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Analysis of conceptual approaches to the definition of the concept of "functional literacy"

Анализ концептуальных подходов к определению понятия "функциональная грамотность"

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Abstract

The relevance of the article is due to the attention paid by the pedagogical community to the category of "functional literacy", the ambiguity of its interpretation in scientific research, the requirement to respond to the changing demand of society for the quality of education. Moreover, the results of a survey of practicing teachers indicate some difficulty in understanding functional literacy. The purpose of the study is to analyze conceptual approaches to defining the concept of "functional literacy" and develop a generalized model of the structural elements of functional literacy. To achieve this goal, a combination of general scientific methods was used: a descriptive method, including methods of comparison, interpretation and generalization; synchronous theoretical analysis of conceptual approaches to the definition of the concept of "functional literacy" and its components; questioning; pedagogical forecasting; modeling. As a result of the study, conceptual approaches to the definition of the concept of "functional literacy" were analyzed, the definition of the concept of "functional literacy" and its components – mathematical literacy, natural

Аннотация

Актуальность статьи обусловлена вниманием педагогической общественности к категории «функциональная грамотность», неоднозначностью его трактовки в научных исследованиях, требованием реагирования на изменение запроса общества на качество образования. Кроме того, результаты опроса учителей-практиков свидетельствует о некоторой сложности понимания функциональной грамотности. Цель исследования – провести анализ концептуальных подходов к определению понятия «функциональная грамотность» и создать обобщенную модель структурных элементов функциональной грамотности. Для достижения поставленной цели был использован комплекс общенаучных методов: описательный метод, включающий приемы сопоставления, интерпретации и обобщения; синхронный теоретический анализ концептуальных подходов к определению понятия «функциональная грамотность» и ее составляющих; анкетирование; педагогическое прогнозирование; моделирование. В результате исследования проанализированы

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science literacy, reading literacy, financial literacy – was given. In the conclusions, the authors note that the analysis of conceptual approaches to the definition of the concept of "functional literacy" and its components contributes to the improvement of the ways and mechanisms for the formation of functional literacy of students.

Keywords: functional literacy, mathematical literacy, reading literacy, financial literacy, natural science literacy.

Introduction

Functional literacy in education is becoming one of the main topics for discussion at all levels: from government agencies in the field of education to educational institutions. (Hägström and Schmidt, 2021). The modern world has become much more complex, the visual-digital world has replaced the analogue-textological surrounding world, which requires the expansion and reinterpretation of the concept of "functional literacy" (Mangnus et al., 2021). Since functional literacy is understood as the ability of a person to use the knowledge acquired during life to solve a wide range of life tasks in various fields of human activity, communication and social relations, its development in schoolchildren is necessary for the development of society as a whole. An insufficiently developed level of functional literacy among adolescents prevents their adaptation and socialization in society (Yates, 1995).

The purpose of this study is to describe the approaches of Russian and foreign researchers to the definition of "functional literacy" and its components. This goal predetermines the solution of the following tasks:

- to analyze and generalize the approaches to the definition of the concept of "functional literacy" in scientific research;
- to ascertain the ideas of educational practitioners about functional literacy through a survey;
- to develop a generalized model of the structural elements of functional literacy.

концептуальные подходы к определению понятия «функциональная грамотность», дано определение понятия «функциональная грамотность» и её составляющих: математическая грамотность, естественнонаучная грамотность, читательская грамотность, финансовая грамотность. В выводах авторы отмечают, что анализ концептуальных подходов к определению понятия «функциональная грамотность» и его составляющих способствует совершенствованию путей и механизмов формирования функциональной грамотности обучающихся.

Ключевые слова: функциональная грамотность, математическая грамотность, читательская грамотность, финансовая грамотность, естественнонаучная грамотность.

The research hypothesis is a generalized model of the structural elements of functional literacy, developed on the basis of an analysis of the conceptual approaches of Russian and foreign researchers of the problem under consideration, will reveal the problems of the formation of individual components of functional literacy in a unified approach to reading literacy, mathematical literacy, natural science literacy, financial literacy.

