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ORGANIZATION OF INDEPENDENT WORK ON THE SUBJECT "MATERIAL DESIGNING" IN THE FIELD OF TECHNOLOGICAL EDUCATION IN THE CREDIT-MODULE SYSTEM

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Abstract. The article discusses one of the urgent tasks of the modern education system - bringing education in line with world standards. The ways of introducing a credit-modular system into the education system based on European standards are described. Including the methods used in the training of technology teachers on the credit-modular system in higher education. There is a method of organizing independent work in the field of material designing. The features of the tasks of independent work are taken into account. The types of independent work are also explained. The advantages of using the credit-modular system in higher education are described, recommendations are given, the importance of training future teachers through self-study is revealed.
Keywords: Credit module, education system, educational standards, scientific programs, self-study hours, number of credits, distance learning, educational platform, self-study assignments, literature, colloquium, abstract, essay, presentation, case study.

I. Introduction

In the reform of higher education in Uzbekistan and in the analysis of national and world higher education, we can clearly see the following tradition:

- Current education requires continuous education, because both the student and the specialist constantly need to improve their knowledge and skills of independent work.

- In today's fast-paced society, the organization of the educational process requires a radical change: especially the reduction of the workload of the audience leads the student to spend more time on independent work, rather than sitting as a passive listener.

- It can be seen that the center of gravity in education has shifted to independent learning rather than teaching.

- It should be noted that the study of independent work of the student is not an independent, free education of the individual, but the independent activity of the student, which is systematically controlled by the teacher. Because in the current credit-module system, independent work remains the main activity of the student. Therefore, the student's independent work and study in the classroom is 50-50%.

From the technological point of view of students' independent learning, the following can be distinguished.

- Goals and objectives of the selection of independent work. The purpose of independent

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work is determined by what kind of specialist he is, what requirements are placed on this specialist. Depending on the profession, this entry is focused on the study of professional theories and systems as well as professional technologies.

- In choosing the content of the student's independent work, in determining the technology of independent work, it is necessary to take into account the qualification or professional requirements. Sources of independent learning (literature, laboratory experience, self-analysis should be taken into account. The individual mental characteristics of the student should also be taken into account. Reading, intellectual ability, level, motivation, specificity of the subject.)

II.Literature review

Analysis of the existing pedagogical and psychological literature shows that the concept of "independent work of the student" is interpreted differently. The independent work of the student is considered as a form of educational and scientific knowledge, a form of organization of education and a means of education. [10, 11, 13] There are many types of classification of students' independent learning according to different criteria. For example, B.P.Esinov for didactic purposes [2], E.A.Golant and V.P.Strezikozin for knowledge sources, M.G.Graunov and I.Y.Lerner [5], depending on the type of assignments, I.E. Ukt, O.A. Nielsons classified species according to their multi-stage classification.

Thus, the classification of types of student independent work depends on: pedagogical purpose, the nature of the student's activity, the type and appearance of the student's independent work, the place of the student's independent work, the student's degree of independence, as well as the specific purpose and content of education.

III. Analysis

In the effective organization of independent work of students in higher education, the teacher (tutor, adviser) must know and follow the following principles:

- The principle of organization
- The principle of consistency and coherence
- The principle of activity
- The principle of individual approach
- The principle of demonstration
- Understandable to everyone
- Scientific basis of student time
- Assignment of homework

- In the learning process, it is necessary to involve students in a variety of independent learning, creative activities and allow them to show their abilities to the maximum.

The subject "Material designing" (international code MatM2006) in the curriculum of technological education in pedagogical higher education institutions is taught in the first semester of the educational process. The number of ECTS credits is 6 and the weekly load is 6 hours. The course i.e. module type is mandatory. Classroom hours are 90 hours, of which 40 hours are lectures,

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30 hours are practical and 20 hours are laboratory work. At the same time, in the credit-module system, 90 hours are allocated for independent study, taking into account that the audience and independent learning will be 50% -50%. In this model curriculum, 16 topics are given for boys in the following order.

