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Diagnosics Of Pedagogical Staff Readiness For Teaching Natural Sciences In English

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Abstract

This article analyzes the formation of pedagogical staff readiness for teaching natural sciences in English within the frame of updated content of education. The theoretical and empirical research is conducted to examine the readiness of the working at school and using new technologies pedagogues for teaching in English. The results of research allow improving the pedagogical process at the secondary school as a contemporary educational system uses English language in teaching natural sciences. In conclusion, the development of a technique begins with the theoretical analysis of the readiness essence of pedagogical staff for teaching natural sciences in English.

Keywords: readiness, pedagogue, natural sciences, education.

Diagnóstico de la preparación pedagógica del personal para la enseñanza de las ciencias naturales en inglés

Resumen

Este artículo analiza la formación del personal pedagógico para enseñar ciencias naturales en inglés en el marco del contenido actualizado de la educación. La investigación teórica y empírica se lleva a cabo para examinar la preparación para el trabajo en la escuela y el uso de pedagogos de las nuevas tecnologías para la enseñanza en inglés. Los resultados de la investigación permiten mejorar el proceso pedagógico en la escuela secundaria, ya que un sistema educativo contemporáneo utiliza el idioma inglés para enseñar ciencias naturales. En conclusión, el desarrollo de una técnica comienza con el análisis teórico de la esencia de la preparación del personal pedagógico para la enseñanza de las ciencias naturales en inglés.

Palabras clave: preparación, pedagogo, ciencias naturales, educación.

1. INTRODUCTION

According to the State program of development of education and science of the Republic of Kazakhstan for 2016-2019, using three languages in teaching process becomes a foreground sphere of educational system development of the Republic of Kazakhstan. From 1 September 2019, all 10-11 forms will experience the phased transition learning of «Chemistry», «Physics», «Biology», «Informatics» in English. In order to improve the level of English language proficiency and teaching other subjects through English, in

2016 Educational Excellence Center of Nazarbayev University organized the training course of qualification enhancement for 675 teachers of secondary school from all regions of Kazakhstan. In 2017, 5010 teachers successfully completed Educational Excellence Center of Nazarbayev University program aimed at English language proficiency improvement and acquisition of the content of the above-mentioned subjects in English. The training of teachers is realized on the basement of Educational program (Program) of the course of qualification enhancement for teachers of secondary school developed by Educational Excellence Center of Nazarbayev University. The Program contains information about learning the English language by teachers of the secondary school, preparation for teaching «Chemistry», «Physics», «Biology», «Informatics» in English and development of professional competencies within the frame of updated content of secondary education. Nevertheless, the state experiences the shortage of qualified pedagogues ready to carry out the pedagogical activity within the frame of updated content of education.

We emphasize the importance of the pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. In modern pedagogical and psychological science, the extensive theoretical and practical material about the readiness of the teacher for pedagogical activity is saved up. These studies prove that readiness represents a fundamental condition of the successful performance of any activity. The significant contribution to the development of psychological and pedagogical aspects of this problem was made by (Dyachenko & Kandybovich, 1976; Kucheryavenko, 2011). The contribution to the improvement of psychological and pedagogical readiness was made by

Kazakhstani scientists Akhmetkarimova (2012), Zhampeisova & Khan (2011), Kustobayeva (2002), Makridi (2007), Adambekova (2011), and others. The works of foreign authors devoted to various aspects of professional education in the countries of Europe arouse interest (Sulistyaningsih et al, 2019; Saidi & Siew, 2019).

The analysis of the issues concerning «readiness» concept, shows the following discrepancies: whether the readiness is a condition reflecting the functional level of the subject of activity, or a quality reflecting the personal level of the subject of activity, or an ability realizing the capacity of the subject of activity. Thus, the precise differentiation of the presented bases of readiness of the subject for activity is required. We need a fund of theoretical and empirical knowledge, which is available in pedagogical science, expresses the content and structure of teacher's readiness for professional activity, and methods of its formation in the course of training. The potential item is what we do not have in relevant existing scientific ideas about the concept of «readiness», the ways and methods of its formation. On the basis of definition of readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education as a mastering of all components of pedagogical activity: motivational, intentional, procedural and creative, we constructed the structure of readiness representing system with 4 components (Table 1).

