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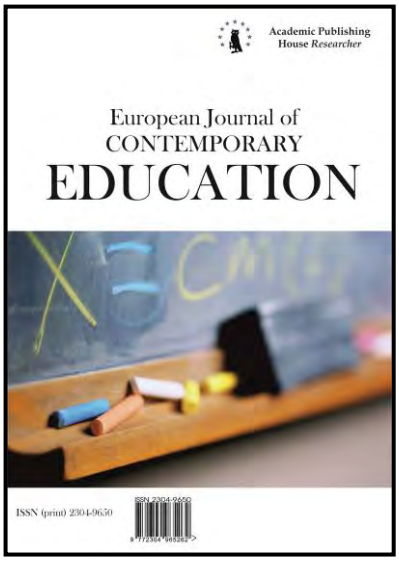

A Case Study of Developing Research Competency in University Students

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Abstract

The research featured the measures required to plan scientific and research activities that develop research competency in university students. The authors explained the necessity to plan research activities in the way that would allow students to master educational and cognitive techniques and perform practical actions aimed at solving personal and socially significant tasks. The article outlines theoretical background of research work planning at institutions of higher education.

The concept of research competency was defined as a combination of motivational, gnoseological, operational, and personal components, developed at such a level that allows one to successfully apply the acquired research skills and knowledge in practical tasks. The authors believe that the development of research competency is the final result of education. Competencey as a new mental formation develops while mastering certain activities during the learning process. The phenomenon includes knowledge, skills, personality traits, and personal qualities. The paper introduces a set of criteria indicators that can be used to assess the level of research competence in students. The article also focuses on interactive methods, social media, and changing the role range of participants.

A set of experiments registered some positive changes in the parameters of the components that together make up research competency. The results revealed a higher level of motivation, which indicates that the students are growing more aware of the value of science and research. They also demonstrated a better-developed gnoseological component. This improvement can be explained by the fact that research work activated such cognitive processes as systematization, planning, comparison, and generalization. A higher development level of the operational and personal components was reflected in better quality research reports and scientific publications.

Keywords: research competency, education, professional training, students, components of research competency, criteria-based indicators of competency development.

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1. Introduction

The domestic system of education is currently undergoing some changes in its organizational, substantive, and structural aspects. The changes are aimed at providing variability and personal orientation. The emerging education system requires a different attitude to the methods of obtaining knowledge by students, i.e. a new type of thinking. It is not enough anymore for students simply to learn prefabricated knowledge: students have to master the methods of scientific knowledge that will help them to acquire and apply knowledge by themselves by using traditional or novel ways and means.

The paradigm of the ultimate goal of education is changing as well: it is a competent professional and researcher with well-developed skills that make it possible to plan independent research activities. In this paper, research activity is an active, objective, logical, orienting, and integrating cognitive activity, which implies conscious and purposeful actions of students.

The main objective of the education system is to train competent and creative specialists that are able to plan their activities. According to N. Van den Berg, conventional skills are becoming less and less important, while non-standard and interdisciplinary skills are playing an increasingly important role (Van den Berg, 2017). The university graduate is a harmoniously developed specialist able to carry out various types of activities (Mustafa et al., 2019).

Let us consider the theoretical background of the research planning by university students. A. Obukhov defined the concept of research as a process of creative perception of the environment and oneself in the world (Obukhov, 1999). I.A. Zimnaya considered the research process as part of one's activity in the whole diversity of the informational environment. In this process, all the activities of the subjects are aimed at certain objects: without changing them, they are reflected by the objects and are then returned back to the subjects, but this time as knowledge about the objects (Zimnyaya, 2006).

Thus, research activity is an active form that contributes to the development of the individual psychological characteristics of the researcher. We consider the research process as a joint activity of an experienced researcher and a beginner. During their interaction, the latter expands his or her field of knowledge, thus producing new scientific knowledge.

The structure of research activity includes such elements as goal setting, motivation, research object, research methods, and efficiency. Research activities are aimed at acquiring new scientific knowledge, identifying new technological research methods, and achieving the research objective. Thus, research activity contributes to understanding the surrounding reality. When conducting research, it is important that this activity should be accepted by all its subjects, as this makes their actions more conscious, motivates them to meet the goal, and encourages their activity.