Literature Review

Due attention is paid nowadays to the formation of students' functional literacy in Russia: regular government events are held, road maps have been developed for methodological support of teachers on the formation of functional literacy in students, grants are allocated for the implementation of measures to improve the functional literacy of students, etc. (Zuckerman et al., 2013). Researchers note a change in society's demand for the quality of general education in Russia. This is due to objective information about the quality of general education in the Russian Federation in comparison with international standards (Basyuk & Kovaleva, 2019).

The concept of "functional literacy" first appeared in the works of Russian scientists in the early 2000s. For example, Leontiev (2016) characterized this concept as follows: "A functionally competent person is a person who is able to use all knowledge, skills and abilities that are constantly acquired throughout life to solve the widest possible range of life tasks in various

spheres of human activity, communication and social relations". Leontiev (2016) notes that a person with a high level of functional literacy is able to use the acquired knowledge, skills and abilities to solve various life problems, problems in social, scientific activities, in communication. Functional literacy is the ability to adapt as quickly as possible in the external environment and to function actively in it.

Azimov & Shchukin (2009) define functional literacy as "the ability of a person to enter into a relationship with the external environment and adapt and function in it as quickly as possible." Functional literacy should be distinguished from common literacy, which presupposes a person's possession of such skills as reading, writing, listening, and solving arithmetic actions of different levels. Functional literacy is a higher level of skills and abilities that contribute to the successful, productive solution of social, professional tasks (Azimov & Shchukin, 2009).

Vinogradova et al., (2018) defines functional literacy as a basic education of a person, which allows its systematic practical use. The definition of functional literacy in the PISA (Program for International Student Assessment) study is associated with the skills and knowledge required by fifteen-year-olds to function fully in modern society. Thus, functional literacy according to PISA is a set of defined competencies, where competence refers to the ability of students to apply knowledge and skills acquired in school in life situations (OECD, 2019).

In some works, the concept of functional literacy is used in terms of "information literacy" in vocational training. Thus, Koler-Povh & Turk (2020) note that the systematic training of engineering students in Slovenia in compulsory information literacy programs objectively increased their competence in publishing. Similar results in medical students at the University of Texas in the formation of professional competencies were noted by Waltz et al., (2020).

Methodology

A combination of general scientific methods: a descriptive method, including methods of comparison, interpretation and generalization; synchronous theoretical analysis of conceptual approaches to the definition of the concept of "functional literacy" and its components; pedagogical forecasting; modeling was used to achieve this goal.

The methodological basis of the research is the modern philosophy and methodology of pedagogical science. Within the framework of the study, the epistemological principles are of particular importance: the relationship between theory and practice in the process of scientific cognition, the principle of consistency, the dialectical unity of the general and the particular in pedagogical phenomena.

Results and Discussion

To understand functional literacy, the authors will consider its components, namely: reading, mathematical, natural science, financial literacy.

Reading literacy can be considered the foundation of literacy in general and functional literacy in particular. The concept of "reading literacy" appeared in Russian pedagogy relatively recently. This term has become widespread due to a number of international diagnostics, in which Russia has participated since the end of the 20th century. The original definition of reading literacy was developed for the first PISA study in 1998-2001 based on the consensus of a group of experts from countries-participants in the PISA-2000 test (OECD, 2019). This definition was based in part on the International Reading Literacy Survey and the International Adult Literacy Survey. The definition of reading literacy used in the PISA-2000 test has developed under the influence of modern reading theories based on the idea of the active nature of reading, models of text comprehension and theories of solving reading problems. In accordance with these ideas, the linguistic person understands the text due to some "previous" background knowledge, which makes it possible to perceive and interpret the text depending on the socio-cultural characteristics of the reading context and the reader himself. The reader needs to apply different strategies and skills to make sense of the text, which depend on the goals of the reading and the type of text (Walgermo et al., 2018).

