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**E.V. Prokopets**

Innovative University of Eurasia, Kazakhstan  
(e-mail: podsolnuschek@mail.ru)

### **Methodological Foundations of the Application of the Project Method in Teaching Object-oriented Programming**

#### **Abstract**

*The main problem:* The article discusses the author's methodology based on the application of the project method in teaching students of the specialty 1304000 «Computer Engineering and Software» object-oriented programming. The author cites the most important aspects that need to be based on building a methodology for teaching object-oriented programming. At the same time, teachers need to focus on the process of activating the cognitive independence of students. On the basis of the methodology proposed by the author for teaching students the basics of object-oriented programming using the project method, a teacher's activity strategy has been developed aimed at forming students' cognitive independence.

*Objective:* description of methodological recommendations that activate the cognitive independence of students in the study of object-oriented programming through the use of the project method.

*Methods:* The article analyzes the State mandatory standard of technical and vocational education of the Republic of Kazakhstan, a standard curriculum and a working curriculum on the discipline "Fundamentals of object-oriented programming". Based on the results of the analysis, a teaching methodology was developed aimed at the formation of cognitive independence through the use of the project method in the educational process.

*Results and their significance:* The practical result of the analysis carried out by the author was the methodology of teaching object-oriented programming to college students. The main condition for the application of this technique is the use of the project method, the observance of which is necessary for the development of cognitive independence of students. The results of the study have practical significance, which consists in creating conditions for the development of creative abilities, activation of students' cognitive independence. The methodology proposed by the author of the article will contribute to improving the effectiveness of studying the discipline.

*Keywords:* project method, object-oriented programming, Delphi, teaching methodology, cognitive independence.

#### **Introduction**

In the field of professional software development, object-oriented programming (OOP) currently occupies a leading place. In this regard, the inclusion of the basics of this programming paradigm in the curriculum of college students is a prerequisite for the training of future specialists in this field.

The main and important role is played by the choice of a programming system. Having studied the pedagogical literature on this issue, the author came to the conclusion that the Delphi programming system is the most suitable for the initial level of studying OOP.

The chosen topic can be considered relevant at the moment. The purpose of this article is to describe the author's methodology of teaching OOP students using the project method (MP) and the organization based on the application of this methodology of the educational process aimed at activating the cognitive independence (CI) of students.

#### **Materials and methods**

The author of this article presents an attempt to develop a methodology for teaching OOP using MP based on the considered State Mandatory Standard of Technical and Vocational Education of the Republic of Kazakhstan (CSMSTaVE), a standard curriculum and a working curriculum on the discipline «Fundamentals of object-oriented programming» for students of the specialty 1304000 «Computer engineering and Software» [1, 2].

The problem lies in the insufficient degree of development of methods of studying in colleges of any kind of object-oriented programming paradigm. Due to the fact that this process is essential at the initial stage, at the moment there is not a single educational manual on OOP that meets the requirements of the methodology [3].

Object-oriented technologies have become the prevailing paradigm and culture of modern information technologies.

The objectives of teaching OOP at college are the students' development of new programming principles based on an object-oriented approach, the students' acquisition of theoretical and practical knowledge and skills and the development of students' CI. This approach to teaching programming sets the task of developing a methodology for teaching OOP, which should include the technology of studying basic algorithmic constructions using PM, which will contribute to the development of CI among students [4].

### **Results**

Basing on the content of the course discussed above, the CSMSTaVE and the Working curriculum on the discipline «Fundamentals of object-oriented programming», the author of this article suggests a methodology for teaching OOP using PM, which activates CI students.

The discipline «Fundamentals of object-oriented programming» is a continuation of the course «Fundamentals of algorithmization and programming», in which OOP issues are not discussed, and is designed for 1 academic semester.

The methodology proposed by the author of this article for teaching OOP using PM consists of the following topics:

«Working with projects» topic. In this topic:

– the process of developing a project scenario and observing the necessary sequence of actions is studied;

– the types of files that make up the project of applications developed in the Delphi environment are considered, as well as files describing forms and program modules

– the main project file is studied in detail. The process of saving project files is studied;

– students learn to develop the simplest applications.

