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DEVELOPMENT OF CRITICAL THINKING OF STUDENTS IN EDUCATIONAL PROCESS

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Abstract

The authors of the article raise the problem of the students' critical thinking development in the educational process of secondary school. The urgency of the problem is substantiated, the purpose of the research is outlined, the theoretical positions of scientists whose scientific interests lie in the field of solving the problem of students' critical thinking development are reflected. The basic theoretical positions of scientists underlying the disclosure of the essence of the concept of "critical thinking" are defined here: the definition of the concept of "critical thinking", the stages of formation of the essence of this concept, the functions of critical thinking (evaluative, stimulating, search for truth, etc.), the ways of application of critical thinking, etc. The authors formulate the techniques of the students' critical thinking development: the use of a graphical image of the structure of arguments for the proof and formulation of the thesis, techniques for contextual retelling, evaluation of the text, narrowing, questions (in the context of the topic of the lesson, the problems of modernity, etc.), techniques of finding of sophisms in the text, etc. The authors give the list of questions for writing a critical analysis, which is based on four laws of logic. The authors offer a sample of a critical analysis of the article "Personality as a subject of history" by P. I. Belyaev for students of the 10th grade (subject: the History of Russia), topic: "Political repressions of the 30s".

Keywords: Critical, argued, analysis, deductions, logical, reflexive.

1. Introduction

The study showed that the developed technologies and methods of students' critical thinking development do not fully meet the needs of nowadays practice. The objectives of the basic educational program at school, according to the Federal state standard of basic General education, are formation and development of a personality, admitting its individuality, identity, uniqueness and uniqueness. Our research has shown that one of the essential characteristics of individuality is its criticality, which is expressed in the person's ability to develop his own point of view in a reasoned, logical way, to defend it with logical arguments, to assess information adequately, to put forward different points of view according to the certain criteria, to problematize the situation, to be critical of himself, other people and their positions (Zhurakovskaya, 2016). There are some pedagogical technologies in the school educational process that would contribute to the development of personality in its individuality, expressed in the ability of the student to "blow up" established concepts, to doubt the generally recognized truths, to think alternatively, unconventional, original. These qualities provide individuals with a more vivid manifestation of their individuality.

The scientific novelty of the results of the study is to justify the reception of the text critical analysis on the basis of the laws of logic. They are the laws of right thinking, treated as a "tool for the detection and establishment of the source": the laws of identity, non-contradiction, exclusion of the third, sufficient grounds and requirements of the laws arising from their violation.

The theoretical significance of the study is to expand the conceptual apparatus of pedagogical science by clarifying and concretizing the content of the concepts of "critical thinking", "text critical analysis", the development of a new list of questions for the critical analysis of the text.

The practical significance lies in the development of guidelines for writing the text critical analysis, practical demonstration of the use of techniques for writing the text critical analysis.

Limitations of the study are due to the fact that the formation of students' critical thinking suggests that the teacher should not only possess the technology of critical thinking of students, but he should also think alternatively, outside the box, should inspire students to a unique "flight" of thought, to "polite" skepticism and to find out his own point of view.

2. Problem Statement

Requirements of the current Federal state educational standard of General education dictate the development of students' critical thinking, which determined the problem statement that includes the need to find out techniques of its development

3. Research Questions

The interest to the problem of the critical thinking formation mostly originated due to the development of the Concept of modernization of general education (hereinafter - the Concept) in Russia. According to the concept, "competence approach" involves the formation of so- called students ' key competencies. Key competencies can be understood as the most common (universal) developed ways of acting (abilities and skills), allowing a person to understand the situation, to achieve some results in

personal and professional life in a particular society. However, the key competence, according to the Concept, will require critical thinking and critical process proficiency (Kasprzhak, 2002). In addition, the development of the personality in its individuality is one of the main goals of education in Russia which is expressed in the student's ability to think argumentatively, to develop his own point of view and to defend his logical arguments, etc.

4. Purpose of the Study

The purpose of this study is to design and test new methods of students' critical thinking development.

5. Research Methods

The main research methods are:

- theoretical methods: study of theoretical sources and scientific publications, Internet resources, analysis, synthesis, generalization;

- diagnostic methods (testing, test task);

- statistical methods of experimental data processing.