1. Alloys and their state diagram.

2. Iron-carbon alloys.

3. Analysis of classification and marking of steels and cast irons.

4. Production of non-ferrous metals. Technological processes of non-ferrous metals production.

5. Chemical-thermal processing.

6. Special methods of obtaining ingots.

7. Basics of metal welding. Special methods of welding.

8. Physical bases of metal cutting process. Cutting force, force, cutting speed.

9. Lathes. TV-7. Metal cutting machines.

10. New modern composite materials and technologies.

11. Metallic materials. Technological processes of production of details and products from wood, plastic and rubber.

12. Materials used in the manufacture of details.

13. Thermosetting and thermoplastic plastics. Natural and artificial rubbers.

14. Cutting of metals. Drilling machine.

15. Milling machine for cutting metal.

16. New modern non-technologies.

If we look at the topics and distribute the time equally to them, the student should work independently on each topic for up to 5 hours. Some topics take even longer.

Topics from the first to the sixth in independent study are devoted to metallurgy, methods of obtaining metals. The study of alloys and state diagrams teaches students how the internal structure of a metal is formed. Textbook materials and, of course, electronic libraries, websites and videos can be used effectively in this area. In the process of studying iron-carbon alloys, students learn what alloys are steel and what alloys is cast iron. In the classification of steel and cast iron, in their subsequent activities, students will learn the tools used in training workshops, what part of the machine is made of what material, what brand of steel or cast iron. Of course, these independent works play a very important role in their educational and scientific activities. In the fourth topic, students will gain a deep understanding of non-ferrous metals, their properties and production technology. Learn about raw materials and products of non-ferrous metals plants and factories in the Republic of Uzbekistan. In the fifth and sixth topics, students will learn about the effects of external weather, increasing the durability of metals, chemical effects on the metal, corrosion. They learn how much metal corrosion erodes in a year, and can also find out through animations and videos. They will also know which non-ferrous metal to use where.

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In the sixth topic, they get acquainted with the art of casting and learn which part or item is cast. They get acquainted with the secrets of the art of casting.

Welding of metals is given in the seventh topic. Topics 7,8,9,14,15 also describe the mechanical methods of metalworking. Welding methods and equipment are studied. They get acquainted with lathes, drilling, milling machines and see the theory and practice of their use.

In the eleventh topic you will need to learn a number of details about non-metallic materials: wood materials, plastics, rubbers and products made from them.

Thirteenth topic thermoreactive and thermoplastic plastics learn natural and artificial rubbers. They can see slides and videos about them. At the end of the independent work, the topic of the most modern nanotechnologies is given, and students learn it as well.

The teacher should give the tutor or advisor a credit score to monitor the student's mastery of this independent work because the student gets 3 out of 6 credit points in this subject from independent study, or independent work. In order for a student to study independently, it will be necessary to place materials on these topics in the HEMIS program.

We have tried to address these issues as part of our research. We have compiled a schedule of which independent assignments to submit to the student within what timeframes. Because a student cannot submit a 90-hour topic at once. In his spare time, the teacher should acquaint the student with the machines and equipment of 96 laboratories and workshops. In addition, as part of the study, we provided links to videos posted on YouTube on each topic. If students can't find the topics we have covered in independent study on the Internet, in the HEMIS program, on the Moodle platform, then the teacher can make a video on this topic and post it on YouTube. For this, of course the video will need to be uploaded to YouTube after receiving a positive review. Below we present a table of Internet links (Table 1) on some topics of independent work for students to use in the subject "Material designing".