Table 1 – Structure of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education

Components	Content of component
Motivational	<p>The recognition by pedagogical staff the social importance of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education.</p> <p>The realizing of importance of readiness formation for teaching natural sciences (physics, informatics, chemistry, biology) in English.</p> <p>An ability to diagnose, correct the psychological and pedagogical situations and use the creative approach in teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of the updated content of education</p> <p>The availability of professionally significant, personal qualities (high level of cognitive and internal motivation development, adequate self-assessment)</p>
Intentional	<p>The Subject, psychological and pedagogical, methodical knowledge, abilities, skills, competences.</p> <p>An ability to activate and develop the apparatus of categories of natural sciences (physics, informatics, chemistry, biology) in Russian, Kazakh and English languages within the frame of updated content of education.</p> <p>The awareness of a technique of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education.</p>

Procedural	<p>An ability to organize teaching natural sciences (physics, informatics, chemistry, biology) in Russian, Kazakh and English language within the frame of updated content of education.</p> <p>An ability to solve the psychological and pedagogical situations of teaching within the frame of updated content of learning natural sciences (physics, informatics, chemistry, biology).</p> <p>An ability to develop personal experience of creative activity within the frame of updated content of education.</p>
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While determining the content of structure, we admitted the position that each teacher has to have an appropriate level of English language proficiency and competence of teaching natural sciences (physics, informatics, chemistry, biology) within the frame of updated content of education. Taking into consideration this issue, we give the following definition for the professional readiness investigated by us. We define readiness as a professional quality of the teacher's identity. This quality integrates in itself the existence of the positive attitude to professional activity, subject, psychological, pedagogical and methodical knowledge, abilities, skills, competencies and also knowledge of a technique of teaching of natural sciences (physics, informatics, chemistry, biology) in English, the experience of creative activity within the frame of updated content of education. We developed the criteria of the required readiness, the criteria were inserted into a concept of «readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education» and these criteria became the semantic nuclear of the concept:

- Positive attitude forward professional activity;

- The subject, psychological and pedagogical and methodical knowledge, abilities, skills, competencies;
- Knowledge of a technique of teaching natural sciences (physics, informatics, chemistry, biology) in English;
- Creativity within the frame of updated content of education.

The criteria of readiness allowed the identifying the following levels of its formation: high, average and low.

1.1. High level of readiness

The pedagogical staff deeply understands the social importance of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. They realize the importance of the required readiness formation; they have professionally significant, personal qualities (high level of cognitive and internal motivation development, adequate self-assessment); Perfectly-formed ability to diagnose, correct psychological and pedagogical situations and use creative approach in teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education (Jenaabadi & Shad, 2013).

1.2. Average level of readiness

Pedagogical staff demonstrates the sufficient level of understanding the social importance of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. They understand the importance of the required readiness formation. They have professionally significant, personal qualities (high level of cognitive and internal motivation development, adequate self-assessment); sufficiently formed ability to

diagnose, correct psychological and pedagogical situations and use creative approach in teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education (Bryakova, 2010; Jenaabadi & MansourShad, 2013).

1.3. Low level of readiness

The analysis of the real conditions of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education will identify the percentage of the researched readiness in each of the allocated levels: high level – from 90 to 100%, average level – from 50 to 89%, low level – from 0 to 49%. Within the frame of the specified gradation – there is a certain number of indicators, which is available for pedagogical staff: the less we indicators find, the lower the level of readiness. The state Program of stage-by-stage preparation of pedagogical staff for teaching natural sciences (Chemistry, Biology, Physics and Informatics) in English till 2019 points out (Kondrashova, 1987):

- The increase of English language proficiency up to Elementary level according to all-European criteria for determination of the level of foreign language proficiency (Common European Framework of Reference for Languages - All-European criteria for determination of the level of foreign language proficiency – CEFR);

- The development of the communicative competences corresponding to the level of English language proficiency; training pedagogical staff of natural and mathematical direction to acquire academic English and subject terminology; teaching methods of subject learning through English.

Within the frame of updated content of education the pedagogical staff must:

-Acquire the English language 2 levels above, then their initial level;

-Know and understand the subject terminology and academic English;

-Understand the necessity of providing language support for pupils studying a subject through English language (Kankalik, 1990).

