

Structures and Models Formation of Scientific Competencies of Students in the Process of Continuous Vocational Education

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Abstract--- *This article presents the results of the study, which was conducted on the basis of Nosov Magnitogorsk State Technical University. The theoretical foundations of the formation of research competencies of students in the process of continuing professional education are outlined. In the process of conducting experimental work, a model was developed for the formation of students' research competencies, the requirements for the development of which are presented in the article. The pedagogical conditions for the effective formation of students' research competencies, the stages of continuing education are given and thoroughly substantiated. The proposed methodology was developed taking into account the selected principles and levels of research competencies of students, given in the article and corresponds to different stages of training. At the same time, the methodology for the formation of research competencies of students in the process of continuous professional education has a certain structure: the goal, the participants (teachers and students), the learning process in the NGO process and the result. Studies show that distance learning is of the greatest interest for professional development. Therefore, the article pays special attention to distance learning and innovative teaching methods that affect the final result of the experiment, which is given in the form of tabular data.*

Keywords--- *Research Competence, Professional Education, Experimental Work, Forming an Experiment, Pedagogical Conditions.*

I. INTRODUCTION

The development of research activities in all spheres of life also affects the need for active, independently-minded specialists, who, along with the ability to adapt to emerging conditions, could change them taking into account the new situation of professional activity, would be able to adequately assess the changes that occurred, have experience in self-fulfilling research competence [1]. This leads to a complication of the mechanisms of education and, accordingly, the activities of people engaged in this field [2]. The initial base of research on the formation of research competencies of students (hereinafter referred to as RCS) in the process of continuing

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professional education (hereinafter referred to as CPE) is described in M.M. Gladysheva's works [3, 4].

As a goal, we have defined the formation of students' research competencies (hereinafter RCS) in the process of continuous professional education (hereinafter referred to as CPE).

Important for the formation of RCS is the activity of the teacher. The teacher with the help of the developed methodology and personal interaction with the student helps to achieve the highest result in the formation of RC and the personality of the future specialist. At the same time, the result of the research work should be a certain level of RCS formation in the CPE process.

II. MATERIALS AND METHODS

Analysis, comparison, the principle of objectivity, the nomination and testing of hypotheses, stating and forming experiments.

In the process of conducting experimental work, a model of RCS formation in the CPE process has been developed. When designing the model, the levels of RC formation and stages of continuing education were highlighted. Also, a certain predictable result corresponded to each level of RC.

When developing the model, the following requirements were taken into account:

1. The quality of students' training should meet the modern needs of society;
2. The levels and stages of the formation of RCS in the process of CPE s;
3. The results of the ascertaining and formative experiment.

III. RESULTS AND DISCUSSION

The effective functioning of the RCS formation model in the CPE process is determined by the implementation of pedagogical conditions that influence the organization of the educational process, making it more interesting and rich in creative situations. Continuous learning process allows you to prepare professionals who are able to apply their knowledge and skills in practice at different levels of training. [5, 6]. When identifying and justifying pedagogical conditions, the conditions given in Figure 1 were taken into account.

