

# FORMATION OF STUDENTS RESEARCH SKILLS BASED ON TECHNOLOGIES FOR SOLVING PROBLEMS USING SOFTWARE TOOLS

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**Abstract.** *The main purpose of using information technologies in education is determined by the fact that they are most effectively implemented such didactic principles as scientific, accessibility, visibility, consciousness and activity of students. Information technologies open up wide opportunities for activating the formation of students' research skills. The use of modern software tools in the educational process helps to increase the interest in learning and its effectiveness. The article deals with the formation of students' research skills based on technologies for solving problems using software tools for computer science classes.*

**Keyword:** *Information technologies, research skills of students, formation of research qualities, modern software tools, the purpose of practical training, stages and algorithms for solving the problem, the effectiveness of using software tools to solve the problem.*

**Introduction.** The modernization of the educational activities of the university in the light of improving the quality of training of highly qualified specialists is associated with the introduction of information technologies in the educational and research work of students [1].

In modern conditions of the rapid development of science and technology, the rapid accumulation and updating of information, it is important to awaken in a person an interest in the accumulation of knowledge, teach him to learn, develop initiatives, creativity and independence among students. The basis in this work is the formation of students' research skills on the basis of information technology [2].

## **Main part**

Modern information technologies serve as a means of developing such student qualities as [3]:

- ✓ systemic scientific;
- ✓ constructive-shaped;
- ✓ algorithmic thinking;
- ✓ contributing to the variability of thought processes;
- ✓ development of imagination and intuition;
- ✓ the formation of information and communication and research skills.

All types and forms of educational and scientific work in the university should be aimed at the formation of these qualities of activity. Therefore, the teaching methodology at the university presupposes such an organization to teach students the ability to independently

acquire and replenish knowledge, to think in an original way and make independent decisions with a consulting, guiding role of a teacher.

The new qualification model of a future specialist assumes such requirements for a graduate as:

- ✓ possession of skills for independent acquisition of knowledge and advanced training;
- ✓ the ability to translate the acquired knowledge into innovative technologies and specific solutions;
- ✓ readiness for social and professional mobility, etc.

The listed requirements determine an increase in the role of students' research work in organizing the educational process of training specialists.

At the present time, the emerging new style and way of life creates conditions for active activity. Research culture is a vehicle for scientific and educational activity. The transformation of a student into a subject of the educational process capable of independently assimilating, evaluating and using the results of research activities in the process of professional training speaks of the development of his personality, his conscious interest in getting an education [4-8].

Research skills are general educational, since they have the property of broad transfer and can be effectively used in the study of all disciplines at the university and in future professional activities, the basis of their formation is research activity.

Research activity of students is one of the forms of individual work of students, an essential part of the process of training future specialists and contributes to:

- ✓ activation of mental activity and independent assimilation of knowledge, the formation of professional skills and abilities, ensures the formation of the professional competence of the future specialist;
- ✓ develops cognitive and creative abilities of the individual;
- ✓ encourages research work.

Research skill can be formed in the process of university students working on a thesis project, and the terms of these skills [9]:

- ✓ the ability to define and formulate a research goal;
- ✓ the ability to diagnose and analyze the theoretical state of the research problem;
- ✓ the ability to plan the experimental part of the study;
- ✓ the ability to process the results of the experiment;
- ✓ the ability to summarize and evaluate the results of the experiment.

In the course of performing research work, the student must learn to think, analyze tasks, take into account conditions, set tasks, solve emerging problems, i.e. the process must gradually turn into a creative one.

At the present stage of development, society needs people with good creative potential, capable of making non-standard decisions, able to think creatively [10-12]. The objectives of teaching computer science are mastering the skills to work with various types of information using a computer and other software. The use of information technologies in the educational process makes it possible to make practical lessons interesting, dynamic, and a huge flow of studied information more accessible.

The purpose of the practical lessons of the informatics course is to show the use of software tools for solving problems, improve the skills of drawing up mathematical models, test the ability of students to highlight the properties of an object that are essential for solving a problem [13-14].