«Working with components» topic. This topic:

– is devoted to working with components and basic functionality when using them in the process of application development: placing on a form, highlighting, deleting and copying;

– considers principle of using the built-in help;

– studies shapes, their properties (visibility, setting titles and icons), setting sizes and positions, automatic placement, setting colors;

– has the practical part aimed at application development.

«Linear algorithms» topic:

– the implementation of a linear algorithm is being studied by using the capabilities of Delphi;

– application development: «Arithmetic», «Product of numbers», etc.

«Branching algorithms» topic:

– is devoted to the implementation of the branching if ... else construction in the Delphi environment;

– application development: «Testing», «Dialogue», etc. Theme «Cycles»;

– implementation of cycles with Delphi capabilities;

– application development. Topic «Arrays»;

– working with StringGrid, Button, ListBox components;

– sorting, searching for the maximum, minimum and specified elements.

«Working with text» topic:

– the implementation of algorithms using strings is considered.

«Working with files» topic:

– studying working with files, saving, opening, editing;

– using SaveDialog, OpenFileDialog components;

– application development.

«Records» topic:

– is dedicated to working with records in Delphi;

– application development.

«Multimedia» topic:

– The Animate component is studied in detail. And the features of working with it;

- MediaPlayer component. And the features of working with it;
- Application development is aimed at the practical application of components in the field of video viewing and animation.

«Graphics» topic:

- in this topic, we study the ways of using the Image and Shape components, which serve as a means for displaying graphic information;

- the Canvas properties for the Image Editor (image display) and Shape (geometric shape display) components are considered;

- practical tasks are focused on the formation of images programmatically.

«Modeling» topic:

- modeling of physical and mathematical processes;

- using the Timer component.

«Games» topic:

- development of various games taking into account the capabilities of Delphi.

«Modules and functions» topic:

- modules;

- creation, connection;

- application development;

- functions;

- implementation of subroutines and procedures in Delphi.

Let's take a closer look at several projects using the methodology proposed by the author of this study.

The Dictionary project (Topic «Working with files»)

Problem statement: It is necessary to develop a program in the Delphi environment, the purpose of which will be to compile a dictionary of new terms and help the user with this. The program should provide for the possibility of making changes to the dictionary, additions and reductions in the number of terms. It should also be taken into account that when choosing a term on the control panel, the user should familiarize himself with the ordinal number of the word in the list and with the total number of words in the dictionary.

Explanation of the problem: In the process of developing this project, it is necessary to provide for the following functionality:

- drop-down list for storing terms;

- tags for locking buttons;

- buttons for working with a list of terms.

Project execution technology: Project components are placed on the form in accordance with Figure 1. The components that will be needed to solve the task and their purpose are shown in Table 1.

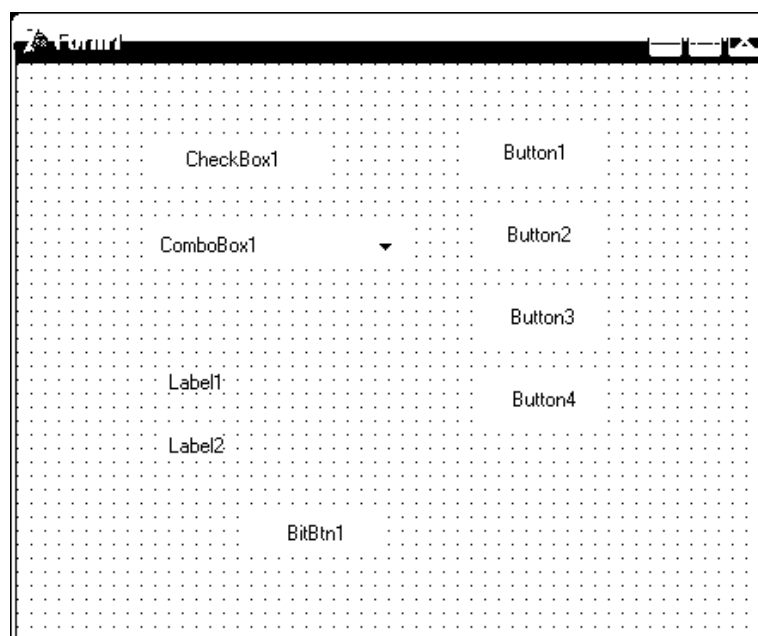


Figure 1 – Dictionary Project form

The properties for the project components must be set according to Table 1 below.