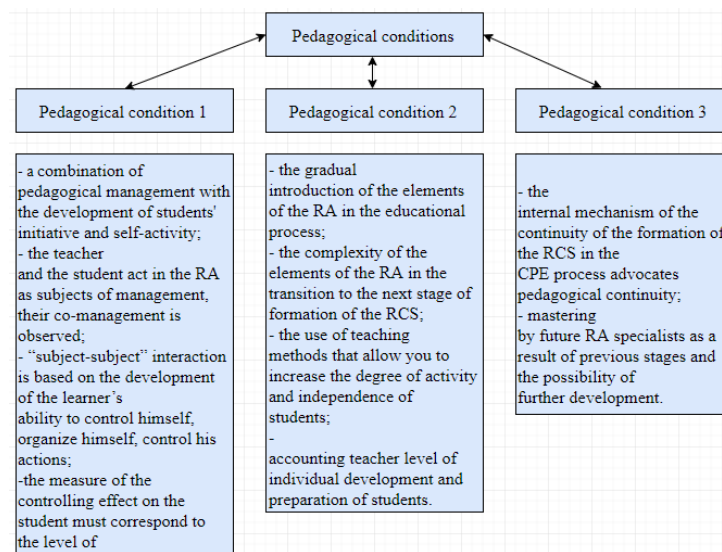


Figure 1: Pedagogical Conditions

The method of RCS formation was developed in an integrated manner in the process of CPEs and revealed within the developed model, which is an example of a structurally informative type and the pedagogical conditions of effective RA formation highlighted above. At the same time, the method of forming a RCS in CPE process contains a certain structure, which includes teachers and students, who in the process of lifelong education go towards the achievement of the set goal.

We formed the RCS in accordance with the following steps, principles and requirements presented in Figure 2.

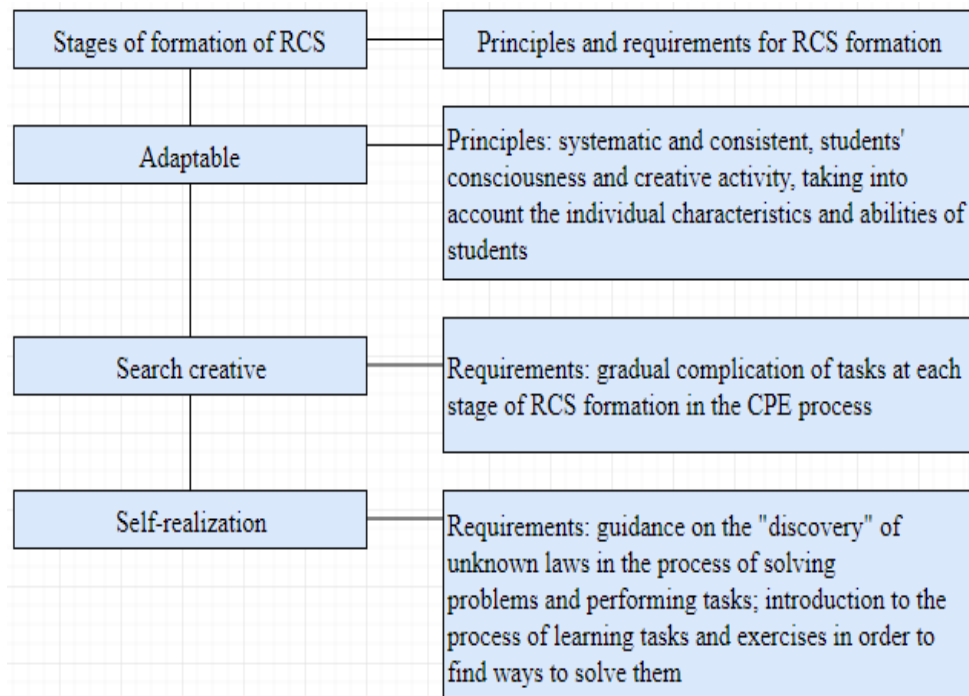


Figure 2: Stages, Principles and Requirements of the RCS Formation

The model development process took into account the interconnectedness and integrity of all components. All components of this model implement the specified function in a complex, depending on other components included in this model. In this case, the end result is the development degree of RCS, to which all components of the model in the CPE process aspire. The formation of RCs depends not only on the developed model, but also on the methods that are different at each stage of continuous education, as well as the pedagogical conditions, principles and requirements for future specialists.

The method of forming RC was developed in stages, taking into account the principles and outlined requirements (Fig. 3).

The advanced training of professionals already working at the enterprise is important at the stage of self-realization. The studies show that distance learning is of the greatest interest for professional development.