Let us consider the sequence of passing the stages of solving the problem using the software for the problem. For example, the driver of a light car moving at a certain constant speed sees a red traffic light and applies the brake. After that, the speed of the light car began to

decrease every second by 3 meters. It is required to find the distance that a light car will travel to a complete stop.

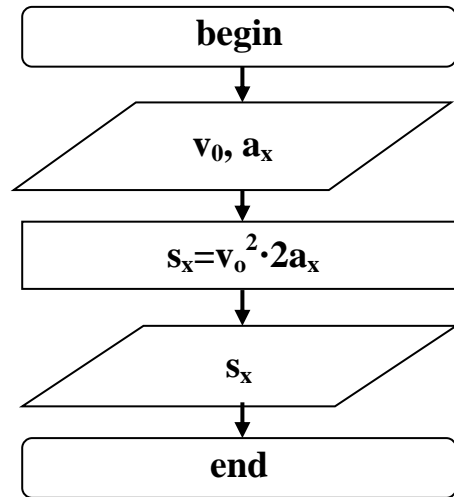
The solution of the problem. 1. Data:  $v_{0x}$  - initial speed;  $v_x$  - final speed;  $a_x$  - acceleration (equal to  $-3 \text{ m/s}^2$ ). Find:  $s_x$  is the distance the car will travel to a complete stop.

2. The formula for displacement is:  $s_x = v_{0x} (v_x - v_{0x}) / a_x + a_x / 2 (v_x - v_{0x})^2$ .

Hence the final speed is zero:  $s_x = -v_{0x}^2 / 2a_x$ .

With  $a_x = -3 \text{ m/s}^2$  we get  $s_x = -v_{0x}^2 / 6$ .

3. Let's represent the algorithm for solving the problem in the form of a block diagram:



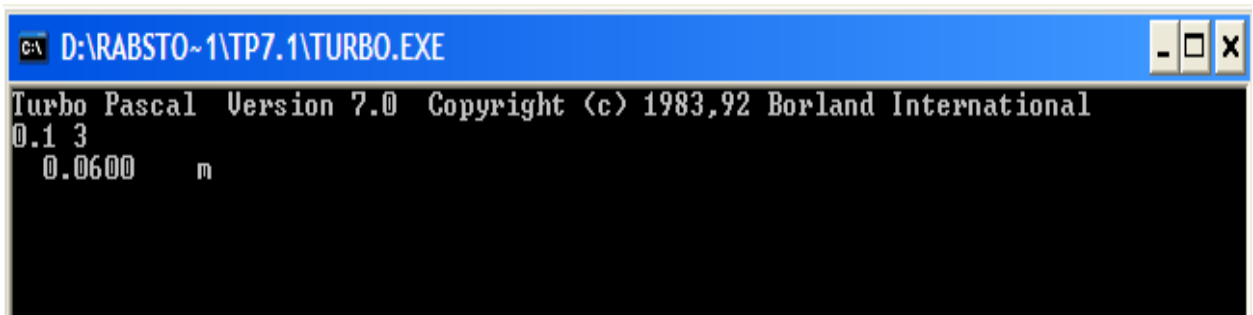
a) Solving the problem algorithm in Excel:

	A	B	C	D	E
1	Solution of the problem Решение задачи				
2	$v_x$	$a_x$	$s_x$		
3	0,1		=a3^2*2*b3		
4	0,3	3			
5	0,5	3			
6	0,7	3			
7					

b) Solution of the problem algorithm in Pascal:

```

D:\RABSTO~1\TP7.1\TURBO.EXE
File Edit Search Run Compile Debug Tools Options Window Help
NONAME00.PAS
program r12;
var v0, ax, sx:real;
begin read(v0,ax);
sx:=v0*v0*2*ax;
writeln(sx:8:4, 'm');
end.
  
