Management of Students' Self-organization in the Context of the Development of Information and Analytical Skills in the Digital Environment


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Abstract

The article reveals the features of the implementation of the developed software product in order to develop the level of future teachers' self-organization in the digital environment. The purpose of this article is to justify the need to implement the developed software product aimed at developing the level of future teachers' self-organization and the formation of information and analytical skills in the digital environment. In order to assess the formation of information and analytical skills, we developed a methodology based on performing operations with text, where each skill was assessed on a scale from 0 to 2. As a result of diagnostics, we found that the majority of students are dominated by a low and medium level of formation of information and analytical skills. As a means of self-organization management, a description of the designed software module was presented, which contributes to an increase in the level of development of information and analytical skills. The authors suggested that the introduction of the developed software product into the digital environment will be aimed at increasing the level of development of information and analytical skills of future teachers. According to the results of the work, the conclusion was made about the effectiveness of the process of forming information and analytical skills of students by using an integrated approach to the selection and compilation of tasks and building a unified digital environment.

Keywords: Digital Environment, Information and Analytical Skills, University Training of Teachers, Self-organization.

Introduction

The digital transformation of Russian education will inevitably lead to changes in the field of updating the content of teaching staff training. The transition from the assessment of knowledge, skills and abilities to the formation of universal competence in future teachers is one of the most important tasks of professional pedagogy. The solution to this problem is largely

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associated with the introduction of a digital educational environment, which is characterized as a complex multifunctional system containing innovative teaching technologies, information resources and electronic means of communication that meet certain criteria and contribute to the formation of the necessary skills. Studying the structure of the digital educational environment in domestic and foreign scientific research, it is necessary to note its importance for professional communication and exchange of experience in teaching students (Abrosimov, 2005; Zakharova, 2003; Lobachev, 1999; Soldatkin, 1999; Tikhomirov, 1999; Khutorskoy, 2003; Kholodkova, 2009; Jeffrey, 2001; Kaszap, 2001; Lemire, 2001 and others).

The analysis of the research showed that the digital educational environment is the most important tool that affects the management of self-organization of students. The diversity of the content of the concept of self-organization is explained by the systemic nature of the psyche, manifested in the sensory-perceptual organization, individual-personal orientation and variability of the student's activity, etc. (Vorobyova, 2012; Kopeina, 1983; Loginova, 2012; Mikhnevich, 2012; Hasan, 2010; Crocker, 2010; Rousseliere, 2010; Dumont, 2010; Hale, 2010; Srinivas, 2010; Osteen, 2011).

The first studies on the relationship of self-organization with learning activities and professional knowledge, skills and abilities were to describe the optimization of the student's workload (Golneva, 1972; Ishkov, 2004; Kapustin, 2005; Klochko, 2005; Kostromina, 2010; Kopeina, 1983; Laudis, 1991; Faleeva, 2012; and others). At the present stage, studies of the psychological and pedagogical aspects of self-organization are associated with the presentation of the prerequisites and conditions for the formation of the student's ability to self-organization.

The presence of disagreements between scientists regarding the interpretation of the concept of "self-organization" allows us to draw a conclusion about the variety of approaches to the definition of self-organization as a characteristic of a person; personality abilities, acmeological characteristics of the subject of activity. When characterizing self-organization, one should proceed from the following approaches that have been identified by scientists: personal (Dyachenko, 1998; Kandybovich, 1998; Kopeina, 1983, etc.); activity (Elkanov, 1995; Kuzmina, 1995; Ustinova, 2000; etc.); personality-activity (Amirova, 1993; Aryanina, 1998; Kotova, 2008, etc.).