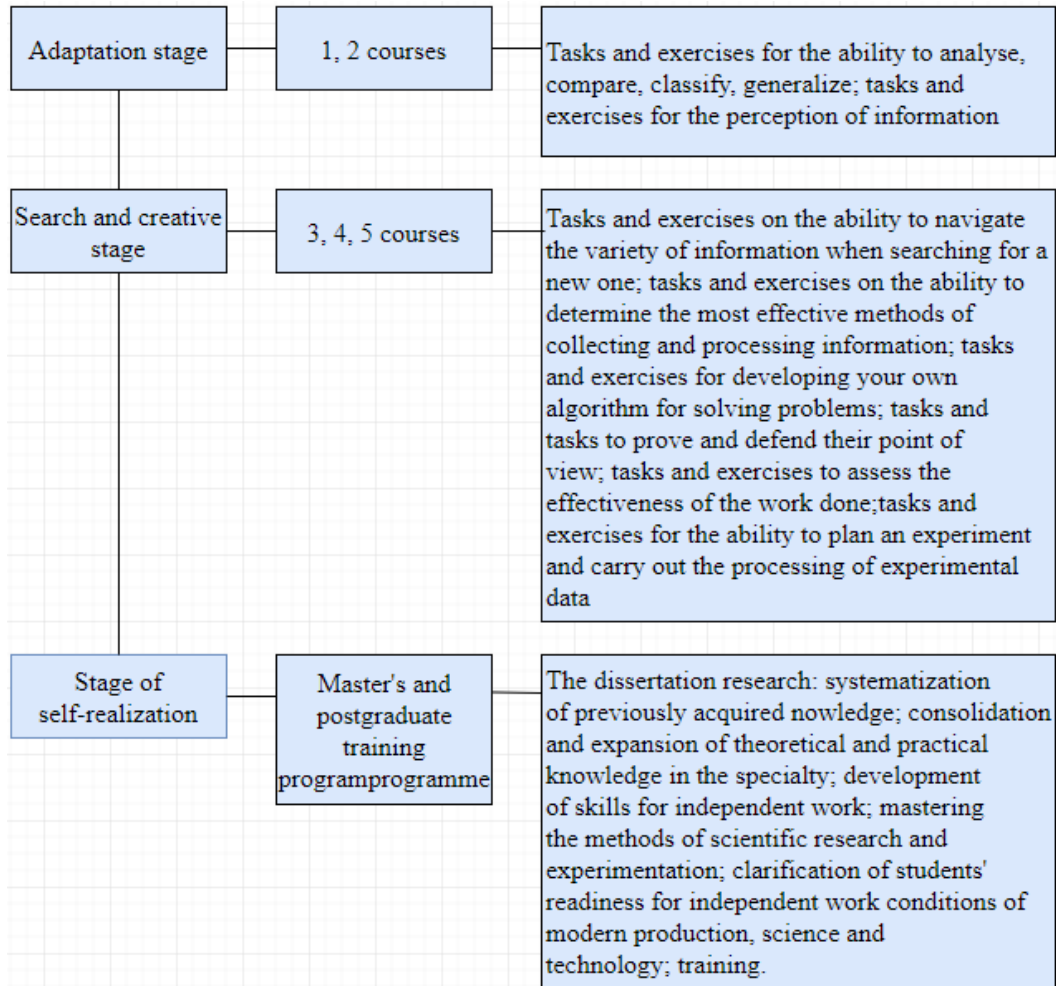


Figure 3: Methods of Formation of RC

In the process of RC formation at the stage of self-realization, distance education is important. The main features of distance education are shown in Figure 4. At the same time, Nosov Magnitogorsk State Technical University created a distance learning system (DLS), embedded in the educational portal of the university [7].