PISA defines reading literacy as the ability of a person to understand and use written texts, reflect on them and engage in reading in order to achieve their goals, expand their knowledge and capabilities, and participate in social life (Zuckerman, 2010). This definition gives grounds to assert that the concepts of "reading literacy" and "reading" are synonymous only in part. Reading in Russian pedagogy is considered as "the process of transcoding a graphically fixed text into sound speech, its understanding" (L'vov, 1997). Reading results in comprehension and

comprehension of written texts. The concept of "reading literacy" implies an active, purposeful and constructive use of reading in different situations and for different purposes. The reader brings into the act of reading his cognitive abilities (attention, memory, ability to critical analysis, logical thinking, visualization); motivation (purpose of reading, interest in content, self-assessment of reading efficiency); knowledge (lexical and thematic knowledge, linguistic and discursive knowledge, knowledge of understanding strategies) and experience.

The Progress in International Reading Literacy Study (PIRLS) considers reading literacy as "the ability to understand and use written language in all its variety of forms for purposes required by society and / or valuable to the individual. Readers construct their own meanings based on a variety of texts. They read to learn, to participate in school and out-of-school reading communities, and for fun" (Mullis & Martin, 2015). The presented definition also indicates the metacognitive competence of a linguistic personality with a high level of reading literacy, namely: involuntary intellectual control of information processing processes; knowledge of the stages of metacognitive actions; reflection of cognitive processes; justification of the chosen methods, techniques and methods of teaching; inclusion of this product in the overall picture of the world and oneself.

In modern Russian teaching practice, the most popular and generally accepted definition was proposed by Vinogradova et al., (2018): reading literacy is the need for reading activity for the purpose of successful socialization, further education, and self-development; readiness for semantic reading and perception of written texts, analysis, assessment, interpretation and generalization of the information presented in them; the ability to extract the necessary information to transform it in accordance with the educational task; navigate with the help of various textual information in life situations. The presented definition, in our opinion, reflects the key points of reading literacy and indicates such important aspects as motivational (the need for reading activity), cognitive (perception of written texts, analysis, evaluation, interpretation and generalization of the information presented in them) and pragmatic (textual information makes it possible to solve specific problems in certain life situations).

The above definitions help to single out and characterize the main structural elements of reading literacy.

1. Situation. This nomination is understood as life circumstances that presuppose the solution of a problem or the achievement of a particular goal based on the text. Conventionally, four types of situations can be distinguished: personal, educational, public, business. Each type of situation presupposes its own set of texts: personal situations – biography, letter, live journals, blogs, etc.; educational – textbook, manual, article and other scientific and educational literature; public situations – official documents, forums, news websites, etc.; business situations – announcement, instruction, laws, decrees, orders.
2. The text with the help of which a problem is solved or a certain goal is achieved. Depending on the format of information presentation, the texts can be continuous (information is presented exclusively in a verbal way); discontinuous (information is presented in a non-verbal way in the form of tables, diagrams, figures, etc.); mixed (inside one text information is located both in solid and non-continuous formats).
3. Reading skills. The indicated structural component presupposes the readiness of the subject to most effectively perform actions in accordance with the goals and conditions in which one has to act, namely: to find information in the text; integrate and interpret it; evaluate the content and form of the text. Moreover, reading skills provide for mastering different strategies for reading texts: strategies for pretext activity, strategy for textual activity, strategy for post-textual activity.

Mathematical literacy is also an important component of functional literacy. It should be noted that at present the concept of "mathematical literacy" is not well-established in both domestic and foreign scientific literature. This term was one of the first to be mentioned in the United States back in 1944, when the National Council of Teachers of Mathematics (NCTM) commission announced in its post-war plans that the school should ensure the formation of mathematical literacy for all students. However, the definition of this concept was not given. The 1989 NCTM standards set out five general goals to help students achieve math literacy: "1) to learn to appreciate math; 2) to gain confidence in their ability to master mathematics; 3) to be able to solve mathematical problems; 4) to master mathematical speech; 5) to learn to reason mathematically" (Crosswhite et al., 1989).

The first attempt to provide a clear definition was made in the original PISA program in 1999 (OECD, 1999), which was subsequently revised and supplemented several times for subsequent PISA cycles. Currently, most researchers, both Russian and foreign, use the following definition: "mathematical literacy is the ability of an individual to reason mathematically, formulate, apply, interpret mathematics to solve problems in various contexts of the real world" (OECD, 2018). The context can be personal, professional, scientific or public spheres of a person's life.