Table 1 – Components and their properties

Component	Property	Meaning
Form1	Caption	dictionary
	Height	270
	Width	345
	Font	normal, 10
Label1, Label2	Caption	delete name
Button1	Caption	Add
Button2	Caption	Remove
Button3	Caption	Edit
Button4	Caption	Save
CheckBox1	Caption	Read only
ComboBox1	Text	Delete Text
	Items	Computer science Programming Delphi Project Colour Student University Institute

In the OnClick event handler of the Button1 component (procedure TForm1.Button1Click), the following code must be typed into operator brackets (begin end):

```
ComboBox1.Items.Add (ComboBox1.Text);
if ComboBox1.ItemIndex = -1
then
ComboBox1.Text := "";
ComboBox1.Items.SaveToFile ('словарь.txt ');
```

In the OnClick event handler of the Button2 component (procedure TForm1.Button2Click), the following code is inserted into operator brackets:

```
if MessageDlg('Do you really want to delete the record?',
mtWarning, [mbYes, mbNo], 0) = mrYes
then
```

```
ComboBox1.Items.Delete(ComboBox1.ItemIndex);
ComboBox1.Items.SaveToFile ('словарь.txt ');
```

In the OnClick event handler of the Button4 component (procedure TForm1.Button4Click), type the following code in operator brackets:

```
ComboBox1.Items.SaveToFile ('словарь.txt ');
```

The list of words will be loaded from the file словарь.txt . To do this, when activating the project (procedure TForm1.FormCreate(Sender: TObject));let's write the following code:

```
ComboBox1.Items.LoadFromFile ('словарь.txt ');
```

In the section describing global variables (Implementation), it is necessary to describe the variable num.

```
num:integer;
```

In the OnClick event handler of the Button3 component (procedure TForm1.Button3Click), the following code must be typed into operator brackets:

```
ComboBox1.Items.Delete (num);
ComboBox1.Items.Add (ComboBox1.Text);
if ComboBox1.ItemIndex = -1 then ComboBox1.Text:= "";
ComboBox1.Items.SaveToFile ('словарь.txt ');
```

In the OnClick event handler of the ComboBox1 component (procedure TForm1.ComboBox1), the code must be written in operator brackets:

```
if:= ComboBox1.ItemIndex;
label2.Caption:=inttostr(ComboBox1.ItemIndex+1);
```

Further in the program, in order for the list items not to be edited or deleted when the "Read Only" switch is selected and the "Add", "Delete", "Edit and Save" buttons to be inactive, it is necessary to enter the OnClick event handler of the CheckBox1 component (procedure TForm1.CheckBox1Click) write the following code:

```
if CheckBox1.Checked = False then ComboBox1.Style:= csDropDown else
ComboBox1.Style:= csDropDownList;
if CheckBox1.Checked = false then Button1.Enabled := true
else Button1.Enabled := false;
if CheckBox1.Checked = false then Button2.Enabled := true
else Button2.Enabled := false;
if CheckBox1.Checked = false then Button3.Enabled := true
else Button3.Enabled := false;
if CheckBox1.Checked = false then Button4.Enabled := true
else Button4.Enabled := false; end;
procedure TForm1.ComboBox1Change(Sender: TObject);
begin
Label1.Caption:=inttostr(ComboBox1.Items.Count); end;
procedure TForm1.FormCloseQuery(Sender: TObject; varCanClose: Boolean);
begin
ComboBox1.Items.SaveToFile ('словарь.txt');
```

*Additional tasks for the project.*

1) Programmatically implement the ability to add terms when pressing the <Enter> key.