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№	Independent study topics	Internet addresses of topics
1	Alloys and their state diagram.	https://www.youtube.com/watch?v=0UzrhT2ABFA
2	Iron-carbon alloys.	https://www.youtube.com/watch?v=Inj6MgMcow4 https://www.youtube.com/watch?v=XyIZs2VQK_I
3	Analysis of classification and marking of steels and cast irons.	https://www.turbinist.ru/49551-rasshifrovka-marok-staley-i-chugunov.html http://stroyres.net/metallicheskie/vidyi/chyornyie/zhelezo/stal.html
4	Production of non-ferrous metals. Technological processes of non-ferrous metals production	https://www.ugmk.com/activity/primary_production/tsvetnaya-metallurgiya/
5	Chemical-thermal processing.	https://stankiexpert.ru/spravochnik/materialovedenie/khimiko-termicheskaya-obrabotka.html
6	Special methods of obtaining castings.	https://znaika.ru/catalog/9-klass/chemistry/Splavy.html
7	Basics of welding metals. Special methods of welding.	https://www.youtube.com/watch?v=l2mTiHmyBTk https://www.youtube.com/watch?v=EFkTC6u-CJ8
8	Physical bases of metal cutting process. Cutting force, force, cutting speed	https://studref.com/385814/tehnika/fizicheskie_osnovy_protsessa_rezaniya https://metallicheckiy-portal.ru/articles/rezka/sposoby-rezki-metallov
9	Lathes.TV-7. Metal cutting machines.	https://www.youtube.com/watch?v=gLuY3AAW8ec https://www.youtube.com/watch?v=2r-rHoWK4Js
10	New modern composite materials and technologies	https://www.youtube.com/watch?v=TqMcBQnceKQ https://www.youtube.com/watch?v=L8K9GS0AywU
11	Metallic materials. Technological processes of production of details and products from wood, plastic and rubber.	https://www.youtube.com/watch?v=qASZ81YwWYc https://www.youtube.com/watch?v=qOP1v_PIVi8 https://www.youtube.com/watch?v=rmm-ztRRJ2s
12	Materials used in the manufacture of	https://www.youtube.com/watch?v=h12yCgNrJ9

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	details.	8
13	Thermosetting and thermoplastic plastics. Natural and artificial rubbers.	https://www.youtube.com/watch?v=702pf4SU5cI https://www.youtube.com/watch?v=QZpzl9HwP5U
14	Metal cutting. Drilling machine.	https://www.youtube.com/watch?v=PnsU7xHwyKg https://www.youtube.com/watch?v=8GSrwaugzIs
15	Metal cutting milling machine.	https://www.youtube.com/watch?v=YknxDHgZLfk https://www.youtube.com/watch?v=y6Daoq7qhis
16	New modern nanotechnologies.	https://www.youtube.com/watch?v=B4SiroYfT6c https://www.youtube.com/watch?v=zbkJSUvcgUY
№	Independent study topics	Internetaddressesoftopics
1	Қотишмалар ва уларнинг ҳолат диаграммаси.	https://www.youtube.com/watch?v=0UzrhT2ABFA
2	Alloys and their state diagram.	https://www.youtube.com/watch?v=Inj6MgMcow4 https://www.youtube.com/watch?v=XyIZs2VQK_I
3	Iron-carbon alloys.	https://www.turbinist.ru/49551-rasshifrovka-marok-staley-i-chugunov.html http://stroyres.net/metallicheskie/vidyi/chyornyie/zhelezo/stal.html
4	Analysis of classification and marking of steels and cast irons.	https://www.ugmk.com/activity/primary_production/tsvetnaya-metallurgiya/
5	Production of non-ferrous metals. Technological processes of non-ferrous metals production	https://stankiexpert.ru/spravochnik/materialovedenie/khimiko-termicheskaya-obrabotka.html
6	Chemical-thermal processing.	https://znaika.ru/catalog/9-klass/chemistry/Splavy.html
7	Special methods of obtaining castings.	https://www.youtube.com/watch?v=l2mTiHmyBTk https://www.youtube.com/watch?v=EFkTC6u-CJ8
8	Basics of welding metals. Special	https://studref.com/385814/tehnika/fizicheskie_osnovy_protsessa_rezaniya

