Diagnostic testing of Russian EMERCOM cadets on their readiness for research activities

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Abstract. The article discovers the substance of the readiness for research activities of cadets of the Ministry of the Russian Federation for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters (EMERCOM). It considers the structure of this readiness and describes its components (motivational, cognitive, organizational and practical, evaluative and reflexive); determines criteria characteristics reflecting the three-level manifestation of the readiness for research activities of the Russian EMERCOM cadets; proposes a set of methods for assessing the level of their readiness for research activities by motivational, cognitive, organizational and practical, evaluative and reflexive criteria; describes diagnostic methods and result-measuring tools for each of the above criteria used in studying the level of readiness for research activities of cadets of the Siberian Fire Rescue Academy of Russian SFS EMERCOM; presents the results of diagnostic testing on the readiness for research activities; It was found that 59% of the cadets have a low level of readiness to organize and carry out research activities.

1. Introduction

Currently, the system of higher professional education, including universities of the Russian EMERCOM, has the task of training a specialist capable of continuous professional self-development and ready to carry out research activities in a particular area of knowledge. One of the important aspects of completing this task is a comprehensive assessment of the level of readiness for research activities (RA) of EMERCOM cadets.

With due regard to modern approaches to the definition of the RA essence, basing on the works of B.G. Ananiev, S.L. Rubinstein, V.A. Slastenin, I. Yu. Stepanova, V.A. Adolf, and others, earlier we formulated a definition of the readiness for research activities of Russian EMERCOM cadets, which is understood as integrative characteristics of their personality determining the ability for research activities, including a system of methodological knowledge and knowledge of the main components of this activity, as well as skills to implement them, and importance of these characteristics for solving research and professional problems [1].

2. Methods

Let us describe the structural components of the readiness for research activities of Russian EMERCOM cadets and the criteria for determining the levels of its formation.

As a result of the theoretical analysis of the readiness for research activities of Russian EMERCOM cadets, we have identified motivational, cognitive, activity-based, reflexive components [2] and the
corresponding criteria: motivational (presence of motives for RA; interest in RA, participation in scientific projects, conferences; manifestation of cognitive activity; awareness of the RA importance for professional self-development), cognitive (knowledge about science and organization of research activities), organizational and practical (research skills, publication activity), evaluative and reflective (ability to analyze, evaluate and reflect on own research activities, to adjust and plan own actions in scientific knowledge), the formation of which, in aggregate, is an indicator of the level of readiness for RA of a Russian EMERCOM cadet. One of the tasks of the experimental work [1-3], some of the results of which are presented in this publication, was to identify the level of readiness for research activities of Russian EMERCOM cadets under each of the above criteria.

In accordance with these criteria, we determined criteria characteristics reflecting the three-level manifestation of the readiness for research activities of Russian EMERCOM cadets (high, medium, low), presented in table 1.

**Table 1.** Level characteristics of the readiness of Russian EMERCOM cadets for RA.

| Criteria                  | Levels and criteria characteristics                                                                 |
|---------------------------|------------------------------------------------------------------------------------------------------|
| Motivational              | Shows high cognitive activity; among the motives for RA, the prevailing ones are “interesting”, “professional growth”, etc.; shows strong interest in RA, in participation in scientific projects and conferences; realizes the importance of RA for professional self-development |
| Cognitive                 | Has systematic knowledge of science and implementation and organization of RA                        |
|                           | Shows moderate cognitive activity, motives for RA may include pragmatic ones, such as “get a grade”, “career”, etc.; shows little interest in RA, in participation in scientific projects and conferences; partially realizes the importance of RA for professional self-development |
|                           | Has basic knowledge of science and implementation and organization of RA                               |
|                           | Shows no cognitive activity, motives for RA include only pragmatic and obligatory ones, such as “get a grade”, “under compulsion of the teacher”; shows a fragmentary interest in RA, does not participate in scientific projects and conferences; does not understand the importance of RA for professional self-development |
|                           | Has fragmentary, unsystematic knowledge about science, fragmentary ideas about the implementation and organization of RA |
| Evaluative and reflexive  | Able to analyze, evaluate and reflect on own RA, adjust and plan own actions in scientific knowledge   |
|                           | Shows partial ability to analyze, evaluate and reflect on own RA, further research activities are not adjusted in full (if at all) |
|                           | Not able to analyze, evaluate and reflect on own RA, further research activities are not adjusted       |

Among the indicators of the level of readiness for research activities of Russian EMERCOM cadets are integrity and manifestation degree of its main criteria: motivational, cognitive, organizational and practical, and evaluative and reflexive.

Diagnostic testing by the indicated criteria of how well the readiness for research activities of Russian EMERCOM cadets is formed requires using complex assessment methods.

In our research, we propose a set of methods for assessing the level of readiness for research activities of Russian EMERCOM cadets, which we used for diagnostic testing at Siberian Fire Rescue Academy of SFS Russian EMERCOM.