We should mention that the main purpose of the test was to identify the formation of students' logical and reflexive thinking.

We used tests on students' logical thinking as a scientific tool. They included questions to test students' ability to make conclusions, to summarize, to generalize, etc. Also, the method of diagnosis of student's reflexivity level was used. In addition, the students had some creative tasks. They had to finish up a story on the basis of its' critical analysis. One of the criteria of the correctness of the fulfilling the task was not to guess but to give a correct version of the story ending. The end of the student's story should coincide with the original end of the story written by its author. The student has to make several conclusions in order to write the story ending.

Experimental work involved 908 adolescent students and 32 teachers. Pedagogical experiment was the main empirical method of our experimental work, which was carried out within the usual educational process while studying subjects of humanitarian and natural-mathematical cycles.

The study involved students and teachers of the following educational institutions: Moscow region: state school № 1, Protvino town; lyceum in Istra town; school of the Lipitsi village, Serpukhov district of Moscow region. Kemerovo region: state school №13, №49, № 79, Lyceum № 35, Novokuznetsk city; state school № 4, Myski town; state school № 31, Osinniki city; state school № 25, Mezhdurechensk town.

The study of theoretical sources and scientific publications confirmed the relevance of the study, allowed to determine modern trends in the students' critical thinking development, to identify the main problems and develop new methods of students' critical thinking development.

The theoretical basis of the study. We considered the works of scientists who studied the theoretical ideas on the critical thinking (S. Brookfield, A. V. Butenko, E. Glaser, S. I. Zair-Bek, D.

Curtis, A. Korzhuev, K. Meredith, D. Macpac, R. M. Moore, I. V. Mushtavinskaya, H. Noris, P. Raoul, A. V. Popkov, R. Paul, K. Popper, J. Steele, Ch. Temple, R. Ennis, D. Halpern, D. Hatcher, etc.).

According to the first critical thinking studies (1970-1982), this concept was understood as a logical thinking. This concept was associated not only with logic, but also with reflexive thinking in critical thinking studies in 1982-1990-s. Critical thinking involved the identifying assumptions process, the checking out, evaluation, and clear ideas development (Paul & Elder, 2006).

Modern researchers still define the essence of critical thinking as perfect, free and full of creative thinking (Facione, 2011; Ennis, 2011). Many authors highlight logic as the basic critical thinking component. For example, critical thinking is understood as a rational or correct thinking corresponding to the laws of logic (Halpern, 2003; Fisher, 2005; Hicks-Moore & Pastirik, 2006, Gelder, 2005).

Critical thinking also has no clear understanding in Russian psychology and pedagogy. Critical thinking is understood as:

- the process of problem solving, including evaluating of the relation to it (Varlakova, 2016);

- reflexive thinking as an analysis and evaluation of actions, as a confidence in the reliability level and as a knowledge validity (Gorshunova, 2002; Uzturk, 2016);

- logical, reflexive thinking, implying the critical mind as the ability to evaluate strictly the work of thought and weigh all the pros and cons (Kalhor, 2014).

6. Findings

Based on the analysis of the above studies, critical thinking will be understood as logical (correct), reflective thinking, focused on a reasonable consideration of a variety of approaches to making a reasoned and balanced decision in relation to any judgment, the problem under consideration, including an assessment of the thinking process.

The analysis of scientists' works (S. Brookfield, A. V. Butenko, E. Glaser, S. I. Zair-Beck, A. Korzhuev, K. Meredith, D. Macpac, I. V. Mushtavinskaya, E. Norris, P. Raoul, A. V. Popkov, R. Paul, K. Popper, D. Halpern, etc.) allowed us to identify the scope of critical thinking that includes: making an informed, reasoned decision and evaluation, revision of ways of thinking and representation of meanings, the analysis and making of alternatives, problem solving, work with information (critical text analysis).

The development of students' critical thinking contributes to the formation of the following skills:

- to evaluate the adequacy, effectiveness of stages and results of mental activity;

- to discover alternative ways of problem solving;

- to think independently, logically correctly, to check the correctness of judgments, to carry out critical analysis of the text;

- to think critically about reality in moral its evaluations, to have culture of ethical values in world, society, oneself.

