

PEHPP 2019**Pedagogical Education: History, Present Time, Perspectives****COGNITIVE ACTIVITY OF STUDENTS IN THE
CIRCUMSTANCES OF THE EDUCATIONAL ENVIRONMENT
INFORMATIZATION**

S. H. Bijieva (a), F. Yu. Botacheva (b), L. M. Elkanova (c)*

*Corresponding author

(a) North Caucasus State Academy, Cherkessk, Russia, csapiyat@yandex.ru

(b) North Caucasus State Academy, Cherkessk, Russia, fatima_botash@mail.ru

(c) North Caucasus State Academy, Cherkessk, Russia, Liza_Elkanova@mail.ru

Abstract

The article is dedicated to solving the scientific problem of the formation of cognitive activity of students of a medical university in the process of studying natural sciences in the circumstances of informatization of the educational environment. The purpose of the article is to identify the effectiveness of the use of information digital technologies in the process of formation of cognitive activity of students of a medical university. The study is based on the analysis and generalization of psychological, pedagogical, methodical literature on the problem of research. The main research methods were: observation, questionnaires, analysis of the results of educational activities, survey, testing, methods of statistical data processing. A focused training experiment in the process of studying natural sciences was built on the basis of the systematic use of such digital teaching technologies as: multimedia lectures with video demonstrations of physical experiments, virtual laboratory work, web quests. During the study, the components of the studied quality of the students were identified; the possibilities of digital information technologies' impact on the formation of this quality of students are revealed; the pedagogical conditions of the effective use of information digital technologies in the formation of cognitive activity of students of a medical institute in the process of studying natural sciences are highlighted. The results of the study showed that the created pedagogical conditions based on the use of digital information technologies provide positive dynamics in the development of the levels of the studied quality of students of a medical institute.

2357-1330 © 2020 Published by European Publisher.

Keywords: Digital information technology, cognitive activity, psychological and pedagogical conditions, digital educational environment.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 Unported License, permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

1. Introduction

The rapid development of scientific and technological progress places high demands on all members of society. Highly qualified, creative specialists are needed, those who are capable of not only performing certain labor functions, but also of making decisions independently, analyzing their actions, predicting their possible consequences, being ready to take responsibility for the fate of the country and its successful socio-economic development. For the further effective development of the economy, the introduction of digital technologies in all spheres of human activity is necessary.

This led to the emergence of new requirements for teaching students of higher educational institutions: there was an acute problem of improving the theory and practice of the educational process, there was a need to develop new approaches to professional training of students taking into account modern requirements of society, international experience in higher education, but at the same time without losing the uniqueness of the domestic academic culture.

Consequently, the organization of such a pedagogical process, which would not only serve as the basis for expanding the knowledge system, but would also contribute to the development of the value, intellectual, cultural, creative potential of students, has become an urgent problem of higher education. It is necessary to create such an educational environment in universities that would be aimed at developing students' professional, general professional and general cultural competencies, and would be based on personality-oriented and innovative teaching technologies.

2. Problem Statement

Innovative processes in the education system are the subject of research by many domestic and international scientists (Greany, 2018; Klarin, 2017; Lee, Mak, & Burns, 2016; Slastenin & Podymova, 2007; Záhorec, Hašková, & Munk, 2019). Conclusions and recommendations of these authors are widely used in the educational process of educational institutions, including universities. However, the listed studies do not fully reveal the features of the formation of cognitive activity of university students in the conditions of informatization of the educational environment. In this regard, the research problem is the study of the influence of digital information technology on the formation of cognitive activity of students on the example of the study of natural sciences at a medical university.

The work of many domestic and international scientists (Klimbei, Yadrova, & Nurzhanova, 2017; Maslow, 1970; Songkram & Puthaseranee, 2015) was devoted to the study of this problem as one of the priority tasks of pedagogical science. One of the conceptual approaches to solving the problem under study in modern higher education is the environmental approach, that is, an approach based on the design, creation and use of an electronic educational environment using digital technologies (Alt, 2018; Atanasyan, 2009; Chen, Breslow, & De Boer, 2018; Krasilnikova, 2003). These technologies today include: adaptive, cloud, mobile, etc. The most used digital technologies in the education system today are interactive laboratory tables, robotics or robotic teachers, augmented reality technologies, virtual laboratories.

