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The Mentoring System as a Factor in the Sustainable Development of Higher Education

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ABSTRACT
The work examines the mentoring system as a mechanism for implementing continuity in education, which effectively contributes to the sustainable development of higher education. The authors propose a concept for the formation of this system, which is interpreted as a system of connections that dignifies the entire educational environment of the university and covers all areas of work. The work formulates the principles that determine the construction and functioning of the system in any of its models, provides a list of skills, abilities, competencies that mentors and their wards must possess for the successful implementation of mentoring in any areas of work. Particular attention is paid to the model of mentoring in the organization of practice-oriented scientific work of students, in particular, project activities. The experience of using this model at the Ural State University of Economics (Yekaterinburg, Russia) and its effectiveness are discussed.

Keywords: *continuity, mentoring model, project activities, bloom's taxonomy.*

1. INTRODUCTION

Continuity is the most important condition for dynamic long-term progress in a given direction. Reliance on previous experience, which is being transformed by each new generation, has always been one of the imperatives for the development of various spheres of Russian culture and above all science and education. The strong traditions laid down in the era of the Enlightenment (starting from the second half of the 18th century) survived even during the period of radical revolutionary changes in the first half of the 20th century and ensured the intensive successful development of Russian science and education. The specialists trained by Soviet universities showed high competitiveness and were in demand in the labor markets of various countries. Student scientific societies (SSS), student design bureaus (SDB) actively functioned in the Soviet higher school. Starting from the first year, students were involved in work in SSS and SDB. They developed research projects under the guidance of teachers, researchers and engineers and presented them to various authorities. In essence, these were organizational forms of the implementation of continuity, effectively contributing to the development of students' creative abilities, the formation of research skills and participation in presentation events.

The most common formats for the final state certification were diploma research works and design projects. A sufficiently high-level specialist (with a candidate or doctor of science degree) usually supervised their development. Continuity took place here as well, since the “graduate student” was in direct contact with a graduate student of the same supervisor. It should be emphasized that all this activity was carried out at the most serious level and was not imitative or playful in nature.

The effectiveness of SSS and SDB gradually began to decline during the years of "stagnation" (late 70s – early 80s), and these formats of work with students practically ceased to exist during the perestroika period, in the process of countless educational reforms with a widespread transition to the bachelor's system. They were replaced by project activities, business games, trainings, etc., united by the abbreviation RWS – research work of students, organized and directed by teachers. Although there were sometimes notable achievements within its framework, RWS was predominantly educational in nature: information search dominated in project activities, business games mainly imitated problematic professional situations and tested options for their well-known solutions. All this, to a certain extent, contributed to an increase in the level of motivational activity, the development of professional skills and abilities, and, in general, the effectiveness of the learning process. However, the competence-based approach, which is the basis of the modern paradigm of education, provides for the formation of universal and professional competencies specified in the state educational standards developed for each area of training. Competencies presuppose the presence not only of the traditional «knowledge-skills-competences» triad, which determined learning outcomes within the framework of the previous educational paradigm, but also a fairly diverse application of this triad, i.e. certain experience of real work. Its imitation cannot provide the required experience. At the same time, a number of problems are associated with the activities of a university teacher in the new conditions. They consist in the need: to constantly improve in the field of the taught discipline, processing ever increasing volumes of information; master rapidly developing, often radically changing tools and learning technologies; meet the increasing demands, determined by numerous quantitative indicators of performance. The direct interaction of the teacher with the students is constantly and significantly complicated. Most recently, the situation has worsened due to the pandemic and the resulting transfer of all types of training sessions to a distance format. Although a significant number of universities technically provided this transfer, however, with the dominance of this format, effective work is technologically and methodologically difficult for most students and teachers. All this negatively affects the quality of the results of the educational process, the stability of the educational system in general and higher education in particular. These factors determine the need to emphasize the independent work of students, which is the most important attribute of the modern paradigm of education, contributing to the development of knowledge economy [1]. This work, especially in a remote format, should be part of an optimally organized controlled process. The problem of continuity arises with particular urgency here.