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	methods of welding.	https://metallicheckiy-portal.ru/articles/rezka/sposoby-rezki-metallov
9	Physical bases of metal cutting process. Cutting force, force, cutting speed	https://www.youtube.com/watch?v=gLuY3AAW8ec https://www.youtube.com/watch?v=2r-rHoWK4Js
10	New modern composite materials and technologies	https://www.youtube.com/watch?v=TqMcBQnceKQ https://www.youtube.com/watch?v=L8K9GS0AywU
11	Metallic materials. Technological processes of production of details and products from wood, plastic and rubber.	https://www.youtube.com/watch?v=qASZ81YwWYc https://www.youtube.com/watch?v=qOP1v_PIVi8 https://www.youtube.com/watch?v=rmm-ztRRJ2s
12	Materials used in the manufacture of details.	https://www.youtube.com/watch?v=h12yCgNrJ98
13	Thermosetting and thermoplastic plastics. Natural and artificial rubbers.	https://www.youtube.com/watch?v=702pf4SU5cI https://www.youtube.com/watch?v=QZpzl9HwP5U
14	Metal cutting. Drilling machine.	https://www.youtube.com/watch?v=PnsU7xHwyKg https://www.youtube.com/watch?v=8GSrwaugzIs
15	Metal cutting milling machine.	https://www.youtube.com/watch?v=YknxDHgZLfk https://www.youtube.com/watch?v=y6Daoq7qhis
16	New modern nanotechnologies.	https://www.youtube.com/watch?v=B4SiroYfT6c https://www.youtube.com/watch?v=zbkJSUvcgUY

Table 1

IV. Discussion

Independent work of students in the field of material science in the field of technological education in pedagogical higher education institutions is a unique educational and methodological activity of the student, which is aimed at independent performance of educational tasks, interest in reading and knowledge in the field of "Material designing". The content of the student's independent work is related to the performance of practical tasks that allow forming logical deep thinking, creative activity, and a research approach in the study of the material.

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Typically, a student's independent work includes the student's completely independent work, as well as the student's independent work under the guidance of a teacher, which is performed outside the classroom.

In the form of full-time education, the total number of hours of a student's independent work in the bachelor's degree is half of the volume of the subject, and almost half of it is devoted to the student's independent work under the guidance of a teacher. In part-time education, it is desirable that the volume of independent work of the student is 4/5 of the volume of the subject. [5]

Under the guidance of a teacher, the student's independent workload is not fully included in the teacher's workload, but for contact classes a separate workload is assigned to the teacher (calculation work, course work, course project, graduation work, master's dissertation, research supervisor, basic doctoral student guidance, etc.).

The organization of independent work of the student is based on the basic normative documents of the university, including working curricula, science modules in accordance with the requirements of independent study.

Independent work of the student can be introduced in the following forms:

- types of independent work performed by the student directly on his mobile device;
- Independent work of the student under the guidance of a traditional teacher.
- Independent work of the student under the guidance of the teacher in electronic form.

Types of independent work performed by the student directly through the mobile device can include:

• Preparation for lessons - study of lecture notes, videos, practical exercises and descriptions of laboratory works;

• Information retrieval - study of Internet materials through the digest presented in the interests;

• FAQ (frequently asked questions) - search for answers to problems of interest through educational programs;

• Forum - exchange of views on science topics on telegram channels or distance learning platforms;

• Test-solving - strengthening of materials related to the science module through exercises in teaching test programs;

• Preparation for the test - preparation for the expected intermediate and final examinations in the subject.

Independent student work under the guidance of a traditional teacher:

• problem solving - solving problems on the topic of practical training and presenting it in writing;

• abstract - a written statement of the problem, in which scientific sources are commented or scientific work, books are analyzed analytically;

• colloquium - a conversation to check the mastery of the theoretical part of the training module;

• essay - a written statement of personal opinion on a topical issue in a critical, journalistic and other genres;

• presentation - presentation on slides and videos on a given topic;

• search for solutions to problems in the production of case studies in the prescribed form;

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• work games - gaining professional skills by imitating, staging, role-playing professional processes;

• glossary - a brief explanation of terms on a given topic.

