

Artículo de investigación

Independent work of students in professional educational institutions

Самостоятельная работа студентов в профессиональных учебных заведениях

Trabajo independiente de estudiantes en instituciones educativas profesionales

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The reform of education in Russia has led to emergence of new learning pattern. Today, among numerous changes that have occurred in competence-based approach context, we note tendencies towards changes in teacher's role in a student's life, reduction in classroom hours and increase in the share of students' independent work. In order to preserve and increase effectiveness of student learning, educational institutions should aim at finding new ways to use classroom hours to organize students' independent work. Insufficient knowledge of this topic actualizes the process of its further development. The purpose of our research was to verify the structure of independent work developed by the authors at a technical school in order to increase student training level. For this, the authors conducted an experiment in which two groups of second-year students of 25 people each took part. The results of the differentiated classification of two groups in the course "Engineering Graphics" were compared. The first group of students studied according to the structure available in the college, the second - with the help of the pattern developed by the authors. As a result, it was found that the second group has a higher level of training. The results of the experiment allowed us to conclude that the structure of independent work developed by the authors is very effective and its implementation will allow achieving positive results in students'

Аннотация

Реформа образования в России привела к появлению новой модели обучения. Сегодня среди многочисленных изменений, произошедших в контексте компетентностного подхода, мы отмечаем тенденции к изменению роли педагога в жизни студента, сокращению аудиторных часов и увеличению доли самостоятельной работы студентов. Чтобы сохранить и повысить эффективность обучения студентов, учебные заведения должны стремиться найти новые способы использования аудиторных часов для организации самостоятельной работы студентов. Недостаточная разработка этой темы актуализирует процесс ее дальнейшего развития. Целью нашего исследования была проверка структуры самостоятельной работы, разработанной авторами в техникуме с целью повышения уровня подготовки студентов. Для этого авторы провели эксперимент, в котором приняли участие две группы студентов второго курса по 25 человек в каждой. Результаты дифференцированной классификации двух групп по курсу «Инженерная графика» сравнивались. Первая группа студентов обучалась по структуре, имеющейся в колледже, вторая - по схеме, разработанной авторами. В результате выяснилось, что вторая группа имеет более высокий уровень подготовки. Результаты эксперимента

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competences development and in future graduates training.

Keywords: Independent work, technical school, occupation, credit, competencies.

позволили сделать вывод о том, что разработанная авторами структура самостоятельной работы имеет высокую результативность, а ее реализация позволит достичь положительных результатов в развитии компетенций студентов и в подготовке будущих выпускников.

Ключевые слова: самостоятельная работа, техникум, профессия, кредит, компетенции.

Resumen

La reforma de la educación en Rusia ha llevado a la aparición de un nuevo patrón de aprendizaje. Hoy, entre los numerosos cambios que se han producido en el contexto del enfoque basado en la competencia, observamos tendencias hacia cambios en el papel del maestro en la vida de un estudiante, reducción en las horas de clase y aumento en la parte del trabajo independiente de los estudiantes. Para preservar y aumentar la efectividad del aprendizaje de los estudiantes, las instituciones educativas deben apuntar a encontrar nuevas formas de usar las horas de clase para organizar el trabajo independiente de los estudiantes. El conocimiento insuficiente de este tema actualiza el proceso de su desarrollo posterior. El propósito de nuestra investigación fue verificar la estructura del trabajo independiente desarrollado por los autores en una escuela técnica para aumentar el nivel de capacitación de los estudiantes. Para ello, los autores realizaron un experimento en el que participaron dos grupos de estudiantes de segundo año de 25 personas cada uno. Se compararon los resultados de la clasificación diferenciada de dos grupos en el curso "Gráficos de ingeniería". El primer grupo de estudiantes estudió de acuerdo con la estructura disponible en la universidad, el segundo, con la ayuda del patrón desarrollado por los autores. Como resultado, se encontró que el segundo grupo tiene un mayor nivel de entrenamiento. Los resultados del experimento nos permitieron concluir que la estructura del trabajo independiente desarrollado por los autores es muy efectiva y su implementación permitirá lograr resultados positivos en el desarrollo de competencias de los estudiantes y en la formación de futuros graduados.

Palabras clave: Trabajo independiente, escuela técnica, ocupación, crédito, competencias.

