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USE OF SUMS AT PHYSICS IN THE PROCESS OF ABILITIES AND SKILLS FORMING OF STUDENTS SELF-EDUCATION

Т.О. Семакова, О.П. Сіліщенко. Використання фізичних задач у процесі формування умінь і навичок самоосвіти студентів. У статті розглянуті можливості використання фізичних задач з метою формування умінь і навичок самоосвітньої діяльності студентів технічних коледжів.

T.O. Semakova, O.P. Silishchenko. Use of physical sums in the process of abilities and skills forming of students self-education. In the article the use of physical sums with the purpose of forming of abilities and skills of students` self-educational activity in technical colleges is considered.

Introduction. Requirements of Bolon convention which are inculcated in the educational process of educational establishments stipulated the necessity of strengthening of teachers' attention to organization of independent work of students, successful implementation of which foresees a presence of abilities and skills of self- educational activity (ASSA).

In the system of secondary trade education to solve this task can technical colleges which are included in the structure of higher educational establishment and execute a double function: they give youths general education and simultaneously prepare to professional activity of the proper direction.

The most notable complication in realization of independent work at physics is traditionally related to the insufficient level of students` abilities to do sums. There are supervisions of teachers, control papers results and questionnaire of the first year students of technical colleges of Ukraine [2].

That is why **the purpose of** our **research** is a question of possibilities of physical sums use in the process of students ASSA forming in technical colleges.

Material and research results. Competence, informative-active and reflexive approaches, which we adhered to during research,are allowed to consider that self-educational *abilities and skills* are abilities and skills of the generalized type, which are related to perception, understanding, processing, coding, memorizing and recreation of information. Taking into account the noted approaches we distinguish

the following components of ASSA of students: organizational, *informative, intellectual and reflexive [2].*

The analysis of students' activity as for doing sums was conducted by means of discovering their possibilities for forming of ASSA in the conditions of technical establishment and influence on the reflexive sphere of students.

We connected the first condition with research of question about the observance of gradual growth of difficulties at doing sums by students and giving possibility of interdisciplinary connections .

The second condition was connected with a question about possibilities of independent realization by the students of process of doing sums at physics.

The search of methods of realization of reflex approach to forming students ASSA in the process of physics study foresaw the study of contents of every stage of students activity at doing physical sums. Generally accepted is an idea about structure of process of doing physical sums, which includes: orientation, planning, implementation, control.

Taking into account the modern opinions of scientists to organization of educational-cognitive activity of students [8] with the obligatory draw in of reflex, we consider that the stage of realization of final reflex must become the finishing stage of doing sums, and the given activity foresees introduction of current reflex each of four noted stages of this type of activity.

The analysis of contents of operations which consist of students actions in the process of doing sums is allowed us to form the picture of contents of ASSA, which can be formed for students at implementation of this type of activity. Their content is represented in table. 1.

With the purpose of determination of forming ASSA possibilities during doing sums at physics it was analyzed recommended for the use of MES of Ukraine textbooks and collections of sums[1; 3; 4; 6]. As a result, it was discovered that the textbook of L.Zhdanov [3] does not include sums.

Textbooks [1; 4] include sums, the method of doing which is not concerted with principle of gradual growth of difficulties, dividing into training sums and tasks for the independent doing is absent, the amount of sums of polytechnic and interdisciplinary contents is limited.

Recommended collection of sums [6] has the following failings: absence of tasks for conducting control of knowledges, absence of sums of polytechnic and production contents and the amount of interdisciplinary sums is limited.

According to these reasons the given collection of sums does not promote self-educational activity (SA) of students, and absence of tasks which would allow to differentiate work of students according to their queries and levels of preparation doesn`t involve students to independent work with this type of educational literature.