Modern researchers believe that the students' critical thinking development is achieved through: the group work (Chun-Lok Fung & Fostering, 2019), the use of complex trainings and critical thinking strategies and simulation (live modeling, virtual modeling, structural modeling) in the students' training (Zarifsanaiey, Amini, & Saadat, 2016); visual thinking courseware (VTC) that includes visual effects (ability to represent, transform, generate and evoke symbolic, non-linguistic information) to improve

students' critical thinking skills (Md Noor, 2015); formation of statistical thinking skills and skills to doubt statements and hypotheses (Aizikovitsh & Kuntze, 2016); the use of step-by-step problem-solving strategies within the framework of debates, by clarifying the nature of the problem, collecting and systematizing relevant information, assessing the reliability of this information, by analyzing and formulating logical, convincing conclusions, by evaluating, etc.   (Rear, 2017); the study of interdisciplinary subjects through developing students' critical thinking skills (Cheung, 2016); reasoned argument work in the problem solving: criticism of peers, collaborative graffiti group work (Fung, 2014)

Thus, we believe that critical thinking performs: an evaluative function, manifested in the assessment of the adequacy, effectiveness of stages and results of mental activity; stimulating function involves the stimulation of the need for new knowledge, skills, interest in independent research; the function of finding the truth, expressed in the verification of the correctness, truth of judgments of both their own and other people.

Based on the analysis of works on critical thinking, we have developed and tested the following techniques of its development: the use of graphical images of the structure of arguments for the evidence and deduction of the thesis, techniques for contextual retelling, evaluation of the text, judgments, questions (in the context of the topic of the lesson, the problems of modernity, etc.), technique of finding sophisms in the text, technique of the critical text analysis development, etc (Zhurakovskaya, 2011).

Next we reveal the essence of the technique of the critical text analysis development. This technique requires making a list of questions to a critical text analysis.

Tyaglo (2001) suggests a list of critical questions in his works, which is a modification of the list of critical questions of American colleagues Neil and Stuart (1998).

Here is a list of critical questions proposed by Tyaglo (2001):

"1. Was the text problem stated and the conclusion given? 2. What arguments can proof the given conclusion? 3. What is the structure of the argument? 4. What words or phrases are ambiguous? 5. Are there false or poorly defined concepts in the text? 6. What are explicit and implicit value assumptions? 7. What are explicit and implicit descriptive assumptions? 8. What are the conditions of the argument admissibility? 9. Is the problem correct? 10. Does the conclusion correspond to the problem? 11. Are the arguments valuable? 12. Are the reasons made correctly? 13. Is the argument strong enough? 14. What logical mistakes have been made? 15. What reasonable modifications of the problem or conclusions are possible?".

We believe that a more detailed and reasonable list of questions is required for secondary school students. Thus, we offer a list of questions based on the laws of logic:

1. To analyze the author's goals (Why was the text written? What problem was raised by the author?); What can determine the reliability of the expert's opinion? Who gives arguments in problem support? (Is the expert a real specialist in the field? What are the proofs of his competence?).

2. Reveal the internal structure of the text and find the links to other objects (other topics of the school course, unit).

3. Are all the concepts, judgments in the text formulated and defined correctly? Are all the judgments and arguments true?

4. Are all the concepts, judgments used in the same certain sense? Is it kept during the whole process of reasoning?

5. Are there any logical errors in the text: "substitution of one concept by another", "thesis substitution", the wrong use of the homonym, etc?

6. Are the judgments in the text consistent?

7. Are there any alternative solutions of the text problem? Is there a clear choice of the alternative problem solutions?

8. Which of the two conflicting judgments is true?

9. Are there any true judgments in the text that are given without sufficient grounds? Have all the arguments been used to prove the truth of the thesis?

10. Is there a sufficient correlation between the premise (argument) and the conclusion, between the thesis and the grounds? Are there any mistakes in deductive, inductive reasoning, etc.?

11. Is the premise, justifying the conclusion, strong enough? Are there enough arguments? What premises are missing, or what extra information could have justified the conclusion? What is stronger: arguments or counter-arguments?

