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The individual educational trajectory as a means for the formation of students' informational-analytical skills in a digital educational environment

La trayectoria educativa personal como el medio de la formación de habilidades de información y análisis de los estudiantes en un entorno educativo digital

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Abstract
The article analyzes the literature on the problems of building an individual educational trajectory of students in the conditions of a digital environment and its application for the formation of informational-analytical skills, presents the results of the study devoted to the formation of informational-analytical skills among first-year students of pedagogical areas of training. The results of diagnostics indicate that informational-analytical skills are insufficiently formed. There is description of software modules that can act as components of a digital educational environment that contributes to the formation of students' informational-analytical skills in the conditions of building an individual educational trajectory.
Keywords: individual educational trajectory, informational-analytical skills, digital educational environment.

Resumen
El artículo analizala literatura sobre los problemas de formar una trayectoria educativa personal de los estudiantes en condiciones del entorno educativo digital y de aplicarla para crear las habilidades de información y análisis.Están presentados los resultados del estudio de la formación de habilidades de información y análisis de los estudiantes del primer curso de los estudios de pedagogía. Los resultados del diagnostico confirman que las habilidades de información y análisis están desarrolladas de forma incompleta. Están descritos los módulos de programa que pueden ser componentes de un entorno educativo digital que contribuye al desarrollo de habilidades de información y análisis de los estudiantes en formación de una trayectoria educativa personal.
Palabras clave: trayectoria educativa personal, habilidades de información y análisis, entorno educativo digital

1. Introduction

The competence- and system-activity based approaches implemented in the current Federal state educational standards of higher education imply the orientation towards the development of students' skills for independent

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learning activities, as well as towards the formation of readiness for self-development and continuous education (Sysoev, 2013). The organization of the educational process on the basis of an individual trajectory of education is constantly in the projects of modernization of Russian education (Sivolapova). O. A. Karabanova believes that at the present stage of introduction of P. Ya. Galperin's concept of the phased and systematic formation of mental actions and concepts, the emphasis is shifted to the study of patterns and mechanisms that substantiate the individual trajectory of development (Karabanova, 2012). The issue of creating resources aimed not at an average student, but at a specific child is relevant.

A. P. Sheptulin, I. N. Smirnov, T. S. Vasilieva, V. V. Orlov, A. A. Makarenya considered the characteristics of the development process in educational systems from a philosophical position. L. I. Bozhovich, L. S. Vygodsky, A. V. Zaporozhets, A. N. Leontiev, A. R. Luria considered the development process from an anthropological standpoint in the historical-evolutionary concept. V. I. Slobodchikov, G. A. Tsukerman considered it necessary to determine the conditions of psychological and pedagogical support of the child (Slobodchikov, 1996).

In a dynamically developing world, it is necessary to improve the professional level constantly, therefore, the importance of independent educational activity and the ability to build one's own educational trajectory is increasing (Sysoev, 2013).

A. K. Pavlov defines an individual trajectory of development as a purposeful differentiated program that provides self-determination and self-realization with pedagogical support. (Pavlov, 2013). A. K. Sivolapova, T. P. Gilmulina believe that an individual trajectory contributes to the development of life strategies, individual-creative and professional development of the individual (Sivolapova, 2016).

S. A. Vdovina, B. G. Erykova, G. M. Kuleshova, N. I. Leonov, Yu. V. Tolbatova, A. V. Khutorskoy regarded an individual educational trajectory as a personal route for the implementation of the student's educational activity.

Considering the concept in the context of modern educational standards, some authors believe that an individual educational trajectory is a reflection of the process of accumulation of educational results (Plaksina).

We also view an individual educational trajectory from the standpoint of the psychophysiological characteristics of students (Belousova, 2019), which is consistent with the ideas of T. A. Timoshina, who considers it necessary to take into account the psychical, psychological and psychophysiological characteristics of students (Timoshina, 2010).

M.A. Shemanaeva highlights the following advantages of teaching using an individual educational trajectory: variability of content, methods and means of education; integration of classroom and extracurricular activities; contribution to the achievement of integrative educational results (key competencies) (Shemanaeva, 2017).

There are two approaches to designing an educational trajectory. The first is to choose an educational area and build a trajectory according to the educational area. The second approach is the differentiation of training according to certain criteria (Ogorodnikova, 2012; Sedakova, 2013). We adhere to the second approach in our research.