It seems that the proliferation of the mentoring system can provide a constructive solution to this problem. Mentoring is not a new phenomenon in the educational process. It has a long history dating back to ancient times and even deeper. The special influence of mentoring on intellectual development was noted by many outstanding scientists, including A. Einstein [2]. In fact, the functioning of the aforementioned SSS and SDB relied heavily on mentoring. The relevance of studying and applying the mentoring model is evidenced by numerous scientific publications in Russia and abroad. Numerous scientific publications in Russia and abroad testify to the relevance of studying and applying the mentoring model. Most of the research is devoted to mentoring in the professional sphere (medicine, pedagogy, etc.), when established professionals share their experience with beginners [3-5]. In publications describing the activities of mentors in higher education, the fruitfulness of "equal" mentoring is emphasized, when an undergraduate student supervises a junior student [6-8]. Equality of status creates favorable conditions for the exchange of experience. Mentoring is also widespread in the scientific field [9, 10]. The widespread use of computer technology has provided the possibility of electronic (online) mentoring, which has become especially relevant recently in the context of a pandemic [11, 12]. There are a number of models of mentoring - from traditional (“one-on-one”) to team (a team of mentors for a team of mentees) [13, 14], and depending on the goals and conditions of the educational process, a specific model or their combination can be used. However, the modern educational environment of the university, being a complex system influenced by many factors, requires a systematic approach to organizing the functioning of all its components, including mentoring. It seems that just such an approach is appropriate for ensuring the sustainable development of this environment.

In connection with the above, the purpose of this study is to develop the concept of a mentoring system in a modern university. The tasks of the work include identifying the principles underlying the organization of this activity, considering some models of mentoring, generalizing the experience of mentoring in organizing the educational process in the natural sciences – chemistry and physics – at the corresponding department of the Ural State University of Economics (USUE) (Russia).

2. MATERIALS AND METHODS

The methodological basis of this work includes a number of approaches: system-synergetic, which interprets mentoring as a complex system with numerous direct and feedback links, integrated into the educational environment of the university; personal-hermeneutic, regulating the communicative aspects of the interaction of subjects; structural-functional, which determines the construction and distribution of functions of subjects in the used mentoring model.

The object of the research was the scientific and educational process, implemented by the Department of Physics and Chemistry, USUE. The research participants were students enrolled in the bachelor's programs "Biotechnology", "Applied Informatics". Ethical aspects related to student participation are respected in accordance with the rules established by the 1975 Declaration of Helsinki.

3. RESULTS AND DISCUSSION

The following concept of the mentoring system is proposed. Mentoring is interpreted not as a dedicated cluster in the organizational structure of a university, but as a system of direct and feedback links that permeates its entire educational environment and encompasses all areas of work: educational, scientific, educational, organizational, etc. The goals of mentoring are different for different areas of work, and the models used may also differ, but the basic principles of mentoring are the same for all models of its implementation. All models include 3 levels of activity of participants with respectively 3 statuses: manager (specialist, in particular, teacher), mentor (senior student, graduate student), trainee (ward, in particular, junior student).

The following principles can be distinguished:

— integrity, which determines the relative independence of all participants in the process and the correlation of their joint actions, due to the unity of the main goals;

— parity, according to which, on the one hand, there is a vertical hierarchy with observance of a certain subordination due to differences in the status of participants and the measure of their responsibility, on the other – partnership, taking into account the interests of everyone, a harmonious combination of these relationships guarantees effective interaction;

— continuity, providing a consistent transmission of the experience of activity, cultural and moral values, which is the essence and meaning of mentoring;

— fractality, revealing the analogy of the tasks to be solved and the nature of work on different scales, carried out by participants at different levels;

— situationality, indicating the need to consider real topical problem situations in science, economics, culture, education of youth, etc.;

— personal growth, orienting work in the mentoring system towards the formation, improvement and self-improvement of personal qualities, which can be the main task or be carried out in the course of solving other problems.

