FEATURES OF MENTAL ACTIVITY OF STUDENTS – ESPORT PLAYERS

Dr. Vlada Igorevna Pishchik, Department of educational psychology and organizational psychology, Faculty of psychology, pedagogy and defectology of Don State Technical University, Rostov-on-Don, Russian Federation
E-mail: vladaph@yandex.ru

Dr. Galina Anatolyevna Molokhina, free researcher, Rostov-on-Don, Russian Federation
E-mail: molokhina@yandex.ru

Dr. Elena Anatolyevna Petrenko, Department of Psychology and Personnel Management, Southern University (IMBL), Rostov-on-Don, Russian Federation
E-mail: petrenko19789@mail.ru

Dr. Yuliya Vladimirovna Milova, Solomensky district in Kiev center of social services for families, children and youth. A leading psychologist, Kiev, Ukraine
E-mail: blacksea66@yandex.ru

A R T I C L E   I N F O

A B S T R A C T

The study of the peculiarities of thinking of young people professionally engaged in computer gaming activity is a new and little-studied topic in cognitive psychology. The article presents the results of empirical research of peculiarities of thinking of students-e-sport players and students engaged in computer gaming activities or amateur players. The sample consisted of students-eSports players and students who are not engaged in eSports aged 17 to 20 years. Such techniques were applied: «Intelligence structure test» by Amthauer, R. (IST), «Test of critical thinking» by Starkey, L., the technique «Thinking style» by Belousova, A. K., «Brief indicative test (BIT)» by Busin, V.N., Vanderlik, E.F. The article presents data proving the fact that students who spend more than four hours a day playing computer games have a relatively lower level of logical and critical thinking than students who do not play computer games. The results demonstrate statistical connections between the indicators of gaming activity and the peculiarities of thinking. The factors influencing the low level of formation of logical and critical thinking among students-eSports players are discussed.

1. INTRODUCTION

The problem of studying the impact of the computer environment, in particular the game virtual reality on the socio-psychological characteristics of the person is increasingly of interest among psychologists. The relevance of psychological studies of the impact of gaming computer activities on the functioning of cognitive processes of a human, his thinking, is due to the need to develop educational programs that promote the development of mental activity of boys and girls involved in eSports. Computer games are one of the main ways to spend leisure time among young people, and systematic gaming activities in the network has an ambiguous effect on the development of mental processes.

The Russian Federation included eSports in the official register of sports in 2016, this discipline is qualitatively new and has no analogues in the historically established list of sports, and therefore there is the relevance of its research. ESports is a game competition using computer technology, in this type of activity, the computer simulates a virtual space within which participants compete. An attractive feature of eSports is its democracy in relation to the physical capabilities of the competitors. The attractiveness of computer games is due to a number of factors: the plot, emotional atmosphere, graphic aesthetics, «swinging» or the ability to acquire new skills, the achievability of the goal, obtaining intellectual pleasure,

Corresponding Author

Dr. Vlada Igorevna Pishchik, Don State Technical University (DSTU), Russian Federation
E-mail: vladaph@yandex.ru

etc. (Boyle, E., Connolly, T. M. and Hainey T., 2011; Makalatiya, A. G. and Matveeva, L. V., 2017). Today, the authors (Avetistova, A. A., 2005; Granic, I., Lobel, A. and Engels, R. C. M. E., 2014; Sherry, J. L., 2004) introduce one more factor that may well form the attractiveness of online gaming. It is experienced, implemented «flow experience». It is associated with the phenomenon of the experience of immersion in games (Jennett, C., et all., 2008). The immersion involves complete disconnection from reality, the loss of time frames. The immersion is greatly influenced by the game's graphic design elements (Roohi, S. and Forouzandeh, A., 2019).

Interactivity of a computer network game allows to involve real players in virtual joint activity, making them active subjects influencing events in the game and with absolute freedom of expression (Burlakov, I. V., 2000). The computer game is a formative activity in which «there is an embedding of the received virtual game experience in real structures of the personality, and the result of such embedding is difficult to predict» (Polutina, N. S., 2010, p. 94).