12. Mention how the text is related to your personal experience and that of the others. Give arguments.

13. What context does the author use when he gives arguments? Try to see the author's personality behind the text. Ask him questions.

Let us explain how we formulated these questions.

The basic laws of thinking are divided into formal logical laws and the laws of dialectical logic. The laws of logic are the laws of correct thinking, a "tool to discover and establish the truth" as the desired result of logical thinking. Critical thinking is considered to be a specific type of reflection, based on knowledge of elementary logic and relevant specific sciences. Thus, in order to make a list of questions for critical text analysis, it is necessary to find out whether the laws of logic are violated there. Let's study them.

1. The law of identity is formulated as follows: "Every concept and judgment must be identical to itself while reasoning", no matter how many times they appear in the argument and what relationship or engagement they have with other thoughts. Otherwise it will be another thought (Getmanova, 2006). Thus goes the 3rd question to the critical text analysis: "Are all the concepts, judgments in the text formulated and defined correctly? Are all the judgments, arguments, thesis true? " And question 4: "Are all the concepts, judgments used in the same certain sense? Is it kept during the whole process of reasoning?".

In case of violation of this law an error occurs. That error is called "substitution thesis", that in the course of the proof or refutation deliberately or unconsciously can be substituted. In addition, logical errors occur when using homonyms. Thus question 5: Are there any logical errors in the text: "substitution of one concept by another", "thesis substitution", the wrong use of the homonym, etc.? There are a lot of sophisms that can deviate a reader from the problem (Uzturk, 2016).

2. The law of non-contradiction: "Two opposite judgments cannot be true at the same time and in the same relation". Question 6: "Are the judgments in the text consistent? ".

3. The law of exclusion of the third is formulated as following: «One of the two conflicting judgments is true while the other is false, and the third is not given". On its basis, the 7th and 8th questions were given: Are there any alternative solutions of the text problem? Is there a clear choice of the alternative problem solutions? Which of the two conflicting judgments is true? (Kalhor, 2014).

4. Similarly, on the basis of the 4th law of sufficient grounds, the 9th and 10th questions to the critical text analysis writing were formulated (Tyaglo, 2001, Neil & Stuart, 1998): Are there any true judgments in the text that are given without sufficient grounds? Have all the arguments been used to prove the truth of the thesis? Is there a sufficient correlation between the premise (argument) and the conclusion, between the thesis and the grounds? Are there any errors in deductive, inductive reasoning, etc.?

Then we formulated the 11th question: Is the premise, justifying the conclusion, strong enough? Are there enough arguments? What premises are missing, or what extra information could have justified the conclusion? What is stronger: arguments or counter-arguments?

As we have mentioned it is important to check all the premises and arguments' correctness. Thus we have question 1: What determines the reliability of the expert's opinion, who gives arguments in thesis support?

Hence comes the 13th question to critical text analysis: What context does the author use when he gives arguments?

Thus, we have made questions to the critical text analysis based on the laws of formal logic (Getmanova, 2006).

Here are some guidelines for students on the critical text analysis writing:

Read the text.

2. Answer the 1st and 2nd questions. Study structural components of the text, such as: an introduction that includes problem statement, the main part where the author offers different points of view on the topic under consideration, ... conclusion. Another structure of the text is also possible.

3. Study questions № 3-5 and note these violations while reading. If there are no violations in the text you should not write about it in the analysis.

4. Read the text again and try to answer questions № № 6 - 10. Mark the premises (arguments) in defense of the arguments and its' conclusions. And then answer the question: "Are the arguments (premises) strong enough? Is there a clear link between arguments and conclusions?".

5. Check all the conclusions.

6. Answer questions №№ 12, 13.

7. Remember that the author can have his own point of view. It is necessary to respect his opinion.

8. The purpose of the analysis is to get closer to the truth, but not to "defeat" someone's position.

Here is a sample of a critical text analysis of the article "Personality as a subject of history" by Bilalov (2008) (10 grade, topic: "Political repressions of the 30s. ").