Introduction

The state and society in general today require graduates who are capable of independent creative activity, ready to actively engage in work process immediately after university graduation (Bulaeva, et al 2018). Such employees become competitive specialists, highly demanded in the labor market. It is worth noting that modern education pattern has led to a significant reduction in real classrooms and increase in independent work share (Fedorov, et al 2017). However, in order for a student to work productively independently, it is necessary to work out class-room process so that students can acquire a large amount of information and apply this knowledge independently in future (Garnevska, et al 2018). Therefore, it is important to pay attention to student activities arrangement (Garina, et al 2018). Based on the analysis of scientific literature, the article actualizes the problem of organizing independent work at a modern vocational school (Kustov, et al 2017).

Students must be taught to work independently (Kutepov, et al 2017). Such training includes the development of a system for modeling educational activity itself, determining the most favorable time schedule by students, understanding and working out of rational algorithm with educational material work, mastering ways of generating various action plans, taking notes, organizing and solving educational problems (Ilyashenko, et al 2018a).

Under the conditions of changes that have occurred, the role and importance of independent work have increased significantly (Ilyashenko, et al 2018b). Independent work has become one of the main tools to improve effectiveness of students training in vocational schools (Kuznetsov, et al 2018). Independent work arrangement is becoming one of the key issues in modern educational process.

An important condition for content transformation into a system-forming factor is to focus teachers and student's attention on development of reflexive competencies (Vaganova, et al 2017a). It is on this basis that success of educational and cognitive competencies development will occur as well as determination to independent scientific and intellectual activity (Vaganova, et al 2018) will be created.

Educational organization should be equipped with appropriate technology available to students (Vaganova, et al 2017b). New types of simulators, automated training and control systems are needed that will allow students to acquire knowledge, skills and practical experience at any time and in their usual rhythm (Chirva, et al 2018).

The most important role is played by students' readiness for independent work which includes the ability to self-manage educational activities, a certain level of self-discipline and stable motives for performing tasks for independent work (Markova, et al 2018).

Finally, the teacher, along with their familiar functionality, needs to expand the range of professional activities while fulfilling the role of an academic consultant, leader, and accompanying students' independent activities with counseling and expertise.

It is also important to create conditions for free communication between all participants of educational process. At the same time, vocational school didactics should also undergo changes in terms of organizing training sessions.

Theoretical basis

Scientific literature analysis on the issue of students' independent work in vocational schools showed that the essence of this pedagogical category was revealed from various positions. Many scientists interpret this concept as a specific type of educational activity, there is an opinion that independent work is a learning method, and a number of researchers present independent work as a means of involving students in active cognitive activity (Smirnova, et al 2017a). The subject of students' independent work arrangement and the disclosure of its essence, in particular, was done by such scientists as V. Graf, I.I. Ilyasov, V.Ya. Laudis (Smirnova, 2018a). In their opinion, independent work is a system of organizing pedagogical conditions that enable students to manage their learning activities (Makhometa, et al 2018). Many scholars emphasize that the main feature of independent work is lack of teachers' direct involvement (Smirnova, et al 2017b). B.P. Osipov says that independent work is work performed at a time specially provided by a teacher without his direct participation but according to his task (Smirnova, et al 2018b). Researchers identify other signs of the phenomenon under consideration, for example, N.V. Chekaleva characterizes planned, cognitive, organizational and methodically directed student activities that he performs without teachers' direct involvement to achieve specific results (Tsyplakova, et al 2016).

This concept is considered in works of AG Kazakova, A.S. Lynda, R.B. Sroda, B.P. Esipov, L.V. Zharova and O.A. Nilson, I.A. Winter IN AND. Zagvyazinsky who say that the essence of independent work depends on general concept of educational process (Natalie, et al 2019). That is, on the one hand, learning essence is to develop necessary students' competencies. Independent work becomes a way of consolidating knowledge and gaining skills. On the other hand, if learning is a way of independent cognitive activity development, then independent work is a way to develop creativity and professional thinking (Vaganova, et al 2019). That is, on the basis of all the above, we conclude that independent work acts as a way of shaping independence and activity of an individual, his reproductive and creative abilities, the ability to navigate both in theory and in practical situations, to independently set and solve practical problems (Lubov, et al 2019).

Independent work, speaking about the highest form of student learning activities, plays a crucial role in personality development and activities of future specialists.