In accordance with the assertion, derived by Orekhov, S. I., the mechanism of formation of virtual reality is divided into two stages: position and representativeness (Orekhov, S. I., 2002). Position helps players navigate in virtual reality: the playing individual has an idea of how he can interact with the objects of the game. Representativeness is that a computer game reflects a certain pattern of actions. There is a large number of game genres: from the shooter to simulator of God. All of them is a representation of certain laws and ideas from the real world. Positional-representative mechanism in advance gives us an idea of what the characters look like, what the playing field looks like, what the rules are. However, in addition to the position and representativeness the game also includes the area of fantasy – not in the human head, but between a man and a computer. Therefore, it would be wrong to talk about the aircraft simulator or chess on the computer screen as a computer game in the true sense of the word (Vishnevskij, A. V., 2014). In the research of psychologists who study the impact of computer games on the development of the cognitive sphere in adolescence, both positive and negative results of such influence are presented. Some works indicate that the computer players characteristically developed logical thinking, emotional stability, rationality, foresight, ability to make difficult decisions and successfully collaborate with others (Fomicheva, YU. V., SHmelev, A. G. and Burmistrov, I. V., 1991; Sylvén, L. R. and Sundqvist, P., 2012). In other works, on the contrary, the negative consequences of the transformation of the interests and motivational sphere of players, the ability to establish social contacts and cognitive abilities, the increase in aggressiveness and anxiety level, as well as the formation of gaming computer addiction are stated (Anderson, C. A., et all. 2010; Ivanov, M. S. 2004, Sobkin, V. S. and Evstigneeva, YU. M., 2001; Shapkin, A. S., 1999).

E-Sports players, of course, have certain psychological characteristics, which makes them a potential object of research within the framework of psychology. ESports is most popular among young people, so the authors consider that it is most appropriate to conduct research based on a sample of students. There are few works in the literature on cognitive styles specifics of the players (Bogacheva, N. V., 2014; Vojskunskij, A. E., 2010), especially professional eSports players. In this regard, it is of particular interest to study their logical, intuitive, style characteristics of mental processes. We assume that eSports players differ in their styles of thinking from the amateur players.

2. MATERIALS AND METHODS

The objects of the study were students aged between 17 and 20 years, engaged in eSports (hereinafter referred to as eSports players) and amateur players, not engaged in eSports. The total sample was 70 people of both sexes, girls make up 30% of the total sample. 30 students are engaged in eSports and 40 students are not engaged. ESports players have been members of computer multiplayer team game genre of multiplayer online battle arena developed by Valve Corporation for 3 years and more.

We were interested in the type of eSports and its specifics in our work with eSports players. The main game is a computer multiplayer team game Dota 2, which is a battle on the map of a special kind, which involves two teams, each team is a group of five players who control the virtual space heroes with certain sets of abilities, the purpose of the heroes is to destroy the enemy and save their own base. The success of the battle depends on the consistency of the participants on the battlefield in the virtual space. This game is an eSports discipline. Tournaments are held in

different countries of the world since 2015, the prize fund is estimated in millions of dollars.

The main research methods were: observation, interview, psychological diagnostics. The methodical tools were psychodiagnistic techniques: «Intelligence structure test» by Amthauer, R. (IST) (subtest 2 «Excluding the word», subtest 3 «Analogies», subtest 4 «Generalization», subtest 6 «Arithmetic tasks»); «Test of critical thinking» by Starkey, L. (2004), the technique «Thinking style» by Belousova, A. K. and Pishchik, V. I. (2015), «Brief indicative test (BIT)» by Bendyukov M. A. and Solomin I. L. (2006).

Such methods of mathematical and statistical analysis as descriptive statistics, Mann-Whitney U-criterion to identify the significance of differences, Spearman correlation analysis to define the closeness of the relationship features were used.

