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**ORGANIZATION OF INDEPENDENT WORK OF STUDENTS  
WITH DISABILITIES**

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***Abstract***

One of the main tasks of modern education is the development of the complete human being, which is realized through a competency-based approach to learning. The competency-based approach is the priority orientation of education towards its result: the formation of the necessary competencies, self-determination, socialization, development of individuality and self-actualization. Independent and individual work of students plays a great importance in the development of personality and the formation of the necessary competencies. Independent work of a student is one of the main components of the educational process, it contributes to the formation of knowledge, skills and ensures the acquisition of creative techniques by a student. The article considers the methodological aspects of the organization of independent work for students with disabilities in mathematics in conditions of a competency-based approach on the example of studying the courses “Elements of higher mathematics”, “Probability theory and mathematical statistics”. Particular attention in the study is paid to the importance of a person-centered approach to teaching, the adaptation of didactic materials and the integration of students with disabilities in the educational process. This is updated by the main provisions of inclusive education, such as the introduction of new teaching methods, the adaptation of curricula, the change in the forms, methods and techniques of teaching students with disabilities.

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**Keywords:** Competency-based approach, inclusive education, independent work in mathematics.



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## 1. Introduction

Modern society presents key challenges for the education system - the search for effective ways of personal development. To solve this problem, the education of our country has adopted new educational standards, targeting school teachers, college and university teachers at studying, in the process of which a person is formed who can think independently, solve complex problems and is capable of self-education.

One of the ways to solve this problem is to realize a competency-based approach. Many scientists - teachers, psychologists, and teachers – deal with the competency-based approach (Mikhashchenko, 2015; Morodenko & Gileva, 2019; Troyanskaya, 2016; Zhafyarov, 2016). The essence of the competency-based approach is that the student does not receive ready-made concepts, definitions and formulas, but conditions are created so that the students themselves form the knowledge necessary to solve practical problems. According to Troyanskaya (2016), competency-based professional education is an objective phenomenon in education. The market places new demands on specialists for the goals, results and pedagogical technologies of training. As a goal, the formation of specialist's corresponding competencies is considered.

At the present stage, much attention is paid to inclusive education, the education of children and adolescents with health limitations (HL). As the statistics shows, every year the number of students with disabilities increases. At the same time, any person, even with disabilities, has the right to receive education at school, a intermediate vocational educational institution (IVE), or at a university (HVE) (Kosova & Izetova, 2020; Zorina, 2018). Many teachers, psychologists deal with the issues of organizing students' independent work, they show various ways of organizing independent work of students with disabilities. The most common ones are the organization of self-study with a differentiated or individualized approach in teaching students with disabilities (Seregina, 2018). A number of scientists give author's definitions of the independent work of students (schoolchildren). By independent work of students, we mean the planned educational, educational-research activities of students, carried out on the instructions and with the systematic guidance of the teacher, but without his participation (Gusev, 2014; Morodenko & Gileva, 2019).

## 2. Problem Statement

Our study is aimed at finding methods and techniques for organizing the independent work of students with disabilities while teaching mathematics at a secondary special educational institution, and at adapting existing didactic and evaluating materials to the characteristics of students with disabilities. Psychologists, teachers, doctors note that students with locomotor impairments often cannot establish cause-and effect relationships, identify the main thing in the text, cannot use concepts correctly, cannot work with definitions, formulas, theorems. Students with locomotor impairments may have decreased attention, they do not remember the material well, are very excitable, and are prone to mood swings (Kashtanova et al., 2017; Martynova, 2016a). The teacher should take into account all these features of students with disabilities and adhere to the recommendations, given by scientists, on the organization of the educational process for such students.

- When holding classes, it is necessary devote more time to completing tasks.
- Alternate different types of oral and written assignments.
- Sound and visual representations of educational material should duplicate each other.
- Use cognitive enhancing methods.
- Use visual materials, training videos.
- Classes should not last for more than an hour or an hour and a half.
- Reserve time for physical exercises (exercises for the eyes, for hands, etc.)
- There is a necessity for breaks of 10-15 minutes between classes.

Due to the characteristics of health, the emotional and psychological state of students with disabilities, their independent work should be based on an individualized approach to learning. Such work should be well-organized by a teacher who has received professional training on the work with students with disabilities and knows the health characteristics of people with various diseases.

### **3. Research Questions**

In the course of the study, it is necessary to answer the following questions.

How to organize effective independent work with students with disabilities in mathematics in the conditions of a competency-based approach to learning?

How to prepare highly-qualitative didactic materials for independent work of students with disabilities in mathematics?

What criteria should be used in evaluating the knowledge, received by students in the course of independent work?

### **4. Purpose of the Study**

The purpose of the study is the search and adaptation of effective techniques and methods of organizing the independent work of students with disabilities in teaching mathematics in a specialized secondary educational institution and the development of didactic, test materials for the implementation of individualized independent work of students with disabilities in mathematics.