*Task hint:* Enter the code into the onKeyDown event handler of the ComboBox1 component: if Key = #13 then.

2) Implement the output of the total number of words in the list and the number of the selected word using labels.

*Task hint:* You need a code that assigns the value ComboBox1 to the panel header.Items.Count, enter the Change event handler for the ComboBox1 component. In the OnClick event handler of the ComboBox1 component, you need to insert a code that assigns the value ComboBox1 to the header of another panel.ItemIndex+1. It should be remembered that the numbering starts from zero, the second element will get the value -1, etc.

3) Provide for the possibility of saving changes to the dictionary when the project is closed.

*Task hint:* Add code to the CloseQuery event handler of the Form1 component that saves the list in a file 'glostext.txt'.

4) Sort the list of terms.

*Task hint:* It is necessary to set the value "True" in the Sorted property for the ComboBox1 component.

### **Discussion**

The peculiarity of this technique is the construction of the educational process based on the use of MP, consisting of the main stages:

- problem statement, which consists in the exact formulation of the problem to be solved and writing the application script;
- explanation of the task;
- project development plan;
- individual tasks.

When using this methodology, built on the basis of the use of PM, for a better understanding of the principle of programming in Delphi, students are given a detailed review of the development of the simplest programs and on their basis similar tasks are given, which, starting from the simplest, gradually move to more complex ones, which contributes to more effective development of CI. Thus, at the end of the course, students should develop their own project or one of the proposed ones in this course as a generalization and systematization of the acquired knowledge, skills and abilities formed by the CI.

### Conclusion

On the basis of the described methodology, the author published a training manual «Workshop on object-oriented programming in the Delphi environment». The methodology of teaching OOP with the use of PM proposed by the author of this article meets all the goals and objectives included in the CSMSTaVE, and also makes it possible to increase the effectiveness of teaching the course "Fundamentals of object-oriented programming".

The use of PM in teaching PLO allows you to build an educational process on the educational dialogue between a student and a teacher, take into account individual abilities, develop creative abilities, and activate students' CI.

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**Е.В. Прокопец**

Инновациялық Еуразия Университеті, Қазақстан

**Объектіге бағытталған бағдарламалауды оқытуда жоба әдісін қолданудың әдістемелік негіздері**

**Аңдатпа**

*Негізгі мәселе:* Мақалада 1304000 «Есептеу техникасы және бағдарламалық қамтамасыз ету» мамандығының студенттерін объектіге бағытталған бағдарламалауға үйрету кезінде жобалық әдісті қолдануға негізделген авторлық әдістеме қарастырылады. Автор объектіге бағытталған бағдарламалауды оқыту әдістемесін құру кезінде негізделуі керек маңызды аспектілерді келтіреді. Бұл жағдайда мұғалімдер студенттердің танымдық тәуелсіздігін белсендіру процесіне назар аударуы керек. Мақалада сонымен қатар, бұл әдістемені қолданудың сәттілігі ТЖКБМЖМС-да жасалған студенттерді оқыту мақсаттарына қол жеткізу дәрежесіне, сондай-ақ қазіргі білім беру талаптарына сәйкес әзірленген объектіге бағытталған бағдарламалау бойынша әдістемелік нұсқаулыққа байланысты екендігі атап өтілген. Автор ұсынған студенттерді жобалық әдісті қолдана отырып, объектіге бағытталған бағдарламалау негіздеріне оқыту әдістемесінің негізінде студенттердің танымдық тәуелсіздігін қалыптастыруға бағытталған оқытушы қызметінің стратегиясы жасалды.

*Мақсаты:* объектіге бағытталған бағдарламалауды оқыту процесінде жобалар әдісін және оларды оқу процесінде практикалық қолдану стратегиясын қолдану арқылы студенттердің танымдық тәуелсіздігін жандандыруға бағытталған әдістемелік ұсыныстардың сипаттамасы.

