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Organization and Forms of Students' Independent Work on Higher Mathematics at Pedagogical University

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Annotation: *in this paper, we consider the organization and forms of independent work of students in teaching mathematics in a pedagogical university. The urgency of work is determined. Types of independent works on the level of complexity are given. The approximate variants of the tasks of independent work at the mathematics course are given.*

The main thing in the strategic line of organizing independent work of students in a pedagogical university is not to optimize its individual species, but to create conditions for high activity, independence and responsibility of students in the classroom and outside it in the course of all types of educational activities in the pedagogical university.

The simplest way - reducing the number of classroom classes in favor of independent work - does not solve the problem of increasing or even maintaining the quality of education at the same level, because a decrease in the amount of classroom work is not necessarily accompanied by a real increase in independent work that can be implemented in the passive version (2, 6).

In the standards of higher vocational education, at least half of the student's time budget is allocated to out-of-class work - 24 hours a week, on average for the entire period of study. This time can be fully used for independent work. In addition, most of the time devoted to classroom activities also includes independent work. Thus, the time for independent work in the educational process is quite enough, the question is how to effectively use this time (1).

In the general case, two main directions of constructing the learning process are possible on the basis of independent work of students. The first is an increase in the role of independent work in the classroom.

Implementation of this path requires teachers to develop methods and forms of organizing classroom classes that can provide a high level of student independence and improve the quality of training.

The second is to increase the activity of students in all areas of independent work during extracurricular time (2).

The main task of organizing independent work of students (CDS) is to create psychological and didactic conditions for development

intellectual initiative and thinking in math classes of any form. The main principle of the CDS organization should be the transfer of all students to individual work with the transition from formal fulfillment of certain tasks with the passive role of the student to cognitive activity with the formation of one's own opinion when solving the set problems and tasks. The goal of the CDS is to teach the student to work sensibly and independently on first with the training material, then with scientific information, to lay the foundations for self-organization and self-education so as to instill the ability to further continuously improve their qualifications.

A decisive role in the organization of the CDS belongs to the teacher, who should work not with the student-in general, but with a specific personality, with its strengths and weaknesses, individual abilities and inclinations. The task of the teacher is to see and develop the best qualities of the student as a future specialist of high qualification.

When studying mathematics, the organization of the CDS should represent the unity of three interrelated forms:
1. Extra-independent independent work;
2. Audit independent work, which is carried out under the direct guidance of the teacher;
3. Creative, including research work.

The independent work of students in discipline is carried out at training sessions under the direct supervision of the teacher and on his instructions (5).

Extra-independent independent work is performed by students on the instruction of the teacher, but without his direct participation (5).

Types of extracurricular MDS in mathematics are diverse: preparation and writing abstracts, reports and other written works on the given topics. It is desirable for the student to give the right to choose a topic and even the head of the work; doing homework of a diverse nature. This is the solution of problems; solution of crossword puzzles selection and study of literary sources; development and drawing up of various schemes; execution of graphic works; making calculations, etc .; fulfillment of individual tasks aimed at developing students' independence and initiative. Each student receives an individual assignment according to the level of complexity (5, 6).

Let us give an example of individual independent work of students on the subject of higher mathematics on the topic under study: "Indefinite integral.

Methods for integrating an indefinite integral ". In this group of students, the minimum tasks consisting of 30 options are worked out (7,8).

Task 1. Find the indefinite integrals (the result is verified by differentiation)

Options:

№ 1 a) $\int 4cos^2 \frac{x}{2} dx$ б) $\int \frac{1+2x^2}{x^2(1+x^2)} dx$ в)$\int 3^x \cdot e^{3x} dx$

г) $\int \frac{dx}{\sqrt{(3x-5)}}$ д) $\int cos^3 x dx$ е)$\int sin^2 x dx$

Task 2. Find the indefinite integral by the substitution method:

Options:

№ 1 a)$\int \sqrt{a^2 - x^2}$ б)$\int \frac{\sqrt{x^2+a^2}}{x^2} dx$ в) $\int \frac{dx}{x\sqrt{2x-9}}$

г) $\int arcsinx dx$ д) $\int x\sqrt{x-1} dx$ е) $\int \frac{dx}{\sqrt{x}+\sqrt[4]{x}}$

Task 3. Find the indefinite integrals using the method of integration by parts:

Options:

№ 1 a) $\int e^{ax} cos\beta\, x dx$ б) $\int \frac{x dx}{sin^3 x}$ в) $\int cos lnx dx$

г) $\int x \cdot tgx dx$ д) $\int x \cdot sin(x + 4)\, dx$ е) $\int x^3 lnx dx$

Tasks for secondary students. With the students of this group it is necessary to work out also the solution of more complex (than minimum problems) examples (7,8,9).