G. F. Berseneva believes that one of the conditions for building an individual educational trajectory for students in order to expand their professional competencies is building the stages of educational activities. The first stage is self-determination, the second stage is building an educational route – building an individual program of educational and industrial practice, the third stage is to assess the effectiveness (Berseneva, 2014). Other researchers suggest organizing the scientific work of students (Sivolapova, 2016) as a condition for the implementation of an individual educational trajectory.

O. A. Plaksina, T. A. Matveeva distinguish the following conditions for the design and implementation of an individual educational trajectory: availability of information for participants of the educational process, modularity of educational programs, monitoring of educational achievements, resource support (Plaksina, 2013).

In modern conditions, it is undoubtedly relevant to design an individual educational trajectory in a digital educational environment.

The possibilities of using the digital environment in educational systems have been repeatedly considered in the works of Russian and foreign scientists (Barakhsanova, 2018; Afanasyeva,2018; Kushcheva,2018; Psomos, 2012; Koukopoulos, 2019; Wang, 2020).

A number of scientists associate the construction of an individual trajectory of students' training with the use of the capabilities of the digital educational environment (Nikitin, 2015; Lomakin, 2013; Vanitha, 2019; Chunaev, 2018).

We consider the digital educational environment as a means for the formation of informational-analytical skills in students in the context of building an individual educational trajectory. We mean by informational-analytical skills the mastery of methods of searching, processing information and obtaining new knowledge using information and communication technologies (Korchemkina, 2020).

Purpose of the study: to substantiate the need for the formation of informational-analytical skills in students and to characterize the components of the digital educational environment for the formation of these skills in the context of building the individual educational trajectory.

2. Methodology

Earlier we developed a codifier of informational-analytical skills, in which all skills were divided into three groups: information search, reproductive and productive transformation of information, heuristic transformation of information. In total, 17 different skills were identified that are necessary when working with information. Further, there was developed a diagnostic technique based on working with text, while each skill was assessed on a scale from 0 to 2: 0 – not formed, 1 – not fully formed, 2 – formed. Thus, the subject could score from 0 to 34 points.

As a result of diagnostics of the level of formation of informational-analytical skills, students were divided into three groups: low level – from 0 to 12 points; average level – from 13 to 23 points; high level – from 24 to 34 points.

In addition, a correlation analysis was carried out to test the hypothesis about the existence of a direct relationship between the level of formation of informational-analytical skills and student progress (average score of the examination session). Due to the fact that we can talk about a linear relationship between the indicators, and the distribution of numerical values is close to normal, the Pearson correlation coefficient was used to assess the density.

The study involved 58 first-year students of full-time training enrolled in areas 44.03.01 Pedagogical education, profile "Primary education"; 44.03.05 Pedagogical education (with two training profiles), profiles "Primary education. The English language", "Primary education. Preschool education". Research timeframe – April – July 2020.

3. Results

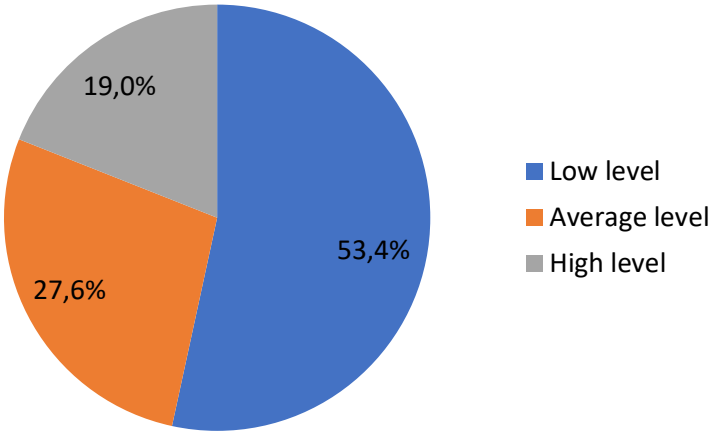
The diagnostic results are presented in Table 1 and Figure 1.

Table 1
The results of diagnostics of the formation of informational-analytical skills

The level of formation of informational-analytical skills	Number of students, people	Share of students,%
Low level	31	53,4%
Average level	16	27,6%
High level	11	19,0%

Source: authoring

Figure 1
The results of diagnostics of the formation of informational-analytical skills



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Thus, only 19% of students have a high level of formation of informational-analytical skills, while a low level was recorded in 53% of students, that is, in most of the researched population.