*Әдістері:* Мақалада 1304000 «Есептеу техникасы және бағдарламалық қамтамасыз ету» мамандығының студенттері үшін Қазақстан Республикасының техникалық және кәсіптік білім берудің мемлекеттік жалпыға міндетті стандартына, «Объектіге бағдарланған бағдарламалау негіздері» пәні бойынша үлгілік оқу жоспары мен жұмыс оқу бағдарламасына талдау жүргізілді. Талдау нәтижелері бойынша оқу процесінде жоба әдісін қолдану арқылы танымдық тәуелсіздікті қалыптастыруға бағытталған оқыту әдістемесі жасалды.

*Нәтижелер және олардың маңыздылығы:* Автор жүргізген талдаудың практикалық нәтижесі колледж студенттерін объектіге бағытталған бағдарламалауға оқыту әдістемесі болды. Бұл әдістемені қолданудың негізгі шарты-жоба әдісін қолдану, оның сақталуы білімалушылардың танымдық дербестігін неғұрлым қарқынды дамыту үшін қолайлы жағдайлар жасайды. Зерттеу нәтижелері теориялық маңыздылығынан басқа, шығармашылық қабілеттерін дамытуға жағдай жасауда, әркімнің жеке ерекшеліктерін ескере отырып, білімалушылардың танымдық тәуелсіздігін жандандыруда практикалық маңыздылыққа ие. Мақала авторы ұсынған әдістеменің оқудың тиімділігін арттыруға ықпал етеді.

*Түйін сөздер:* Жоба әдісі, объектіге бағытталған бағдарламалау, Delphi, оқыту әдістемесі, танымдық дербестік.

**Е.В. Прокопец**

Инновационный Евразийский университет, Казахстан

**Методические основы применения метода проектов при обучении объектно-ориентированному программированию**

*Основная проблема:* В статье рассматривается авторская методика, построенная на применении метода проектов при обучении студентов специальности 1304000 «Вычислительная техника и программное обеспечение» объектно-ориентированному программированию. Автор приводит важнейшие аспекты, на которые необходимо опираться при построении методики обучения объектно-ориентированному программированию. При этом педагогам нужно акцентировать внимание на процессе активизации познавательной самостоятельности студентов. В статье также отмечается, что во многом успех применения данной методики зависит и от степени достижений целей обучения студентов, заключенных в ГОСТИПО, а также от разработанного в соответствии с требованиями современного образования методического руководства по объектно-ориентированному программированию. На основе предложенной автором методики обучения студентов основам объектно-ориентированного программирования с использованием метода проектов, разработана

стратегия деятельности преподавателя, направленная на формировании у обучаемых познавательной самостоятельности.

*Цель:* описание методических рекомендаций, направленных на активизацию познавательной самостоятельности студентов посредством использования метода проектов в процессе обучения объектно-ориентированному программированию и стратегии их практического применения в учебном процессе.

*Методы:* В статье был проведен анализ Государственного общеобязательного стандарта технического и профессионального образования Республики Казахстан, Типового учебного плана и Рабочей учебной программы по дисциплине «Основы объектно-ориентированного программирования» для студентов специальности 1304000 «Вычислительная техника и программное обеспечение». По итогам проведенного анализа, была разработана методика обучения, направленная на формирование познавательной самостоятельности с помощью применения в учебном процессе метода проектов.

*Результаты и их значимость:* Практическим результатом проведенного автором анализа стала методика обучения студентов колледжей объектно-ориентированному программированию. Основным условием применения данной методики является—использование метода проектов, соблюдение которого создает благоприятные условия для более интенсивного развития познавательной самостоятельности обучающихся. Результаты исследования, помимо теоретической значимости, имеют и практическую значимость, заключающуюся в создании условий для развития творческих способностей, активизации познавательной самостоятельности обучающихся посредством учета индивидуальных особенностей каждого. Предложенная автором статьи методика будет способствовать повышению эффективности изучения дисциплины.

*Ключевые слова:* метод проектов, объектно-ориентированное программирование, Delphi, методика обучения, познавательная самостоятельность.

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