```



```

C:\ D:\RABSTO~1\TP7.1\TURBO.EXE
Turbo Pascal Version 7.0 Copyright (c) 1983,92 Borland International
0.1 3
0.0600 m

```

b) Solution of the problem algorithm in C ++:

```

#include<iostream.h>
#include<conio.h>
#include<cmath>
using namespace std;
int main()
{
    float v0,ax,sx;
    cout<<"v0=";
    cin>>v0;
    cout<<"ax=";
    cin>>ax; sx=v0*v0*2*ax;
    cout<<sx;
    getch();
}

```

You can test the compiled program by executing Excel, Mathcad, Delphi and C ++ several times with different initial data. After that, a conclusion can be drawn. The teacher, together with the students, discusses which software tool is most effective for solving the problem.

The technology of working in Microsoft Excel and MathCad environments in this case has an advantage over programming languages. Debug fragments can be left in the finished table or in the MathCad document in order to make sure that the solution is proceeding correctly at a certain stage in solving the problem.

For the creative use of the capabilities of Excel with the various computing capabilities of the program, you can show examples of the practical use of the processor, for example, in computer science lessons for solving economic problems.

### Results and discussions

The use of software tools for solving problems in practical lessons in informatics confirms that computer technology of teaching is the process of preparing and transmitting information to teachers, a means of implementation, which is a computer. This approach reflects the initial understanding of computer technology as the use of software for solving problems.

The Excel program used in the educational process must meet the general didactic requirements: scientific nature, accessibility, problematic, clarity, consistency and consistency in the presentation of material, conscientiousness of teaching, independence and activity of activity, the strength of knowledge assimilation, the unity of educational, developmental and educational functions. Excel program not only allows you to automate calculations, but also is an effective tool for modeling various options and situations. The main effectiveness of using Excel for solving economic problems in the study of computer science is teaching techniques and methods for constructing mathematical models of economic problems, developing skills in using Excel to solve economic problems, developing competence to analyze and search for rational solutions, forming and developing skills in analyzing the obtained numerical results from economic points of view.

The use of MS Excel spreadsheets makes it possible to speed up the process of processing measurement results and frees up time for analyzing the results in order to better understand the physical laws and phenomena studied in practical work.

During the experiment, with the introduction of modern software, intermediate certification of the knowledge of the students of the control and experimental groups was periodically carried out using test tasks and practical work. We obtained the following results of the formation of information competence of students on the basis of technologies for solving problems with the help of software tools for a practical lesson in informatics, based on which the average scores of their progress were calculated (see table). Tasks in tests and practical works were multilevel and were rated from 1 to 5 points.

Most of the students in the control group are able to solve professional problems according to the previously studied model and using exactly those software products that were studied at the university.

Experimental group students try to find the optimal solution, choose the right software for this, or master new software. Students, along with the usual form of classes, additionally performed individual tasks according to options from the specified task.

<b>Control stages</b>	<b>Average score of intermediate certification (CG)</b>	<b>Average score of interim certification (EG)</b>
1	3,48	4,09
2	3,57	4,25
3	3,59	4,31
4	3,69	4,4
5	3,77	4,49

To assess the parameters of an experiment in pedagogy, the null hypothesis is used. As a null hypothesis  $H_0$ , a proposal was put forward that the level of formation of information competence did not increase after the application of the technology developed by us in the process of teaching this discipline. The opposite hypothesis  $H_1$  was formulated as follows: the complex application of the technology developed by us contributes to an increase in the level of formation of information competence of students in the specialty "Mathematics and Informatics".

During the test, the validity of hypothesis  $H_1$  was confirmed. The obtained statistical data are considered as time series, for the processing of which mathematical modeling was used.