The selected approaches contribute to a comprehensive presentation of the self-organization process, reflecting several positions that complement each other in characterizing this concept. Describing self-organization from the point of view of a personal approach, it is necessary to highlight the complex of individual characteristics of a student, ensuring his ability to organize his own activities to solve the assigned tasks. The activity approach is aimed at considering self-organization as a process that includes a complex of interrelated operations, skills and abilities necessary for the successful independent activity of a student. Considering self-organization in the framework of the personality-activity approach, it is necessary to present a set of individual characteristics of a student and operational skills that affect the result of the activity. The technical approach serves as the basis for understanding self-organization from the point of view of developing and presenting techniques and techniques that help to increase the effectiveness of the student's organization of their own activities, the correctness of the actions performed, non-standard and creative approach to building the structure of actions.

Describing self-organization within the framework of the above approaches, it is worth determining the skills and abilities of self-organization that characterize the structure of the student's personality in the activity. Mikhnevich S.N. under the skills of self-organization understands a complex of personal actions (planning, organization, control, assessment) based on educational knowledge, the specifics of organizational activities and manifested through self-regulation, allowing effective sociocultural design.

A. B. Klimova connects the effectiveness of self-organization of the student's educational activity with the level of development of information and analytical skills, which are determined by the methods of working with text information: search, analysis, evaluation, processing, reflection of text information. Analyzing the student's work with text information, M.L. Kusova and S.V. Plotnikova identified the following necessary information actions in the process of working with the educational text: information request; search for a source of information; pre-text processing, informed choice of the source; extraction and understanding; post-text processing and interpretation; control and evaluation of the results of information activities. N.D. Zhilina and L.D. Tarenko, developing the structure and highlighting the features of the formation of information and analytical skills at various levels of education, believed that it was necessary to apply developmental tasks using information technologies.

Foreign researchers (Bezanilla, et al., 2019; Enniss, 2001, etc.) often divide information and analytical skills, where they pay special attention
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Materials and Methods

In order to substantiate the need to use a digital environment to increase the level of development of information and analytical skills in future teachers, we conducted a scientific research on the basis of the South Ural State Humanitarian and Pedagogical University. At the theoretical stage of the research, we analyzed the literature to develop criteria for the selection of components of the digital environment for the formation of information and analytical skills of students. The codifier of information and analytical skills developed by us is based on the traditional algorithm for working with information (search, processing, storage), where the stage of storing information is omitted by default, and the stage of processing is represented by reproductive-productive transformation and heuristic transformation of information. Each described stage of information and analytical skills (information search, reproductive and productive transformation, heuristic transformation) includes a set of skills, which are presented as follows (Figure 1).

![Figure 1. Codifier of information and analytical skills](image)

To diagnose the formation of information and analytical skills, we interviewed 96 first-year students studying in pedagogical areas. As a result of diagnostics, we found that the majority of students are dominated by a low and medium level of formation of information and analytical skills (53.4% and 27.6%, respectively). In order to increase the level of formation of information...
and analytical skills among university students, we recommend using special tasks and software modules, which are based on our codifier of skills.

As an example, we will give the program module “Passport of the student's somatic health” (certificate of state registration of the computer program No. 2020610839 dated 01.21.2020), which was specially developed by us for laboratory work in the discipline "Age anatomy, physiology and hygiene". The laboratory work developed by us is based on the principle of assessing the physical condition of a person, which includes the method of standards and the method of indices and involves the implementation of the following activities: studying theoretical material, performing measurements, calculations.

When starting to work with the software module, the student must enter his personal data (last name, first name, gender, age), which will be automatically reflected in the report indicating the purpose of the laboratory work, the necessary equipment and basic theoretical concepts. Further work with the software module is built in pairs based on the use of additional measuring equipment and guidelines for performing measuring operations. Choosing the appropriate method by clicking on the name, the student receives individual initial data for further calculations, which are necessary to perform the assessment of the physical condition by the method of standards and the method of indices. In the process of completing this task, the student needs the following information and analytical skills, which are formed and used at this stage:

- Productive reading, highlighting the main idea;
- Processing of numerical data, performing calculations;
- Work with tables;
- Comparison;
- Abstraction;
- Presentation of processed information.

Assessing physical development by applying the method of standards and building a profile of physical development, the student should fill out the appropriate table (Figure 2).