In the scientific and methodological literature, many related concepts can be found: "quantitative literacy", "statistical literacy", "logical literacy", "critical mathematical literacy". For example, Nikolskaya (1978) defines the concept of logical literacy as an indicator of the assimilation of a complex of logical knowledge, abilities, skills to be mastered by the graduate of a secondary school.

Kovaleva (2005) defines the concept of mathematical literacy as "the ability of a person to determine the role of mathematics in the world in which he or she lives, to express well-founded mathematical judgments and to use mathematics in such a way as to satisfy the present and future needs of a creative, interested and thinking citizen".

A number of Russian researchers consider the mathematical literacy of students in the context of the formation of their functional literacy. Thus, Valeev (2020) characterizes a functionally competent student in terms of mathematical competence as capable of performing the chain of actions indicated in the model of mathematical literacy of the PISA study: "to recognize the problems of the surrounding reality, formulate them in the language of mathematics, solve them using mathematical methods, analyze the methods used, interpret the results obtained taking into account the problem posed and formulate the results of the solution." Thus, the concept of "functional mathematical literacy" is introduced in order to emphasize the inclusion of mathematical literacy in the process of forming a functional one.

In addition, the problem of the relationship between the concepts of "mathematical competence" and "mathematical literacy" is widely discussed in the scientific literature. According to Denischeva & Krasnyanskaya (2017), functional mathematical literacy implies the formation of students' mathematical competence through a specially designed system

of tasks, divided into three groups. The first group includes tasks that require the reproduction of mathematical facts and methods, and the performance of calculations for their solution. The second group includes tasks aimed at establishing connections and integrating material from different areas of mathematics. The tasks of the third group require the isolation of the problem in life situations, solved with the help of mathematics with the further creation of a solution model. Based on this research, Valeev (2020) proposes a three-level model of the mathematical competence of schoolchildren, on the basis of which he classifies the tasks from the PISA mathematical literacy study according to the corresponding levels.

In the understanding of Jablonka & Niss (2014), "mathematical literacy", "quantitative literacy" and "numeracy" focus on mathematics as a tool for solving non-mathematical problems, while the concepts of mathematical competence (and competencies) and mathematical proficiency focus on the fact that means mastering mathematics in general, including the ability to solve both mathematical and non-mathematical problems.

In all the listed approaches to the definition of the concept of "mathematical literacy", common features can be distinguished. Thus, all researchers emphasize its activity-oriented and integrative nature. There is also agreement that mathematically literate citizens should not be experts in mathematics and that mathematical literacy is based on knowledge that should be available to everyone.

In PISA (OECD, 2018; OECD, 2019), natural science literacy as a component of general functional literacy represents a person's ability to take active citizenship on issues related to natural sciences and their willingness to take an interest in natural science ideas. A natural science literate person seeks to participate in a reasoned discussion of problems related to natural sciences and technology, which requires the following competencies from the person: to explain phenomena scientifically, to evaluate and plan scientific research, to scientifically interpret data and provide evidence.

According to Fakhriyah et al., (2017), studying the level of education in physics and biology among prospective primary education teachers in Indonesia, "scientific literacy is interpreted as the use of scientific information to solve problems in everyday life." According to researchers, scientific knowledge should be reflected in skills,

attitudes and literacy for solving various problems, therefore, it is necessary to be proficient in research methods, noting that professional knowledge is based on the functional level. Achieving the functional level is possible only through the involvement of students in research activities and the practical use of these activities.

Thus, natural science literacy is a level of education that makes it possible to solve standard life tasks in various fields of activity on the basis of practice-oriented knowledge, including a set of skills and abilities that ensure a person's full participation in the life of society, a person's ability to enter into relations with the external environment, quickly adapt and function in it.