A. Leontovich interpreted the research activities of university students as a creative joint activity, where two subjects are looking for solution together. During the search, they exchange cultural values, thus shaping a worldview (Leontovich, 2003). This definition emphasizes that research process is a co-creativity of the student and the teacher in their search for a particular solution. This approach allows students to connect new knowledge with their own learning and thereby build links between content, activity, and technological tools (Tseng, Yeh, 2019). That is why the concept of research competence, or scientific-research competence, is a popular issue of various studies worldwide.

According to the systematic approach, this concept is considered as an integral part of professional competency and is considered as a component of its development (A.A. Derkach, T.A. Smolina V.A., L.A. Golub). The present research adheres to this point of view. V.N. Vvedensky characterized competence as a combination of such important qualities as critical thinking, mobility, and variability. These three qualities allow one to apply in practice the learned research skills and knowledge (Verbitsky, Larionova, 2009).

Scientific sources reveal two approaches to the definition of competency. In the first approach, competency is considered as a personal quality (A.K. Markova, B.G. Ananyev). The second defines competency as elements of human activity and the versatility of this activity, which allows one to solve various tasks (V.S. Lednev, V.N. Myasishchev, N.V. Kuzmina).

Therefore, this concept includes a set of definitions that characterize a person: personal characteristics; characteristics that reflect one's interaction with other people; characteristics that reflect the specifics of one's work performance.

Theoretical studies show that the development of research competency is the final result of education. Competency as a new mental formation develops while mastering certain activities during the learning process. The phenomenon includes knowledge, skills, personality traits, and personal qualities. According to C.P.M. van der Vleuten, the development of a skill means equal development of each of its components, while growth is defined as a monotonous process that results from training (Van der Vleuten, 1996). According to foreign studies, competencies are developed in the context of interdisciplinary training in problem situations (Stentoft, 2017), specially organized researches (Howard et al., 2013) and projects (Hamnett, Korb, 2017), research projects (Krajcik, Blumenfeld, 2006), a combination of full-time and online learning (Kintu et al., 2017), and a mixed educational environment (Geng et al., 2019).

Russian scientists have ambiguous views on research competence. A.A. Ushakov and I.I.Kholodtseva see it as an ability to navigate in non-standard and uncertain situations (Petrov, 2004). A.V. Khutorskiy, M.I. Gubanova, S.N. Chistyakova, and A.K. Markov interpret research competency as part of professional competency, depending on a particular area of activity (Khutorskoy, 2005).

Therefore, by developing research competency, we contribute to the professional development of the future specialist. In this paper, we consider the concept of research competency as one's ability to apply knowledge and skills in situations when a professional task has to be resolved in a scientific field. We distinguish several components in the structure of research competency.

Under the motivational component, we understand the following qualities: desire to solve the problem; conscious goal setting; ability to plan the necessary work. According to the modern motivational studies, internal motivation prevails over external motivation in people engaged in creative activity. This ratio indicates that people are involved in a variety of activities, because they like it, not because they pursue any tasks. Of course, such a division is conditional, since the internal motive comes from the person, while the external motive serves as a stimulus. E.V. Lesteva suggests considering a combination of primary and secondary motives. Primary motives are congenital. Secondary motives are predominant and acquired, e.g. motive of achievement, motive of power, etc. In scientific research, scientists recognize the priority of the achievement motive, i.e. desire to achieve the set objectives (Lesteva, 2009).

The essence of the gnoseological component is the knowledge system of the student. During research, the student should have ideas about the methodological apparatus, research methods, and methods of goal setting.

The operational component determines the qualities that are important during research. These qualities include the skill of conducting experiments and the ability to adjust one's actions to the changes that may occur during research.

The personal component defines the ability to analyze the obtained results, to conduct self-assessment, and to draw conclusions.

The components of research competency provide a better understanding of the research content and a better planning.

These components reflect the essential features by which this or that phenomenon is evaluated. Thus, we took some characteristics as indicators of the development of the research competency in university students.

When studying a research competence, it is important to define criteria and indicators of its development. A theoretical analysis revealed the fact that transitions to higher levels are associated with new characteristics that develop skills and expand knowledge. We distinguished three levels of research competency development in students: low, medium, and high (Table 1).