Depending on the direction of the work and the model used, the contingent of mentors is formed:

— a leader who attracts the most prepared and successful senior students to this activity – as a rule, using the traditional «mentor-learner» model in research work;

— student asset, acting under the direct supervision of the dean's office (or a similar structure) – when using the group model "mentor-group of trainees".

The implementation of the above principles in any mentoring model provides that mentors and trainees have a number of the skills that are improved in the process of joint activities.

In relation to a mentor, the most essential are:

— the ability to clearly understand the goal and tasks set by the head, to formulate, based on them, the goal and tasks of the trainee's work;

— the willingness to demonstrate the qualities, skills, processes mastered by the ward and motivate him to work by his own example with an appropriate emotional coloring (sincere interest, conviction, inspiration, or, on the contrary, calmness – depending on the situation, the specifics of the activity and the model of mentoring);

— the ability to plan your work, including work with the ward;

— the skill to develop and deliver instruction (formal and, especially, informal), describing the actions of the trainee, if possible, step by step;

— the skill of searching for information resources and orientation in them to provide appropriate assistance to the trainee;

— the ability to use the techniques, tools required for work, to demonstrate mastery of them in a regime favorable for the perception of the trainee;

— the willingness and ability to generate and strengthen trust by spending enough time with the trainee, if possible meeting his expectations, delving into his needs and satisfying them, fulfilling the assumed obligations (promises), taking into account gender, psychological and other characteristics of the trainee;

— the willingness to provide correct feedback: tactfully to resolve controversial issues, to substantiate disagreement with arguments, to make specific comments, respecting the dignity of the learner, to show tolerance in relation to some deviations from the usual behavioral aspects;

— the ability to manage relationships, to see, to understand the risks and to assess the possibilities of their prevention;

— the willingness to constantly stimulate the learner, encourage his initiatives and insignificant successes;

— the skill of assessment and self-assessment: highlighting strengths and weaknesses, points of the growth;

— the willingness to expand the social circle of the ward in the relevant field, to share their contacts and to provide assistance in establishing contacts.

In turn, the student must show:

— the interest in the subject of work and in its results;

— the desire and ability to actively perceive the material presented by the mentor, to understand accents expressed in non-verbal language (gestures, facial expressions, glances);

— the intention to ask questions in order to penetrate the essence of the problems under consideration and find their possible solutions;

— the tenacity in mastering methods, tools of work, necessary for its implementation;

— the self-criticism and constructiveness in the perception of critical assessments from a leader or mentor;

— the discipline and patience with continuous step-by-step development of the skills and abilities during routine work;

— the willingness to rationally treat various work results, including negative ones, and their long absence;

— the initiative, striving for the independence.

Leaders are at the head of mentoring. They initiate all types of activities, choose mentoring models, interact directly with mentors and trainees, and organize their interaction.

A university is a scientific and educational institution. This area of activity of the teachers and mentors is dominant. From the standpoint of modern pedagogy, the training of a qualified, competitive, creative specialist is guided by the goals of cognitive activity, represented by Bloom's taxonomy [15]. The transformed hierarchy of these goals (transformed Bloom's taxonomy) for 4 areas of the student's cognitive activity, led by a mentor, is shown in Table 1.

To achieve these goals, it is appropriate to use the traditional mentoring model. At the same time, it is desirable that the leader or mentor have practical experience of work outside the university, in particular, a master's student or postgraduate student with such work experience can be involved as a student's mentor.

Within the framework of the described concept, a practice-oriented project activity of students is organized at the Department of Physics and Chemistry of USUE [16]. For example, we can consider the organization of work on the original interdisciplinary project "Virtual laboratory of electron microscopy and its use in a practice-oriented educational process in physics." The project manager is an associate professor of the department, a mentor is a postgraduate student, a trainee is a 2nd year undergraduate student in the direction of "Applied Informatics". The functions of all participants at each stage of project development are presented in Table 2.

