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Metacognitive Engagement Skills Development through Teaching Text Comprehension Methods

Evgeniya N. Kameneva-Lyubavskaya[1,2*], Tatyana V. Borzova[2]

[1] Far Eastern State Medical University, Khabarovsk, Russian Federation
[2] Pacific National University, Khabarovsk, Russian Federation

[*]Corresponding author: klen .93@mail.ru

Abstract

Introduction. One of the main aspects of text comprehension is going beyond the information actually provided in the text, which needs to be linked with the context, previous knowledge, interpreted and analyzed. This requires a high level of metacognitive engagement in activities, which allows proper planning of one's actions when working with a particular text, reflecting on or evaluating the level of comprehension. Metacognitive engagement consists of metacognitive knowledge (declarative, procedural, conditional) and metacognitive regulation (planning, information management strategies, comprehension monitoring, debugging, evaluation). The purpose of this article is to study the impact of teaching text comprehension methods on students' metacognitive engagement in activities: possession of metacognitive knowledge and strategies. **Methods.** The study involved 190 students from the Far Eastern State Medical University of the Ministry of Health of Russia: 95 of them were included in the experimental group that underwent special training in text comprehension methods, while 95 students were included in the control group. In order to determine metacognitive engagement, the "Metacognitive Awareness Inventory" questionnaire by G. Shraw and R. Dennison in adaptation by A.V. Karpov and I.M. Skityaev was used. **Results.** Students in the experimental group who underwent training in text comprehension methods demonstrated better metacognitive skills than those in the control group who did not receive such training. **Discussion.** Increasing metacognitive engagement is possible through teaching students text comprehension methods. The methods included in the training program are as follows: creating an illustrative plan for the text, marking the text, asking questions,

creating a conceptual table, searching for associations, creating an oral secondary text, determining the reader's projection, and identifying contradictions.

Keywords

text comprehension, metacognitive engagement, metacognitive engagement in activities, metacognitive knowledge, metacognitive regulation

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Introduction

In the higher education process, the text is a key unit of the educational system, and text comprehension is an important qualitative indicator of learning efficiency. Text comprehension in this study is understood as going beyond the author's written information, connecting it with previous knowledge and experience, identifying problems not mentioned in the text, contradictions not mentioned by the author. The psychological and pedagogical aspect of text comprehension is related to the development of cognitive functions in education. In modern conditions of digitalization, the educational process requires students not only to acquire new knowledge, develop cognitive skills, but also to analyze their cognitive activities (Borzova, Mosunova, 2020; Artelt & Schneider, 2015; Kofeynikova, Nikolaeva, Khukumatshoyeva, 2019; Babaev, Kylychova, 2020). Students should not only evaluate what and how much they have learned or found out, but also how they acquire this knowledge and what else they need to do in order to further understand phenomena and events in the surrounding world (Flavell, 1979; Pushkareva, 2009). The process of text comprehension requires using the metacognitive strategies – "consciously chosen actions aimed at achieving specific goals, which require conscious planning, monitoring, evaluation, and correction of the reading process (Berlin Khenis et al., 2024), which influence learning success, help in making decisions about educational trajectory and self-education (Gabdullina, 2023; Dmitrienko, Ershova, 2022; Perikova,

Lovyagina, Byzova, 2019; Magomedova, 2024; Akopova, 2022; Melnikova et al., 2022). Metacognition is manifested in the ability and readiness for metacognitive engagement in cognitive activities and metacognitive regulation based on metacognitive knowledge and strategies (Hammedin, Sauhan, 2020; Yakin et al., 2024).

The main construct of the study – "metacognitive engagement in activities" – is an integral index of the development of students' metacognitive knowledge and strategies. Metacognitive engagement in activities allows individuals to consciously approach the understanding of educational information and text.

Metacognitive engagement involves having metacognitive knowledge and metacognitive regulation (Schraw & Dennison, 1994). A person's knowledge about their own thinking process is particularly important in the process of psychological self-regulation (Dinsmore, Alexander, Loughlin, 2008). Further, self-regulation is necessary for the development of student autonomy and independence (Schraw & Dennison, 1994).