Analysis

The authors have developed independent work pattern for the course "Engineering Graphics" for the second year in major "Construction and Maintenance of Buildings and Structures" in Nizhny Novgorod Construction Technical School. The article presents several developed independent researches which are accompanied by relevant instructions that will help students to better navigate the task, in addition, before

performing independent work, the authors offer students a special video that describes their activities step by step. To this video, each student has constant access. So before conducting independent work, students fix covered content. The experiment involved two groups of students, 25 people in each. The first group carried out independent work under the pattern available at college, the second on the basis of the work developed by the authors. Evaluation took place on a five-point scale. 40% of students from the first group were rated "excellent", 45% of students were rated "good", and 15% of the students received "satisfactory" rating. The second group showed better results. Firstly, the percentage of "excellent" marks has significantly increased - 60%, 35% of students have received "good" mark, 15% - "satisfactory" mark. The study shows high impact of independent work developed structure.

Students independent work arrangement at vocational school should take place in several stages, since this work requires orderliness and systematic character, as well as interaction of a teacher and a student on the basis of partnership. To increase the level of organization of students' independent activities, we have developed a pattern of independent work in the course "Engineering Graphics". Course - 2, major "Construction and operation of buildings and structures." Venue: "Nizhny Novgorod Construction College". Before carrying out independent work, the students went through several stages in which the teacher carried out ancillary activities: defining the goal of independent work; specifying problem tasks; self-assessment of readiness for independent work in solving the tasks; choice of ways and means of solution; planning independent work to solve the problem; direct execution of tasks; self-monitoring of work performance; evaluation of the results; reflection.

The academic course "Engineering Graphics" refers to general professional cycle of compulsory courses for the major "Construction and Maintenance of Buildings and Structures". It determines knowledge of graduates' professional activities.

The purpose of studying the course is the students' mastering knowledge, skills, abilities and competencies necessary for carrying out and reading various-purpose drawings and solving engineering-geometric problems in a drawing.

As a result of course studies, the student must: read design and technological documentation; carry out drawings of geometric bodies and projections of points lying on their surface in manual and machine graphics; carry out technical drawings and drawings of parts in manual and machine graphics; draw up design, technological and other technical documentation in accordance with current regulatory framework; know the rules of reading design and technological documentation; know how to graphical

representation of objects, spatial images; know the laws and methods of projection drawing; know and apply the requirements of state standards of the Unified system of design documentation and the Unified system of technological documentation; know the rules of making drawings, technical drawings, sketches and diagrams; technique and principles of applying dimensions. An instructional video was presented for the students, in which each action was reviewed in detail. Before doing each work, students could independently repeat the content at any time. Criteria for evaluating graphic independent work:

The mark "excellent" is given for: design and content of the drawing, which corresponds to the requirements of the Unified system for design documentation; performance of work in accordance with the task; accuracy and aesthetics of the drawing.

The mark "good" is given for: insignificant violations of the requirements of the Unified system for design documentation in the design of the drawing; careless execution of the drawing.

The mark "satisfactory" is given for: repeated violations of the requirements of the Unified system of design documentation when drawing up a drawing, making images and dimensioning; minor deviations from the task; careless execution of the drawing.

Table 1. Independent work on the discipline "Engineering graphics".

Topic title	Name of independent work for students	The amount of hours allocated to perform
Topic 1.1. General information on the technical chart.	№1. Execution of drawing font.	2
	№2. Listing format and title block for graphic and text documents.	2
	Number 3. Line drawing.	2
	№4. Perform simple contours with dimensioning.	2
Topic 1.2. Geometric constructions.	№5. Execution of species in axonometric image details.	4
	№6. Geometric construction.	4
	№7. Work "Basic Terms".	1

The article presents several independent works developed by us, which are accompanied by relevant instructions that will help students to better navigate the task.

Independent work "Drawing the format and title block for graphic and text documents."

Objective: to study graphic formats.

All drawings must be made on sheets of standard paper. Forms of paper sheets are determined by the size of the outer frame of the drawing. It is held in a solid thin line at a distance of 5 millimeters from the outer frame. On the left, a 20 millimeter wide field is left for filing. The designations and sizes of the parties are set by GOST 2.304-68. Data on the main formats are given in table 2.

Table 2. Basic paper sheets.

Format notation	Dimensions of sides form (millimeters)
A0	841x1189
A1	594x841
A2	420x594
A3	297x420
A4	210x297

Rules and procedures for carrying out work.

Work should be done on A3 or A4 paper with a pencil.