1.4. Participants

The contingent of pedagogical staff included city and village teachers of «Chemistry», «Biology», «Physics» and «Informatics» of secondary school of the republic. It should be noted that pedagogical staff had various experience of studying the English language: some of them learned language earlier; others did not even know the English alphabet as they were acquiring German or other languages. The total number of teachers of the secondary schools participating in an experiment – was 100 and the number of students – 100, including 50 respondents of the experimental group (EG) and 50 respondents of the control group (CG). The total number of respondents was 200. The base of research: Pavlodar State Pedagogical University, The training course of qualification enhancement for the pedagogical staff of secondary school teaching «Informatics», «Physics», «Chemistry» and «Biology» in English organized by Educational Excellence Center Nazarbayev University (Ahmadi et al, 2014).

2. METHODOLOGY OF RESEARCH

2.1. General Characteristics

Before the empirical analysis of activity products of pedagogical staff in Pavlodar region, we with the help of theoretical analysis and observation defined the specifics of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. On the basis of the analysis of the «readiness» concept and above-mentioned features, we defined the specifics of pedagogical staff preparation for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education (Akhtaeva, 2008):

- The main goal is the formation of communicative competence of pedagogical staff, overcoming a language barrier and fear to speak English. This approach places emphasis on the language use and formation of confidence in real speech situations;

- The problem of the pedagogical staff consists in the formation of abilities to express an idea with limited vocabulary and without fear of making English grammar mistakes that provides immersion in the language while teaching «Chemistry», «Biology», «Physics» and «Informatics».

Being guided by specific indicators of the researched readiness revealed and formulated by us, we carried out the empirical research in schools of the Pavlodar region. 200 teachers, who arrived to participate in training courses of qualification enhancement for pedagogical staff, were the respondents of the experiment. The results of the analysis showed that the level of teachers' readiness was different. always – 81%, frequently - 12%, never – 7%. Diagnostics of the readiness showed that its indicators are revealed in the concrete pedagogical activity of the teacher judging by which it is possible to speak about

readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. Observations and conversations with teachers showed the importance of the level of English language acquisition in teaching natural sciences. We think that the high percentage of the teachers who are not interested in learning the English language as the main aspect of teaching natural sciences is stipulated by the insufficient focus of training programs on this type of activity in a higher education institution. In addition, it can be explained by inertness of teachers, by lack of desire to be engaged in self-education: that is an ability to break psychological barriers, which appear the process of new information perception. Only 8% of teachers are trying to master the English language independently through a prism of teaching natural sciences (physics, informatics, chemistry, biology) (Durainovakova, 1983; Tao & Xuguang, 2018).

Thus, the results of the analysis of the theoretical bases of professional readiness of pedagogical staff for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education confirmed that «readiness as a professional quality of the teacher's identity integrates in itself the existence of the positive relation to professional activity, subject, psychological and pedagogical, methodical knowledge, abilities, skills, competencies, technique of teaching natural sciences (physics, informatics, chemistry, biology) in English and experience of creative activity within the frame of updated content of education». The praxis of specialists training in higher education institutions in our republic demonstrates the existence of deep contradictions between the required level, orientation, content of specialists training and traditional

approach to the organization of training, development of its contents, priorities identification.

2.2. Instruments and Procedure

For the purpose of definition of the initial condition of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education the complex of methods was used: questioning, observation, testing, analysis of pedagogical situations and solution of pedagogical tasks, analysis of documentation and products of activity and statistical data. During the experiment the following problems should be solved:

- To define an initial condition of the researched readiness;
- To reveal the capacities of the subjects included in the content of State standard of higher education for the realization of the readiness formation.

In order to solve the issues, we checked the validity of the conclusions formulated at the stage of the theoretical analysis of scientific literature and educational documentation. In the process of investigation, we studied the capacity of teaching content, educational process and we came to the following conclusions:

- In the pedagogical process of higher education institution there are potential capacities for the formation of readiness of pedagogical staff for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education;
- The content of subjects has a sufficient capacity for the formation of the readiness;

- The purposeful system of teachers' activity in higher education institution, the coordination of actions between the chairs of Pedagogics, Psychology, English Philology and Methods of Natural Sciences Teaching with orientation to object of teachers' activity are necessary for the formation of readiness of pedagogical staff for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education.