The relevance of studying the metacognitive engagement in activities while teaching text comprehension methods is determined by the following components:

1. The importance of cognitive development in the context of functional illiteracy, the "inability of a person who is formally able to read and write, understand and analyze texts" as a civilizational risk of the 21st century (Pischalnikova, 2021). The digitalization of education, along with the unlimited possibilities of computer technologies for accessing information, may have negative consequences for the psychological development and socialization of students (Pischalnikova, 2021; Karpov, 2023). Among the negative consequences of digitalization of education is a low level of cognitive development, leading to problems in learning, perception, and understanding of scientific texts as a key educational process unit.

2. The importance of students' metacognitive development in the context of the effectiveness of psychological and pedagogical support in the digital educational space, as well as the need for the development of metacognitive regulation as a condition for integrating students into conscious, reflexive perception of educational and scientific information and activating cognitive functions in the learning process (Melnikova, 2022; Pronenko, Belikova, Skripkina, 2023).

3. The dissonance between the high demands of modern education in the context of the digital civilization, the constantly increasing volume of information required for assimilation, and the low level of metacognitive engagement in activities among students.

4. The need for internal (content-based) rather than external technologization of educational processes using approaches based on the laws and principles of cognitive development of students, for example, differentiated teaching, which allows struggling students to grasp the basics of taught subjects well, and advanced students to acquire information "above the norm."

The metacognitive approach in psychology

The prefix "meta" in epistemology refers to information about "oneself" (Kundin, 2017). Therefore, metacognitive strategy in the educational process involves understanding and changing the structure of cognitive processes itself, rather than just a set of information and knowledge as in cognition. The metacognitive approach in psychology began to be actively developed and applied with the emergence of the works of J. Flavell, who described the structure of metacognition, including knowledge, strategies, and feelings (Flavell, 1979). Subsequently, over the course of a decade, the focus of research on metacognition has shifted towards the study of control and activity strategies (Perikova et al., 2020). Metacognition is a relevant subject of study in various areas of psychology (Table 1).

Table 1

Metacognitive Studies in Different Branches of Psychological Science

Psychology Branches	Subject of Study	Research Objectives	Key Researchers
Development a Psychology	Metacognitive elements at different ages of human life	1. Determining when and how a person tarts to think metacognitively. 2. Identifying changes in metacognition throughout life. 3. Qualitative measurement of aspects of metacognition.	1. Zimmerman B.J. 2. Kloo D., Rohwer M. 3. Brinck I., Liljenfors R. 4. Hertzog C. 5. Chernokova T.E.
Experimental and Cognitive Psychology	Metacognitive feelings	1. Assessment of metacognitive judgments during cognitive activities. 2. Assessing the degree of confidence in these judgments. 3. Studying processes influencing the success of cognition. 4. Studying metacognitive control and monitoring.	1. Koriat A. 2. Fomin A.E., Bogomolova E.A.

Psychology Branches	Subject of Study	Research Objectives	Key Researchers
Education Psychology	Learning self-regulation	1. Determining how different aspects oflearning interact with each other. 2. Identifying factors influencing the degree of involvement in independentlearningprocesses. 3. Establishing the relationship between metacognition and learning success. 4. Identifying factors influencing the development of metacognition.	1. Pintrich P.R. 2.Zimmerman B.J. 3. Chernokova T.E. 4. Panadero E. 5. Kofeynikova Y.L.
Personality and Social Psychology	Metacognitive beliefs about the intentions of others and oneself	1. Evaluating self-efficacy, the needforknowledge,controlover one's and others' mental states and processes.	1. Jost J.T. 2. Bem D.J. 3. Frigth (2012). 4. Holmogorova A.B. 5. Perikova E.I.
Clinical Psychology	Metacognition as a system of specific personality characteristics influencing the development and/or treatment of psychopathology	1. Identifying ways therapists work with the metacognitive component of patients to alleviate their condition. 2. Establishing the relationship between metacognitive components and the patient's existing illness.	1. Wells A. 2. Lysaker P.H. 3. Sun S. (2017). 4. Provorova A.N.

In summary, it can be said that metacognition, metacognitive skills "have universal applicability, they can be subject-specific and vary in different content areas of cognition and activity" (Kashapov, Bazanova, 2021, p. 394). Researchers focus on studying the independence of one's own thinking: not on quantitative, but qualitative cognitive characteristics: how the cognitive process occurs in a person and how they can regulate it themselves (Kharzeeva, 2012).