Independent work "Implementation of simple contours with the application of dimensions." The drawing is made out of the internal frame. In the lower right corner of the drawing, draw the main inscription in accordance with GOST 2.104-68. The text in the drawing field and in the title block should be 3.5, 5, or 7 millimeters in font, and dimension numbers, 3.5 or 5 millimeters. The work is performed in thin lines, then the final stroke is drawn by drawing the lines in accordance with their purpose. Stroking begins with dash-dotted and solid thin lines, and then draw the main solid lines: first, the curvilinear sections, then the straight lines.

Task: on a sheet of A4 drawing paper, draw the lines of the drawing frame and the main one.

Objective: gaining skills in affixing dimensions.

Task: Perform a drawing of one of the options on a drawing sheet of A4 format and dimension it, defining them by cells. The side of the cage is 5 mm.

Instructions for completing the assignment: To study GOST 2.307-68; Prepare a sheet of A4 paper with a frame at a distance of 5 mm from the edges of the top, right and bottom; 20 mm from the edges to the left; arrange the layout of the drawing field: arrange the image on the format so that it is equally removed from all sides of the format. A sample of independent work performance is represented below.

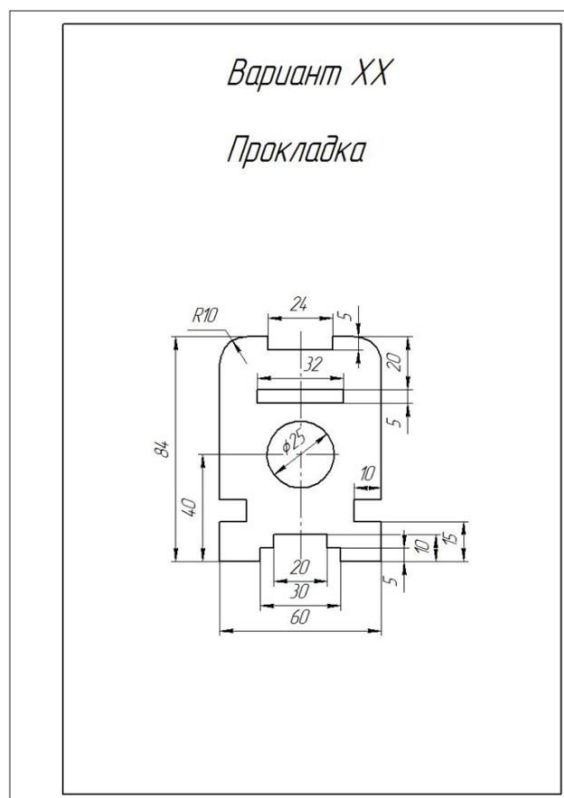


Figure 1. Sample do-it-yourself Below are the options for students.

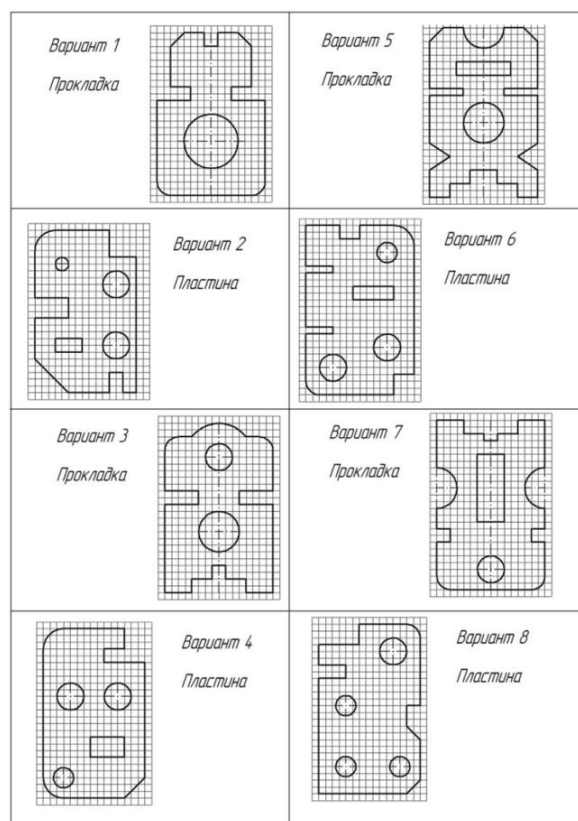


Figure 2. Sample do-it-yourself work

Independent work "Geometric construction."

Task: Build the outline of the technical details.

