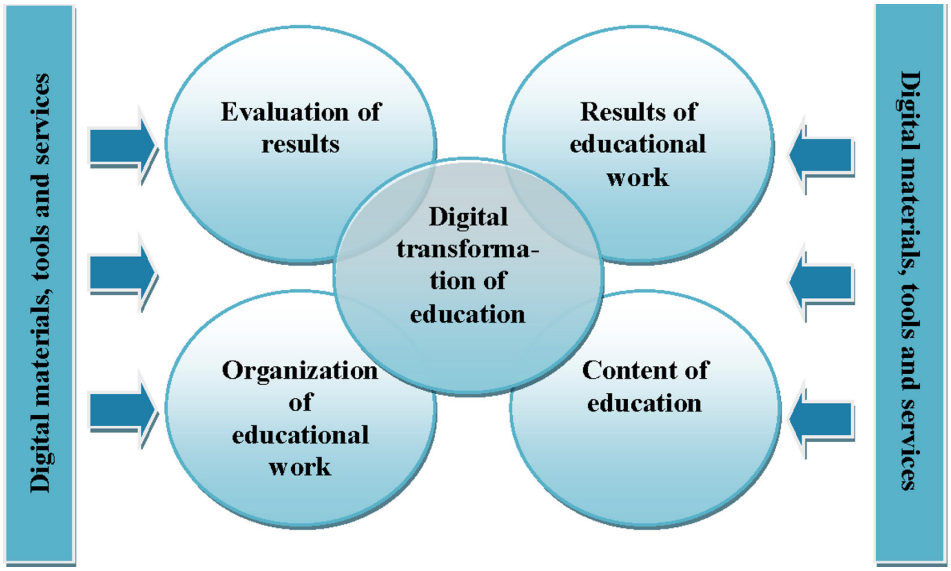

Fig. 1. Digital transformation as a system update of the basic components of the educational process in the digital environment

S.I. Makovskaya, the Minister of Education of the Krasnoyarsk Territory, in her report «Education 2020 +: quality management in the terms of changes» at the August Pedagogical Council on August 25, 2020 notes: «Speaking about the digital transformation of education, we understand that we get an additional opportunity to achieve the main priority, adopted last year at the level of the regional education system is a transition from mass unified education to individualized education aimed at ensuring the success and competitiveness of each child, which in the current situation retains its relevance and developing energy of the regional education system.»

Within the framework of the national project «Education», two federal projects are being implemented – «Digital educational environment» and «Teacher of the future» (Pasport natsional'nogo proekta, 2018). The aim of the project «Digital Educational Environment» is to create conditions for the introduction of the modern and safe digital educational environment by 2024, which ensures the formation of value for self-development and self-education among students of educational institutions of all types and levels, by updating the information and communication infrastructure, training personnel, creating a federal digital platform.

Digital transformation (digitalization) of education is bringing the school in line with the challenges and opportunities of the modern information society and the digital economy.

Formulation of the problem

Nowadays it is the system of education that must ensure the final transition to the digital age and make education of the same quality for everyone.

The process of functional literacy of students in the context of digital transformation will be more effective taking into account the regional specificity of the educational environment.

In the context of our research, in order to create the model for the formation of functional literacy, the formation of its components (reading, financial, mathematical, science, creative thinking) in the Priyenisei Siberia (Krasnoyarsk Territory) is being analyzed.

Discussion

Let us analyze the results of the diagnostic work on reading literacy, obtained on the representative sample, which give a fairly volumi-

nous and objective idea of the reading literacy of sixth-graders in the Krasnoyarsk Territory. To obtain reliable data, in 2018, 18 schools of the region were included in the representative sample, and in 2019–17 schools in the region, in 2021–11 schools in the region. In 2020, the regional diagnostic work on reading literacy for students in grades 6 was planned for November 2020, however, due to the increase in morbidity and the transition of grades 5–8 in most cities to distance learning, this work was postponed to January 2021 (Krasnoyarsk COKO).

In 2018, 26,349 sixth-graders from secondary schools of the Krasnoyarsk Territory completed the diagnostic work on reading literacy (this is 91.03 % of the total number of 6th grade students in the region), and in 2019–27,997 sixth graders (this is 91.06 % of the total number of 6th grade students in the region), in 2021–28,528 students, which is 79.91 % of 6th grade students in the region (84.71 % of the number of possible participants).