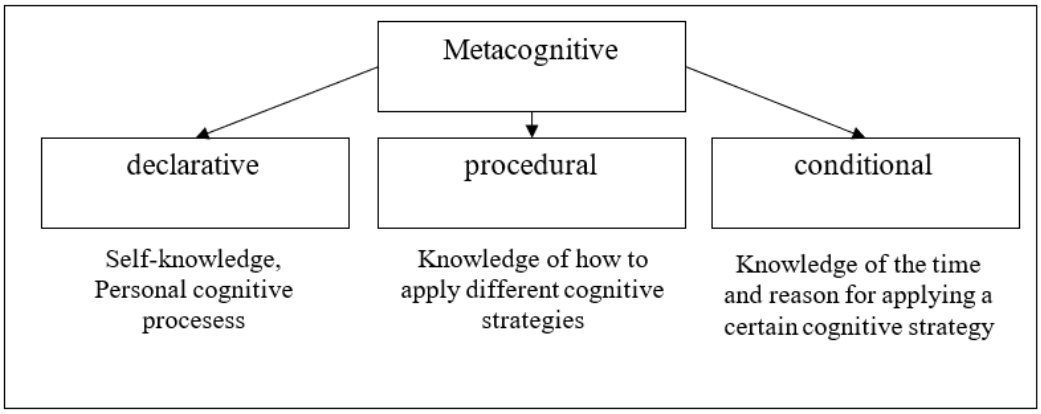
Self-regulation of the cognitive process is crucial in the educational process. In recent decades, the volume of knowledge required for acquisition has been constantly increasing, and students need to independently structure their educational process (Smirnova, 2021). In addition, some industries are now implementing a policy of continuous education, especially in healthcare and education, where adult professionals need to independently plan and control their educational trajectory, accumulate points for certification and promotion. The success of learning directly depends on metacognitive engagement skills (Krebs & Roebers, 2010; Zohar & Dori, 2012; Isaacson & Fujita, 2006; Tobias & Everson, 2000; Schunk & Zimmerman, 2003; Karpovich & Koroleva, 2020).

Metacognitive Knowledge

For the successful education attainment, modern individuals require a high level of developed metacognitive engagement skills, which include various elements of general metacognitive knowledge (Fig. 1).

Metacognitive knowledge involves a reflective understanding of information about a particular process and the role of the individual in it (Yong & Fry, 2008; Byzova, Perikova & Lovyagina, 2019).

Figure 1
Elements of metacognitive *knowledge*



As shown in Fig. 1, metacognitive knowledge includes declarative, procedural, and conditional knowledge (Karpov, 2005). Declarative knowledge comprises information about oneself, what is easier or harder for the learner, in what form it is easier to perceive, memorize, and process information, which ways of text comprehension are simplest and most effective for them personally. Procedural knowledge allows learners to understand how to apply different learning methods, including methods of understanding educational material, while conditional knowledge helps in selecting them depending on the situation and the complexity of the task, text, or provided information.

Metacognitive Regulation

It is important to note the metacognitive regulation skills that students should possess during the process of text comprehension:

- Planning, through which students organizes their activities;
- Information management strategies, which allow working with the flow of knowledge, selecting necessary data;
- Comprehension monitoring, which enables drawing intermediate conclusions, monitoring the completeness and quality of the completed activities;
- Debugging;
- Evaluation, which allows assessing the quality of the entire educational work.

Research Objective

The aim of the study is to examine the impact of teaching students methods of text comprehension on metacognitive engagement in activities: mastery of metacognitive knowledge and strategies.

To acquire skills of metacognitive engagement in activities during education, students need to be provided with tools that promote greater engagement in educational activities and self-monitoring. We believe that teaching students methods of text comprehension can be such a tool, enabling them to better analyze and understand what they read, plan and analyze their own educational activities.

Methods

Sample

The study involved 190 students from the Far Eastern State Medical University of the Ministry of Health of Russia, with 95 students in the experimental group who underwent special training in methods of text comprehension (48 males and 44 females), and 95 students in the control group (37 males and 58 females). The average age of the students was 19.31 $\pm$ 1.67 years.

Research Methods

The assessment of text comprehension levels was conducted using a set of tasks formulated according to the methods of text comprehension (Table 2):

1. Make an illustrative plan of the text.

2. Divide the text into the following blocks: information familiar before reading; unknown but comprehensible information; unknown and incomprehensible information.

3. Formulate questions to clarify incomprehensible information.

4. Identify the main phenomena or processes described in the text and highlight their comparative features.

5. Associate the identified phenomena and processes with facts, phenomena, and events.

6. Briefly retell the text using the illustrative plan of the text.

7. Relate the meaning of the text to your existing knowledge or life experience.

8. Find a contradiction in the text or formulate it based on your existing knowledge or life experience.

Students received 1 to 5 points for each task (where 1 is the lowest score, and 5 is the highest score).