An analysis of scientific sources provided the fallowing definitions. We believe that the predominance of professional-axiological and cognitive motives in scientific and research activities can affect the development level of the motivational component. In the development of the operational and gnoseological components, priority belongs to the qualities of the personality of the students and the acquired research skills. While observing the development of research skills in students, we identified some specific characteristics of the skills.

We proceeded from the fact that the criteria indicators should combine standard features that make it easy to assess the level of development of research competence in students (Table 1).

Table 1. Levels of research competency development in students

Levels	Components			
	Motivational	Gnoseological	Operational	Personal
High	The students demonstrate an internal motivation for self-educational activity, which is reflected in their self-affirmation and self-expression; they are focused on the constant expansion of their knowledge and show high cognitive activity.	The students have knowledge of the main components of the methodological research apparatus; they know scientific methods and methodology of scientific research. Presentation of scientific materials is logical.	The students can organize their research process; they plan their own self-education using different forms and techniques; they are able to choose the sources of knowledge independently; they are able to transfer the acquired knowledge and skills into specific research circumstances. They can formulate the problem and research hypothesis, consolidate material, and draw conclusions.	The students display initiative in the search for research topics and involve others in the process during teamwork; they bear responsibility for their part of the research.
Medium	The students occasionally show interest in self-education, which is reflected in their self-affirmation and self-expression; they are focused on the constant expansion of their knowledge.	The students does not possess sufficient knowledge of the main components of the methodological research apparatus; they know some scientific methods and research methodology; they display occasional violations in the logic of presentation.	It is difficult for the students to organize research process, as well as self-education; they experience problems while transferring acquired knowledge and skills in research circumstances; it is hard for them to formulate the problem and hypothesis, as well as to consolidate materials and reports.	The students experience difficulties in taking the initiative in the search for research topics; they are passive in teamwork; they are unwilling to accept responsibility for their part of the research.
Low	The students show no desire for self-educational activities, self-affirmation, or knowledge expansion; the cognitive interest is low.	The students know neither methodological research apparatus nor scientific methods; the knowledge of research methodology is poor; there are serious violations in the logic of presentation.	The students can organize neither their research nor self-education; they fail to transfer the acquired knowledge and skills to research circumstances; they are unable to formulate the problem and hypothesis; they cannot consolidate information and draw conclusions.	The students are passive in determining the problems of scientific research, withdraw from teamwork, and do not accept responsibility for their part of the

				research.

This set of criteria-based indicators makes it possible to determine the qualitative changes in the development level of research competency in students during research work at a university.

2. Materials and methods

The present study featured the development level of research competency and its structural components in students of the Institute of Education, Kemerovo State University (Kemerovo, Russia). The empirical methods included polling and psychological testing. The experiment involved 74 first-year students of the Institute of Education.

To study the motivational component of research competency, we used the test of life-purpose orientations as adapted by D.A. Leontyev, as well as T. Ehlers' methods *Motivation for Success* and *Motivation Failure Avoidance*.

When studying the gnoseological component, we used the method of *Professional Readiness* by A.P. Chernyavskaya and the test *Readiness for Self-Development* by T.A. Ratanova and N.F. Shlyakhta.

The operational component was assessed with the help of such techniques as the questionnaire *Level of Subjective Control* by E.F. Bazhin, E.A. Golynkina, and A.M. Etkind and the questionnaire *Style of Self-Regulation of Behavior* by V.I. Morosanova.

The personal component was studied using T. Leary's *Diagnostics of Interpersonal Relationships*.

The quantitative and qualitative analysis involved methods of mathematical statistics (Student's t-test criterion for dependent samples). Statistica 6.0 software was used to check reliability of mathematical calculations.

The first-year students were divided into two groups: the experimental group consisted of 36 students majoring in Primary Education, while the control group consisted of 38 students majoring in Preschool Education. These groups were comparable: both groups majored in humanities, both curriculums presupposed advanced training according to similar programs. By the onset of the experiment, the students had had no serious experience in scientific research, since they start doing their first course projects during their third year. Therefore, the conditions for research competency development were equal in both groups, and they could undergo a comparative analysis. However, the conditions were slightly different at the opening phase of the experiment, since the experimental group had one discipline too many.