3. RESULTS

The results are presented in tables and figures. The results of the diagnostics of logical thinking of students by the method of Amthauer, R. IST are summarized in table 1 and are clearly shown in figure 1.
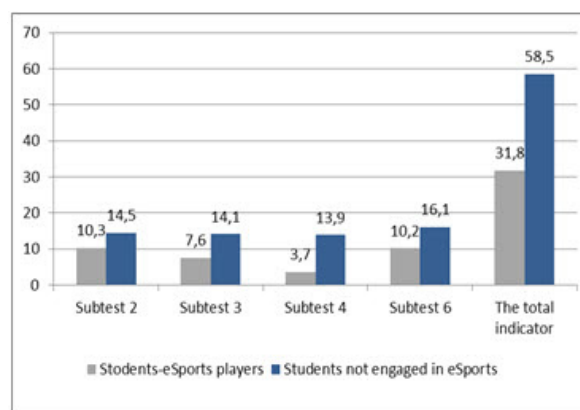
Table 1. Results of diagnostics of the level of development of logical thinking of eSports students and students who are not engaged in eSports

Indicator	Group of students-eSports players	Group of students not engaged in eSports	Mann-Whitney test
Subtest 2 «intuitive conceptual thinking»	10,3	14,5	57,000*
Subtest 3 «conceptual logical thinking»	7,6	14,1	51,500*
Subtest 4 «conceptual categorization»	3,7	13,9	17,500**
Subtest 6 «abstract thinking»	10,2	16,1	35,000**
The total indicator of logical thinking	31,8	58,5	26,500**

* Differences are significant at the level of 0,05
** Differences are significant at the level of 0,01

To assess the logical thinking of students such subtests were used: the second subtest – the development of intuitive conceptual thinking, the third subtest – conceptual logical thinking, the fourth subtest – conceptual categorization and the sixth subtest – abstract thinking. The diagnostic results showed that the level of development of logical thinking of students actively playing computer games is relatively lower than of the students who are not engaged in eSports, and the worst situation is with conceptual categorization. Then

Figure 1. Results of diagnostics of the level of development of logical thinking of eSports students and non-eSports students

The tasks of the second subtest are aimed at assessing the development of conceptual thinking operations based on intuitive analysis. These operations characterize the ability to see, highlight the main, significant thing in the descriptive, unstructured material, to understand the inner meaning of statements, messages, to separate the essential, constant properties, characteristics of objects and phenomena from the «external», secondary ones. The presence of conceptual intuitive thinking is necessary to use scientific, theoretical knowledge in real life. This intelligent operation is based on intuitive analysis. Mental activity is when a person gradually «cleans» information from all secondary, superficial, superfluous, cuts off, discards all unnecessary and leaves only its essence. Usually a person is not aware of the principle on the basis of which he acts when «cleans» information, makes a decision or makes a conclusion. He just feels, knows that it's important, that's right, and basically he does not make mistakes. The results of our study suggest that students-eSports players are characterized by a lower level of development of operations of intuitive conceptual thinking.

Tasks of the third subtest measure the development of operations of conceptual logical thinking. They characterize the ability to identify objective laws, the relationship between the phenomena of the world, allow to see the internal logic in the sequence of events, changes, isolate algorithms of activity. Through these operations the ability to understand the logic of evidence, the meaning of formulas, rules, their scope; generalize and partially transform their own knowledge and experience, transfer them, use in other, similar life or educational situations; «throw» logical bridges with a lack of information or knowledge gaps are formed, as a result the

possibility of understanding the general meaning of the message retain. Conceptual logical thinking characterizes the general ability to learn, can compensate for the shortcomings of any intellectual operations, provide an understanding of any tasks, problems and scientific constructions through reasoning. It is fully conscious, has an operational reversibility. It is used to search for cause-and-effect relationships, highlight the logical sequence in the presentation of information, evidence and justification of intuitive guesses, logical verification of conclusions, linking scientific constructions. Low rates of conceptual logical thinking of eSports players indicate that gaming activity forms a different direction of thinking of students.