The methodology for studying metacognitive engagement in activities involved the use of the **"Metacognitive Awareness Inventory"** questionnaire by G. Shraw and R. Dennison (1994) adapted by A.V. Karpov and I.M. Skityaeva (2005). Mathematical methods for data processing and analysis included the Student's t-test and Spearman's correlation coefficient.

Research Stages

At the first stage of the study, we assessed the level of text comprehension among students in both the control and experimental groups.

Next, students' levels of metacognitive engagement in activities were evaluated using the "Metacognitive Awareness Inventory" questionnaire by G. Shraw and R. Dennison (1994) adapted by A.V. Karpov and I.M. Skityaeva (2005).

At the second stage, we conducted specialized training for students on methods of text comprehension, analyzing changes in metacognitive engagement indicators. The training was conducted during 15 classes in a face-to-face format. Each class focused on one of the eight methods of text comprehension, as presented in Table 2. For example, the first class, "Creating an Illustrative Plan of the Text," required students to read the text in full, identify its separate sections, and determine the main idea of each section before creating illustrations based on the text. The next class was dedicated to "Text Marking" and "Question Formulation." "Text Marking" allows students to identify familiar and unfamiliar information, as well as what is understood and not understood. The latter is clarified by formulating specific questions. Introduction and training of the eight methods of text comprehension was conducted using one text; subsequently, in each class, students received a new text to practice their comprehension skills.

Emphasis was put on the universality of the proposed methods of text comprehension, i.e., the ability to apply them in organizing self-learning processes and studying various disciplines.

The methods of text comprehension discussed during the training are presented in Table 2 (Kamenyeva-Lyubavskaya & Borzova, 2023).

Table 2
Methods of Text Comprehension

Method	Essence of the Method
Creating an Illustrative Plan of the Text	A plan in the form of drawings reflecting the main sections of the text.
Text Marking	Marking the text during its primary reading: a) information already known before reading; b) unknown but understandable information; c) unknown and unclear information.
Formulating Questions	Formulating specific questions about unclear information.
Creating a Conceptual Table	Creating a comparative table to analyze the characteristics of definitions or phenomena described in the text, and the relationships between them.
Searching for Associations	Creating images based on facts, phenomena, and events.

Method	Essence of the Method
Creating an Oral Secondary Text	A brief retelling of the text aimed at highlighting its main idea and key sections.
Defining Reader Projection	Transferring the meaning of what has been read to personal experience and existing knowledge.
Identifying Contradictions	Identifying disruptions in the relationships between components of phenomena or processes presented in the text.

At the third and final stage, the obtained results were processed, and a comparative analysis of the effectiveness of teaching text comprehension methods to students in the control and experimental groups, as well as the identification of differences in the level of metacognitive engagement, was conducted.

Results

For the analysis of text comprehension levels, students worked with various texts using the comprehension methods presented in Table 2, for which we assigned grades from 1 to 5, where 1 is the lowest score and 5 is the highest.

At the beginning of the experiment, all students demonstrated equally low levels of skills and abilities in working with texts, with the average score for all completed tasks being 1.98 $\pm$0.24 for the control group and 1.96 $\pm$ 0.27 for the experimental group. This confirms the calculated Fisher's criterion of 1.34, which is in the zone of insignificance.

The level of metacognitive engagement before the experiment in both groups was below average: 100.17 $\pm$ 24.87 in the control group and 97.77 $\pm$ 25.54 in the experimental group. The level of metacognitive knowledge was average: 36.28 $\pm$ 6.15 in the control group, and 37.34$\pm$ 5.34 in the experimental group. At the same time, there was an average level of declared knowledge (26.34 $\pm$ 4.24 in the control group and 23.89 $\pm$ 3.21 in the experimental group). The levels of procedural and conditional knowledge were low (below 6 on both indicators in both groups). The level of metacognitive regulation was also average: 65.24 $\pm$ 14.34 in the control group and 64.25 $\pm$ 15.21 in the experimental group. Low scores were noted in information management strategies, comprehension monitoring, and debugging. The levels of planning and activity evaluation in both groups were above average.

To evaluate the effectiveness of the special training in text comprehension methods at the final stage of the experiment, the mathematical processing of the results using Spearman's correlation coefficient was performed (see Table 3).

