eISSN: 2229-3213 pISSN: 2229-3205
The Journal of Applied Science and Social Science
Volume 16,Issue 05 May, 2026

USING PROBLEMATIC EDUCATION TECHNOLOGIES TO INCREASE THE EFFICIENCY OF TEACHING OBJECT-ORIENTED PROGRAMMING LANGUAGES

Hoshimov Orzimurod Parda ugli
Doctoral student at Navoi State University
https://doi.org/10.5281/zenodo.20186916

Abstract. This article presents the possibilities of problem-based learning technology in increasing the effectiveness of teaching object-oriented programming languages, as well as proposals and recommendations for its application.
Keywords: Borland C++ Builder, programming, problem-based learning, creative thinking, logical, algorithmic**.**

Problem-based learning is an advanced teaching technology, the task of which is to encourage active learning and form a scientific and research style in thinking. Therefore, the use of problem-based learning technology is considered appropriate in increasing the effectiveness of teaching subjects, including programming languages, and in developing critical, logical and algorithmic thinking of students [1].

The main idea of problem-based learning is the independent acquisition of knowledge by students in solving problem situations. This is an important technology in increasing the effectiveness of teaching computer science and information technology and developing students' creative thinking about information technologies. Because the development of computer technology, software, information technology creates the need to deepen the content of the computer science course in relation to practical issues and creates difficulties in studying them. The complexity of computer systems, networks, technical objects, and the complexity of their management and maintenance make it urgent to train specialists in effective and optimal actions in solving practice-oriented problem tasks [2].

The professor-teacher creates a problem situation, directs students to solve it, organizes the search for a solution. Thus, in the process of finding a solution, the student acquires new knowledge, he masters new ways of acting. The problem situation is created by the teacher through the use of a number of special methodological techniques.

Depending on the nature of the interaction, teachers and students distinguish four levels of problem-based learning [3]:

1. Level of non-independent activity - students' perception of the explanation of the lesson, mastering the model of mental activity in a problem situation, independent work of the student, exercises of a memorizing nature, oral repetition;

In the study of object-oriented programming, the independent activity is manifested in the study of ready-made texts of programs. For example, the following program code and project window are provided for developing a computational project in the Borland C++ Builder programming environment to generate a matrix A(N,N) with diagonal elements of one and the remaining elements of zero [4, 5]:

```
{
StringGrid1->ColCount=StrToInt(Edit1->Text);
StringGrid1->RowCount=StrToInt(Edit1->Text);
```

```
int i,j,n=StrToInt(Edit1->Text);
for(i=0;i<=n;i++)
for(j=0;j<=n;j++)
if ((i==j)||(i+j==n-1))
StringGrid1->Cells[i][j]=1;
else
StringGrid1->Cells[i][j]=0;  }
```

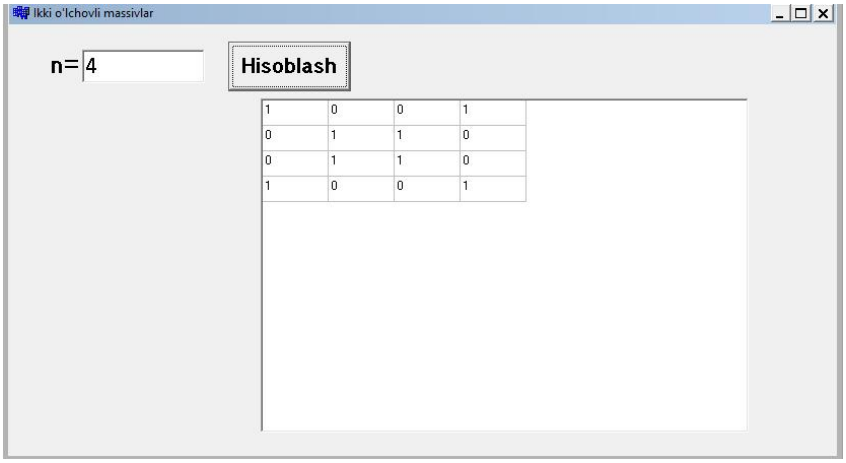

Figure 1. Project window for generating a matrix A(N,N).