Thus, the comparison of the received results of the ascertaining experiment with the developed theoretical model of the readiness showed the necessity to organize a special work to form the readiness of pedagogical staff for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. The above-mentioned issues demonstrated the necessity to develop specifically organized experimental-pedagogical activities for the formation of the readiness with 3 stages: theoretical, integral and practical (Kustobayeva, 2002).

3. RESULTS OF RESEARCH

During the forming experiment, the content and methods of the required readiness were developed and approved. For the purpose of the organization of experimental and pedagogical work, we defined the following tasks: to develop and approve a special course for the readiness formation. To use the potential capacities of the State standard of higher education, the Educational program of the training course of qualification enhancement for schoolteachers developed by JSO «Nazarbayev University» and the subjects of all types of the

praxis in the formation of components of the readiness. To reveal the pedagogical conditions promoting the formation of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education.

Experimental work was developed based on the theoretical model of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education and results of the comparative analysis of the initial condition of the teachers and students' readiness. Each stage of the experimental-pedagogical work had the «control tests» with the purpose to determine the dynamics of the levels of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education taking into account the criteria and indicators according to the developed model.

3.1. Interim survey results

The results of the first «intermediate test» revealed the reduction the number of pedagogical staff with the low level of readiness and insignificant increase in number with the average level of readiness and an insignificant number of respondents with the high level of readiness. But special changes of levels of the researched readiness were not observed (Leontiev, 1992).

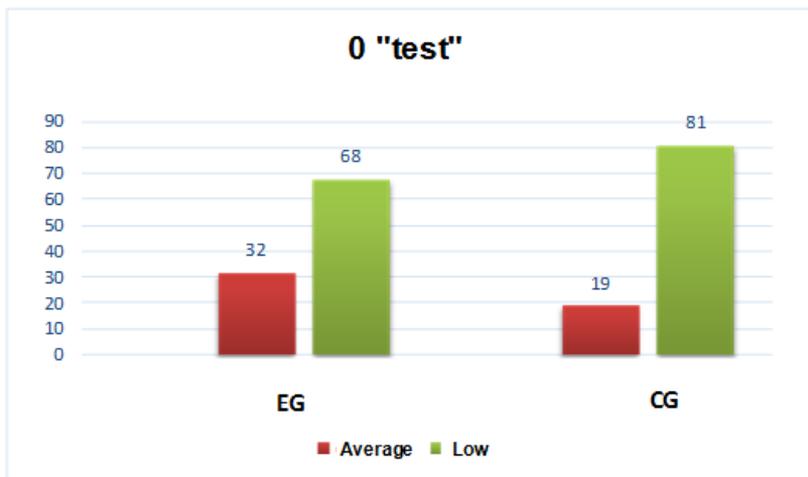


Figure 1 – Results of the zero survey

The results of the «first test» pointed out that knowledge and skills, which can be acquired in the course of psychological and pedagogical disciplines within the existing programs and standards, are not enough for the effective preparation of pedagogical staff for the issues under consideration. It defined the necessity of the organization of the subsequent stages of experimental-pedagogical work. The purpose of the second stage was the formation and systematization of theoretical knowledge according to the subject of our research and armament of pedagogical staff with practical abilities to form readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. The acquisition of knowledge was promoted by complex of psychological and pedagogical disciplines, techniques of teaching natural sciences in English, by special course «Psychological and pedagogical bases of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education». The

purpose of the course: is mastering the concepts and abilities for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education (Abulkhanova, 1980).

The tasks and test materials disclosing subject, psychological and pedagogical, methodical knowledge, abilities, skills, competencies and pedagogical situations for checking the knowledge of a technique of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education were prepared to form the intentional component of readiness.