• group project - joint project work of 3-5 students;

• calculations - graphics and calculations, which are usually written on the basis of established methodological guidelines for technical sciences (engineering graphics, electrical engineering, information technology, etc.);

• course work - written and arithmetic work on the basis of established methodological guidelines, which are performed on the basis of established methodological guidelines on the problems of science or a set of disciplines;

• course project - calculations on the basis of the established methodical manuals on the problems of science or a set of disciplines (technical mechanics, technological processes and devices, disciplines on which the project works are carried out);

• diploma project - a project work on the basis of established guidelines, designed with graphic drawings and calculations, aimed at the design of a manufacturing enterprise or its division on a given topic in the specialty;

• internship report - a report based on the established methodological guidelines for the conducted internship (acquaintance, production, undergraduate internships);

• participation in science clubs - the student prepares visual aids in science clubs, such as models, models, slides, samples;

• participation in competitions - the student's participation in various competitions under the scientific guidance of the teacher ("Young Inventor", student startup projects, etc.);

• participation in science olympiads - participation in olympiads held among higher education institutions in science;

• presentations at scientific conferences - presentations at scientific and technical conferences of higher education institutions, national and international on the topic of scientific research;

• publication of scientific theses and articles - the publication of abstracts in the collections of scientific conferences and articles on scientific research in scientific journals;

• participate in the preparation of teaching materials - participate in the preparation of textbooks, manuals, manuals, guidelines and other teaching materials;

Independent work of the student under the guidance of the teacher in electronic form:

• Link - open an Internet link and comment on the video or text in a certain volume;

• Chart - limited analysis of tables, diagrams and charts.

• Q / A - written answers to questions posed by the teacher on the distance learning platform in the prescribed amount;

• Review - write an annotation to the source provided.

• SWOT - the student SWOT-analyzes a concept to a limited extent;

• Interview - conduct a conversation on the study of the problem and upload it to the distance learning platform;

• Google Apps - collaboration on the Google Classroom platform to perform tasks in the form of slides, tables, texts;

• Digest - a set of Internet links on a given topic, compiling a card index and a brief

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description of them;

• Report - students submit their laboratory report to the distance learning platform.

Independent work of the student under the guidance of the teacher is presented in the syllabus of the subject on the modules of science, indicating their description, topics, assignments, forms of conduct, the amount of hours.

The content of the student's independent work is determined by the nature of the subject, the technical capabilities of the university and the educational and methodological support of the library.

The student's independent work should be based on innovative technologies. The form of independent work of the student under the guidance of the teacher in the classroom includes textbooks and primary resources of students, group assignments, individual analytical activities. The independent work of the student under the guidance of the teacher is carried out according to the schedule, indicating the date, time, audience and tutors for the entire academic year in each subject. Classes in the framework of student-independent work under the guidance of a teacher can be in the form of consultations and interactive forms, the ratio of which is determined by the complexity of the subject, the amount of classroom time allocated for their study.

The student, who is consulted individually, signs a journal to record the work of the teachers. The quality of TMI is controlled by the department, which approves the size, content and type of report of TMI, determines the scope of work, sequence and deadlines, reviews reports of students and teachers on the results of TMI.

V. Conclusion

During their independent work, the student becomes a mature specialist in their field. Given that the subject of "Material designing" is the main subject in the training of teachers of technology, the independent work of students in the study of this subject is of particular importance. Methods of organizing independent work of students are described. At the same time, we have provided Internet addresses for students and teachers on a tabular basis for independent work, which contain videos and tutorials in Russian and Uzbek. Organizing students' independent work at a high level increases the effectiveness of education.

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