### **5. Research Methods**

The study has been conducted on the basis of the Kurgan pedagogical college, in the groups with students with special needs, specializing in “Information systems”, “Applied informatics”, while studying the courses “Elements of higher mathematics” and “Probability theory and mathematical statistics”. The pilot testing consists of three stages: initial, training and final. At the first stage, we studied and analyzed scientific, educational, educational-methodological literature on the organization of independent work of students with disabilities, syllabuses of the disciplines “Elements of higher mathematics”, “Probability theory and mathematical statistics”, on the basis of which the relevance of this issue was identified. At this stage, the work was carried out, aimed at finding methodological ways of teaching students with disabilities,

theoretical materials were defined and systematized, detailed lecture notes, reference materials and educational didactic material were developed.

At the second, training stage of the testing, the developed materials were tested in the classes on the disciplines “Elements of higher mathematics”, “Probability theory and mathematical statistics” in the first and years of study of the Kurgan pedagogical college, both with students with disabilities and practically healthy students.

At the last stage, the results of the pilot testing were summed up.

### **5.1. Theoretical and practical aspects of the organization of independent work with students with disabilities**

Due to the peculiarities of health, emotional and psychological state of students, the individual independent work of students with disabilities has a number of features (Martynova, 2016 b).

- It is necessary to combine the amount of class and independent work correctly.
- It is necessary to organize the work of students outside the classroom in a proper way from a methodological point of view.
- The student must be provided with the necessary educational and didactic materials.
- Regular monitoring of independent work should be organized, and measures, encouraging the student for its completion, it should be taken.

The students, entered this educational institution, should have the necessary amount of knowledge in mathematical disciplines, this knowledge is the basis for the independent acquiring of new knowledge and their subsequent application. In practice, in the context of the reduction in classroom activities while maintaining the content, low mathematical preparation of junior students, planning, organization and implementation of the student’s work in the absence of a teacher, that is, independent work, come to the fore. In junior years of study, the degree of independence of students is low, so the teacher has an active position in developing and monitoring it, the process of independent work becomes more conscious and gradually turns into a creative process as the student moves to senior courses. The main task of organizing independent work in junior courses is to teach students to acquire knowledge independently, which means to teach how to work with a textbook, special materials, and special equipment.

To organize independent work, teachers and methodologists (Gusev, 2014; Seregina, 2018) recommend the use of the following techniques:

- Read the text to yourself or aloud.
- Retell the contents of the material, which has been read, aloud and to yourself.
- Discuss the material in pairs or in groups.
- Divide the text, which has been read, into semantic parts.
- Draw up a plan of the read material independently, which can be used by the student when answering at the test or exam.
- Organize work with a table of contents, subject index.

- Organize work with drawings, illustrations, diagrams, tables, presentations, dictionaries, encyclopedias.
- Conduct work on the concept, term, formula.

The main purpose of using the first three techniques is to teach students to memorize the material, to develop their oral speech, and to teach them to use mathematical terms. The discussion of the material read usually takes place in the form of a conversation. The teacher asks the students questions. Let us give an example of such a conversation on the topic “Matrices, operations on matrices”. Before beginning the lecture, the student receives specially-prepared materials, containing brief theoretical information, diagrams and examples. After explaining the new material, the student reads the text of the lecture notes and answers the questions of the teacher. Here is an indicative list of questions for the discussion (Lukerianova, 2017).

- Find and read the matrix definition?
- Find an example of a square matrix in the text?
- Give the examples of the use of matrices in everyday life?
- Read the definition of the same type of matrices. Give examples.
- Which matrices are called equal?
- Find, read and repeat the definition of the sum of two matrices?
- Formulate and write down the properties of the matrix addition operation?
- What methods prove the properties of matrix addition? What mathematical statements have been used to prove these properties?

The work on division of the text into semantic parts should be organized as follows: the teacher suggests dividing the presented text on the topic “Random Variables” into semantic parts and giving names for them. As the practice shows, the correct understanding of the concept is facilitated by working with mathematical reference books, encyclopedias to identify the origin of terms (natural number, divisor, divisible, multiple, congruence modulo).

The main type of independent work is written work, which includes the following types.

- Solving problems to sum up the material covered.
- Construction of the tasks by students themselves.
- Organization of work on mistakes.
- Doing home assignment.

At present, to improve the learning process, a large number of educational technologies have been developed; for the more effective organization of independent work of students with disabilities, we use the elements of individualized training technology (Makarov, 1994). At the beginning of the academic term, the student receives all the educational methodological materials for the study of the course, which include: the training syllabus, course schedule, study guide. When compiling educational materials, it is necessary to adhere to the basic requirements, recommended for the organization of the educational process of students with disabilities (Martynova, 2016a).