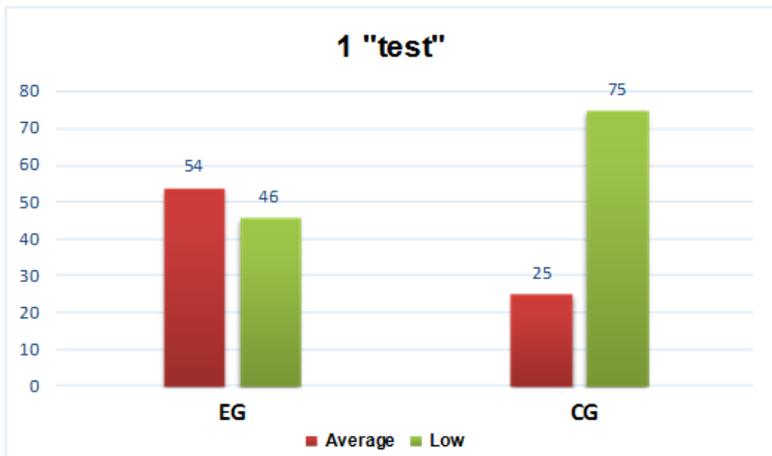


Figure 2 - Results of the first survey

Second «test» was carried out at the integrating stage to define the dynamics of changing the readiness levels after the special course «Psychological and pedagogical bases of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame

of updated content of education». The changes in the ratio of levels of readiness formation took place due to the systematization of theoretical knowledge by pedagogical staff in the field of the updated content of education. Second «test» allowed to define the reduction the number of pedagogical staff with the low level of readiness (15%) and vice versa, the growth of average level (62%) and the growth of respondents with the high level of readiness (23%). The important role of this stage belongs to creative activity, which includes a number of creative tasks: the compiling of natural sciences terminological dictionaries (physics, informatics, chemistry, biology) in English (Ananiev, 1980; Berkah & Sawarjuwono, 2019).

Thus, this stage of experimental work with clear settings, subject content, and didactic-methodical provision reflected the appropriate level of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. Various tasks in the process of special course allowed to increase gradually the level of required quality. The special course «Psychological and pedagogical bases of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education», purposefully brought pedagogical staff to the understanding of the essence of the readiness. Relying on the results of the experimental and pedagogical work, carried out within the frame of the training course of qualification enhancement for teachers of secondary school teaching «Informatics», «Physics», «Chemistry» and «Biology» in English, organized by Nazarbayev University for pedagogical specialties at the Pavlodar State Pedagogical University, we understood that the special course must be acquired by students before

their pedagogical practicum and by schoolteachers during courses of qualification enhancement on the basis of Nazarbayev University.

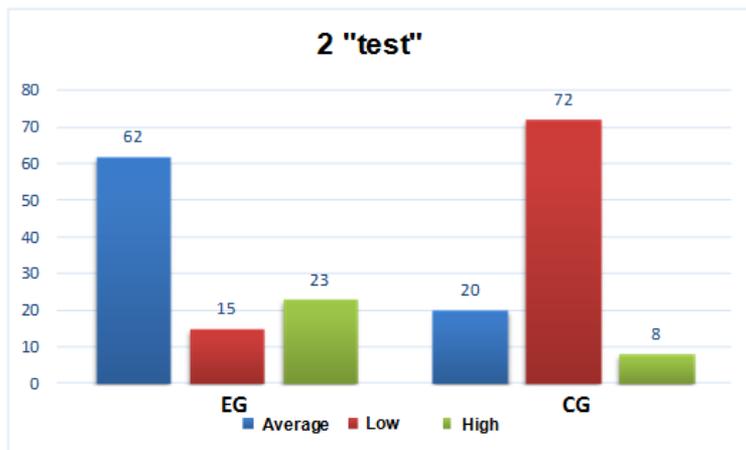


Figure 3 - Results of the second survey

The third practical stage facilitates the work process by a special program of pedagogical practicum developed by us. Here the system of practical tasks assumed the actualization of intentional and procedural components of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. The results of the third test showed the growth of the number of pedagogical staff with high level and considerable reduction the number of teachers with the low and average levels. It demonstrated the efficiency of the work. The final stage of experimental and pedagogical work signals the increase of the procedural component and the changes of tests' results for identification of the readiness levels certify it. The first and

second stages of experimental and pedagogical work are characterized by an increase in the intentional component. It is explained by the specifics of the disciplines studied at these stages.