The average percentage of completing the diagnostic work on reading literacy in 2019 in the region was 41.64 % (for option 1, this indicator is 46.62 %, for option 2–36.61 %). On average, the students scored 16.66 points (maximum score – 40). The girls did it better than the boys, and the difference between the completing the tasks by the girls and boys is greater than that of the students in urban and rural schools.

The average percentage of completion of the diagnostic work on reading literacy in 2021 in the region was 38.06 %. On average, the students scored 15.22 points (maximum score – 40). The average score on a 100-point scale is 41.66. The girls did it better than the boys, the difference between the results of the girls and boys is less significant than between the results of the students in urban and rural schools.

In the 2020–2021 academic year, the percentage of students who reached the basic and advanced levels (in the amount of 58 %) significantly decreased, and the percentage of the students who showed a reduced level and a level insufficient for further education (in the amount of 42 %) increased, which is primarily related to the impact of the pandemic (long period of distance learning, morbidity among teachers and students). For comparison: in 2018 and 2019, 71 % and 73 % of sixth graders crossed the border of the basic level, did not reach the basic level of reading literacy of 29 % and 27 %, respectively.

In the studies of functional literacy conducted by the Center for Assessment of the Quality of Education of the Krasnoyarsk Territory, there is no data on the formation of financial literacy due to the fact that such diagnostic work is not carried out. It is worth noting that students of the Krasnoyarsk Territory take part in the Olympiads in financial literacy: the Moscow Olympiad for schoolchildren in financial literacy, the Online Olympiad «Young Entrepreneur and Financial Literacy», the All-Russian Online Olympiad in Financial Literacy, the International Olympiad in Financial Security, etc.

In March 2021, 7th grade students of all secondary schools of the Krasnoyarsk Territory completed the regional diagnostic work on mathematical literacy (KDR7) (no diagnostic work was carried out in 2018 and 2019). It was attended by 26,754 seventh graders, which is 87.44 % of the total number of 7th grade students in the region. The average percentage of completion for option 1 of the diagnostic work on mathematical literacy in the region was 37.15 %, for option 2–37.70 %. The average percentage of completing the diagnostic work on mathematical literacy in the region was 37.42 %. This year the girls completed the work slightly better than the boys (the average percentage of completion is 0.7 % higher). The average percentage of implementation of MFA7 in urban schools is more than 3 % higher than in rural ones. The border of the basic level was crossed by 67.45 % of the participants of the CRA7. Of these, 21.36 % showed an increased level. Approximately one in three seventh graders has not reached the basic level.

The assessment of the level of science literacy in world practice is carried out within the framework of the Program for International Student Assessment (PISA), in which the Russian Federation also takes part. PISA (PISA, 2021) is a three-year study that compares the systems of education of several dozen countries. It is attended by 15-year-old students who

complete assignments in several areas, including natural science literacy. At the same time, the focus is not on the assessment of academic knowledge and content elements of a particular academic subject, but on the ability to act with their help, to comprehend facts, draw conclusions, and make decisions in situations as close as possible to real ones.

To ensure the objective conduct of the procedure and obtain reliable data on the state of affairs in the field of science literacy in the system of basic general education of the Krasnoyarsk Territory, a representative controlled sample of students has been compiled. The representativeness of the sample makes it possible to extend the conclusions obtained from the analysis of the results on this sample to the entire population of eighth-graders in the Krasnoyarsk Territory.

In 2018, 26,942 eighth-graders of all secondary schools of the Krasnoyarsk Territory performed the regional test in science (KKR8) (this is 91.3 % of the total number of 8-grade students in the region), and in 2019–25,266 eighth-graders (this is 89.22 % of the total number of 8th grade students in the region), in 2021–24,839 eighth graders (this is 86.66 % of the total number of 8th grade students in the region).

The average percentage of completion for option 1 of the diagnostic work on science literacy in the region in 2021 was 29.82 % (in 2019–40.28 %), for option 2–27.43 % (in 2019–40.64 %). In the 2020–2021 academic year, the girls did the tasks better than the boys (the average percentage of completion is about 3 % higher). For comparison: in 2019, the boys did it better than the girls. The average percentage of implementation of KDR8 in urban schools is almost 6 % higher than in rural ones, in 2019 the difference was 2 % (Krasnoyarsk COKO).

In 2021, PISA has introduced the assessment of creative thinking in the functional literacy research for the first time. As part of our research, following the conceptual provisions of PISA, by creative thinking we mean the ability to productively participate in the process of developing, evaluating, and improving ideas aimed at obtaining original and effective solutions and / or new knowledge and / or vivid expression of imagination (Framework for the Assessment of Creative Thinking in PISA-2021).