- Tasks in the training materials should be presented in the order in which the student will do them. Students are informed about the deadlines for completing assignments.
- Each assignment should be provided with instructions that would allow understanding where to take theoretical material from to do the assignment.
- In order to understand the tasks and the plan of actions by students with disabilities, they need to be formulated clearly, precisely, briefly. The tasks should be arranged from easier to more difficult ones.
- It is necessary to state clearly in what form the task should be done and how to report on the work done.

The main theoretical provisions of the methodology for organizing independent work of students with disabilities in mathematics are presented, let us consider the methodology itself.

## **5.2. Methodological aspects of organizing independent work with students with disabilities**

We offer the following methodology of students' work with teaching materials in courses "Elements of higher mathematics", "Probability theory and mathematical statistics". The student begins with an introduction to the teaching syllabus and course schedule, schedule of individual consultations, schedule of reports for each section. The course schedule contains the name of the studied sections, topics; chapter numbers, paragraphs from recommended literature, dates of consultations, dates of report on each topic. The study guide, developed in accordance with the above requirements, contains the basic concepts, important theorems, formulas, problem solving samples, tests to check the mastering of theoretical material, questions for the test, questions for the exam (credit). The study guides are differentiated by difficulty levels. Students choose the level of difficulty individually, each works at his own pace. Choosing the literature to study new material, they can compare different approaches in the presentation of this material by textbook authors. The student begins to study the topic himself with the theoretical information that can be studied by using the provided study guides (notes, cards) or using the recommended educational literature. After the basic concepts, definitions, theorems and formulas are studied, the student is invited to test his knowledge by answering the test questions.

Having worked out the theoretical material, the student studies the samples of solving problems of the first and second difficulty levels and solves the problems on the topic, proposed to him. The student may find it difficult to complete the task, in this case he comes back to the textbook, study guides, consults with the teacher. The student will pass a credit (an exam) for the course if he gives a report on each topic, gets a test done. The report on the topic is in the student's answering the questions, proposed to him, which he is given in advance; is in showing the tasks, solved independently; solves 2 - 3 tasks of any difficulty level, proposed by the teacher.

Performing independent work, the student can find out the sum of his points and, if necessary, can improve his result by choosing tasks of a higher level of difficulty on specific topics. At the same time, a database can be used for current work, which is convenient for both the teacher and the student. Computer testing in the theoretical part will greatly facilitate the work of the teacher in checking students' work, eliminate the element of cheating, and increase the student's independent work skill. In addition, the teacher

can make changes to tasks, vary difficulty levels. Tests of current control consist of two types of tasks: recognition and reproduction of the main provisions of the theory, and solving basic problems.

## 6. Findings

At the training stage of the experiment, in the first and second year groups (13A, 23A), where there were students with disabilities, specializing in “Information Systems”, “Applied Informatics”, while studying the courses “Elements of Higher Mathematics” and “Probability Theory and Mathematical statistics”, all the main provisions of the methodology for organizing independent work, described above, were followed, the experiment lasted 3 terms. Along with the experimental groups (13A, 23A), the students of the control groups (13, 23) were trained according to the traditional methodology. At the end of each semester, intermediate certification was conducted in the above disciplines, the results of which are presented in Table 01.

**Table 01.** Results of pedagogical experiment

№ Of group	Number of students (all in all)	Number of students with disabilities(distant learning)	% of the quality of control group		% of the quality of experimental group	
			Before	After	Before	After
13	13	2 (1)	7.7	7.7	-	-
13 A	13	2 (1)	-	-	7.7	15.4
23	13	2 (1)	7.7	7.7	-	-
23A	12	3 (2)	-	-	8.3	16.7

The analysis of certification papers and other documents has shown that in the control groups the quality of passing the intermediate certification did not change practically, and in the two experimental groups there was an increase in the quality of academic performance of students with disabilities. The percentage of quality shows the ratio of the number of students with disabilities who have passed the intermediate certification with “good” and “excellent” marks to the total number of students in the group.

Based on the results of the experimental work on the organization of independent work of students with disabilities, we can draw the following conclusions.

- The pilot testing was carried out in a college environment, students with disabilities studied together with practically healthy students, and, as an option, on distance learning.
- The methodology of teaching, developed by the team of authors, has had a positive effect, the developed didactic materials have been carefully prepared and tested.

## 7. Conclusion

In conclusion, let us note that this issue is not fundamentally new, but quite relevant today, especially in relation to students with disabilities. The described technique is based on the provisions of the technology of individualized learning, on a competency-based approach to learning, the accumulated experience of the authors of the article, and has shown its effectiveness in organizing independent work of students with disabilities. As the results of the pilot testing have shown, it is advisable to apply this technique in a group

with a few students. When organizing the educational process using the technology of individualized learning, distance learning of students with disabilities can be used. The described methodology has been tested and proves that various types of independent work and the use of different forms of its implementation contribute to more effective training of students with special needs, expanding and deepening their theoretical and practical knowledge, skills in the studied disciplines. The described methodology of working with students with disabilities can be applied in teaching students of other areas of training.

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