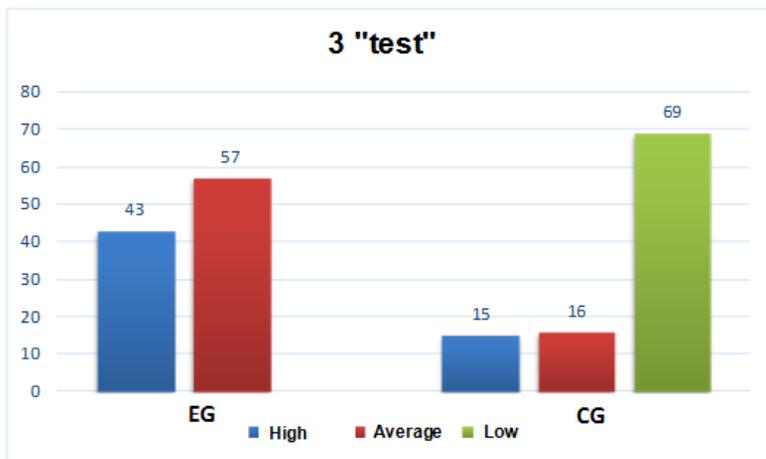


Figure 3 - Results of the third survey

Thus, estimating the readiness of the pedagogical staff for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education, the actual material disclosing the dynamics of indicators' growth of readiness was selected. Dynamics of levels changing of the readiness is presented in table 2.

Table 2 – Dynamics of levels of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education (%).

№	Levels of	The results of «tests»
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	readiness	0 «test»		1 «test»		2 «test»		3 «test»	
		EG	CG	CG	CG	EG	CG	EG	CG
1	High	-	-	-	-	23	8	43	15
2	Average	32	19	54	25	62	20	57	16
3	Low	68	81	46	75	15	72	-	69

The comparison of the «tests» results gives the chance to observe positive dynamics of change of the former professional quality: if the initial zero «test» showed the low level of the readiness (68%), the final «test» reflected the positive changes in levels of the researched readiness. Final «test» reflected the increase of a number of examinees with the high level of readiness (43%), the reduction of a number of examinees with low level and vice versa, the increase a number of examinees with an average level of readiness (57%). Above-stated data received by us as a result of experimental and pedagogical work allowed to draw the following conclusions:

- The objectivity of the structure of the researched readiness is confirmed, it leads to rapprochement of the intentional, procedural and creative aspects of training, which is revealed in successful knowledge mastering;

- The validity of the existence of the levels of the researched readiness formation is proved;

- The technique of formation of the researched readiness developed by us promoted the creation of necessary conditions for an increase in levels of the researched readiness formation.

4. DATA ANALYSIS

The analysis of the experimental work gives the grounds to consider that the readiness of pedagogical staff for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education is important and necessary. Moreover, it is possible to carry it out in the conditions of the purposeful and systematic organization of experimental and pedagogical work. The results of experimental and pedagogical work confirm it. The theoretical justification and practical development of the content and technique of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the updated content of education confirmed our hypothesis. If during the training in higher education institution along with studying of psychological and pedagogical disciplines purposefully equip pedagogical staff with content and technique of teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education, then in the course of professional training the readiness for teaching in English is formed, which is allowing to work within updated content of education.

5. CONCLUSION

World trends of the globalization of education impose new requirements to the identity of the teacher, who must be a creative personality with original, problem and pedagogical, critical thinking, the translator of the best international experience applying new technologies. The solving of this contradiction is possible by the

development of structure and content of readiness components and identify the levels of readiness formation as a professional quality of the teacher. The development of a technique begins with the theoretical analysis of the readiness essence of pedagogical staff for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. From the methodological point of view, the theoretical position of our research was identified by the conceptual framework of the research, specification of such aspects as «readiness», «professional quality» and «professional training». The readiness of pedagogical staff for teaching natural sciences (physics, informatics, chemistry, biology) in English within updated content of education is one of the important issues in professional preparation for pedagogical activity.

6. DISCUSSION

During the experimental and pedagogical work, we introduced the definition of «pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education», the structure, criteria, indicators and levels of the researched phenomenon were developed. The results of diagnostics of the initial condition of the researched readiness defined the character and dynamics of the changes occurred in the course of readiness formation. The analysis of the results of experimental and pedagogical work proves the efficiency of the technique developed by us. The conducted research pretends to have theoretical - experimental character; it affects only one of the aspects

of a multiple-factor problem and does not apply for an exhaustive solution of the problem of pedagogical staff readiness for teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education. During the research and evaluation of its results, new problems were outlined the solution of which was very important. There is further theoretical-methodological research of different aspects of pedagogical staff readiness for professional activity, the use of new educational technologies in teaching natural sciences (physics, informatics, chemistry, biology) in English within the frame of updated content of education.

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