After analyzing the formation of separate skills, it can be noted that, to the greatest extent, the respondents have developed the following skills: compilation; division of text into sections, wording of headings; work with diagrams. These skills have been fully or partially formed in 60-80% of students. At the same time, a number of skills in a significant proportion of students (more than 50%) have been practically not formed, mainly, this refers to the skills related to heuristic transformation of information: analysis, abstraction, concretization, etc. Also, difficulties are observed with the highlighting of the necessary information in the found sources, working with tables, drawing up schemes.

The correlation analysis of two data series (the level of formation of informational-analytical skills and the average score of the examination session) showed that the Pearson correlation coefficient is 0.748, which allows us to conclude that there is a direct linear relationship with a high level of density of the relationship. Thus, we can say that informational-analytical skills contribute to a more successful assimilation of the educational program.

According to the results of diagnostics of the level of formation of informational-analytical skills and correlation analysis, it can be concluded that it is necessary to increase the efficiency of formation of these skills. We believe

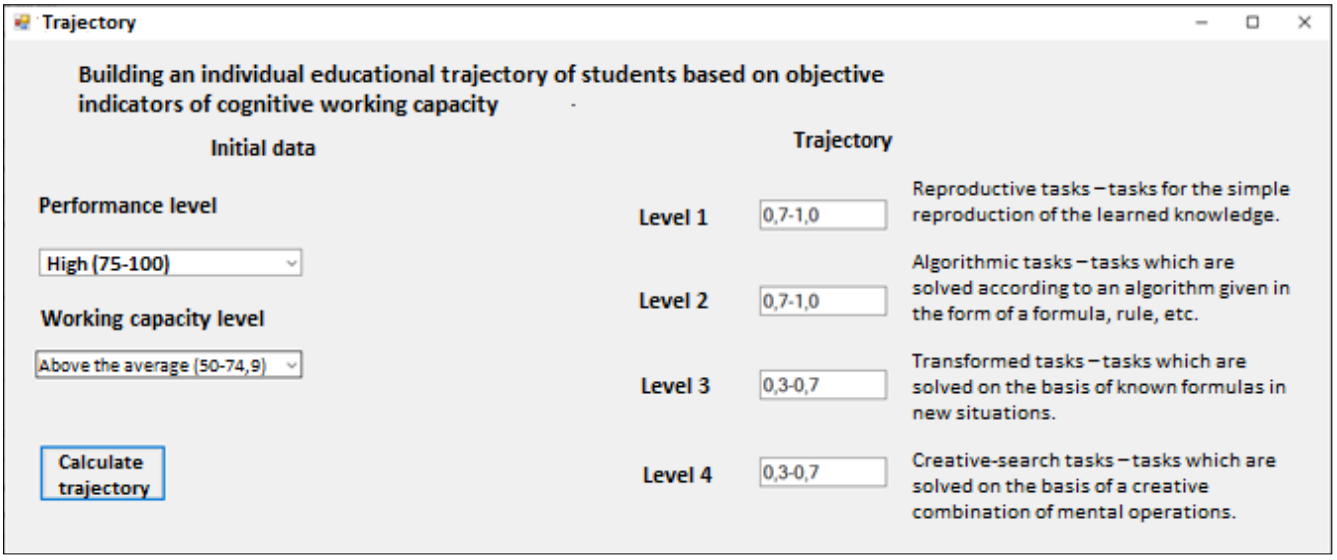
that for this purpose it is necessary to use in the training process a digital environment that contributes to the construction and implementation of an individual educational trajectory.

There are various approaches to the individualization of the educational process in the digital environment. One of the approaches supposes designing tasks based on the results of a certain level of students' knowledge. P. V. Nikitin, I. A. Fominykh, R. I. Gorokhova suggest using an automated environment for constructing an individual trajectory of students' training (Nikitin, 2015). The difficulty level of tasks is designed based on the results of the entrance testing. The tasks assume three levels of complexity that correspond to the level of competence formation: below the threshold level – the competence is not formed; threshold level – average value; high level. A modular model for controlling students' individual trajectory based on the theory of finite automata is also proposed.

In our research, we also adhered to the idea of offering students multi-level tasks, however, as a basis for determining the level of tasks for each student, we propose to use not the level of basic knowledge, skills and abilities, but psychophysiological indicators (indicators of the level of working capacity).