The conceptual approaches of the PISA study were adopted as the basis for the development of the toolkit for the project «Development of a model for the formation of students' functional literacy in the context of digital transformation». The PISA study is based on reliably established facts confirming the existence of significant differences in creative tasks in three areas: in the field of verbal expression, in the field of artistic expression, and in the field of problem solving – social, natural, mathematical (Kaufman, Baer, 2004; Chen et al., 2006).

In this regard, the following groups of tasks are given for the study of creative thinking:

− tasks requiring the use of artistic means of verbal and visual («tasks for verbal self-expression» and «tasks for visual self-expression»),

− tasks for solving problems – social and scientific.

A comparative analysis of the results of the performance of the diagnostic work by pupils of the 6th, 7th, and 8th grades in the Krasnoyarsk Territory for certain types of functional literacy allows us to draw the following conclusions, which will be checked in the course of further research:

− for all types of functional literacy, tasks in the PISA format remain unfamiliar to the majority of students in the Krasnoyarsk Territory, and their implementation causes difficulties;

− the results of the diagnostic work make it possible to assert that when completing tasks on all types of functional literacy, students of the 6th, 7th and 8th grades have a low level of formation of general educational skills, the main of which is the ability to work with information presented in various forms (texts, tables, diagrams or figures).

When completing the diagnostic work on reading literacy, 6th grade students of the Krasnoyarsk Territory confidently work with texts on literature, do tasks of various cognitive levels. At the same time, students have diffi-

culty working with texts that include diagrams, tables, etc. (non-continuous texts). It is worth noting that difficulties arise when completing tasks of a reproductive character – to find information given in an explicit form, correlate it with information from another source, and draw a conclusion. The reading literacy of students should be formed in the process of studying all academic subjects, it is necessary to constantly improve the professional skills of teachers, aimed at developing students' skills of conscious reading.

The results of the diagnostic work on science literacy testify to the insufficient practical orientation of the content of science education and its isolation from real life. Most science literacy tasks tested the skills that are not explicitly formed in science lessons. The results obtained indicate that, on the whole, the methodological skills associated with the analysis, generalization and assessment of the proposed situation have not sufficiently been formed among 8th grade students of the Krasnoyarsk Territory. It is in the tasks that require analyzing the results of the conducted science research, confirming or refuting the obtained conclusion using scientific argumentation, that the students showed low results, which actualizes the revision in this direction of the content of not only science, but also humanitarian education. Therefore, systematic work is needed to find effective approaches to the development of students' competencies that characterize science literacy in basic school.

The low percentage of correct completion of the tasks on mathematical literacy can be explained, on the one hand, by the format of the presented tasks, which is unusual for most students, which significantly differs from traditional tasks by a large amount of information and its problematic nature: the condition, as a rule, contains a description of a practical situation with redundant or missing data. The inclusion of plot (text) problems in the diagnostic work, which provide the possibility of applying knowledge in everyday life to solve personal and socially significant problems, helps the student to gain experience in the application of mathematical knowledge, expands understanding of the subject. It is obvious that an increase in the number of such tasks in textbooks and didactic aids in mathematics in primary and secondary schools will improve the quality of subject training and ensure continuity in the development of mathematical knowledge of modern schoolchildren.

The results of the completing by the students of the region of the Olympiad tasks on financial literacy indicate that the structure of financial literacy requires a more detailed study of the toolkit with the study of the nature of the relationship for its objective assessment. A detailed development of this direction for schools in the Krasnoyarsk Territory is at the stage of formation, we are talking about a new special course that introduces the basics of financial knowledge as part of the educational program. At the same time, it should be considered that the developed tasks on financial literacy are aimed not only and not so much at diagnosing the level of financial literacy already achieved, but at getting acquainted with the conceptual framework of this type of functional literacy and the use of the tasks as a toolkit for the formation of patterns of behaviour in various life situations related to finances. They demonstrate the didactic significance of tasks and the possibility of their application in the process of education. An analysis of the problems that students faced when completing the assignments point to deficits in the financial literacy of primary school students and once again focus on the pedagogical potential of the assignments presented in the context of filling the identified gaps.

The reasons for the insufficiently high results of the students in science, mathematical and financial literacy may be associated with the fact that in the process of learning, the students have practically no experience in completing the interdisciplinary tasks, and the development of general educational skills is carried out mainly as part of academic subjects; students rarely find themselves in life situations (including those modelled in the process of learning) in which they need to solve social, scientific, and personal problems.