Objective: to learn how to perform various types of interfaces by the example of the execution of the contour of the technical details.

The order of work: on a sheet of A3 format draw a frame and stamp of the main inscription; draw a kennel details in thin lines, using the rules for constructing mates and tangents; to leave all auxiliary constructions (centers of arcs of conjugations, points of conjugations); trace the outline of the part with a solid base line; dimension; above the image of the part, write its name (font No. 7). Assignment options are presented in Figure 3.

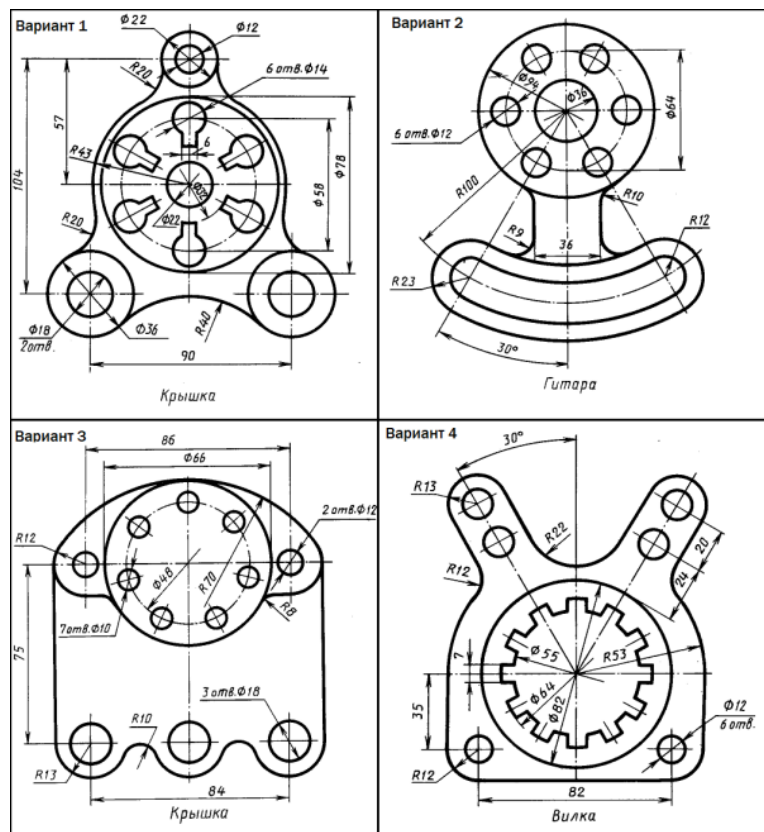


Figure 3. Task execution options.

In order to remove unnecessary tension when studying engineering graphics and at the same time once again fix the basic terms, students need to establish terms for the given definitions in writing. It changes general attitude towards the course. Students are invited to answer the following questions. The fastener is a cylindrical threaded rod at both ends. Drawing working sketches of parts in the assembly drawing. The shape, the size of which is denoted by \emptyset . Smooth transition of one line to another. A temporary drawing is made by hand. Images of a figure on a plane, obtained with the help of projecting rays. The ratio of the dimensions of the object depicted in the drawing to its natural dimensions. The ratio of the diameter of the pitch circle to the number of gear teeth. A table with a list of parts included in the assembly unit. The image of the object obtained by the mental dissection of its cutting plane. Gear. A view of the axonometric projection, in which the axes are located at an angle of 120° to each other. The image of a figure obtained by mental dissection of the object by the cutting plane. Fastener, which is used to connect the gear with the shaft.

To test the effectiveness of developed independent work at Nizhny Novgorod Construction College during intermediate certification of students we used the questions we had developed. On the basis of the results obtained from the two groups (the first in which students studied according to the pattern available at college and the second in which independent work developed by us was implemented) we were able to draw the appropriate conclusions. Intermediate certification was carried out in the form of a differentiated test. We have developed control tasks for the differentiated credit for the course "Engineering Graphics". Task number 1: Types of formats. Points on the surface of geometric bodies. Task number 2: Scale. Name 3 ways to determine the actual size of the segment. Task number 3: Inscription and destination lines of the drawing. Define sweep surfaces. Task number 4: The division of segments, circles into equal parts. Straight perpendicular to the plane; criterion and theorem about the perpendicularity of a line and a plane. Task number 5: Define a mate. Name the main geometric bodies. Task number 6: Name the main circular curves. Types of axonometric projections. Task number 7: Name the main curves. Belonging of a point and a straight line of a plane. Task number 8: Define the slope and taper. The meeting point is straight and plane. Task number 9: Methods of projection. The plane of the general situation. Task number 10: How are called and denoted as the plane of the projections. Define direct private position. Task number 11: Give the definition of direct general position. Main lines of the plane: to give a definition. Task number 12: Traces of a straight line. The plane of the private situation.