According to one of our software products "Building an individual educational trajectory of students based on objective indicators of cognitive working capacity" (certificate of state registration of a computer program No. 201966507 dated November 22, 2019) the design of an individual educational trajectory is based on the psychophysiological state of the student's nervous processes, which is diagnosed on the basis of sensori-motor activity. We have identified seven states of cognitive working capacity and selected four levels of tasks that differ in complexity of performance. The software product allows you to determine the probabilistic performance indicators of each level of tasks in accordance with the selected states (Figure 2). Each level of complexity requires a certain qualitative state of informational-analytical skills.

Figure 2
Building an individual educational trajectory of students based on objective indicators of cognitive working capacity



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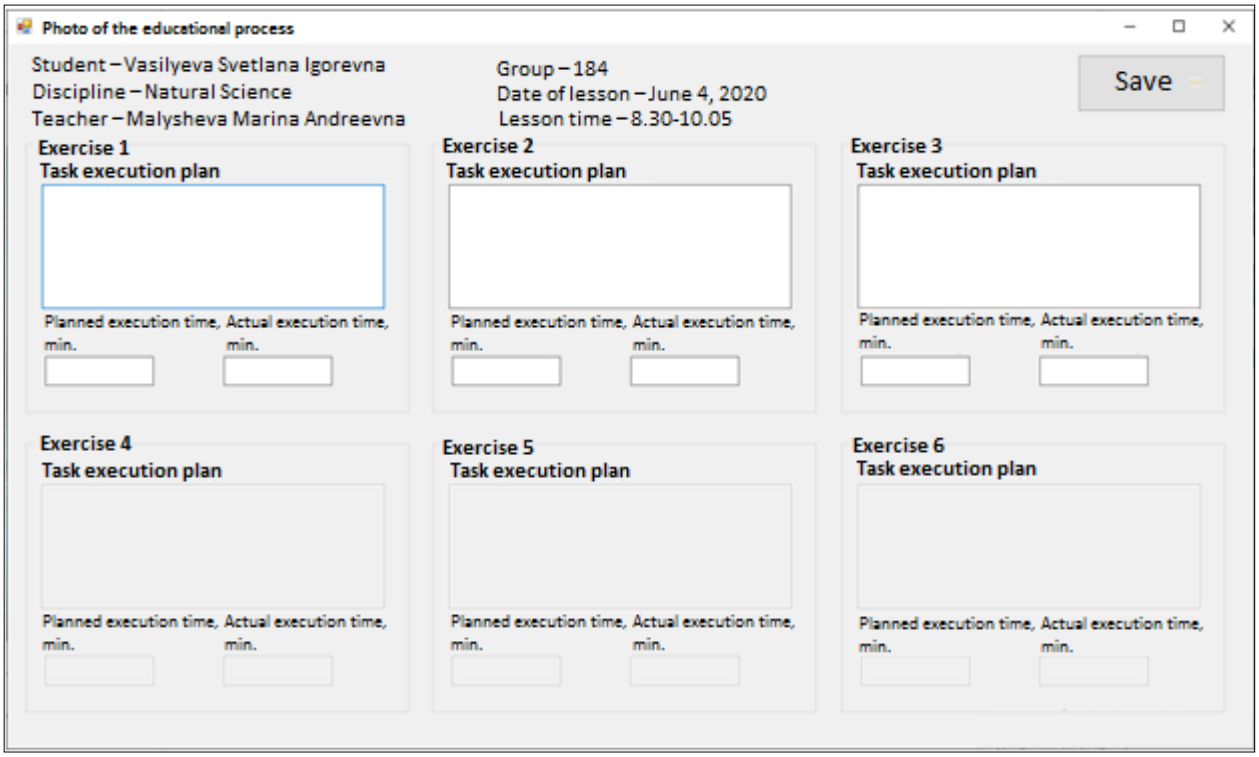
The advantage of this approach is taking into account the individual characteristics of students – the current level of working capacity. However, the main drawback is the fact that the student does not participate in the construction of his own individual trajectory.

One of the approaches in designing an individual educational trajectory can be a time indicator of task completion as a demonstration of cognitive working capacity on the one hand and the level of formation of informational-analytical skills on the other.