Bilalov (2008) wrote an article to draw the readers' attention to the problem of an outstanding personality in the history of mankind. At the beginning of the article the author raises the problem: "How to assess the role of bright, outstanding individuals in the events of national or epochal scale?". Then he reveals the essence of "outstanding personality" concept. He offers the personal characteristics of an

outstanding personality and reveals the problems that a "big-time" politician solves. The author shows the reasons for the emergence of "big-time" and dubious politicians and emphasizes the importance of problem solvation of the absurdity human resource policy. Then, Bilalov comes to conclusion, which reveals the problem solution.

The author of the article is a recognized authority in philosophy as he is a doctor of science (philosophy), professor. That is why, the article is written in a competent and professional key. The article is worth reading. There are some contradictive statements that are connected with the fact that the author does not separate such notions as "outstanding personality" and "historical personality". Bilalov (2008) names outstanding people, prominent, great and world-historical figures. A large degree of historical influence is typical for those people. Not every personality can be called outstanding. An outstanding personality's activity is connected with progressive transformations in the society. Besides, the author believes that Stalin was an outstanding personality. This contradicts the author's definition of "great man". According to the author's ideas "a great man does everything for the people, solves the historical problems of the social progress and humanization." But Stalin did not solve the society humanization problems. Totalitarianism was based on the suppression of human rights and freedoms, on the rejection of the value of human life and individuality. Stalin did not do everything for the wellbeing of the country. Better to say, he was doing everything for one half of the people and he sent the other half to the Gulag. "The totalitarian regime of the 20th century made mankind recollect the most terrible pages of its political history. The anti-human totalitarian regime naturally led to its collapse."

In addition, the author believes K. Jaspers' desire "that no dictator could be considered a great man" to be problematic. At the same time, in conclusion the author names prominent and great those individuals, "who do everything for the people benefit and who solve the historical problems of social progress and humanization of society". Later Bilalov (2008) notes that a politician does not judge by the ideas of good and evil or by justice and injustice but by common interests. Thus "common interests" of the people can be unkind and unfair. How can people live better if the" big-time" politician's interests are unkind and unfair? In addition, the author thinks that "moral principles exist selectively in politics ". I would not like to live in a country where "big-time" politicians go "through me" and my desire for the better future. Who needs such a future and such great personalities? It turns out that there is no sense to justify the activities of such "big-time" politician as the author of the article does.

At the end of the article, the author solves the problem of assessing the activities of outstanding personalities by the defining "great personality". Bilalov (2008) concludes that we do not make obelisks of prominent and great persons and do not name streets in their honor. Great people work for the people and solve the historical problems of social progress and society humanization. In my opinion, in order to get out of the current economic crisis, which gave a rise to the ideology of justifying lies, corruption, cynicism, and in order the state to be ruled by outstanding individuals, it is necessary to solve the problem of the spiritual and cultural component of the country's development, national values, public morality and morality. There is no need to put forward "extraordinary measures" to do these.

I would like to note that Bilalov is deeply concerned about the problem which he studied in the aspect of humanistic values.

Finally, I appreciate Bilalov's ideas on the problem in the context of morality.

If I met the author of the article, I would ask him the following questions: "Dear M. I. Bilalov, if you became the President of the country, what kind of society would you build? What system of social relations would there be? What moral values would form the basis of the long-term development strategy of this country? What alternative ways would you suggest to Soviet socialism and Western capitalism?»».

These techniques of students' critical thinking development were tested in our pilot study. Here are some results. The ascertaining stage of the pilot study was devoted to the study of the indicators of the level characteristics of the of students' critical thinking experience (Tables 1 and 2).

Table 01. Assessment of the indicators of the level characteristics of the of students' critical thinking experience at the ascertaining stage of the pilot study in Istra town, Protvino town and Lipitsy village

Groups	"There is an effect", the problem has been solved			"There is no effect", the problem has not been solved			Number
	Number of students	%		Number of students	%		
1 level - advanced							
1 pilot group	11	(9,4%)	A	105	(90,6%)	Б	116
2 control group	12	(10,0%)	B	107	(90%)	Г	119
2 level – upper – intermediate							
1 pilot group	18	(15,5%)	A	98	(84,6%)	Б	116
2 control group	19	(16,3%)	B	100	(83,7%)	Г	119
3 level –intermediate							
1 pilot group	45	(38,7%)	A	71	(61,3%)	Б	116
2 control group	45	(37,8%)	B	74	(63,2%)	Г	119
4 level – elementary							
1 pilot group	43	(37,0%)	A	73	(63%)	Б	116
2 control group	43	(36,1%)	B	76	(63,9%)	Г	119

Table 02. Assessment of the indicators of the level characteristics of the of students' critical thinking experience of the pilot groups compared with control groups at the ascertaining stage of the study in Istra town, Protvino town and Lipitsy village.