The PISA science literacy model formulates contexts: personal, local (national) and global issues, both contemporary and historical, that require an understanding of science and technology issues. Students are required to demonstrate basic competencies: scientific explanation of phenomena; understanding the main features of natural science research; interpreting data and using scientific evidence to draw conclusions in a specific context. Attitude towards science should be determined by an interest in technology, an understanding of the value of scientific study of issues, where necessary, and awareness of environmental problems, as well as an awareness of the importance of solving them and knowing: understanding the basic facts, ideas and theories that form the foundation of scientific knowledge. Such knowledge includes knowledge of nature and technology (knowledge of content), knowledge of methods of obtaining scientific knowledge (knowledge of procedures), understanding of the validity of these procedures and their use (methodological knowledge) and determines the results of learners.

According to the results of interim monitoring (Froumin et al., 2018), a particular difficulty for schoolchildren is the "transfer" of a life issue, a problem into the scientific field. This indicates that the process of teaching the disciplines of the natural science cycle should include the competence-oriented tasks based on real life situations, experimental work, etc. that, in our opinion, have been already reflected in modern textbooks and educational-methodical complexes.

The next component of the functional literacy framework is financial literacy. The relevance of the formation of the foundations of financial

literacy is determined by the modern socio-cultural situation, the development of a market economy and the functioning of market entities, which are all citizens of the country. In connection with this, a significant number of studies appear on the problem of improving the financial literacy of various social groups: from preschoolers to retirees.

It is worth noting that financial literacy does not imply deep theoretical knowledge of the specifics of the financial market, banking, etc. A financially literate person should know how to effectively manage and control the family budget; how to plan cash expenses for the near future and for the future; how to act in case of unexpected loss of income; how to form a financial reserve, etc. (Opletalová, 2015). At the same time, foreign researchers associate financial literacy of students mainly with understanding the value of savings, the ability to manage them, discussing money issues with parents and teaching financial literacy at school. (Grohmann et al., 2015; Moreno-Herrero et al., 2018).

The low level of financial literacy limits the ability of children, and then adults, to make informed financial decisions, namely: to create reserves of cash and regular savings, to plan for old age, to know the main portfolios of financial products, to be able to assess the risks associated with certain financial products (Atkinson and Messy, 2012). Therefore, research focuses on the organization of financial education, starting from the initial stage of education, which can be the key to improving financial decision-making among the population.

Summarizing the above, the authors note that financial literacy is the assimilation of certain behavioral models, understanding and forecasting financial risks. Financial literacy is essential for making sound financial decisions and managing personal finances. It will be able to manifest itself as a certain social quality of a person, which makes it possible to consciously participate in various processes related to money, inevitably leading to personal and social financial well-being.

The formation of functional literacy in the general education system is determined, first of all, by the high-quality professional training of teachers, since the level of educational achievements of schoolchildren depends on the nature of the educational tasks offered to them by the teachers. As part of the monitoring of the formation of students' functional literacy, a

questionnaire was conducted among teachers working in schools in the Krasnoyarsk Territory (Russia) about their ideas about what functional literacy is. Out of 287 teachers surveyed, the overwhelming majority of 78% preferred to choose an answer from the proposed formulations, and only 22% of respondents offered their own version of the wording of this concept. For example, "a person's ability to navigate in all spheres of life"; "The ability of a person to enter into relations with the entire external environment", "the ability to use knowledge in everyday life", "the ability to apply knowledge to solve life problems." 14% of respondents chose the most generalized superficial version of the wording as a definition: "a person's ability to understand the processes of real life", which does not include the active application of knowledge in real life. 25% of the

respondents preferred the choice of the answer as "a person's ability to navigate in modern information" that is, it also includes a predominantly component of understanding, rather than the effective implementation of knowledge and skills. 39% of teachers emphasized the third formulation, which includes "a person's ability to use in life what he was taught in school", which is more consistent with the official version of the definition of functional literacy, since it reflects the ability to use constantly acquired knowledge, skills, and abilities to solve life tasks.

The analysis of the key concepts of the research issue (mathematical, natural science, reading, financial literacy) allowed the authors to develop a generalized model of the structural elements of functional literacy (Fig. 1).