The opening phase of the experiment involved a set of measures to plan scientific and research activities, adjustment of methods and techniques of training, and definition of the effectiveness of students' personal advancement. The students of the experimental group were engaged in the work of the Young Researcher Association and followed the course of *Organization of Scientific Research*. They participated in a variety of research activities. The activity aimed at the formation of research competency was tested for qualitative changes in cognitive processes and personal characteristics, which were reflected in a more sophisticated reproduction of the surrounding world and more complicated human activities.

This idea was based on student-led research projects carried out in various European universities. The so-called flipped classroom technology seems especially effective: students watch e-videos, study additional sources on their own outside the classroom, and then discuss new concepts and their prospective implementation with the teacher in class (Marín et al., 2018).

There are technologies for attracting social media to the university class (Chawinga, 2017) and systematic cooperation with students and professors from other universities (Arruabarrena et al., 2019). During the experimental work, we tested the game *How to Fail Your Research*, which combined constructivist and experimental strategies (Abbott, 2019).

These technologies ensured the development of research competency in situations when the subject experienced a change in the internal content of the personality. The driving force in this process of self-improvement is the contradictory nature of the existing and desirable level of research competence.

3. Results

At the ascertaining stage of the experiment, the students were questioned in order to identify the initial available level of research competency. The polling revealed information about their attitude to participation in scientific events, and the difficulties they encounter when planning their own scientific and research activities. The questions required complete answers. The questionnaire included a list of alternating open questions that suggested a free answer and closed questions that suggested one possible answer.

92 % of the respondents answered positively to the question *Should students of vocational education institutions do research work?* However, only 54 % gave a positive answer to the question *Would you like to take part in research work?*

When answering the question *Where can you use the results obtained in the course of scientific and research work?*, 88 % of the respondents mentioned nothing but thesis or term projects, which indicates that the students were unaware of the various forms of this type of activity.

The responses to the question *What can motivate you to participate in scientific and research work?* revealed various priorities: to obtain moral good (2.5 %), to obtain knowledge in a particular area that will be useful for further education (4.5 %), for self-expression or self-affirmation (17.5 %), out of interest for this type of activity (22 %), to obtain knowledge that will be necessary in future professional activities (24.5 %), to fulfill the requirements stated in the curriculum (29 %).

As for the question about the difficulties in the scientific and research work, most difficulties appeared to be associated with the inability to state the research problem (14 %), to solve the planned tasks (30 %), to formulate the research apparatus (26 %), to structure and summarize the obtained results (14 %), and to plan the research (16 %).

The polling revealed the lack of knowledge about what constitutes research process, despite the fact that the first-year disciplines have a great potential for organizing research activities. A more thorough study of the responses and personal meetings with the students made it possible to specify the difficulties. On the one hand, the students felt that at school they had not acquired enough knowledge and skills to be able to participate in research. On the other hand, they did not participate in the activities of the young researchers' community.

The obtained data highlighted the problem of purposeful organization of the process of preparing students for research work. We believe that it is necessary not only to inform students about the nature of scientific research work and its effectiveness, but also to develop personal characteristics and skills that are necessary to conduct research. When implementing the set of measures, we took into account the sequence of practical steps: motivating students to be engaged in research activities, initial familiarization with the basic concepts of research work; systematization of ideas about the essence of scientific and research activities; using the knowledge and skills acquired during training to solve research tasks.

We analyzed the content of the components of students' research competency in the reference set to test the developed measures for effectiveness. The results obtained made it possible to split the students into the control and experimental groups. Table 2 shows the mean values of the experimental and control groups before the experiment.

Table 2. Content of the components of students' research competence: mean values at the opening stage of the experiment

Indicator	Mean values		t-criterion	Significance level of the differences (p)
	Experimental group	Control group		
Motivation component				
Motivation for avoiding failures	18.08	18.02	0.33	0.7
Result	25.20	25.18	0.09	0.93
Gnoseological component				
Knowledge acquisition	5.76	5.72	0.86	0.4
Acquiring skills	2.36	2.33	0.81	0.43
Planning	14.50	14.48	0.86	0.4

Goal	27.92	27.90	0.84	0.41
Result	22.21	22.23	-0.08	0.94
Operational component				
General internality	29.26	29.30	-0.26	0.79
Internality in the field of achievements	5.71	5.75	- 0.86	0.4
Internality in the field of interpersonal relations	6.00	6.16	-1.18	0.26
Decision making	12.56	12.05	0.99	0.33
Personality component				
Awareness,	9.06	9.10	-0.33	0.7
Emotional Attitude	11.93	11.70	0.99	0.33
Empathy	49.06	49.46	-1.4	0.17

We compared the groups according to Student's t-test for independent samples to prove that they were statistically equal. The comparative analysis confirmed that the content characteristics of the research competency components in the experimental group did not exceed the results obtained from the control group at the opening phase.