We have developed a software module "Photography of the educational process". Using this software product, students will be able to draw up a plan for completing the task independently, determine the time for completing the task, state the actual time for completing the task and reflect on their own activities.

Figure 3

Photography of the educational process as a means of independent construction by the student of the individual educational trajectory



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This software module, firstly, acts as a means of independent construction of an individual educational trajectory, and secondly, it contributes to the formation of informational-analytical skills, since, when working with a given by the teacher task (information), the student uses and therefore develops these skills to draw up a work plan and determine the execution time.

The described software modules can be included in the digital educational environment as auxiliary, but the main question is the following: what are the main components of a digital environment that contributes to the formation of informational-analytical skills?

In the course of the research, we identified the main criteria for the selection and design of software modules of this format: the use of a codifier of informational-analytical skills; modularity, each task can be considered as a separate module, the software product is a module; individualization of training; information support in the form of clearly structured information; formalization of tasks.

We have developed an example of a software module that meets these requirements – "Biomorphological analysis of plants". This software module is designed for laboratory classes in the discipline "Natural Science" for students studying in the areas 44.03.01 Pedagogical education, profile "Primary Education"; 44.03.05

Pedagogical education (with two training profiles), profiles "Primary education. English language", "Primary education. Preschool education", etc.

The individualization of training in this module is implemented in the fact that students can complete tasks at different speeds and choose the amount of used theoretical material. Students can learn to describe plant species, compose biomorphological characteristics of plants, identify the relationship between morphological characteristics and ecological and geographical features of habitat. In the content part of the software product, a plan of biomorphological analysis is presented, a structured theoretical material that allows to compare the analyzed plant with standards and refer it to a specific group according to each trait. Figure 4 shows one of the working forms of the software module interface, Figure 5 is an example of the information support form.

Figure 4
Working form of the program module
"Biomorphological analysis of plants"