The tasks of the fourth subtest reveal the development of the operation of conceptual categorization. These operations characterize the ability of forming concepts, define specific phenomena within more general categories, systematize knowledge, generalize, structure descriptive, empirical material through the creation of objective classifications. With their help, the characteristic of the phenomenon, the object is given by its generic affiliation, uniquely determined by its position (place) in the system of objective knowledge, it is possible to predict in advance the entire range of its essential characteristics. If the individual formed this operation, then object allocation and assignment to one category or another, determining its generic affiliation becomes a «simple» auto-execute action. The unit of thinking itself becomes larger, a person begins to operate with classes, not individual objects. Thinking becomes multidimensional, complex (linearity, unidirectionality disappear), the ability to theoretical modeling is formed. This ability allows to understand artificial systems (for example, programming languages), scientific constructions (for example, periodic table of elements, determinants used in botany or archeology, etc.). It allows you to easily see and learn the system of «artificial» rules that operate in a certain area, characterizes the sense of the structure of the language (or structural-linguistic abilities). On this subtest, the student players got the lowest value that shows the difficulties in the implementation of the categorization of concepts.

The tasks of the sixth subtest measure the development of formal logical thinking, the ability to operate with relationships, dependencies, regardless of the quality of the information content, to make various logical transformations of the operations themselves.

The subtest can characterize thinking of three types depending on what intellectual operations formal logical thinking (or symbolization of what is) is built on, what relations a person is trained to operate. On the basis of the developed conceptual thinking, a full-fledged abstract thinking can be formed, which raises the functioning of the intellect as a whole to a qualitatively higher level. A new, more perfect type of it arises. The owner of such intelligence receives significant advantages over other people. The speed and accuracy of information processing and penetration into its essence increase several times, because the very principle of its perception changes. In order to master any area of knowledge, a person with the intelligence of the «pre-abstract» type is forced to form a system of representations about this area, then analyze it, generalize and thus highlight the underlying patterns: it always takes a long period of knowledge accumulation, a lot of time is spent on its subsequent systematization. In the presence of abstract thinking the accumulation of knowledge is not required to understand the essence, the system of laws and relationships is captured as you become familiar with the new information. Emerging understanding is holistic and systematic, even if the information comes randomly. The process of familiarization with the material takes place through the imposition of available in the human head natural «abstract» grid that structures and systematizes any incoming information. Instead of a few years of training, a few months is enough for that. The quality of education is also significantly improved. Thanks to abstract thinking, a person sees the incorrectness of constructions, logical inaccuracies and errors in the process of mastering new areas of scientific or practical activity, which are not visible to specialists, if they do not have developed abstract thinking. Indicators of abstract thinking are also significantly lower in the group of students-eSports players.

The found correlations had the opposite character, which allows us to assert about the lower level of development of logical thinking among students-eSports players (table 2).

Table 2. Correlation analysis of eSports activities and indicators of logical thinking

Indicators	eSports activities
Subtest 2 «intuitive conceptual thinking»	- 0,370*
Subtest 3 «conceptual logical thinking»	- 0,470**
Subtest 4 «conceptual categorization»	- 0,670**
Subtest 6 «abstract thinking»	- 0,510**
The total indicator of logical thinking	- 0,570**

* Correlation is significant at the level of 0,05
** Correlation is significant at the level of 0,01

The least close correlation is observed in subtest 2, its tasks are aimed at assessing the development of conceptual thinking operations based on intuitive analysis. It can be assumed that the ability (or inability) of an individual to intuitively identify the main thing is least associated with active playing computer games. In turn, the closest relationship is obtained by subtest 4. Consequently, students-eSports players have less developed ability to identify and refer the object to a particular category, to determine its generic affiliation. Students playing computer games are more characterized by linearity, unidirectionality of thinking than the not playing students.