Note also that the existing banks of assignments for the components of functional literacy do not reflect regional specificity.

While there are tasks with regional themes in the regional diagnostic works. Therefore, the authors consider it appropriate to include a regional component in the substantive basis of the model for the formation of students' functional literacy in the context of digital transformation (Fig. 2), which will contribute to motivation for learning and the formation of regional identity.

For a holistic view of the process of formation of students' functional literacy, we have used the universal method of cognition, it is the modelling method. When creating the model, we were guided by the requirements put forward by A.M. Novikov and D.A. Novikov (Novikov, Novikov, 2010): inertia, simplicity of the model and its adequacy.

As a methodological basis of the model, a systematic approach has been defined. It presupposes the functioning of a multitude of interrelated elements, united by a common aim of functioning and unity of management and acting in interaction with the environment as an integral phenomenon.

The graphical method allows to visualize the composition and structure of the modelled process of forming students' functional literacy. We have defined the main components of

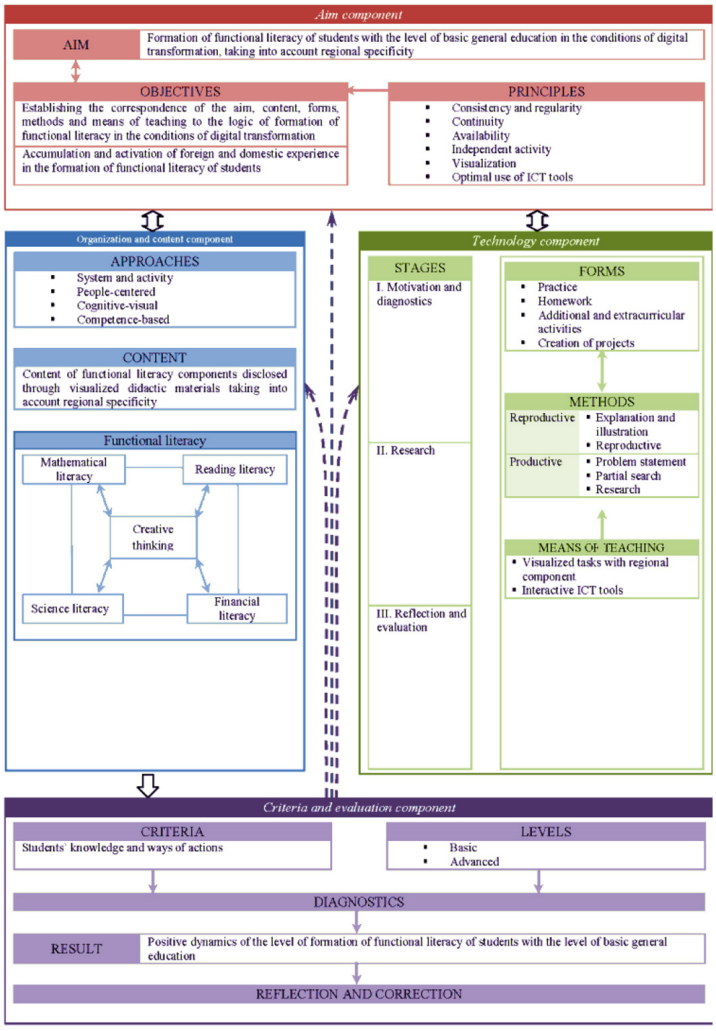

Fig. 2. The model for the formation of functional literacy of students in the context of digital transformation taking into account the regional specificity

the model: the aim component, the organization and content component, the technology component, and the criteria and evaluation component, which in our case are the main elements of the system.

Let us present the characteristics of each component.

The aim component of the model is represented by the following elements: aim, objectives, and didactic principles.

The aim of implementing the proposed model is to form functional literacy of students in grades 6–8 in the context of digital transformation taking into account the regional specificity. The authors believe that the choice of students in grades 6–8 is appropriate, since it is possible to compare with the results of the international PISA project (PISA, 2021), which is focused on 15-year-old students.

The formation of functional literacy acquires particular importance in the context of digital transformation, which implies a systematic update of the objectives and content of training, tools, methods and organizational forms of educational activity in the evolving digital environment.

To achieve the formulated aim, the following tasks were set:

− establishing the correspondence of the aim, content, forms, methods and means of teaching the logic of the formation of functional literacy in the context of digital transformation;

− accumulation and use of foreign and domestic experience in the formation of functional literacy.