The Spearman correlation coefficients calculated in Table 3 show the relationship between the performance in various text comprehension methods, which were evaluated on a scale from 1 to 5, and the fact of participation in special training (where participation in training was coded as 1 and absence as 0). A significant correlation was observed between all indicators (at the significance level of $p \leq 0.05$), and for the "Question formulation" method, the correlation coefficient was 0.74, indicating a significant connection between training and performance. Thus, organized training in text comprehension methods correlates with text comprehension levels.

Table 3

Spearman Correlation Coefficients between Text Comprehension and Participation in Special Training

Text Comprehension Method	Participation in Training (1 – participated, 0 – did not participate)
Creating an illustrative text plan	0,57
Text marking	0,57
Question formulation	0,74
Creating a conceptual table	0,58
Association search	0,53
Oral secondary text creation	0,55
Reader's projection definition	0,56
Contradiction identification	0,49

The research has also involved studying the metacognitive engagement in activities of students in the experimental and control groups using the Metacognitive Awareness Inventory (MAI) developed by G. Shraw and R. Dennison in 1994 and adapted by A. V. Karpov and I. M. Skityaeva in 2005. Metacognitive knowledge in this questionnaire is assessed in terms of declarative, procedural, and conditional knowledge. We compared these indicators in the experimental and control groups using Student's t-test (Table 4).

Table 4

Analysis of Metacognitive Knowledge Indicators in Students of the Experimental and Control Groups

Indicator	Metacognitive Knowledge	Declared Knowledge	Procedural Knowledge	Conditional Knowledge
Average Value in the Experimental Group	46,06 ± 6,39	17,98 ± 4,06	10 ± 3,04	14,04 ± 3,96
Average Value in the Control Group	25,84 ± 5,96	17,48 ± 4,34	7,73 ± 2,84	8,07 ± 2,59
Student's t-Criterion*	21,9	2,6	5,4	12,4

***Note:** $p \leq 0.05$*

In all types of metacognitive knowledge (except for declared knowledge), the experimental group has higher indicators than the control group. This suggests that, while having equal knowledge about themselves and their own cognitive processes, the experimental group possesses greater knowledge about what to apply and in which cases, as well as what they find easier or more challenging.

Table 5

Analysis of Metacognitive Regulation Indicators in Students of the Experimental and Control Groups

Indicator	Metacognitive Regulation	Planning	Information Management Strategies	Component Control	Error Correction Structure	Assessment
Average Value in the Experimental Group	71,22 ± 15,54	14,61 ± 3,52	8,03 ± 1,40	19,49 ± 5,60	14,32 ± 3,80	15,90 ± 2,56

Indicator	Meta-cognitive Regulation	Plan-ning	Information Mana-gement Strategies	Compo-nent Control	Error Correc-tion Structure	Asses-sment
Average Value in the Control Group	54,09 ± 17,67	10,10 ± 3,42	5,44 ± 1,96	12,5 ± 2,78	9,37 ± 3,63	9,62 ± 3,33
Student's t-Criterion*	7,1	9	10,8	12,4	9,2	14,6

***Note:** $p \leq 0.05$*

All indicators of metacognitive regulation of students in the experimental group are higher than those in the control group. This suggests that those who underwent specialized training not only became familiar with text comprehension methods but also improved their planning skills and can structure their activities to maximize understanding of information. Additionally, they can assess their own completed work and, if necessary, correct errors, make adjustments, or add information, which is an integral part of metacognitive engagement in activities (Byzova, 2019).

The conducted research allows establishing a connection between the characteristics of metacognitive processes of students in the experimental and control groups. It was determined that students in the experimental group, after specially organized activities for training in text comprehension methods, possess not only higher skills in working with texts but also a higher level of metacognitive engagement in their activities compared to students in the control group.

Discussion

The obtained results do not contradict studies related to metacognitive engagement in activities. Students with a high level of metacognitive engagement demonstrate a high level of text comprehension and possess more developed metacognitive knowledge and strategies (Pressley, Ghatala, 1990). This study revealed a connection between the fact of training in text comprehension methods and improvements in metacognitive engagement indicators, which confirms the findings of Kofeynikova Y.L., Nikolaeva E.S., and Khukumatshoeva Sh. that a "specially organized learning environment aimed at the formation of processes and self-determination and the development of the ability to choose the most optimal strategies for achieving set goals" is necessary for

the development of metacognitive knowledge and strategies (Kofeynikova, Nikolaeva, Khukumatshoeva, 2019). In this case, such a "specially organized environment" is the training in text comprehension methods.