Table 3 presents the results of the diagnosis of the level of formation of general mental abilities, the level of critical thinking and thinking styles. The majority of the subjects experience obvious difficulty in the interpretation of the facts, statements, schedules, in determining the meaning of the values in the description of facts, events and their distribution by categories.

Table 3. Results of the diagnostic of the stylistic peculiarities of thinking of students-eSports players and students not involved in eSports

Indicator	Group of students-eSports players	Group of students not engaged in eSports	Mann-Whitney test
The level of general mental ability	22,60	20,70	174,000
The level of development of critical thinking	13,15	15,90	124,500*
Proactive thinking style	4,84	3,83	125,000*
Critical thinking style	3,96	4,54	182,500
Managerial thinking style	4,35	3,81	186,000
Practical thinking style	5,18	5,34	183,000

* Differences are significant at the level of 0,05
** Differences are significant at the level of 0,01

We do not find significant differences in the level of general mental abilities among students-eSports players and students who are not engaged in eSports.
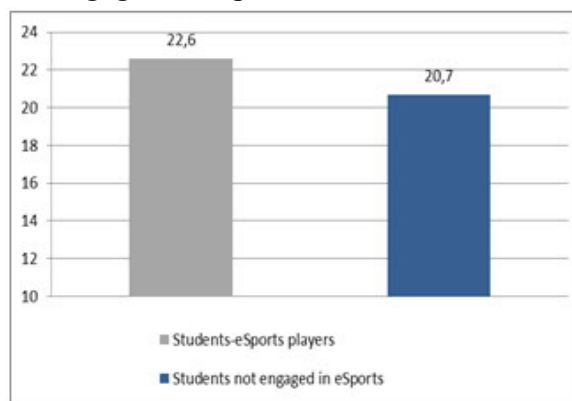
Figure 2. Results of diagnostics of the level of general mental abilities of eSports students and non-eSports students

ESports students have a lower level of critical thinking than non-eSports students (U = 124,500, $\rho \geq 0,05$).
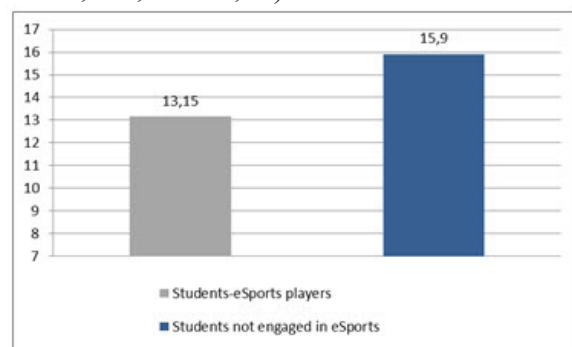
Figure 3. Results of diagnostics of the level of critical thinking of students-eSports players and students that are not involved in eSports

The ability to analyze, identify significant arguments, planned and existing logical connections among statements, questions, concepts at a high level is typical for students with a high level of critical thinking. Students with a low level of critical thinking find it difficult to assess information or judgments analytically, ignoring obvious alternative points of view; find it difficult to make reasonable, judicious, error-free conclusions, identify the consequences arising from the data, formulate a strategy for finding and collecting information in order to clarify the evidence, design alternative hypotheses; it is difficult to substantiate key results, to present reasoning using convincing arguments, to create a graphical presentation to explain and illustrate the actual material.

An acceptable level of development of

critical thinking skills is characterized by the ability to apply critical thinking skills in the analysis and evaluation of their own or others' logical judgments in order to confirm, approve, correct reasoning or results.

The results of the test indicate an insufficient level of development of critical thinking skills among students-eSports players.