Figure 4 shows the results of the first group of students.

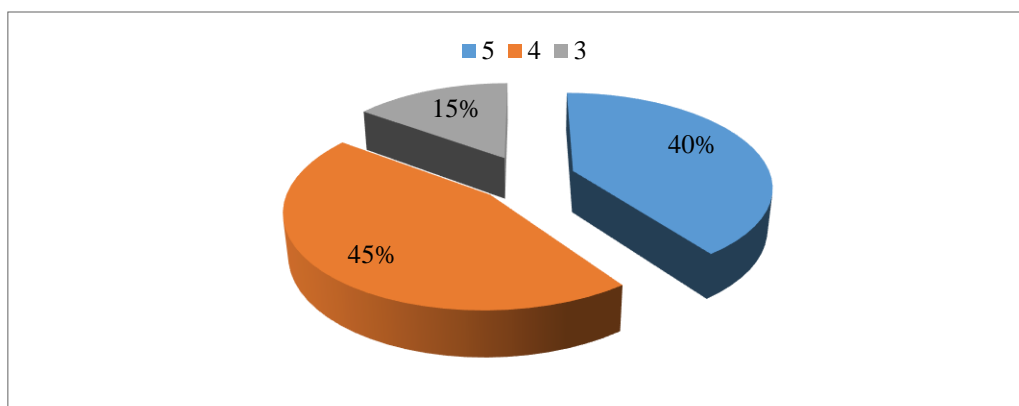


Figure 4. The results of the first group of students, in whose studies the structure of independent work used in the technical school was used.

40% of students from the first group were rated "excellent", 45% of students were rated "good", and 15% of the students received "satisfactory" rating. Figure 5 shows the results of the second group.

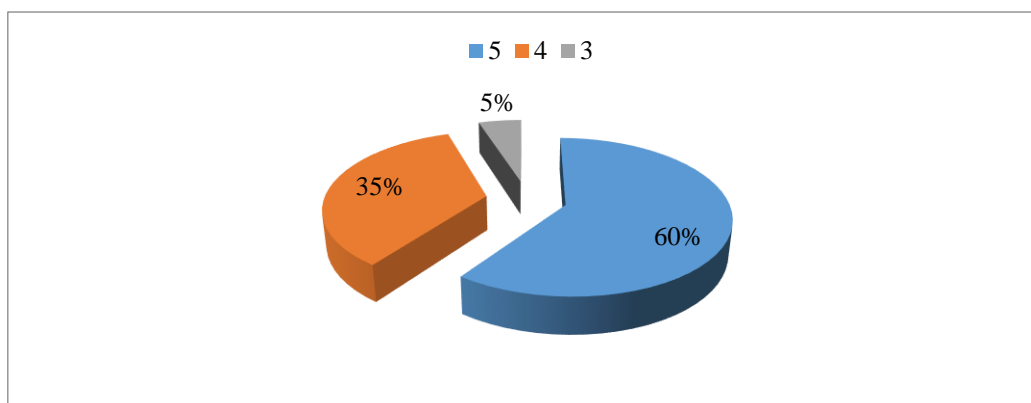


Figure 5. Results of the second group of students, in whose studies the structure of independent work developed by the authors was used.

Indicators of the second group are significantly higher than the first. The percentage of students who received "excellent" mark increased, it rose from 40% to 60%, which testifies to the effectiveness of the developed independent work tasks.

As a result of independent work, students form the following professional competencies. They are able to select building structures and develop simple components and details of building structural elements; develop architectural and construction drawings using information technology; perform simple calculations and design of building structures.

Conclusion

Students' independent work of at a technical school is an integral part of his competence development. A student who carries out independent work at a high level is demanded in the labor market and is highly competitive. In order to improve the process of students' independent activities at Nizhny Novgorod Construction College, we have introduced the updated pattern of independent work in the course "Engineering Graphics", major "Construction and operation of buildings and structures." The results obtained after the test testify to the effectiveness of the authoring, therefore its further introduction into the activities of any technical school will contribute to students' training improvement.

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