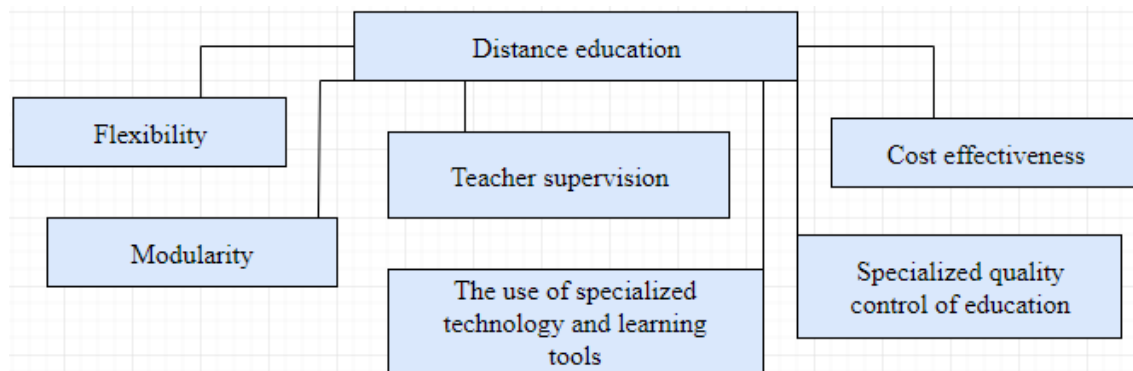


Figure 4: Distance Learning

This distance learning system assumes the following categories of users and their activities (Table 1).

Table 1: DLS Users

<i>User</i>	<i>Activity</i>
Administrator	Registers users in the system, creates and accounts training groups and courses, including students and teachers, assistants and examiners. In order to protect data and information he creates backup copies of courses and the current state of the system.
Teacher	He develops lectures, practical and laboratory work on a specific course, organizes and conducts classes with students, keeps a attendance journal in the DLS, conducts testing, and discusses with students specific questions in the course.
Trainees	They are trained in courses provided by the DLS: they study lectures, perform laboratory and practical work on the course, give feedback to the teacher, participate in the discussion process, pass tests, take tests and exams.
Assistant	He is an assistant teacher, advises students on specific issues of the discipline, coordinates the topics of discussions.
Examiner	Checks the results of laboratory and practical work, tests and corrects the marks made by the DLS.
Guest	On the DLS website there is an opportunity to undergo trial training even for an unregistered user who is a guest.
Curator	The teacher, who is the curator of the group, has additional features: communication and control with students of the supervised group, access to personal data of students.

The tools of the DLS users are developed for both the teacher and the student and are presented in Figure 5.