A set of methods for studying readiness for research activities of Russian EMERCOM cadets is presented in table 2.
Table 2. Methods of studying the readiness of Russian EMERCOM cadets for RA.

| Criteria                        | Diagnostic methods, result measurement tools                                                                 |
|--------------------------------|----------------------------------------------------------------------------------------------------------------|
| **Motivational**               | Questionnaire "Motivation for research activities" (self-assessment);                                        |
|                                | Procedural instructions "Degree of manifestation of cognitive activity and interest" (E.M. Razduleva) (assessment by teachers). |
| **Cognitive**                  | Test "Identification of complex ideas about science and implementation of research activities" (Yu.A. Chernokhadskaya); |
|                                | Questionnaire "Students' awareness of research activities"; V.V. Gorshkova; T.A. Zagrivnaya.                  |
| **Organizational and practical**| Procedural instructions "Research skills" (I.A. Aleksandrova) – 3 stages: self-assessment, mutual assessment of students by one another, assessment by teachers; Study of publication activity. |
| **Evaluative and reflexive**    | Questionnaire "Diagnostic testing of reflexivity" (A.V. Karpov); Reflexive sheet (self-assessment of research activities performed). |

3. Results

Let us consider the practical implementation of diagnostic testing of the cadets' readiness for RA by the presented criteria used during experimental work at Siberian Fire Rescue Academy of SFS Russian EMERCOM. Experimental and control groups consisted of cadets studying to get a degree in 20.05.01 Fire safety. In total, 171 cadets (78 people from the experimental group, 93 people from the control group) and seven people from the teaching staff took part in the diagnostic testing.

Motivational criterion research of cadets' readiness for RA offered a questionnaire "Motivation for research activities", where, in the main part of the procedural instructions, the cadets were required to choose the motives underlying their attitude to research activities, and in the additional part it was proposed to grade the motives in the following way: 0 – no motivation; 1 – weak motivation; 2 – average motivation; 3 – strong motivation. For example, in the main part of the questionnaire, there were such motives as "Interest in scientific research", "Desire to acquire research skills", "Necessity to continue education", "Desire to understand the problem under study profoundly", "Desire to organize a professional activity in the future properly", "Forced to engage in research activities on the insistence of teachers", "Desire to participate in research projects, scientific seminars, conferences", etc. According to the results of these procedural instructions, and analysis of the data obtained showed that the majority of cadets – 68% and 70% of the experimental and control groups, respectively – do not show interest in research activities, do not realize the importance of research activities for personal and professional self-development. The students show only minor interest in easy research tasks, but lack of perseverance and effort does not allow them to achieve the necessary results in this activity. This group of cadets does not show interest in participating in research projects and conferences.

In motivational criterion research of the readiness for research activities of the EMERCOM cadets, we were also interested in the teachers' assessment of the cognitive activity manifestation degree of the cadets' interest in research activities (procedural instructions of E.M. Razduleva) [4]. The teachers were asked to fill out observation forms for the following indicators: shows interest in academic research; asks questions about the content of academic research and strives to resolve a problem situation in the course of academic research and research work; is able to establish causal relations of methodological characteristics of research; shows persistence in assimilating and comprehending scientific knowledge; seeks to obtain additional information independently, uses modern sources of scientific and reference literature, encyclopedias; capable of correct, deep, logical judgments and conclusions, analysis, synthesis, generalization, induction, deduction, etc.

The degree of manifestation of the desire for research activity and cognitive activity was assessed according to a 3-point system (3 points – yes, 2 points – sometimes, 1 point – no). For calculation of observation results, the average value of the points scored was recorded. An analysis of the observation results showed that 41% of the surveyed Russian EMERCOM cadets in the experimental and 48% in the control groups do not seek to independently obtain additional information and demonstrate an
episodic interest in the novelties of scientific literature and innovations of our time. According to the diagnostic testing performed, only 32.7% of the respondents in the experimental and 35% in the control groups are interested in scientific research activities; 57.2% of the respondents in the experimental and 59% in the control groups do not feel an independent need to engage in research activities, they require an external stimulus.

To study the level of readiness for RA of the Russian EMERCOM cadets by the cognitive criterion, we have identified the following indicators: knowledge about science, research methodology, and organization of research activities. Our approach develops within the ideas of A.M. Novikov, who states the importance of the development of a general scientific methodological knowledge system in a modern student that synthesize the world view aspects of scientific ideas, views, definitions and philosophical interpretation of phenomena, knowledge about the methods of scientific knowledge, about methodology, organization, and planning of academic research for the formation of graduate's self-efficacy in the information society in real life [5].

To diagnose the formation of readiness for research activities of a Russian EMERCOM cadet by the cognitive criterion, we used the test "Identification of complex ideas about science and implementation of research activities." This test is a set of unfinished sentences affecting a certain area of research activity (categorical structure of science in general, levels, types, forms of research activities), which allows checking the expansion of the scientific and methodological knowledge range, to track the optimal application of the knowledge in practice and make adjustments to the formation of the readiness for research activities among Russian EMERCOM cadets. At the initial stage of the experimental work, the results of the research made it possible to state that 11% of the respondents in the experimental and 10% in the control group demonstrated a high level of complex ideas about research activities (knowledge about science and methodological characteristics of the academic research organization).