The aim and objectives are implemented on the basis of didactic principles that reflect the requirements for the implementation of the pedagogical process: consistency and regularity, continuity, availability, independent activity, visualization and optimal use of ICT tools. The designated principles in the process of forming functional literacy are equivalent, interact with each other and function as an integral system.

The organization and content component includes approaches to learning (system and activity, people-oriented, cognitive-visual, competence-based), the content of learning, which includes the content areas of the functional literacy components.

The technology component of the model under consideration includes a system of forms, methods, and teaching means aimed at the formation of functional literacy.

The stages of formation of students' functional literacy are highlighted taking into account the functional components of students' educational activities and are consistent with organizational forms, as well as methods and means of teaching.

The process of forming functional literacy is implemented through organizational forms of training: practice, homework, additional and extracurricular activities, and creation of projects.

When choosing teaching methods, we relied on the classification proposed by I. Ya. Lerner and M. N. Skatkin: explanatory and illustrative; reproductive; problem statement; partial search; research.

The criteria and evaluation component of the model determines the criteria, levels and indicators of the formation of the components of functional literacy.

Thus, the model developed by us for the formation of functional literacy of students in grades 6–8 in the context of digital transformation, consisting of four interrelated components (aim, organization and content, technology, criteria and evaluation), united by a common aim of functioning in accordance with the logic of the formation of functional literacy, focused on the positive dynamics of the level of its formation in the case of its implementation as an integral system.

Conclusion

Today it is important to talk not only about the assimilation of a certain amount of knowledge by students, but also about the quality of general education in Russia, which determines the importance of conducting research on the state of the problem of the formation of functional literacy. The analysis of the results of regional diagnostic work demonstrates the level of formation of students' functional literacy as a key indicator of the quality of the implementation of the national project «Edu-

cation» and can be used to develop and implement measures aimed at improving the quality of education and effective organization in 2022 and 2023 of the procedures «All-Russian assessment according to the PISA model». In this context, the authors propose a model for the formation of functional literacy of students in the context of digital transformation taking into account the regional specificity. The developed author's model consists of four interrelated components (aim, organization and content, technology, and criteria and evaluation) and is focused on the positive dynamics of the formation of functional literacy in the case of the implementation of the model as an integral system. The content of the model is developed taking into account the specificity of the Priyenisei Siberia, which, according to the authors, will contribute to motivation for learning and the formation of the regional identity of students. The proposed results are, first of all, of practical value for researchers of the stated problem and educational practitioners. Further research in this area involves testing the proposed model to confirm its effectiveness.

References

Basiuk, V.S., Kovaleva, G.S. (2019). Innovatsionnyi proekt Ministerstva prosveshcheniia «Monitoring formirovaniia funktsional'noi gramotnosti»: osnovnye napravleniia i pervye rezul'taty [Innovative project of the Ministry of Education «Monitoring the formation of functional literacy»: main directions and first results]. In *Otechestvennaia i zarubezhnaia pedagogika* [*Domestic and foreign pedagogy*], 1, 4(61), 13–33.

Chen, C., Himsel, A., Kasof, J., Greenberger, E., Dmitrieva, J. (2006). Boundless creativity: evidence for the domain generality of individual differences in creativity. In *The Journal of Creative Behavior,* 40/3, 179–199.

Framework for the Assessment of Creative Thinking in PISA-2021. Available at: https://www.oecd.org/pisa/publications/PISA-2021-Creative-Thinking-Framework.pdf (accessed 05.05.2021).

Kaufman, J., Baer, J. (2004). Sure, I'm creative – but not in mathematics!: Self-reported creativity in diverse domains. In *Empirical Studies,* Vol. 22/2, 143–155.

Krasnoyarskij COKO. Available at: https://coko24.ru/ (accessed 5.05.2021)

Novikov, A.M., Novikov, D.A. (2010). Postroenie obrazovatel'nyh modelej. Kak stroitsya obrazovatel'naya model'? In *Innovacionnye proekty i programmy v obrazovanii,* 1, 3–9.

Pasport natsional'nogo proekta «Obrazovanie» (2018). Available at: https://clck.ru/UcBJ5 (accessed 05.05.2021).

PISA. Available at: https://clck.ru/UcBKG (accessed 29.04.2021).

Popova, O.I. (2018). Transformaciya vysshego obrazovaniya v usloviyah cifrovoj ekonomiki. In *Voprosy upravleniya. Upravlenie v obrazovanii*, 5(54), 158–160.

Uvarov, A. Yu. (2019). Model' cifrovoj shkoly i cifrovaya transformaciya obrazovaniya. In *Issledovatel'*, 1–2, 22–38.