Table 1

Contents of structural components of ASSA, which can be formed at doing of physical sums

Structural components of ASSA	List of abilities entering to every structural components of ASSA
Organizational component	- to forecast the result of doing sums; - to plan and carry out the process of its stage-by-stage doing;
Informative component	- to use reference literature; - to understand a task in different formulations and contexts; - to systematize the offered or independently chosen information as for the given signs; - to draw out from the offered information data and to present them in a table or other form;
Intellectual component	- to analyze a sum specification; - to set and explain consequence connections ; - to prove and refute judgement; - to own at sufficient level by practical comprehensive abilities (measuring, calculable, graphic etc.);
Reflexive component	- to put forvard a few solutions of sums; - to find errors and make suggestions of their correction; - to organize self-control, intercontrol, mutual aid; - to estimate the method of sum`s solution as for rationality.

Taking into consideration all that was mentioned we can make decision, that collections of tasks at physics are informative not educational text-books which can be acceptable for students IA at physics.

Peculiarity of students' studies of physics in the conditions of technical colleges on the first year of education is a considerable satiation of lessons with theoretical material, that is a result of time reduction, intended for doing sums.

We found a way out from this situation in group and tutorial work, oriented to the studies of students of the doing sums methods of sufficient and high levels of complication, and also by means of including to the structure of developed informatively-educational environment of exercises block as for doing sums [2].

Developing them, we aimed to provide the observance of the following terms: giving possibility for the reasonable realization of this type of activity; mastering of approximate basis of actions; including information of interdisciplinary, polytechnic, production contents and assistance of development of

creative thinking of students; providing of partly-searching and research character of activity.

There are such types of works which are able to form the organizational component of ASSA during doing sums:

- an acquaintance with rules and algorithms of doing sums;
- working off the process of planning of activity of doing physical sums;
- acquaintance with requirements as for levels of educational achievements of students during doing physical sums;
- implementation of training exercises according to evaluation of oral answers of students and writing works at doing sums in accordance with requirements.

Mentioned kinds of works teach students to carry out activity at doing physical sums with the help of approximate basis of action, doing, thus, the studies of physics accessible for students with the different levels of preparation.

Development of informative component of ASSA during doing physical sums we connect with tasks , which promote forming of ability to work with information, presented in the different sign-characters systems of coding.

Except for tasks, formulated by a traditional method (for some terms to find an unknown value; to define it, using the graph or chart; to build the graph, chart, etc.), we offer non-standard tasks, for example, doing of tasks with veiled, absent or superfluous information; a task for making of text for sum according to the graph of process; experimental tasks etc.

For example, as for the graph of isobar process which takes place in ideal gas, to define, what co-ordinate axes it is built in.

Suggestion to students to search assists of development of informative component of ASSA: tasks of polytechnic, production character with the account of future specialty; methodical recommendations as for doing sums of certain types; methodical textbooks on doing sums the fragments of which then we include in an informatively-educational environment. There are electronic versions of printing collections of tasks found by the Internet that can be used at lessons [5].

The example of tasks of polytechnic contents for specialities «Production of engines», «Service and repair of cars and engines», found by the Internet, are the following:

1. Why is it better to place a tank with petrol under the earth?
2. Why must a tank for petrol storage be closed with cork with a rubber gasket?
3. When is it more convenient to refuel a machine: in the morning or in the day-time?
4. Why are on the cylinders of motor cycles thin and wide ribs built on?
5. During formation of fuel mixture in a carburetor a temperature becomes lower. What is the reason?

6. The stronger fuel mixture is squeezed in the cylinder of carburetor engine the greater is its power.

But in practice the volume of fuel mixture is diminished only in 7-8 times. How can we explain it?

Tasks, that promote development of intellectual and reflexive components of ASSA, are different types of non-standard tasks [8]:

- with partly wrong data in a condition;
- with error solution. The task of student is to find the amount of errors, correct them and offer right solution;
- of research type . The examples of research type tasks are tasks with the integrated contents, which promote realization of interdisciplinary connections:

1. Knowing Faraday's permanent, to define Avogadro`s permanent.

2. To prove by experimental way the presence of hard matters and gases in a drinking-water.

3. For the analysis of composition of liquid colors a capillary method is used. To mark on a blotting paper drop of mixture of red and dark blue ink and to drip water in it. Mixture will be divided into some components. Why?