Task 1. Find the definite integrals directly:

Options:

№ 1 a) $\int \left(4x^5 - 2\sqrt[3]{x^2} + \frac{3}{\sqrt[4]{x^3}} - \frac{5}{x^3}\right) dx$ б)$\int \frac{\sqrt{arctgx-x}}{1+x^2} dx$

в) $\int \frac{arcsin^2 5x}{\sqrt{1-25x^2}} dx$ г) $\int sin3x cosx dx$

Task 2. Find the indefinite integral by the substitution method:

Options:

№ 1 a) $\int \frac{dx}{(x+1)\sqrt{x^2+x+1}}$ б)$\int \frac{4cos2x}{sin^2 x cos^2 x} dx$

в) $\int x^2\sqrt{4 - x^2} dx$ г) $\int \frac{dx}{2x\sqrt{2x-9}}$

Task 3. Find the indefinite integrals using the method of integration by parts:

Options:

№ 1 a) $\int e^{-\frac{x}{2}} x^2 dx$ б) $\int \frac{x cosx}{sin^3 x} dx$

в) $\int e^{4x-1} \cdot cos(x - 6)\, dx$ г) $\int \sqrt{1 - x} arcsin\sqrt{x} dx$

Tasks for strong students. With the students of this group it is necessary to work out complex problems or tasks for evidence (7,8,9,10).

It is clear that students of this group should solve the problems of level 1 and 2 well (see above). When working with students of this group, you can orient yourself, for example, on Berman's task book (10), and the tasks of raising (in comparison with the average level) the complexity of setting individually for work in the classroom and independently - at home. In addition to the above tasks, students of this group must solve the tasks of such under the following:

a) direct integration (for example, to find integrals using the trigonometry formulas for transforming the integrand

Expressions: Problems No. 1825 and No. 1831 from (10, p.119));

b) the change of variable (for example, to find the integrals using the method of changing the variable: problems # 1902 and # 1904 from (10, c.121));

c) different problems (find the integrals: problems No. 1968, No. 1995, No. 2006 and No. 2008 from (10, c.123));

d) rational functions (for example: problems # 2161, # 2194, # 2229 and # 2230 from (10, c.130)).

From the theoretical exercises of the topic under consideration here, students of this group should be able to prove exercises such as (9, c.54-55)

1.   1. Which of the integrals is greater $\int_0^1 \left(\frac{sinx}{x}\right)^2 dx$ или $\int_0^1 \frac{sinx}{x} dx$

1.   2. Find $\int_{ln2}^{ln6} \frac{e^x \sqrt{e^x-2}}{e^x+2} dx$

3. Find the points of the extremum of the function $f(x) = \int_0^x (t-1)(t-2)e^{-t^2} dt$

In order to develop a positive attitude of students towards an out-of-class CSD, it is necessary to clarify the goals of the work at each stage, to monitor the students' understanding of these goals, gradually forming in them the ability to independently set the task and target selection (2,4).

Independent auditorial work can be realized during practical classes, seminars, laboratory work and during lectures.

When reading the lecture course directly in the audience, it is necessary to control the mastering of the material by the main mass of students by conducting rapid interviews on specific topics, test control of knowledge, interviewing students in the form of games -What? Where? When? etc.

In practical and seminar classes, different types of CDS make the learning process more interesting and raise the activity of a significant part of students in the group (2, 5).

In practical classes in mathematics and pedagogical disciplines, at least 1 hour out of two (50% of the time) should be devoted to independent problem solving. It is advisable to build practical exercises in the following way:

1. Introductory word of the teacher (objectives of the lesson, the main issues that need to be addressed).
2. A quick survey.
3. The solution of 1-2 typical tasks at the board.
4. Independent solution of tasks.
5. Analysis of typical errors in the solution (at the end of the current session or in beginning of the next one).

To conduct classes it is necessary to have a large bank of tasks and tasks for independent decision, and these tasks can be differentiated according to the degree of complexity. Depending on the discipline or on its section, two ways can be used (3, 5, 6):

1. Give a certain number of tasks for independent solutions, equal in difficulty, and put an estimate for the number of tasks solved for a certain time.

2. Issue tasks with tasks of different difficulty and assess the problem for the difficulty of the solved task. Based on the results of the independent solution of problems, an assessment should be made for each lesson. Assessment of the student's pre-preparation for a practical lesson can be done by express testing (closed-form test tasks) for 5, maximum 10 minutes. Thus, with intensive work, it is possible to put at least two estimates for each student at each lesson (2, 6).

Based on the materials of the module or section, it is advisable to give the student a homework assignment and in the last practical lesson on the section or module to summarize the results of his study (for example, to carry out the control work in general on the module), to discuss the assessments of each student, to issue additional assignments to those students who want to increase the grade.

The results of these assignments raise the score already at the end of the semester, in the academic week, i.e. the rating rating for the beginning of the semester is put on the current work only, and the rating rating for the end of the test week takes into account all the additional types of work (6,2).

Of the various forms of CPC for practical classes in senior courses, the best are "business games". The topic of the game can be connected with specific production problems or be of an applied nature, include situational modeling problems on topical issues, etc. The purpose of the business game is to give the student the opportunity to develop and make decisions in simulated conditions.

When conducting seminars and workshops, students can carry out CDS individually and in small groups (creative teams), each of which develops its own project (task) (2).

The activity of students in ordinary practical classes can be strengthened by the introduction of a new form of CPC, the essence of which is that for each task the student receives his individual task (option), while the task condition for all students is the same, and the initial data are different. Before starting the task, the instructor gives only general guidelines (the general procedure for the solution, accuracy and units of measurement of certain quantities, available reference materials, etc.).

Another form of CDS in practical exercises may be independent study of schemata, layouts, programs, etc., which the teacher distributes to students along with control questions, which the student must answer during the lesson.

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