![Building a physical development profile](image)

**Figure 2.**

**Task number 2: an example of calculating individual deviations of indicators from the norm**

The data obtained in the table are lined up in accordance with the previous measurements and the table of indicator norms, where the student must calculate two indicators independently, entering the calculated results into the corresponding cells. The verification of the obtained calculation results is carried out automatically, after the correct execution of the calculations, the student has the opportunity to perform further tasks, having familiarized himself with the essence of the standards method. Based on the data of measurements and calculations and the obtained profile of physical development, the student should summarize the results and enter them in the report on laboratory work.

When completing this task, the student will use the following information and analytical skills:

- Productive reading, highlighting the main idea;
- Processing of numerical data, performing calculations;
- Work with tables;
- Comparison;
• Presentation of processed information. The result of the work done by the student is the automatic construction of a graphical model - the profile of the individual's physical development (Figure 3). Based on the study of methodological recommendations, the student needs to perform an assessment of physical development while maintaining the schedule for the report.

![Physical development profile of an individual](image)

**Figure 3.**
An example of an individual's developmental profile

Work at this stage is accompanied by the formation and application of the following skills:
- Productive reading, highlighting the main idea;
- Processing of numerical data, performing calculations;
- Work with diagrams;
- Comparison;
- Generalization;
- Systematization. To assess physical development using the index method, the student must calculate the body mass index (Quetelet index II), performing an assessment of the physical condition (Figure 4). The Rohrer index is calculated and evaluated in a similar way.

![Metaragencies](image)

**Figure 4.**
Assignment № 3: an example of assessing physical condition using the index method
To complete this task, the student will need the following skills:
- Productive reading, highlighting the main idea;
- Processing of numerical data, performing calculations;
- Work with tables;
- Comparison;
- Generalization;
- Systematization;
- Presentation of processed information.

As a result of the laboratory work performed, a report is automatically generated, in the template of which the topic of the work, the goal, the methods used, the main data and the results are entered. The generated report is saved in a format compatible with MSWord, with the possibility of further editing.

At the final stage of writing a report, it is important for a student to have the following skills:
- Comparison;
- Synthesis;
- Generalization;
- Systematization;
- Presentation of processed information.

The process of forming information and analytical skills and their application when performing various stages of laboratory work should be presented in the form of a matrix (Table 1):

### Table 1

<table>
<thead>
<tr>
<th>Information and analytical skills matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

It is obvious from the matrix of information and analytical skills that when performing this laboratory work in a software environment, the student will have formed most of the skills of the second and third groups of the codifier, the skills of the first group are used to a greater extent when working with theoretical material.

### The Discussion of the Results

To develop the content of tasks for practical and laboratory work in academic disciplines, it is necessary to highlight such criteria as:

1. Modularity (each task is a separate module).
2. Informativeness (completed tasks serve as a source of some information).
3. Independence (independent search for sources of information and the allocation of information in them necessary to complete the assignment).
4. Effectiveness (the result of the work is a report containing the results of work with information at all stages and the received “new” information).
5. Individuality (the ability to complete tasks with your own speed and pace of work).

It is important to emphasize that, on the one hand, in many academic disciplines it is possible to present tasks that will be aimed at the formation of most of the skills indicated by us in the codifier and implement them

programmatically, but, on the other hand, the design of tasks necessary for the development of absolutely all skills, is a rather complicated process, so we consider it impractical.

### Conclusion

The developed software module contributes to the formation of a universal competence for the implementation of search, critical analysis and synthesis of information, the use of system approaches to solve the assigned tasks.

In a digital environment, the developed software product can be considered as an effective tool for the formation of information and analytical skills of students.

The further prospect of the research is determined by the development of software modules that will structure the content of the academic discipline in the context of the formation of information and analytical skills.

The general strategy for the implementation of the content of academic disciplines of the educational program can be determined by the structured assignments.

Thus, the effectiveness of the process of formation of information and analytical skills of students is determined by an integrated approach to the selection and preparation of tasks and the construction of a single digital
environment, which will ensure the systematic formation of these skills.

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