2. The level of semi-independent activity is characterized by the application of previous knowledge in a new situation and the participation of students in finding a way to solve the problem set by the teacher. This level is characterized by the study of new material based on the instructions of the teacher. As such prompts, program templates can be used (for example, a program for generating a matrix A(N,N) with diagonal elements of one and the remaining elements of zero in the Borland C++ Builder programming environment (N is a positive integer)) [4, 5]:

```
{
StringGrid1->ColCount=StrToInt(Edit1->Text);
StringGrid1->RowCount=StrToInt(Edit1->Text);
int i,j,n=StrToInt(Edit1->Text);
for(i=0;i<=n;i++)
for(j=0;j<=n;j++)
... }
```

In this, students will need to create the main program code and project window:

```
if ((i==j)||(i+j==n-1)) StringGrid1->Cells[i][j]=1; else
StringGrid1->Cells[i][j]=0;
```

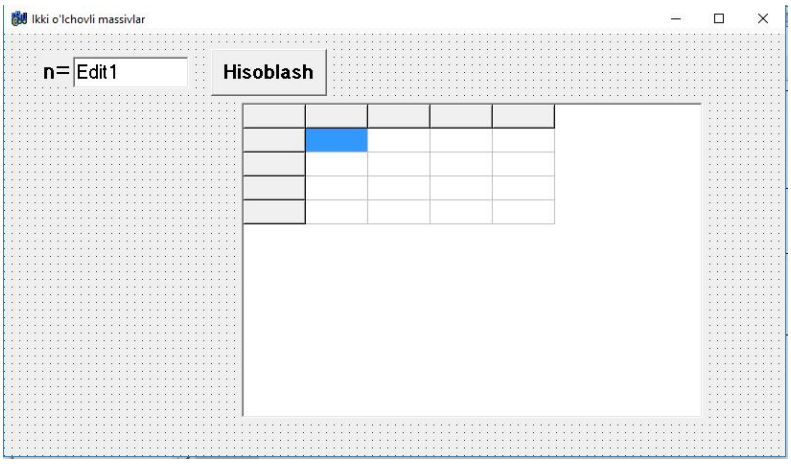

Figure 2. Project window for generating a matrix A(N,N).

3. Level of independent activity - performing tasks of a reproductive-search type, in which the student independently solves the textbook text, applies previous knowledge in a new situation, formulates, solves and proves hypotheses with minimal assistance from the teacher, etc.;

For this level of learning, students should be given a task that they can solve on their own without the help of a teacher. For example, a program in the Borland C++ Builder programming environment to generate and transpose (interchange column and row elements) the matrix X(N,M) for given positive integers N and M [4, 5].

```
{
int i,j,
n=CSpinEdit1->Value,
m=CSpinEdit2->Value;
for(i=0;i<n;i++)
for(j=0;j<m;j++)
StringGrid1->Cells[i][j]=random(10);
for(j=0;j<m;j++)
for(i=0;i<n;i++)
StringGrid2->Cells[j][i]=StringGrid1->Cells[i][j]; }
```

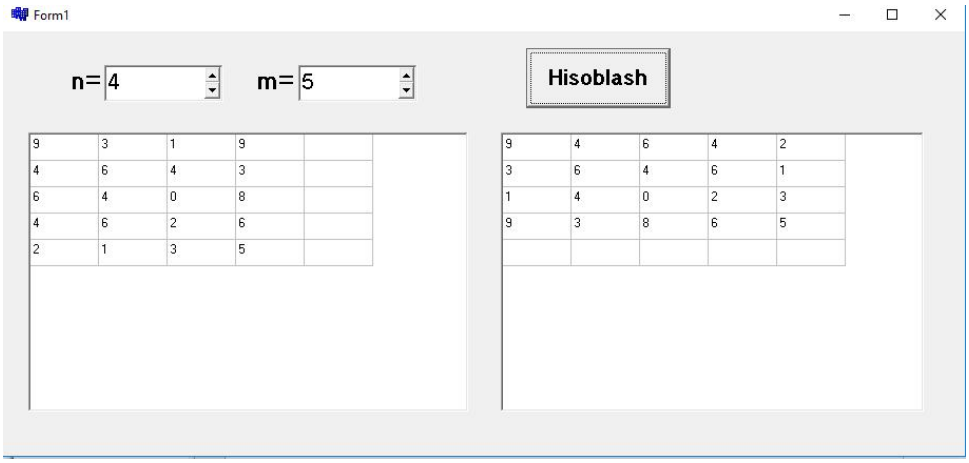

Figure 3. Project window for swapping column and row elements of a given matrix

4. Level of creative activity - performing independent work that requires creative imagination, logical analysis and conjecture, finding and proving a new way to solve an educational problem, drawing conclusions and generalizations based on one's own ideas.