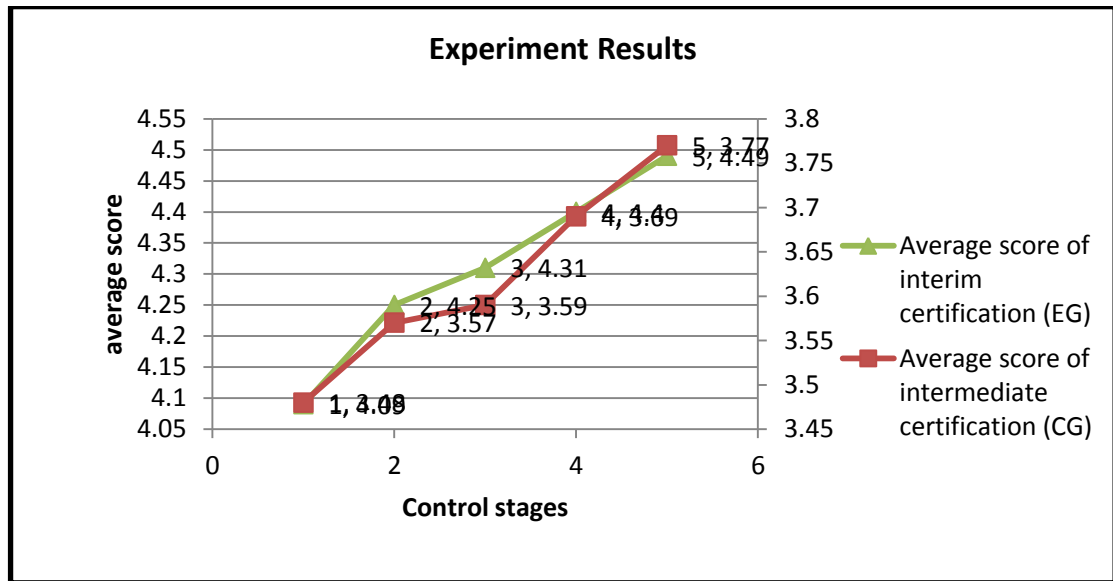
On the basis of the experiment data, a mathematical model was built that shows the dependence of the average scores of intermediate certification of students' knowledge on the application of the methodology developed by us  $Y = 0.35 \ln x + 3.98$ , the graphs of the formation of information competence and the forecast for the next period (see figure).

The quality of the model is confirmed by:

- the coefficient of linear correlation  $r_{xy} = 0.997$ , which means the presence of a very close dependence of the average scores of intermediate certification on the application of the methodology we have developed;

- the coefficient of determination  $R^2$ , meaning that the variation of the result by 99.34% is explained by the variation in the use of this benefit (the percentage of the unexplained part of the variance is 0.66%).

The table shows that the indicators in the experimental group are 19.01% higher than in the usual one.



### Conclusion

Based on the results of the pedagogical experiment, we can conclude:

1. In the developed methodology, new interactive models of practical lessons are proposed using software tools, a Microsoft Excel spreadsheet, Pascal, Delphi and C ++ programming languages, as well as the Mathcad software package for solving problems using software for practical informatics lessons.

2. The complex application of new interactive models for solving problems with the help of software tools for practical training in informatics contributes to the achievement of a higher level of information competence.

3. The analysis of the results of the pedagogical experiment as a whole confirms with a reliability of at least 99% the hypothesis that there is a connection between the use of new interactive models of practical informatics lessons and an increase in the level of information competence formation among students in the specialty "Mathematics and Informatics"

These data allow us to say that the main goal of the experiment of forming the information competence of students in the specialty "Mathematics and Informatics" was achieved - the effectiveness of the technology developed by us for the formation of information competence of students in the specialty "Mathematics and Informatics" was confirmed.

Within the framework of the competencies under consideration, the use of an integrated approach to solving problems using software tools for the practical lesson of informatics forms students' skills and research skills, which allow:

- master the methods of obtaining and applying theoretical and practical knowledge;
- master the technique of conducting experiments;
- use information technology to process measurement results;
- to develop creative thinking and the desire for knowledge;
- develop the ability to organize and plan their activities;
- to stimulate self-education and self-development;
- to bring up responsibility, purposefulness, will, courage in overcoming difficulties.

It should be noted that the process of training future specialists for solving problems with the help of modern software should be consistent, interdisciplinary, presented in various forms of training, which will lay the foundation for the development of interest in this type of professional activity.

The process of preparing future specialists for solving problems using modern software tools during their studies at the university will be effective, provided that students are involved in various forms of educational activities.

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