A similar model was used when organizing work on other projects ("Practice-oriented educational process using a chemical laboratory on the cloud", "Virtual electrochemical laboratory for the analysis of food and non-food products", "Virtual potentiometric method of analysis in a practice-oriented educational process"), which formed the basis of a virtual laboratory workshop in physics and chemistry [17]. The high level, relevance and efficiency of projects are confirmed by obtaining the corresponding patents and certificates of registration of intellectual property. The implementation of projects in the scientific and educational process contributed to ensuring its sustainability during a pandemic.

4. CONCLUSION

Mentoring is an effective way of transferring experience, contributing to the career growth of specialists, the accelerated formation of skills in various types of activities. The concept of the mentoring system outlined in the work was developed to implement the main areas of work in higher education. It is quite versatile and can be used at various levels of education, including pre-university, postgraduate, in any professional cluster. The model of mentoring presented on the example of the organization of project activities of USUE students demonstrates the role of a mentor not only as an intermediary between a leader and a student, but as independent researcher, whose activities increase the effectiveness of the scientific and educational process at the university. Mentoring, as the most indicative format for the implementation of continuity, should contribute to the sustainable functioning of the university, especially in the context of radical changes.

Table 1. Bloom's taxonomy of educational goals as applied to various cognitive areas of mentoring in the organization of scientific and educational activities.

Cognitive areas / Goals (according to Bloom)	Factual	Conceptual	Activity	Creative
Memorization (recognition)	Perception	Questions	Search	Consideration
Comprehension	Interpretation	Discussion	Research	Conclusion
Application	Classification	Study	Designing	Involvement
Analysis	Comparison	Examination	Specification	Overview
Evaluation	Selection	Evaluation	Recommendations	Decision
Creation	Systematization	Conceptualization	Proposals	Theorizing

Table 2. Functions of the participants in accordance with the mentoring model used to organize the project activities.

Stage of project work	Functions of the participants		
	teacher	mentor	student
Determining the direction of the disciplinary area	Development of recommendations for the mentor and student	Acquaintance with the interests, level of knowledge of the student in this area, study of the teacher's recommendations, development of recommendations for the student	Comprehension of recommendations, information search, decision making
Formulation of the topic, goals and objectives	Discussion of the problem state, goals of work with the mentor and student	Studying the problem, determining the directions for its solution, advice on choosing a topic, goal and setting goals	Studying the state of the problem, making decisions about the topic, goals and objectives, coordinating them with the mentor and teacher
Drawing up a work plan	Assessment of the scope and possible terms of work, preparation of technical specifications	Understanding the technical task, drawing up a plan for its implementation, a plan of work with a student, assisting the student in drawing up a plan	Drawing up a plan and agreeing it with a mentor and teacher
Choice of methods and tools	Providing methodological and technical base	Demonstration of the use of the methodological and technical base. Student training (step by step if necessary)	Mastering techniques and tools, developing the skill of using them in work on a project
Project development	Monitoring work on each part of the project, discussion with a mentor and student, operational assessment	Monitoring work on parts of the project, operational adjustments, tips for improvement and optimization	Consistent development of the project, testing the sustainable functioning of each part
Analysis of work results	Monitoring of work on the project, discussion of each part and the entire project	Monitoring work on parts of the project, helping to analyze the results, tips for improvement and optimization	Analysis of the results, their coordination with the mentor and teacher
Formulation of conclusions, development of recommendations	Assessment of conclusions and recommendations, proposals for their correction	Summing up tips, formulating conclusions and making recommendations	Formulation of conclusions, development of recommendations, agreement with a mentor and teacher
Project presentation and evaluation	Elaboration of evaluation criteria, organization of events (including public ones) upon project presentation	Proposals for the presentation of the project	The choice of the format for project presentation, its approval, preparation for the presentation
Project approbation	Determination of formats, sites of approbation and organization of approbation events. Assessment of project implementation prospects	Assistance in preparing for approbation, in assessing effectiveness	Preparation for approbation, participation in approbation, assessment of its effectiveness
Project promotion	Identification of opportunities and ways of promotion. Building contacts. Resolving issues of registration of intellectual property	Exchange of promotion experience, provision of existing contacts	Gaining experience in establishing contacts, participating in the promotion process

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