To study the thinking style, the method of «Thinking style» by A. K. Belousova was used (Belousova, A. K. and Pishchik, V. I., 2011). In the research process of style of thinking, we obtained results that allow us to build a profile of thinking style of young players (figure 4).
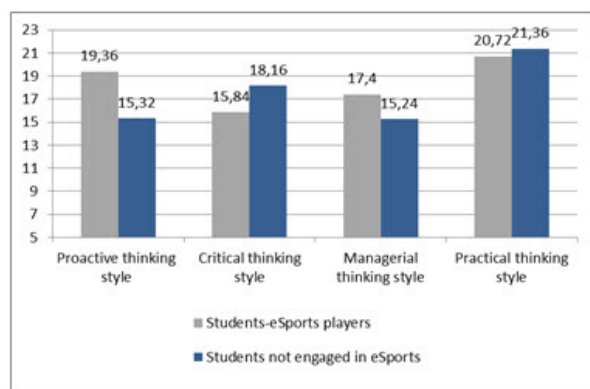
Figure 4. Results of the diagnostic of the stylistic peculiarities of thinking of students-competitive players and students that are not involved in eSports

There are differences in the profile of thinking styles:

- Students-eSports players' profile of thinking style is represented by the following combination of styles: PraTS – ProTS – MTS – CTS.
- Students who are not engaged in eSports are characterized by such profile: PraTS – CTS – ProTS и MTS.

Significant differences between students-eSports players and students who are not engaged in eSports, were found in the expression of an proactive thinking style (U = 125,000, ρ≥ 0,05). For the rest of the thinking styles significant differences were not identified, but we can speak about the stylistic peculiarities in the mental activities of these groups of students, as they can be traced not only by the values of differences in summary measures of severity of thinking styles in groups, but also on the specifics of the structure of the averaged profiles of thinking style. Profile of students-eSports players is dominated by the practical thinking style, then proactive, managerial, critical thinking style completes the profile. In

the profile of students who do not engage in eSports, also dominates the practical thinking style, but the second position in the profile is a critical thinking style, then equally expressed proactive and managerial thinking styles. Whereas the profile of the thinking style is a certain combination of functions aimed at the production and development of tumors, manifested in the dynamics and direction of human mental activity (Belousova, A. K., 2002), we can imagine this combination as a construct that is formed under the influence of external conditions, including human-solved certain tasks. I.e., if it is a general practice oriented the direction of thinking of students-eSports players and students-amateur players, there are clear differences in the stylistic characteristics of thinking of these groups of students. The dominant function of realization of ideas of students-eSports players is associated primarily with the function of generating ideas, finding new solutions, initiation of mental activity, further significant is the meaning, and in the last place is the function of selection of information. Presumably, we can connect this with the tasks that eSports students solve on a daily basis, carrying out specific gaming activities within the framework of team functioning. While students-amateur players are characterized by the conjugation of the function of practical implementation of ideas in the first place with the function of selection of information, and the function of generating ideas and their meaning to other people to a lesser extent determine the mental activity of this group of students, but it is equally important for its implementation. In other words, the style specificity of mental activity is formed under the influence of actual activity and the specificity of the tasks.

Correlation analysis of the relationship between the indicators of style features of thinking showed differences in correlation between groups of students-eSports players and students who are not involved in eSports.

The following correlations were found in the group of eSports-students.

Table 4. Correlation analysis of style characteristics of students-eSports players

	The level of general mental ability	Critical thinking
Proactive thinking style	0,474(*)	0,472(*)
Practical thinking style	-	-0,517(*)
The level of general mental ability	-	0,916(**)
Critical thinking	0,916(**)	-

* Correlation is significant at the level of 0,05
** Correlation is significant at the level of 0,01

Proactive thinking style is positively correlated with the level of intelligence (r = 0,474, $p \leq 0,05$) and critical thinking (r = 0,472, $p \leq 0,05$). Critical thinking is negatively correlated with practical thinking (r = -0,517, $p \leq 0,05$) and positively – with the level of general mental ability r = 0,916, $p \leq 0,01$).

Table 5. Correlation analysis of the style characteristics of students not involved in eSports

	The level of general mental ability	Practical style of thinking
The level of general mental ability	-	-0,482(*)
Critical thinking	0,658(**)	-

* Correlation is significant at the level of 0.05 (2-way).
** Correlation is significant at the level of 0.01 (2-way).