3. Research Questions

3.1. What are the levels of formation of the components of cognitive activity of students: motivational and value, cognitive, activity, reflective-evaluative?

3.2. How to increase the level of formation of cognitive activity of students through the use of digital learning technologies?

3.3. Do digital informational teaching technologies have a positive effect on the formation of cognitive activity of students?

4. Purpose of the Study

The purpose of this work is to study the influence of digital information technologies on the formation of cognitive activity of students of a medical university in the process of studying natural sciences.

5. Research Methods

The experimental study was carried out at the medical institute of the North Caucasian State Academy and consisted of ascertaining, formative and control stages. First and second year students of the medical institute acted as an experimental group. In total, 80 students took part in the experimental study.

To answer the first question of the study, a diagnosis was made of the level of formation of cognitive activity of students. In the structure of cognitive activity, we identified four main components that acted as the main criteria for diagnosing the formation of the levels of students' studied quality:

- motivational and value (consciously positive attitude of students to mastering the system of scientific knowledge);
- cognitive (the totality of students' knowledge in such subjects as "Physics, Mathematics", "Mechanics" and "Quantum Physics");
- activity (a set of skills, the active use of modern information technologies in the process of studying natural sciences by the students);
- reflective-evaluative (students' evaluative attitude to the process of obtaining knowledge and the results of their activities).

Diagnostics of the level of formation of the components of cognitive activity of students at the ascertaining and control stages of studying was carried out using methods such as observation, questioning, analysis of the results of educational activities, survey, testing, methods of statistical processing of experimental data.

To answer the second question of the study, a formative experiment was conducted. In the course of the formative experiment, to achieve the goal of the study, we used such digital information technologies as multimedia lectures with video demonstrations of physical experiments; virtual laboratory workshops; web quests.

In the course of using multimedia lectures, it is possible to programmatically combine textual and graphic accompaniment (photographs, charts, graphs, drawings, etc.) with computer animation and numerical simulation of the processes and phenomena under study. The main advantage of this technology is the ability to use the teacher's interactive interaction with both software and hardware, with the help of which the presentation of lecture material (explanatory, illustrative and problematic type) is projected, as well as the possibility of indirect communication with students (students have the opportunity to ask questions online, review the material in case of misunderstanding or incomplete assimilation of new information) (Mendalieva & Mukasheva, 2015).

Virtual laboratory workshops have become one of the methods for creating a digital information environment in the educational process of a medical university, the main advantages of it are: a high level of safety in use; flexibility and ease of adaptation to any objects, as well as versatility and multifunctionality; the emergence of the possibility of conducting experimental studies, which under normal conditions is impossible or associated with certain time and financial costs; ease of control; the possibility of implementing an individual approach and the independence of the level of student achievement from the level of performance of others; the emergence of the ability to see multidimensional processes that cannot be displayed using real devices (Mendalieva & Mukasheva, 2015).

The most promising area of application of this method is the use of mobile applications for organizing virtual laboratory work, which provide access to cloud services used as a single information field for storing information about students and teachers, indicators of educational activity.

The use of web quests during extracurricular activities as an expansion of students' knowledge of the subjects studied, as an increase in the studied quality of students and their information literacy, has become one of the main methods that made this process possible. Web quests in education are a specially organized type of oriented research activity, for which students search for information in the Internet at the indicated addresses, relying on the support provided by the teacher. Web-quest is a modern innovative technology based on projective teaching methods, including search activities of students with a clear managerial role of a teacher using new ICTs ” (Moskalevich, 2013, p. 291).

In a web-quest, such components as introduction, task, process, sources, assessment, conclusion are distinguished. The use of this technology by students suggests that they themselves can create web quests on topics set by the teacher, and this can be both individual work and group work. The technology of the web quest not only contributes to the formation and evaluation of subject knowledge and skills, but also aims to developing group activity skills, cooperation skills, to forming skills for developing a group work plan in accordance with the goal; to developing the skills of searching and selecting the necessary information on the Internet; to developing the skills of analysis and structuring of information received from the network, the ability to present this information in an abbreviated form (essay, report) or in graphical form (graph, chart) using ICT, etc.