According to many researchers (N.D. Bragin, V.V. Davydov, I.A. Zimnnyaya, T.E. Klimov, etc.), one of the basic effectiveness components of any activity, including research, is the reflection implementation. The reflection stimulates the activity and independence of an individual in research activities, mediates the formation of the corresponding internal motives, ensures their stability by activating and directing research activities (N.D. Bragin). Therefore, when studying the level of readiness for research activities of the Russian EMERCOM cadets, it was necessary and significant to evaluate the reflexive component in its content (by the evaluative and reflective criterion).

In our research, the indicators of the evaluative and reflexive criterion for studying the level of readiness for research activities of Russian EMERCOM cadets are the ability to analyze, evaluate and reflect on their own research activities, adjust and plan their own actions in scientific knowledge.

To assess the above indicators, the students were offered a reflexivity diagnostic questionnaire by A.V. Karpov [6].

An auxiliary method for studying the level of readiness for research activities of Russian EMERCOM cadets by the evaluative and reflective criterion was self-assessment of the results of their own research activities conducted by students. For this purpose, a reflective sheet was developed and offered to the cadets, which they had to fill out after completing their creative research [2].

4. Discussion
An analysis of the obtained research results aimed at studying the readiness for research activities of Russian EMERCOM cadets showed that only 6% of those cadets in the experimental and 9% in the control group have a high level by the evaluative and reflexive criterion.

When studying the level of readiness for research activities of Russian EMERCOM cadets by the organizational and practical criteria, we used procedural instructions "Research skills" of I.A. Aleksandrova. These procedural instructions are significant for our research because they are intended for a comprehensive assessment of research skills by Russian EMERCOM cadets (self-assessment), by teachers, and mutual assessment of students by one another, which ultimately made it possible to obtain the most objective results.
Thus, the analysis of diagnostic testing results of organizational and practical criterion in the experimental and control groups showed that the respondents’ research skills were not sufficiently developed. The evaluation of the academic research skills among Russian EMERCOM cadets by the teachers showed the lowest results. Based on the assessment by teaching staff, we conducted a written questionnaire survey of 7 teachers using the above-mentioned procedural instructions and came to the conclusion that Russian EMERCOM cadets have a low level of academic research skills, which manifests itself in significant difficulties in organizing and carrying out research activities, forecasting the progress of research work, implementation of its results in practical activities. The students experienced particular difficulties in defining the object, subject, goals, and objectives of the research, preparing reports on the results of research work. Thus, a low level was noted in 65 students in the experimental group and 83 Russian EMERCOM cadets in the control group (82% and 89%, respectively).

The study of the self-assessment results showed that 70 cadets in the experimental group and 83 Russian EMERCOM cadets in the control group (90% and 89%, respectively) showed a high level of academic research skills. When the EMERCOM cadets evaluated each other, a high level of academic research skills was revealed only in 7 (9%) students in the experimental group and 8 (9%) in the control group. The conclusive result was calculated using a comprehensive composite assessment and showed the general level of the EMERCOM cadets' proficiency in academic research skills (high level of academic research skills was demonstrated by 8 (10%) Russian EMERCOM cadets in the experimental and 8 (9%) cadets in the control group; average level – 49 (63%) and 64 (69%) cadets in the experimental and control groups, respectively; the low level was shown by 21 (27%) cadets in the experimental group and 20 cadets (22%) in the control group).

Also, when researching the readiness for research activities of Russian EMERCOM cadets (by the organizational and practical criterion), we studied an indicator of publication activity of research results presented in the form of academic research, articles, abstracts in various academic periodicals, and collections of conferences of various levels (regional, all-Russian, international). Thus, Russian EMERCOM cadets, who have more than five scientific publications, in our opinion, showed high publication activity and were attributed to a high level of manifestation of this indicator; students with up to 5 publications showed fragmentary publication activity and were referred to the average level of the studied indicator; and respondents who did not provide evidence of existing published works made up a group of subjects with a low level of publication activity.

In general, according to the levels of criteria manifestation of the readiness for research activities of Russian EMERCOM cadets, the students of the experimental (EG) and control (CG) group were distributed in accordance with the histogram presented in Figure 1.

We see the quantitative indicator characterizing the generalized result of assessing the readiness for research activities of Russian EMERCOM cadets as an arithmetic mean of the numerical values of motivational, cognitive, organizational and practical, and evaluative and reflexive criteria.

Analysis of the results obtained in the course of diagnostic testing showed that 59% of the Russian EMERCOM cadets have a low level of readiness to organize and carry out some research activities, 33% – average and only 7% – high. In accordance with the Pearson criterion [7], it should be noted that there are no significant statistical differences in the manifestation of criteria of readiness for research activities of Russian EMERCOM cadets between the control and experimental groups, which confirms the qualitative similarity and equivalence of the groups.
Figure 1. Levels of criteria manifestation of the readiness for RA of the Russian EMERCOM cadets in the experimental and control groups at the beginning of the experimental work.

5. Conclusion

The data obtained gives grounds for the development and implementation of organizational and educational conditions that contribute to the formation of the readiness for research activities of Russian EMERCOM cadets in the process of their professional training.

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