The training conducted in text comprehension methods positively impacts the development of metacognitive cognition skills:

- Academic skills: students who underwent specialized training in text comprehension methods remember and understand educational information better due to the development of metacognitive skills (Gomes et al., 2014). This is supported by the findings of Artelt, C. and Schneider W., who concluded that metacognitive strategies have a significant influence on the level of text comprehension (Artelt & Schneider, 2015). With acquired skills and a higher level of metacognitive knowledge and strategies, they possess a greater volume of information across various fields of science and are also able to retain information in memory for longer periods (Melnikova, Maksimova, Chikova, Bogdanchikova, 2022). Furthermore, students' academic performance, interest, and productivity improve due to purposeful initiation and regulation of their own activities (Tobias & Everson, 2000; Reeve & Jang, 2006; Dmitrienko & Ershova, 2022). This supports the conclusions of Gabidullina A.Sh. that metacognitive skills "enhance the ability to process and retain new information," leading to a higher academic performance (Gabidullina, 2023, 163). Mastery of text comprehension methods provides learners with a degree of independence when mastering new academic or extracurricular material, allowing them to be active participants of this process (Schunk & Zimmerman, 2003). Students can independently manage the learning process and stimulate their own activities (Pushkareva, 2009; Babaev, Kylychova, 2020; Smirnova, 2021; Krebs & Roebers, 2010).
- Social skills: in the process of training in text comprehension methods, students develop social and communication skills (Bortnikova, Dolzhenkova, 2022). They are able to formulate specific questions effectively when necessary in order to obtain the answers they need. Additionally, these students interact better with one another when engaging in teamwork and project activities.
- Psychological skills: training in text comprehension methods allows students to be more confident in their knowledge, unafraid to ask their mentors questions when needed, and to be more engaged in the learning process (Andreassen & Makarova, 2018; Skinner et al., 2009; Isaacson & Fujita, 2006). A high level of metacognitive engagement should guide learners towards achieving their own goals and create a sense of control over the learning process (Karpovich & Koroleva, 2020). Furthermore, students who have undergone specialized training in text comprehension methods enhance their metacognitive skills, including self-analysis and self-discipline, which are necessary throughout their lives (Glaser, 1991).

Conclusion

The continuously increasing volume of information requires learners to possess developed text processing skills and the ability to analyze their own metacognitive activities. Classes in higher education institutions should include training in management, control, and evaluation tools for their own activities, as well as the development of students' metacognitive engagement in the educational process within the studied disciplines (Zohar & Dori, 2012).

In our study, the increase in metacognitive engagement occurred through training students in text comprehension methods. The methods of text comprehension include creating an illustrative plan of the text, marking the text, formulating questions to the mentor, developing a conceptual table, identifying associations, summarizing, determining a reader's projection, and identifying contradictions. Training students in text comprehension methods enhances their understanding of the material, their ability to draw specific conclusions based on their existing knowledge, and their ability to plan their activities while being aware of what needs to be done to achieve results. It also helps them master cognitive strategies that will be relevant when working with information.

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Author Contributions

Evgenia N. Kameneva-Lyubavskaya – planning and overseeing the research, organizing the empirical study, analyzing and interpreting the obtained empirical data, preparing and editing the manuscript.

Tatyana V. Borzova – theoretical review of foreign and domestic studies, preparing the manuscript, working with sources.

Author Details

Evgenia N. Kameneva-Lyubavskaya – Senior Lecturer at the Department of Nursing with a course in Social Disciplines, Far Eastern State Medical University, Ministry of Health of the Russian Federation, Khabarovsk, Russian Federation; PhD student at the Higher School of Psychology, Pacific National University, Khabarovsk, Russian Federation; Author ID: 822845, ORCID ID: https://orcid.org/0000-0002-9446-4011; e-mail: klen.93@mail.ru

Tatyana V. Borzova – Dr.Sci.(Psychology), Professor, Higher School of Psychology, Pacific National University, Khabarovsk, Russian Federation; Researcher ID: HKE-9138-2023, Scopus ID: 57205363884, Author ID: 278454, ORCID ID: https://orcid.org/0000-0002-2307-9001; e-mail: borzova_tatiana@mail.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.