"At this level, the task should be set by the teacher, and when solving it, the student not only works independently, but also approaches it creatively. You can stimulate creativity using the element of the project method. As an example, an M-order square matrix is given" [4, 5]. The program for replacing the elements lying below its main diagonal with 0 (zero):

```
void __fastcall TForm1::CSpinEdit1Change(TObject *Sender)
{
 StringGrid1->RowCount=CSpinEdit1->Value;
StringGrid1->ColCount=CSpinEdit1->Value; }
//---------------------------------------------------------------------------
void __fastcall TForm1::Button3Click(TObject *Sender)
{
 int i,j,a=1,
n=CSpinEdit1->Value,m=n;
for(i=0;i<n;i++)  {
for(j=0;j<m;j++)
StringGrid1->Cells[j][i]=0;  m--; }}
//---------------------------------------------------------------------------
void __fastcall TForm1::Button2Click(TObject *Sender)
{
 int i,j,a=1,
n=CSpinEdit1->Value,m=n;
for(i=0;i<n;i++) {
for(j=m-1;j<n;j++)
StringGrid1->Cells[j][i]=0;
m--;} }
//---------------------------------------------------------------------------
void __fastcall TForm1::Button1Click(TObject *Sender)
{
 int i,j,
n=CSpinEdit1->Value;
for(i=0;i<n;i++)
for(j=0;j<n;j++)
StringGrid1->Cells[j][i]=random(10);}
```

```
//-----------------------------------------------------------------------
```

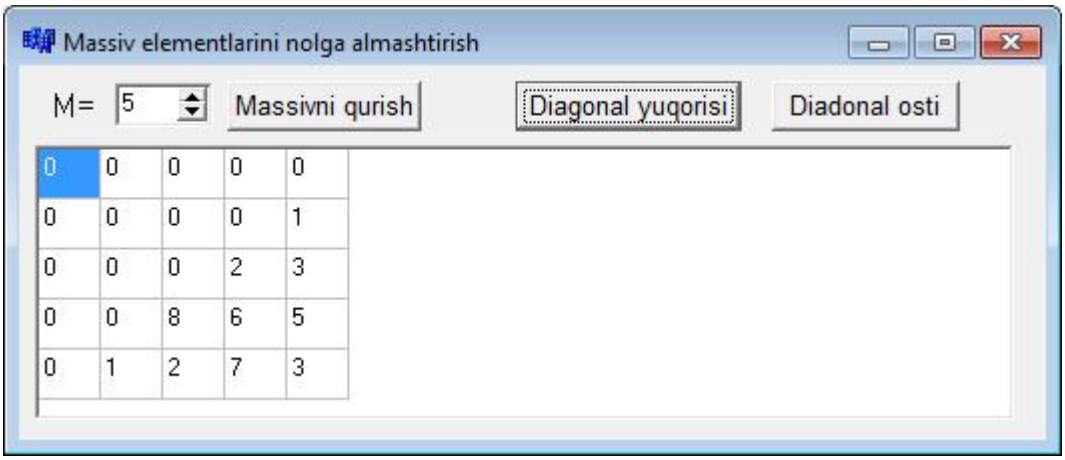

Figure 4. Project window for replacing the elements lying below the main diagonal of a square matrix with 0 (zero).

From the proposed example for the level of creative activity, it can be said that in order to solve the problem, students must first have mathematical knowledge, effectively master mathematical modeling and algorithmization, and have experience using the function keys of the visual environment. At the same time, students are taught independent research and creative thinking. As a result, it is possible to develop the student's programming competence.

Thus, the above methods of problem-based learning can be used in classes on object-oriented programming languages. With the help of such tasks, students will have the opportunity to develop logical, algorithmic thinking in programming, independently program problems, and prepare complex practical projects.

References

1. Tolipova J.O. Pedagogical technologies in teaching biology // Textbook for higher education students. - Tashkent, 2011. – 160 p.

2. Серебреникова, В. В. Технология деятельностного подхода на уроках информатики при изучении темы «Программирование решений» // Молодой ученый. – 2019. – № 12 (250). – С. 288-290.

3. Бороненко Т.А. Теоретическая модель системы методической подготовки учителей информатики // Автореферат диссертации на соискание ученой степени доктора педагогических наук – Спб., 1997. − 335 с.

4. Mirsanov U.M., Tokhirova F.J., Norbekov A.O., Dzhuraeva D.R. Programming // Textbook. - Tashkent, 2021. – 155 p.

5. Ruziyev R.A., Mirsanov U.M., Tokhirov F., Dzhuraeva D.R. Programming Languages // Textbook. - Tashkent, 2022. – 498 p.