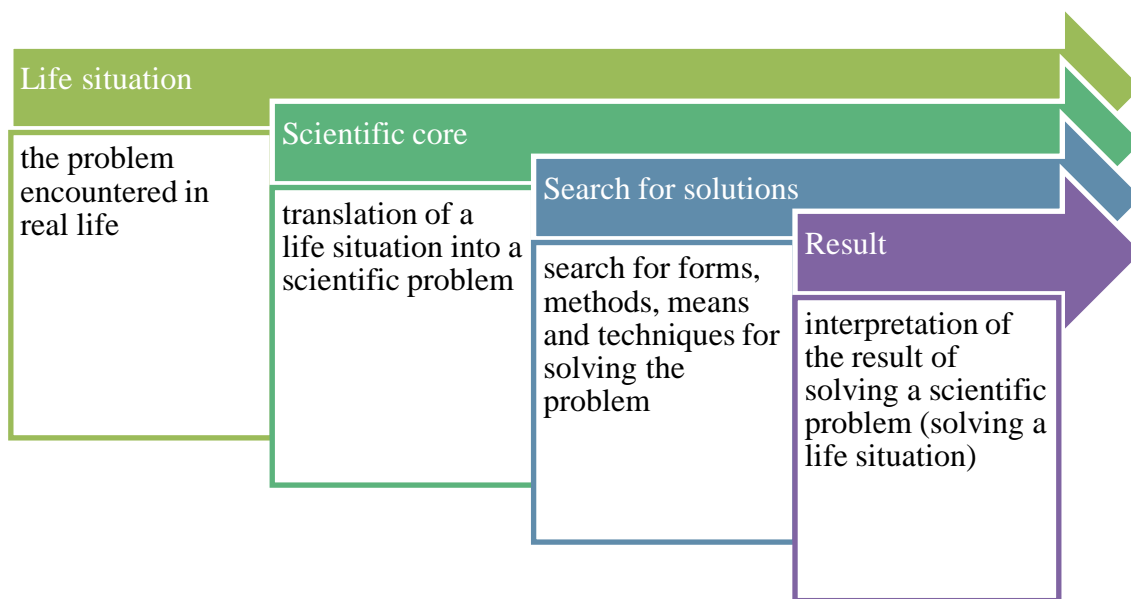


Fig. 1. Generalized model of the structural elements of functional literacy. Source: compiled by the author.

In the context of the research, the authors are interested in the solution of the "life situation", that is, the problem that students may face in real life. The analysis of international comparative studies of education quality shows that the second element of the "scientific core" model causes the greatest difficulty for Russian schoolchildren; students solve a fundamental problem (for example, an equation, inequality, etc.) quite confidently, but they experience certain difficulties when translating a life situation into a scientific problem. The solution of a fundamental problem (the third element of the structural model is "search for a solution") involves the search for forms, methods, means and techniques for solving a scientific problem

and their use to obtain a result. Russian schoolchildren do not experience any particular difficulties at this stage. Interpretation of the result of solving a scientific problem (life situation) is difficult only if the student cannot independently translate the "life situation" into a "scientific problem".

Conclusions

A detailed analysis of conceptual approaches to defining the concept of functional literacy and its components in scientific Russian and foreign research was carried out by the authors. The results of the analysis confirm the feasibility of considering the definition of "functional literacy"

and provide a detailed theoretical basis and a wide range of tools for pedagogical modeling and design. The author's generalized model of the structural elements of functional literacy makes it possible to understand the problems of the formation of individual components of functional literacy in a unified approach to reading literacy, mathematical literacy, natural science literacy, financial literacy.

Nowadays, it is important to consider not only the assimilation of a certain amount of knowledge by students, but also 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. As a scientific result of the study, the authors conclude that certain scientific works on the problem of understanding functional literacy and its components repeat the existing ones, particular duplication of research is observed. In this regard, the proposed scientific results are, first of all, of theoretical value for researchers of the stated problem and educational practitioners, whose understanding of functional literacy often remains fragmentary. The analysis of conceptual approaches to the definition of the concept of "functional literacy" and its components, in our opinion, will contribute to the improvement of the ways and mechanisms for the formation of functional literacy of students. The authors intend to propose a model for the formation of functional literacy, taking into account the regional specifics.

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