As the main pedagogical conditions for the implementation of digital information technologies as a means of forming the studied quality of students in the study of natural sciences, we have identified: strengthening the emotional attractiveness of educational and cognitive activities; implementation of differentiated and individual approaches in educational activities; organization of the educational process as a joint activity of a teacher and students in the dialectical unity of three parties: personal, functional,

substantive; the formation of social and professional reflection in joint activities in the process of using digital technologies; adequate control, analysis and evaluation of the results of independent activity.

6. Findings

At the first, ascertaining stage, the levels of formation of cognitive activity in students of a medical institute were determined: optimal, sufficient, nominal. The results of the analysis and interpretation of the experimental data of the ascertaining stage of the study are presented in Table 01.

Table 01. The level of formation of cognitive activity of students (ascertaining stage)

Criteria for assessing cognitive activity	The levels of formation of cognitive activity of students					
	Quantity	%	Quantity	%	Quantity	%
Motivational and value	10	12.5	33	41.25	37	46.25
Cognitive	12	15	36	45	32	40
Activity	9	11.25	39	48.75	41	51.25
Reflective-evaluative	7	8.8	33	41.2	40	50

From Table 01 it is seen that during the diagnosis in the experimental group, students with the optimal level of formation of the studied quality were identified, although most students were characterized by a nominal, i.e. low, and sufficient (average) level of formation of all four criteria. Most students do not have a consciously positive attitude towards mastering the system of scientific knowledge; the motive of "obtaining a diploma" and general situational interests prevail; they have insufficient limited knowledge in such subjects as "Physics, Mathematics", "Mechanics" and "Quantum Physics"; are not actively using their skills and abilities to work with digital information technologies in the process of studying natural sciences; they also have insufficiently developed skills for evaluative attitude to the process of obtaining knowledge and the results of their activities.

At the second stage of studying, a training experiment was conducted aimed at increasing the level of formation of the studied quality through the use of digital information training technologies (multimedia lectures with a video demonstration of physical experiments, virtual laboratory work, web quests).

At the final stage, in order to answer the third question of the study, the final diagnosis of the levels of cognitive activity of students was carried out (Table 02).

Table 02. The level of formation of cognitive activity of students (the final stage)

Criteria for assessing cognitive activity	The levels of formation of cognitive activity of students					
	Optimal		Satisfactory		Nominal	
	Quantity	%	Quantity	%	Quantity	%
Motivational and value	19	23.75	41	51.25	20	25
Cognitive	22	27.5	39	48.75	19	23.75
Activity	19	11.25	44	48.75	15	51.25
Reflective-evaluative	16	20	40	50	24	30

A comparative analysis of the results of the study before and after the forming experiment showed positive changes in the development of the studied quality of students (Table 03).

Table 03. Comparative results of the level of formation of cognitive activity of students before and after the experiment

The levels of formation of cognitive activity of students	Research stages	
	Control stage (%)	The final stage (%)
Optimal	11	23.8
Satisfactory	43	51.4
Nominal	46	24.8

After the formative stage of the experiment, the experimental group experienced significant changes in the number of students of the nominal level of formation of this quality. The average statistical value of the increase in the level of formation of cognitive activity of students at the nominal level decreased by 21.2%, due to an increase in the number of students of a sufficient level by 8.4% and the optimal level by 12.8%. Most students are characterized by a sufficient level (51.4%) and an optimal level (23.8%) of the formation of the studied quality.

To identify the reality of statistically significant changes in the results of the experimental groups before and after the forming experiment, we used the χ^2 criterion. The obtained value $\chi^2 = 26.4$ when comparing the results in the experimental group before and after the experiment exceeds the corresponding tabular value $m - 1 = 2$ degrees of freedom, amounting to 13.82 with an error probability of less than 0.001%. Therefore, based on the available data from the results of the formative experiment, it can be concluded that the use of digital information technologies in the process of studying natural science disciplines contributes to the formation of all structural components of the cognitive activity of students of a medical university.