Characteristics of the of students' critical thinking experience	φ empirical *	φ empirical * < φcritical*; φ empirical *<1,64 (p≤0,05)	N2	N1
1 level - advanced	0,16	No differences p≤0,05	119	116
2 level – upper – intermediate	0,16	No differences p≤0,05	119	116
3 level –intermediate	0,14	No differences p≤0,05	119	116
4 level – elementary	0,14	No differences p≤0,05	119	116

The analysis of the results of the formation of the students' critical thinking experience showed that only about 9 % of them in the control and pilot groups have the necessary and sufficient skills to develop their own point of view and to doubt the generally recognized truths. About 37% of students have the necessary, but insufficient skills to make conclusions, to assess the information adequately and to differentiate points of view on certain criteria. More than 36% of students demonstrate an elementary level of formation of skills to express doubts in the generally recognized truths, to be critical to the world,

society, oneself. The obtained results allow us to conclude that the indicators of the level characteristics of the of students' critical thinking experience at the ascertaining stage of the pilot study in the pilot and control groups do not differ statistically. Thus they are similar and insufficient. So there are potential opportunities for their improvement.

At the controlling stage of the study, the formation students' critical thinking experience was also studied (tables 3 and 4).

Table 03. Assessment of the students' critical thinking experience level at the controlling stage of the study in Istra town, Protvino town and Lipitsy village

Groups	"there is an effect", the problem has been solved			"there is no effect", the problem has not been solved			Number
	Number of students	%		Number of students	%		
1 level - advanced							
1 pilot group	31	(26,72%)	А	85	(73,28%)	Б	116
2 control group	17	(14,28%)	В	102	(85,72%)	Г	119
2 level – upper – intermediate							
1 pilot group	39	(33,62%)	А	77	(66,38%)	Б	116
2 control group	24	(20,16%)	В	95	(79,84%)	Г	119
3 level –intermediate							
1 pilot group	25	(21,55%)	А	91	(78,45%)	Б	116
2 control group	40	(33,61%)	В	79	(66,39%)	Г	119
4 level – elementary							
1 pilot group	21	(18,10%)	А	95	(81,9%)	Б	116
2 control group	38	(31,93%)	В	81	(68,07%)	Г	119

Table 04. Assessment of significant differences of the students' critical thinking experience level of the pilot groups compared with control groups at the controlling stage of the study in Istra town, Protvino town and Lipitsy village

Indicators of the level characteristics of the of students' critical thinking experience	$\varphi_{empirical}^{*}$	$\varphi_{empirical}^{*} > \varphi_{critical}^{*}$; $\varphi_{empirical}^{*} > 2,31$ (p≤0,01)	n2	n1
1 level - advanced	2,39	differences, p≤0,01	119	116
2 level – upper – intermediate	2,35	differences, p≤0,01	119	116
3 level –intermediate	2,09	No differences, $\varphi_{empirical}^{*} < \varphi_{critical}$ uncertainty zone	119	116
4 level – elementary	2,43	differences, p≤0,01	119	116

Analysis of the diagnostic results showed that the indicators of the students' critical thinking experience level were at the advanced level (26.72%) in the pilot groups, upper-intermediate level (33.62%) is higher than in the control groups (14.28% and 20.16% respectively), and the indicators of the elementary level (18.1%) of the formation of the critical thinking experience are not as high as in the

control groups (31.93%) in the pilot groups. The differences between these indicators are statistically significant (table 4).