At the first stage of the formative influence, the most important tasks were associated with the initial research skills and the expansion of existing knowledge about research process.

At the second stage, the task was to shape the knowledge of research methodology and learn to apply this knowledge and skills to research work, e.g. scientific articles, reports, research projects, abstracts, etc.

When introducing students to scientific and research activities, we observed the sequence of stages of activity: from interest to motivation, and then to practical actions. The stages considered above were integrated; they did not exclude each other, and their objectives continued to be addressed in further research.

Table 3 shows the data obtained at the final stage of the experiment in the control and experimental groups. The results revealed positive dynamics of those content characteristics of students' research competency that were involved in the developed set of measures.

Table 3. Mean values of the content characteristics of the components of research competence in students at the final stage of the experiment

Indicator	Mean values		t-criterium	Significance level of the differences(p)
	Experimental group	Control group		
Motivational component				
Motivation for avoiding failures	14.52	18.10	-3.05	0.00
Reault	28.88	25.22	2.41	0.02
Gnoseological component				
Acquisition of knowledge	8.20	5.75	2.17	0.04
Acquiring skills	5.27	2.37	3.12	0.01
Planning	18.73	14.52	2.41	0.02
Goal	33.10	27.94	2.16	0.04
Result	29.73	22.26	2.28	0.03
Operational component				
General internality	34.00	29.26	2.17	0.04
Internality in the field of achievements	9.14	5.73	2.25	0.03
Internality in the field of interpersonal relations	6.86	6.02	2.16	0.04
Decision making	14.60	12.58	2.39	0.02
Personality component				
Awareness	11.26	9.08	2.70	0.01
Emotional attitude	18.20	11.96	4.51	0.00
Empathy	52.46	49.08	2.17	0.04

The table clearly shows positive changes in the level of content characteristics of the motivational component of the research competence in the experimental group. The mean values for this component in the control and experimental groups demonstrated significant differences at the final stage of the experiment. The indicator *Motivation for Avoiding Failures* demonstrated statistically significant differences, i.e. young researchers from the experimental group stopped searching for external causes of their own failures and reoriented themselves to success ($t = -3.05$, variance = 72 at $p < 0.01$). The indicator *Result* also showed statistically significant difference, which means that the experimental group was satisfied with the achievements they had during the training period ($t = 2.41$, variance = 72 at $p < 0.05$).

The mean values of the content characteristics of the gnoseological component demonstrated significant differences between the results obtained from the control and experimental groups at the final stage. Statistically significant differences of the *Knowledge Acquisition* indicator may indicate that the students from the experimental group accumulated more knowledge about research methods than those from the control group and improved their professional competencies during classes ($t = 2.17$, variance = 72 at $p < 0.05$). Statistically significant differences for the indicator *Acquiring Skills* proved that students from the experimental group gained some research experience ($t = 3.12$, variance = 72 at $p < 0.05$). Other three indicators also demonstrated statistically significant differences: *Planning* ($t = 2.41$, variance = 72 at $p < 0.05$), *Goal* ($t = 2.16$, variance = at $p < 0.05$), and *Result* ($t = 2.28$, variance = 72 at $p < 0.05$). Apparently, the experimental group students mastered several methods that allowed them to achieve their goals. They had a greater willingness to make efforts to fulfill tasks and achieve the set goals.

The mean values of the content characteristics of the operational component also showed significant differences between the results obtained from the control and experimental groups at the final stage: *General Internality* (GI) ($t = 2.17$, variance = 72 at $p < 0.05$), *Internality in the field of achievements* (IA) ($t = 2.25$, variance = 72 at $p < 0.05$), and *Internality in the field of Interpersonal Relations* (IIR) ($t = 2.16$, variance = 72 at $p < 0.05$). The results indicate that the students engaged in scientific activities tended to consider themselves responsible for what was happening to them (GI), including the spheres of goal achievement (IA) and interpersonal interaction (IIR). The indicator of *Decision Making* also revealed significant differences ($t = 2.39$, variance = 72 at $p < 0.05$), which means that the experimental group students developed autonomy and independence in decision making, especially in the professional sphere. They also proved to possess a greater willingness to bear responsibility for the consequences of their own decisions.