There are few connections in the group of students not involved in eSports. The level of general mental abilities of students is positively correlated with critical thinking (r = 0,658, $p \leq 0,01$) and negatively – with practical thinking style (r = -0,482, $p \leq 0,05$).

In general, it was found that the entire sample of students is characterized by a low level of critical thinking skills, problem points are indicators of interpretation, analysis and self-regulation. Most students are characterized by difficulties in interpreting facts, graphic data, unable to identify strong relevant arguments «for» and «against». Despite the fact that such indicators as «assessment», «formulation of conclusions», «explanation» are in the majority of students and e-athletes in the area of high and acceptable levels of development, the problem of formation of critical thinking skills remains open. Indicators of the level of critical thinking significantly lower in the group of students-eSports players.

Thus, the obtained results actualize the problem of further in-depth study of the peculiarities of mental activity of young people engaged in eSports, the creation and implementation of a system of relevant activities and complex projects for the development of scientific, educational and creative environment in the structures involved in the training of eSports players.

4. DISCUSSION

Games are actively included in the life of the younger generation. Computer game becomes a professional activity. There is a controversial problem – games develop cognitive processes or block their development in gamers. Most authors (Clark, K., Fleck, M.S. and Mitroff, S. R., 2011) pay attention to the study of perception, attention, memory of gamers and a lesser extent to thinking. Today, the study of the thinking styles of gamers is an extremely important problem. Bogacheva, N. V. and Vojskunskij A. E. (2015) showed that active players have the following stylistic characteristics of thinking: reflexivity, field independence, flexible cognitive control. Our study contradicts this study, we found out that the development of logical thinking of gamers is low, especially it concerns of conceptual categorization. Maybe this is due to the fact that the conceptual categorization is based on the gamer's vocabulary, his verbal intelligence. However, our data combined with the results of the study of Savchenko, A. A. and Nikishina, N. A. (2011) which proves that the fascination with computer games slows down thought processes.

Studies of the impact of computer games on the cognitive, intellectual processes of players are quite controversial. However, the evidence of developing, training nature of their influence on various processes – from the reaction rate to analytical thinking and cognitive control prevail.

5.CONCLUSIONS

In the course of the study, it was found out that students-eSports players, daily spending more than four hours playing a computer game, have a relatively lower level of development of logical and critical thinking than students who does not play computer games professionally.

There are significant differences between groups of students-eSports players and non-eSports players in the level of development of intuitive conceptual thinking, conceptual logical thinking, in the ability to conceptual categorization, abstract thinking and selective information processing. Through the correlation analysis statistically significant inverse relationship between the practice of eSports and the level of development of logical thinking was discovered.

The majority of students in both groups have an obvious difficulty in the interpretation of the facts, statements, charts; in determining the meaning of; to describe facts, events and their distribution by categories. It is established that the level of critical thinking of students-eSports players is lower than that of students not engaged in eSports.

The differences of the style characteristics of thinking of students-competitive players and students that are not involved in eSports professionally, expressed in the differences of the average profile of thinking and the specifics of the co-ordination of cognitive functions: the initiation of mental activity, selective sampling of information, mislabeled, applied to implement the ideas, were discovered.

The study of style features of thinking showed that there are differences in the profile of students' thinking styles:

- Sudents-eSports players' profile of thinking style is represented by the following combination of styles: PraTS – ProTS – MTS – CTS, in mental activity the focus on practical implementation and generation of ideas dominates.
- Students who are not engaged in eSports professionally are characterized by such profile: PraTS – CTS – ProTS and MTS, in mental activity the focus on practical implementation of ideas an selection of information dominates.

In the group of students-eSports players a closer and more complete correlation between the indicators of the style characteristics of thinking and the level of general mental ability was discovered.

ACKNOWLEDGEMENTS

Abbreviations

PraTS – practical thinking style, CTS – critical thinking style, ProTS – proactive thinking style, MTS – managerial thinking style.

Conflict of interests

The authors declare no conflict of interest.

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