We should mention the positive development dynamics of the students' critical thinking experience level of pilot groups at the controlling stage of the study in comparison with the ascertaining stage: for the advanced level of complexity, the dynamics was expressed in quantitative indicators from 9.4% to 26.72% (φ*=2.78, there are differences, p <0.05) and in qualitative indicators -in the ability of students to think argumentatively, alternatively, logically; adequately assess the information, different points of view on certain criteria, etc.; positive dynamics is also observed in the upper-intermediate level of the students' critical thinking experience formation: from 15.5% to 33.62% , the difference between these indicators is statistically significant (φ*=3.27, there are differences, p<0.05) (Figure 01).
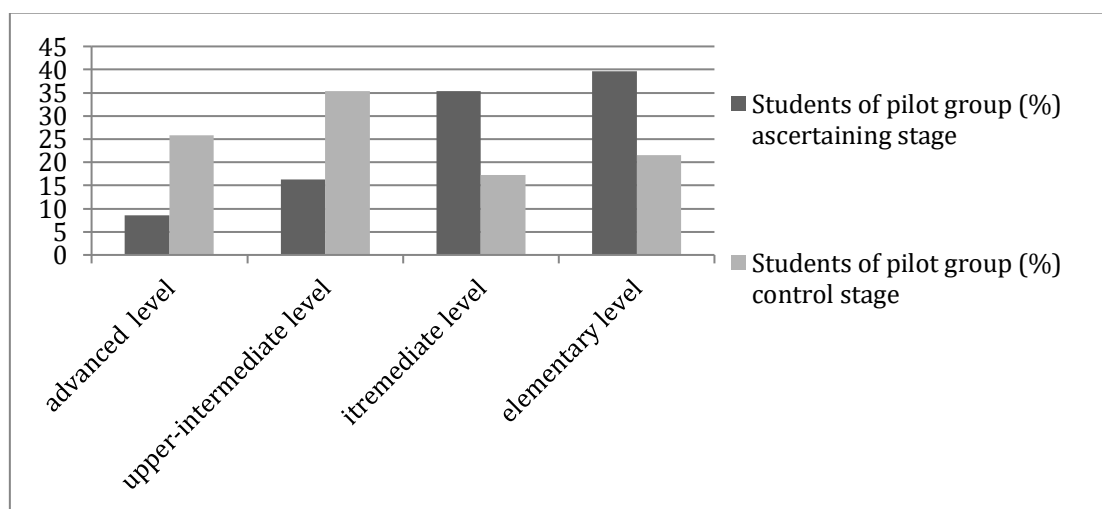

Figure 01. Indicators of the of students' critical thinking experience formation of pilot groups at the controlling stage compared with the ascertaining stage of the study in Istra town, Protvino town and Lipitsy village

The analysis of the diagnostic results showed that students of the pilot groups have better results at all levels of students' critical thinking formation at the controlling stage compared to the ascertaining stage (bar chart 1). These differences are statistically significant.

7. Conclusion

Thus, various techniques of the critical thinking development were developed in the course of our study, one of which has been viewed in this article. The results of the pilot study on the implementation of techniques of the critical thinking development in the educational process showed a positive dynamics of the students' critical thinking experience formation, expressed in their skills to assess different points of view and to evaluate information on the established criteria; to put forward a reasoned, balanced decision in relation to any judgment, the studied problem, to think alternatively and to take a critical look at oneself and other people.

Therefore, the developed techniques of the students' critical thinking formation can be used by teachers to solve the problem of student's personal development in its individuality in the educational

process. The main directions of the further problem research are: the student's critical thinking development by IT means. These means include the usage of graphic images techniques while structuring the argumentation of the statement / thesis (its justification or evidence). The graphical image of the argument structure can be made either in a Word document or in MindManager, XMaind, etc.

References

Aizikovitsh, E., & Kuntze, S. (2016). *Connections Between Statistical Thinking and Critical Thinking: A Case Study*. Springer International Publishing Switzerland. Retrieved from: https://link.springer.com/chapter/10.1007/978-3-319-23470-0_8

Bilalov, M.I. (2008). *Lichnost' kak sub'ekt istorii* [Personality as a subject of history]. Retrieved from: http://dagpravda.ru/obshestvo/lichnost-kak-subekt-istorii/ (accessed: 17.06.2019) [in Rus.].