The mean values of the content characteristics of the personality component also showed significant differences between the results obtained from the control and experimental groups at the final stage: *Awareness* ($t = 2.70$, variance = 72 at $p < 0.05$), *Emotional Attitude* ($t = 4.51$, variance = 72 at $p < 0.01$), and *Empathy* ($t = 2.17$, variance = 72 at $p < 0.05$). The *Awareness* indicator characterized the level of awareness of the specifics of the activity the student was performing. Its improvement may indicate sufficient awareness of the options for professional development. The improved indicator of *Emotional Attitude* is likely to reflect a positive emotional attitude towards the process of learning and career planning. The *Empathy* indicator increased, which denotes that the students grew more sensitive to the needs and problems of other people.

4. Discussion

The data obtained made it possible to analyze the development level of the content characteristics of the research competency components.

To build up research competence in students, it is not enough to teach them basic techniques and methods. They should get acquainted with the work of practicing researches, including the kind of studies they conduct together with students. One way to involve practicing scientists into students' research would be to invite them to classes to demonstrate the main methods and techniques related to problem-based learning or to conduct mini-studies. In other words, teaching staff must provide proper conditions for the acquisition of research experience.

The data obtained are comparable with the results published by C.H. Chena and Y.C. Yang: project-based learning has a more positive effect on student performance compared to traditional learning (Chen, 2019).

In this research, we used productive forms of inclusive participation in various activities of the student research community. As a result, we managed to increase the motivation of students to

participate in scientific research activities. They recognized the value of team work and team support by working in better conditions for further personal self-improvement. Students realized the practical meaning of scientific research, thus learning how to use their intellectual work in satisfying a particular need.

The results clearly show positive changes in the level of motivation, which indicates that the students grew more aware of the value of scientific research. This fact is comparable with the results we obtained in our previous research regarding the subjective position of subjects of education process (Prosekov et al., 2020). Our position is consistent with the research conducted by F. Trede and D. Jackson, who assessed the stage of involvement in the formation of conscious professionals (Trede, 2019).

In addition, the analysis revealed a higher level of formation of the gnoseological component. This must have been associated with the activation of cognitive processes during research, i.e. systematization, planning, comparison, generalization.

The evidence of positive changes in the level of gnoseological component formation is similar with the results obtained by Z. E. Davidson and C. Palermo, who described the development of students' research skills, e.g. their ability to collect, process, and evaluate information, work independently, and think critically (Davidson, Palermo, 2015).

The experimental group showed a better development of operational and personal components. The progress was reflected in students' research reports that summarized their scientific projects for publications. These results are consistent with those obtained by A. García-Aracil, S. Monteiro, and L.S. Almeida, who studied how students accepted a multidimensional perspective of their own academic experience. Extensive academic experience proved to have a positive effect on students' perceptions of their readiness for professional activities (García-Aracil, 2018).

The experimental group demonstrated a faster and more productive development of research competency than the control group.

5. Conclusion

The theoretical analysis of the problem and the experimental studies proved that the development of research competency can be considered from three different angles:

- as one of the areas of pedagogical science that studies the laws of development and formation of the specialist in order to develop stages, content, forms, and methods of professional education (scientific aspect);
- as methodological support for the entire process of education, e.g. compiling curriculums and didactic materials, teacher training, etc. (applied aspect);
- as a direct professional activity of teachers of professional educational institutions (practical aspect).

Each of the proposed aspects has its own tasks, and their solutions require specific training.

The scientific aspect involves the theoretical justification and development of teaching methods. While academic studies only identify certain laws and thereby expand scientific knowledge, this kind of studies also determines the pedagogical conditions for the implementation of laws in the context of the personality development of the future professional.

The applied aspect involves the use of pedagogical and methodological knowledge by teachers that are willing to apply and assimilate the latest scientific data in planning and implementation of education programs.

The practical aspect is provided by the teachers themselves, whose task is to use everything that the contemporary pedagogical science has to offer. The success of their activities depends on their professionalism.

The development of applied and practical aspects relies on the scientific aspect, the latter being the theoretical basis that helps to define goals, stages, methods, and content of the development of research competence.