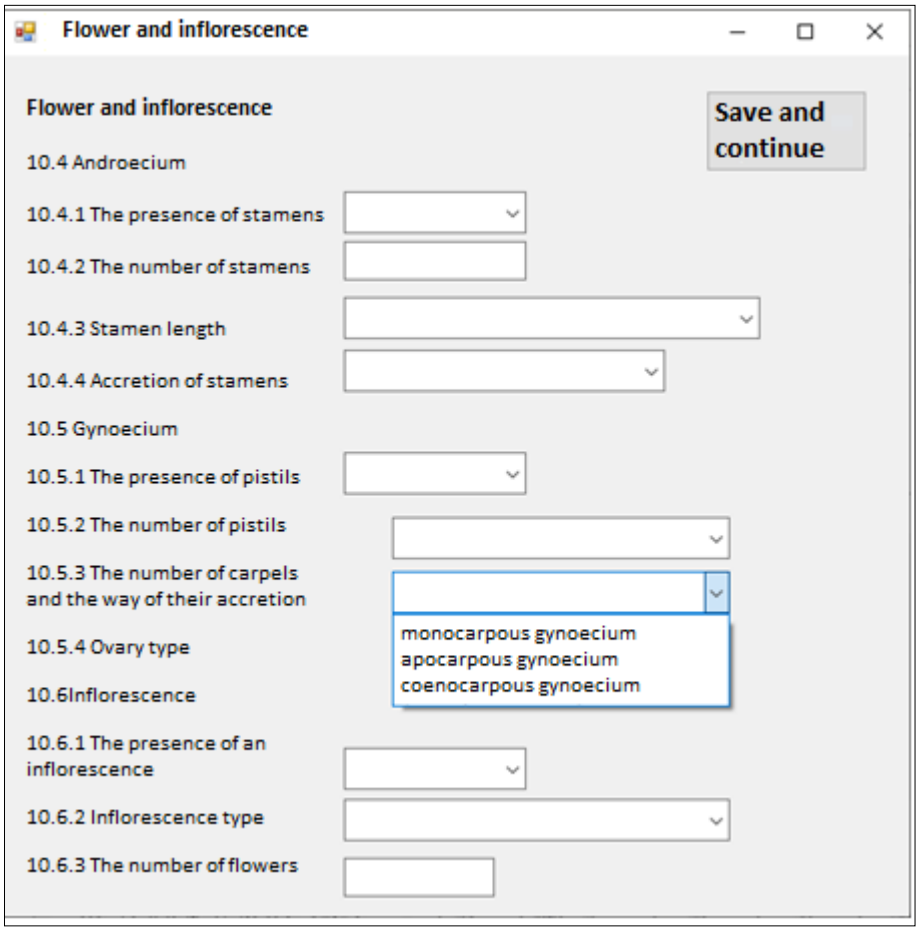

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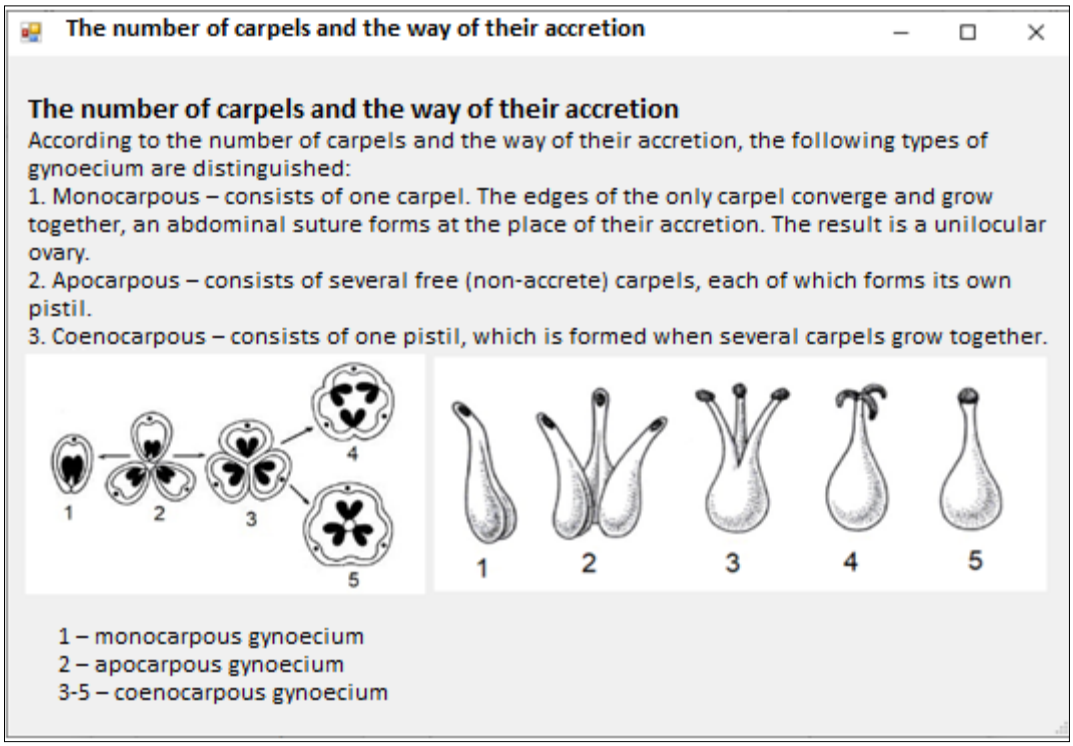
Figure 5
Information form of the program module
"Biomorphological analysis of plants"



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This software module is aimed at the formation of the following informational-analytical skills:

- search for sources of information;

- highlighting the necessary information in the found sources;

- productive reading, highlighting the main idea;

- comparison;

- analysis;

- synthesis;

- abstraction;

- presentation of processed information.

Analysis of curricula and work programs of disciplines shows that similar software products (tasks) can be developed on the basis of tasks for most academic disciplines. At the same time, we do not believe that each program module (task) should be aimed at the formation of all informational-analytical skills included by us in the codifier. The most effective formation and development of informational-analytical skills will be ensured while observing an integrated approach, that is, when combining software modules in all disciplines that meet the criteria we have identified into a single digital educational environment. The software modules "Building an individual educational trajectory of students based on objective indicators of cognitive working capacity" and "Photography of the educational process" should also be included in this environment as a means of increasing the efficiency of building and implementing the individual educational trajectory of students.

4. Conclusions

The study showed that first-year students are dominated by a low level of informational-analytical skills formation. The high density of the relationship between the indicators of the formation of the studied skills and academic performance indicates the need for the formation of these skills.

The organization of teaching students by means of a digital educational environment, the main structural components of which meet certain criteria, as well as the construction of students' individual educational trajectory, which is implemented using both the main and additional software modules of the digital environment, can help to increase the efficiency of the formation of informational-analytical skills.

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