Cheung, C-K. (2016). *Developing students' critical thinking skills through visual literacy in the New Secondary School Curriculum in Hong Kong.* Retrieved from: https://www.tandfonline.com/doi/full/10.1080/02188791.2014.959470

Chun-Lok Fung, D., & Fostering, T.W.L. (2019). *Critical Thinking Through Collaborative Group Work.*

Ennis, R.N. (2011) *Twenty One Strategies and Tactics for Teaching Critical Thinking.* Retrieved from: https://studylib.net/doc/6590954/twenty-one-strategies-and-tactics-for-teaching-critical-t

Facione, P. A. (2011). Critical Thinking: What It is and Why It Counts. *Insight Assessment*, 1-28. http://www.student.uwa.edu.au/__data/assets/pdf_file/0003/1922502/Critical-Thinking-What-it-is-and-why-it-counts.pdf

Fisher, R. (2005). *Teaching children to thing* (2nd ed). Cheltenham: Nelson Thornes.

Fung, D. (2014). Promoting critical thinking through effective group work: A teaching intervention for Hong Kong primary school students. *International Journal of Educational Research*, 45-62.

Gelder, van T. (2005). Teaching Critical Thinking: Some Lessons from Cognitive Science. *College Teaching, 53*, 41-46.

Getmanova, A.D. (2006). *Textbook on logic. With a collection of tasks.* Moscow. [in Rus.].

Gorshunova, E. E. (2002). Investigation of the critical attitude of students to receive information. *School technology, 4*, 76-78. [in Rus.].

Halpern, D. (2003). *Thought and knowledge. An Introduction to Critical Thinking* (4th edition). New Jersey, London.

Hicks-Moore, S. L., & Pastirik, P. J. (2006). Evaluating critical thinking in clinical concept maps: a pilot study. *Evaluation Studies, 3*(1), 1-15.

Kalhor, M. H. (2014). *Pedagogical conditions for the critical thinking formation and the high school students' performance improvement* (Doctoral Dissertation). 176 [in Rus.].

Kasprzhak, A. (2002). Competence approach as a way to achieve a new quality of education. In *materials for experimental work in the Framework of the concept of modernization of Russian education for the period up to 2010.* Moscow. [in Rus.].

Md Noor, H. (2015). *Envisioning the Future of Online Learning Selected Papers from the International Conference on e-Learning* (pp. 291-304). Retrieved from: https://link.springer.com/chapter/10.1007/978-981-10-0954-9_26

Neil, B.M., & Stuart, K. M. (1998). *Asking the Right Questions. A Guide to Critical Thinking* (5th ed). Prentice Hall

Paul, R., & Elder, L. (2006). *The Critical Thinking Reading for Writing.* Foundation for Critical Thinking.

Rear, D. (2017). *Critical Thinking, Language and Problem-Solving: Scaffolding Thinking Skills through Debate*. Springer International Publishing Switzerland. Retrieved from: https://link.springer.com/chapter/10.1007/978-3-319-40956-6_4

Tyaglo, A.V. (2001). *Critical thinking on the basis of elementary logic*. Harkov [in Rus.].

Uzturk, F. (2016). *Fundamentals of critical thinking formation in teaching English at schools of a new type* (Doctoral Dissertation). Dushanbe [in Rus.].

Varlakova, M. L. (2016). *Development of critical thinking of students in learning physics* (Doctoral Dissertation). Kurgan [in Rus.].

Zarifsanaiey, N., Amini, M., & Saadat, F. (2016). *A comparison of educational strategies for the acquisition of nursing student's performance and critical thinking: simulation-based training vs. integrated training (simulation and critical thinking strategies)*. BMC Medical Education. Retrieved from: https://link.springer.com/article/10.1186/s12909-016-0812-0

Zhurakovskaya, V. M. (2011). *Development of critical and conceptual thinking of students: theory and practice*. LAP LAMBERT Academic Publishing GmbH & Co.KG (Germany). [in Rus.].

Zhurakovskaya, V. M. (2016). *Development of the student's individuality in the educational process of the school: basic concepts, mechanism, concept*. Moscow: Perspective. [in Rus.].