- on refutation of vicious idea or determination «Who is right in a dispute?»;
- at choice of right answer from a few other and the reason of this choice;
- of experimental type;
- a task with exiting subjects, paradoxes, sophisms.

We recommend to use collection [7] of tasks which cause students to make conditions of tasks independently, or to do sums, which do not have a single solution ,and promote, thus, of development of higher order thinking and realization of interdisciplinary connections. They are related to knowledge of exact sciences elements, technology, history, art, literature and achievements in sport and other.

Mentioned types of exercises promote of development of motivational sphere of students, causing the personal interest and growth of cognitive activity.

Development of reflexive thinking at doing sums is possible by means of creation situation which assist of development of dialectical thought [2]. Key moments are:

1) application of questions, answer for which can contain opposite judgments. Answers require a choice: a) «or-or»; b) «that and other simultaneously», «neither nor neither other simultaneously»;

2) creation of problems, debatable moments during which a student is made to change his mind of other point of view existence and to refute it correctly.

We give concrete expression of this statement on the examples of questions of production type:

1. Is processing of steel or aluminium more difficult? Why? (for specialities «Technology of processing of materials on machine-tools and automatic transfer lines» and «Instrumental production»).

2. Is it better to use for oiling of machine surfaces water or lubricating materials? Why? (for specialities of «Shipbuilding », «Technology of processing of materials on machine-tools and automatic transfer lines», «Installation and designing of vessels and mechanisms», «Service and repair of cars and engines»).

3. There are two engines in a tram-car. A driver can start them consistently and parallel. How is it better? Explain (for specialities «Production of engines», «Service and repair of cars and engines», «Installation and exploitation of electrical equipment of enterprises and civil buildings»).

Table 2

Reflection of educational activity

Reflection of own actions	
What had I done (result)?	
How had I done it (means, methods, technology)?	
Reflection of thinking	
Why had I done it, what for?	
Had I done that I wanted?	
Had I done it, as I wanted?	
Reflection of attitude	
What is my attitude to what I had done ?	
Reflection «a look in the future»	
What will I do farther in such situations?	
How will I do it in future?	
What will I do it for?	

4. Is force of friction at processing of details useful or harmful on a grinding machine-tool? (for specialities «Technology of processing of materials on machine-tools and automatic transfer lines», «Instrumental production»).

5. Are carburetor or diesel combustion engines more economic profitable?. Why? (for specialities «Production of engines», «Service and repair of cars and engines»).

6. What lighthouses` signals are better to see: those which blink or those not blink? Explain (for speciality «Ship navigation on sea-lanes»).

7. Screens of what monitors are less harmful: lamp or liquid-crystal?

Explain (for specialities of «Servicing of the computer systems and networks», «Software designing», «Servicing of machine-tools with a software running and robottechnic complexes»).

8. Let`s consider a ship`s position in two different systems of counting out: in relation to a boat on a deck it is permanent, in relation to a bank it moves.

So, we can confirm that in the first case kinetic energy of body equals to a zero, and in the second - that a body has certain kinetic energy.

What statement is right? (for speciality « Ship navigation on sea-lanes»).

- in sums at doing of which there are a few variants of solution.

With the purpose of ASSA forming on the stage of control-evaluation activity at doing sums we offer the following methods: self evaluation with commentary, mutual evaluation with commentary, self reflection according to an algorithm (see table. 2).

Conclusions.

The developed method of realization of reflexive studies of students by means of physical sums allows to solve a few tasks, which are related to the following requirements:

- to take into account the individual features of students;
- to assist development of their motivation to educational-cognitive activity;
- to create conditions for growth of cognitive activity of students;
- to realize the interdisciplinary connections of physics with general technical and special disciplines;
- to induce students to the independent getting of information at physics;
- to provide the conscious realization of activity from at doing of physical sums, developing their reflexive thinking.

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