7. Conclusion

Using the considered digital information technologies in the educational process of a medical university allows one to optimize the time spent by a teacher preparing for classes, to increase student motivation, to develop independent activity skills, to develop self-organization, self-control and reflection skills and, in general, to contribute to the formation of students' cognitive activity.

The study of natural sciences using digital information technologies through the implementation of selected pedagogical conditions helps to increase the cognitive activity of students, which is manifested in the formation of stable positive motivation for learning; in possession of sufficient complete scientific knowledge in the studied subjects; in the formation of skills and abilities of independent creative activity; in the active use of their skills and abilities for working with digital information technologies; in the development of skills of evaluative attitude to the process of obtaining knowledge and the results of their activities.

It should be noted that the study does not claim to be exhaustive. It demonstrates the prospects for further improvement of the educational process as a whole, as well as its individual components, further

study of the problem of the influence of digital information technologies on the process of formation of cognitive activity of students at different faculties and of different profiles, including research on the effectiveness of using digital technologies in working with foreign students whose successful learning is hindered by communication difficulties.

References

- Alt, D. (2018). Science teachers' conceptions of teaching and learning, ICT efficacy, ICT professional development and ICT practices enacted in their classrooms. *Teaching and Teacher Education*, 73(1), 141-150. <https://doi.org/10.1016/j.tate.2018.03.020>
- Atanasyan, S. L. (2009). Features of informatization of educational activity in pedagogical universities. Bulletin of the Peoples' Friendship University of Russia. Series: *Education Informatization*, 2, 5-13. [in Russ.].
- Chen, X., Breslow, L., & De Boer, J. (2018). Analyzing productive learning behaviors for students using immediate corrective feedback in a blended learning environment. *Computers and Education*, 117, 59-74. <https://doi.org/10.1016/j.compedu.2017.09.013>
- Greany, T. (2018). Innovation is possible, it's just not easy. Improvement, innovation and legitimacy in England's autonomous and accountable school system. *Educational Management Administration and Leadership*, 46(1), 65-85. <https://doi.org/10.1177/1741143216659297>
- Klarin, N. V. (2017). Instrument of innovative education: transforming education. *Pedagogy*, 3, 19-27. [in Russ.].
- Klimbei, L. V., Yadrova, N. V., & Nurzhanova, R. M. (2017). Modern approaches to the formation of cognitive activity of students. *Modern problems of science and education*, 6, 206. [in Russ.].
- Krasilnikova, V. A. (2003). Informatization of education: conceptual apparatus. *Informatization and education*, 4, 21-27. [in Russ.].
- Lee, I., Mak, P., & Burns, A. (2016). EFL teachers' attempts at feedback innovation in the writing classroom. *Language Teaching Research*, 2(2), 248-269. <https://doi.org/10.1177/1362168815581007>
- Maslow, A. H. (1970). *Motivation and Personality*. N.Y., Harper & Row.
- Mendalieva, N., & Mukasheva, A. (2015). The effectiveness of virtual laboratory work in teaching bachelors in technical areas. *Actual issues of psychology, pedagogy and education*, 2, 157-160 [in Russ.].
- Moskalevich, G. N. (2013). The concept and essence of educational information and communication technology web quest. *Information and technological support of the educational process of a modern university*, 286-293. [in Russ.].
- Slastenin, V. A., & Podymova, L. S. (2007). Readiness of a teacher for innovative activity. *Siberian Pedagogical Journal*, 1, 42-49.
- Songkram, N., & Puthaseranee, B. (2015). E-learning System in Virtual Learning Environment to Enhance Cognitive Skills for Learners in Higher Education. *Procedia - Social and Behavioral Sciences*, 174, 776-782. <https://doi.org/10.1016/j.sbspro.2015.01.614>
- Záhorec, J., Hašková, A., & Munk, M. (2019). Teachers' Professional Digital Literacy Skills and Their Upgrade. *European Journal of Contemporary Education*, 8(2), 378-393. <https://doi.org/10.13187/ejced.2019.2.378>