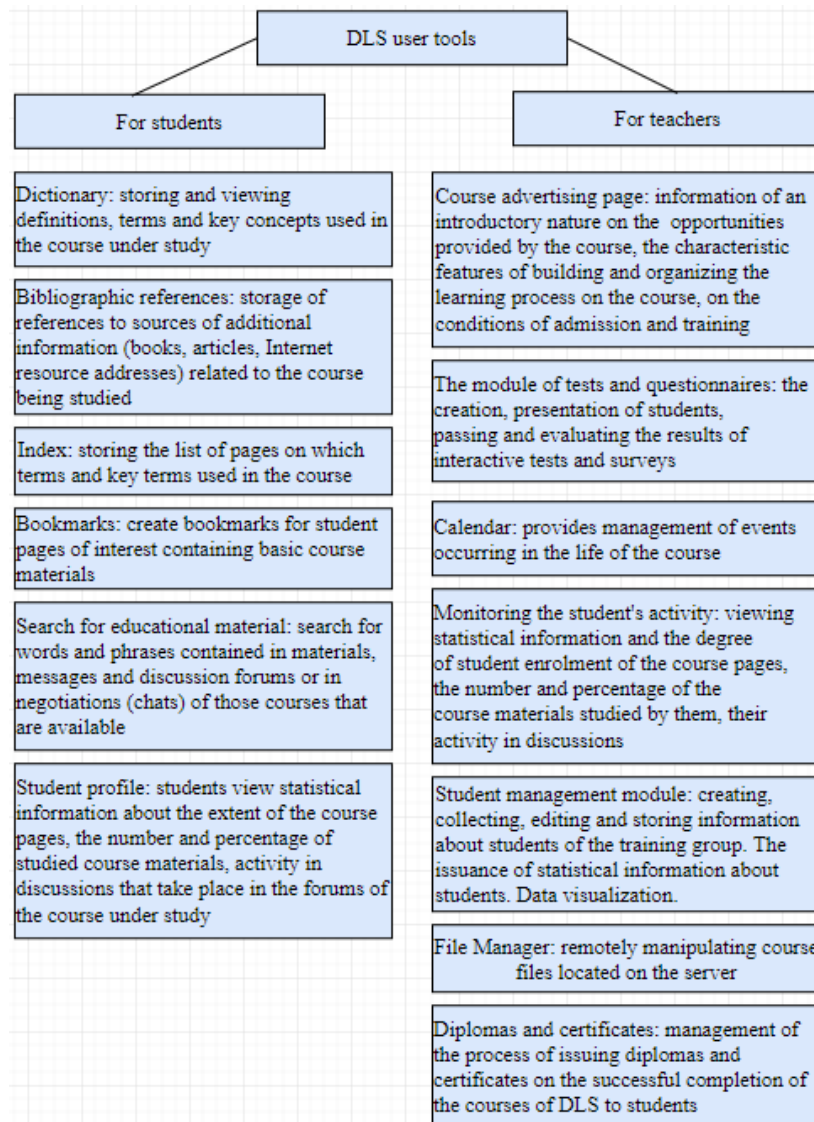


Figure 5: Tools for DLS Users

In addition, the students' participation in research activities involves not only the use of innovative methods and tools in the learning process, but also independent students' research activities. Writing articles, abstracts on a scientific topic is conducted under the supervision of a teacher. Students participate in seminars and conferences of international level, with a trip around Russia and outside the Russian Federation. International cooperation with other universities allows you to analyse and compare your own achievements with the achievements of other specialists, to interact and develop your abilities and competencies. Also students together with teachers take part in the contractual work of the department or the university with PJSC "MMK" of Magnitogorsk and other large enterprises. This makes it possible to establish a student not only as an individual, but also to become a higher level specialist.

The experiment was conducted in Magnitogorsk on the basis of FSBEI HE "NMSTU". At the first stage, the participants in the experiment on the development of RCS were the students of a multidisciplinary college and students of the 1st and 2nd courses of the Energy and Automated Systems Institute (E&ASI). At the second stage, bachelor students and specialists from E&ASI of the 3rd, 4th, 5th courses were involved in the experimental work. At the third stage, experimental work was carried out among graduate and graduate students of E&ASI. In the course of the formative experiment, the levels of RCS formation were identified - low, below average, medium, high. Each level of RC formation is aimed at achieving a specific result. The state of development of RC in the experimental and control groups during the formative experiment is presented in Table 2.

Table 2: The State of Formation of the RCS during the Formative Experiment

<i>Levels</i>	<i>Before EEW</i>		<i>In EEW</i>		<i>In the end of EEW</i>	
	<i>exper</i>	<i>contr</i>	<i>exper</i>	<i>contr</i>	<i>exper</i>	<i>contr</i>
Low	17,6	17,5	8,6	19,8	0	8,3
Below	45,6	45	19,5	35,4	8,3	12,5
Average	32	31,7	53,6	39,6	41,7	62,5
High	4,8	5,8	18,3	5,2	50	16,7
Med	2,4	2,27	2,82	2,3	3,42	2,87
Ceff	1,057		1,22		1,19	
Twatch	0,263		4,278		8,2	

Thus, it can be seen that the formation of RC occurred in two groups - experimental and control. According to the results of experimental work, it can be concluded that more effective learning and goal achievement was in the experimental group.

IV. CONCLUSION

Thus, the pedagogical conditions developed at each stage of learning make the learning process more interesting and rich. The method of RCS formation was developed in an integrated way in the CPE process, taking into account the stages of training, as well as certain principles and requirements for training. For the effective RCS formation, a distance learning system has been created, embedded in the educational portal of Nosov Magnitogorsk State Technical University. According to the experimental work, it is clear that the developed method of RC formation at different stages of training, as well as the principles and requirements in the process of lifelong education, play an important role and influence the efficiency of RCS formation.

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