To facilitate the development of research competency in students, we identified criteria that can be used to evaluate the content characteristics of the components. As a result, we defined three levels of competence development.

In the classroom, students were engaged in research work by solving problem tasks, doing practical work, writing course papers, doing individual and team projects, on-the-job training, industry-based final year projects, etc.

During extracurricular activities organized by the association of young researchers, students took part in research events of various levels, e.g. scientific and practical conferences, festivals, competitions, seminars, round tables, discussion platforms, etc.

During the opening phase, the students were motivated to get involved into scientific and research activities. They also acquired basic information about research planning.

During the main phase of the study, the students acquired theoretical ideas about the research process. They had to solve some practical tasks and apply their knowledge about planning and conducting research activities.

The experiment revealed positive changes in the parameters of components of the research competency. The motivation of the students in the experimental group improved significantly, which means that they grew aware of the value of scientific and research activities. The development level of the gnoseological component also improved. This means that the research activities triggered such cognitive processes as systematization, planning, comparison, and generalization. The good quality of their reports signified a better development level of the operational and personal components.

In general, the present research demonstrated opportunities for increasing the productivity of the scientific and research activities of students participating in the work of the young researchers' association.

References

Abbott, 2019 – *Abbott D.* (2019). Game-based learning for postgraduates: an empirical study of an educational game to teach research skills. *Higher Education Pedagogies*. 4(1): 80-104.

Arruabarrena et al., 2019 – *Arruabarrena, R, Sánchez, A., Blanco, J. M., Vadillo, J.A., Usandizaga, I.* (2019). Integration of good practices of active methodologies with the reuse of student-generated content. *International Journal of Educational Technology in Higher Education*. 16: 10. DOI: https://doi.org/10.1186/s41239-019-0140-7

Chawinga, 2017 – *Chawinga, W.D.* (2017). Taking social media to a university classroom: teaching and learning using Twitter and blogs. *International Journal of Educational Technology in Higher Education*. 14: 3. DOI: 10.1186/s41239-017-0041-6

Chen, 2019 – *Chen, C.H., Yang, Y.C.* (2019). Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Educational Research Review*. 26: 71-81.

Davidson, Palermo, 2015 – *Davidson, Z.E., Palermo, C.* (2015). Developing Research Competence in Undergraduate Students through Hands on Learning. *Journal of Biomedical Education*, 9. DOI: 10.1155/2015/306380

García-Aracil et al., 2018 – *García-Aracil, A., Monteiro, S., Almeida, L.S.* (2018). Students' perceptions of their preparedness for transition to work after graduation. *Active Learning in Higher Education*. DOI: https://doi.org/10.1177/1469787418791026

Geng et al., 2019 – *Geng, S., Law, K.M.Y., Niu, B.* (2019). Investigating self-directed learning and technology readiness in blending learning environment. *International Journal of Educational Technology in Higher Education*. 16: 17.

Hamnett, Korb, 2017 – *Hamnett, H., Korb, A.* (2017). The coffee project revisited: Teaching research skills to Forensic chemists. *Journal of Chemical Education*. 94(4): 445-450. DOI: 10.1021/acs.jchemed.6b00600

Howard et al., 2013 – *Howard, J., Ferguson, M., Wilkinson, P., Campbell, K.L.* (2013). Involvement in research activities and factors influencing research capacity among dietitians. *Journal of Human Nutrition and Dietetics*. 26(1): 180-187.

Khutorskoy, 2005 – *Khutorskoy, A.V.* (2005). Metodika lichnostno-orientirovannogo obucheniya. Kak obuchat' vsekh po-raznomu? [The methodology of personality-oriented learning. How to train everyone differently?]. M.: Vlados-Press. 383 p. [in Russian]

Kintu et al., 2017 – *Kintu, M.J., Zhu, C., Kagambe, E.* (2017). Blended learning effectiveness: the relationship between student characteristics, design features and outcomes. *International Journal of Educational Technology in Higher Education*. 14: 7. DOI: 10.1186/s41239-017-0043-4

Krajcik, Blumenfeld, 2006 – *Krajcik, J.S., Blumenfeld, P.* (2006). Project-based learning. In R.K. Sawyer (Ed.). *The Cambridge Handbook of the Learning Sciences:* 317-334. New York, NY: Cambridge University Press.

Leontovich, 2003 – *Leontovich, A.V.* (2003). Proektirovanie issledovatel'skoi deyatel'nosti uchashchikhsya: [Planning the research activities of students]: Avtoref. diss. ... kand. psikhol. nauk. M. 27 p. [in Russian]

Lesteva, 2009 – *Lesteva, E.V.* (2009). Pedagogicheskoe soprovozhdenie issledovatel'skoi deyatel'nosti uchashchikhsya v protsesse prepodavaniya gumanitarnykh distsiplin [Pedagogical support of students' research activities in the process of teaching humanities]: dis. ... kand. ped. nauk. Smolensk. 202 p. [in Russian]

Marín et al., 2018 – *Marín, V.I., Duart, J.M., Galvis, A.H., Zawacki-Richter, O.* (2018). Thematic analysis of the international journal of educational Technology in Higher Education (ETHE) between 2004 and 2017. *International Journal of Educational Technology in Higher Education*. 15: 8. DOI: 10.1186/s41239-018-0089-y

Mustafa et al., 2019 – *Mustafa, E., Mohd Ariffin, N., Mohd Arshad, A.H., Mohamad, A.M., Hanafiah, N.A.H.* (2019). Roles of Higher Education Institutions (HEIs) in Producing Holistic Graduates. *International Journal of Education, Psychology and Counseling*. 4(32): 29-42. DOI: 10.35631/IJEPC.432004

Obukhov, 1999 – *Obukhov, A.N.* (1999). Issledovatel'skaya deyatel'nost' kak sposob formirovaniya mirovozzreniya [Research activity as a way of shaping a worldview]. *Narodnoe obrazovanie*. 10: 158-161. [in Russian]

Petrov, 2004 – *Petrov, A.A.* (2004). Professional'naya kompetentnost': ponyatiino-terminologicheskie problemy [Professional competence: conceptual and terminological problems]. *Vestnik vysshei shkoly*. 10: 6-11. [in Russian]

Prosekov, 2020 – *Prosekov, A.Yu., Morozova, I.S., Filatova, E.V.* (2020). A Case Study of Graduate Quality: Subjective Opinions of Participants in the Sphere of Education. *European Journal of Contemporary Education*. 9(1): 114-125. DOI: https://doi.org/10.13187/ejced.2020.1.114

Stentoft, 2017 – *Stentoft, D.* (2017). From saying to doing interdisciplinary learning: Is problem-based learning the answer? *Active learning in Higher Education*. 1: 51-61.

Trede, 2019 – *Trede, F., Jackson, D.* (2019). Educating the deliberate professional and enhancing professional agency through peer reflection of work-integrated learning. *Active Learning in Higher Education*. DOI: https://doi.org/10.1177/1469787419869125

Tseng, Yeh, 2019 – *Tseng, S.-S., Yeh, H.-C.* (2019). Fostering EFL teachers' CALL Competencies Through Project-based Learning. *Educational Technology & Society*. 22(1): 94-105.

Van den Berg, 2017 – *Van den Berg, N.* (2017). Boundary-crossing competences of educators and researchers in working on educational issues. *Journal of Finnish universities of applied sciences*. [Electronic resource]. URL: https://uasjournal.fi/in-english/boundary-crossing-competences-of-educators-and-researchers-in-working-on-educational-issues1/

Van der Vleuten, 1996 – *Van der Vleuten, C.P.M.* (1996). The assessment of professional competence: developments, research and practical implications. *Advances in Health Sciences Education*. 1(1): 41-67.

Verbitsky, Larionova, 2009 – *Verbitsky, A.A., Larionova, O.G.* (2009). Lichnostnyi i kompetentnostnyi podkhody v obrazovanii: problemy integratsii [Personal and competency-based approaches in education: problems of integration]. M.: Logos. 336 p. [in Russian]

Zimnyaya, 2006 – *Zimnyaya, I.A.* (2006). Kompetentnostnyi podkhod. Kakovo ego mesto v sisteme sovremennykh podkhodov k probleme obrazovaniya? (teoretiko-metodologicheskii aspekt) [Competency-based approach. What is its place in the system of modern approaches to the problem of education? (theoretical and methodological aspect)]. *Vysshee obrazovanie segodnya*. 4: 20-27. [in Russian]