A New Teaching Approach in Object Oriented Programming Subject in Learning Military Environment

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Abstract

Learning environment is important and affects a student during the learning process in a classroom. Programming subjects are important subjects and requires a high logic in the process of understanding. Computer science industry requires graduates who are skilled in various programming languages. To meet the current industry requirements, lecturers should think of teaching methods that can foster a more interactive and effective learning environment. In National Defense University of Malaysia (NDUM), learning environment for the cadets is different from the other universities because they have to undergo two different conditions of academic and military training. Thus a harmonized approach should be considered in addressing this unique environment. The lecturers have to come out with the best approach in creating a favorable learning environment of a classroom. Presentations and transferring knowledge must be more creative to influence the cadets in order to produce innovative military officers who are intellectual minded. This paper discusses several methods such as using programming contest, poster presentation, visualization tools and programming tools that can be implemented in teaching programming subjects in a military environment.

Keywords: Object-Oriented, Programming, Learning, Teaching OO Programming

1. Introduction

In NDUM, programming subjects are offered to students pursuing the Bachelor Degree of Science Computer majoring in Computer Security, Bachelor Degree of Science Computer major in Intelligent Systems and Bachelor Degree of Engineering. Programming languages that are taught are C++ and Java. Teaching Java programming is divided into two semesters, the first semester is the foundation of Java programming and the second semester is Object Oriented Programming, and using the Java as a programming language. Nowadays, Java language is the language most often used in the computer industry. Java language is an object-oriented language, the lecturer should think of interactive modules and effectively to students. Teaching object-oriented languages are not the same as teaching procedural programming language. A “new pedagogy to teach objects well” is required, as reported by Bergin [1]. Moreover, teaching in NDUM, where the cadets undergo military training is very challenging and requires the lecturer to be more creative in delivering the best methods for teaching object-oriented programming. In the following section, we describe the related work in teaching object oriented programming. In section 3, we explain the proposed methods in the Learning Military Environment for Student Cadets and finally, the conclusions are discussed in section 4.

2. Related Work

Teaching Java Language can be divided into two parts, namely 1) Basic elements in Java and 2) Topics related to Object-Oriented. In the initial stages of teaching Java language, there might not be any problems or hassle because the topic is covers the basic elements in Java. But problems will start to surface when the lectures will start relating on the object; such as Object Oriented Design (class & object, inheritance and polymorphism, handling exceptions and events), Graphical User Interface (GUI) and Advanced GUI and graphics.

Thramboulidis [2] uses a sequence of assignments to teach object-oriented programming. Each assignment is associated with object-oriented concepts, such as use-cases and object interaction
diagrams, class responsibilities, using GUIs, inheritance, polymorphism, event handling, using Java API, hands on exception handling and finding bugs. The set of assignments are designed from a software-engineering-centered view and specifically centered on a design approach.

Yan [3] proposed a way to teaching object-oriented programming with games. This research project the Greenfoot system to show the interaction of objects in the wombats scenario [16]. In Greenfoot system, students will be exposed to the concept of objects such as object-oriented concepts including object, class, observing behaviors, invoking methods and instantiating objects. BlueJ is selected to teach students the Java programming skills [17]. Students use BlueJ to observe behaviors, invoke methods and instantiate objects using the picture game.

Kouznetsova [4] used BlueJ as software tools and card game Blackjack to teach basic concepts of object-oriented design. This paper explains the sequence of assignments made by students, step by step, an elementary Blackjack card game application. This assignment was stimulated in parts by the PlayingCard example used in An Introduction to Object-Oriented Programming [5].


3. Proposed Methods in the Learning Military Environment for Student Cadets

The following methods have been proposed to be implemented in a learning military environment for teaching programming subjects.

3.1 Implementation of Contest Based Programming on a Given Problem or Scenario

Programming subjects for instance C++, Java and others can be difficult for some students because it takes logic and creative thinking in solving a problem. Normally, an assignment provided by the lecturers must be completed within a certain period of time. To overcome the problem of students copying assignments, a contest to complete an assignment within a specified time period with the supervision of lecturers could be the solution. For example, if the allotted time for a certain assignment is one hour, the students that can complete the assignment within one hour, will receive full marks. By using this method, the problem of imitating or copying assignments could be avoided.

Another approach is, students will be given a number of scenarios to solve using certain softwares such as BlueJ, Jeliot or others. The students need to work together in groups. Each group must solve a given problem and each solution should show some important features of object-oriented concepts. These features are instantiating objects and classes, state and methods, invoking methods, observing behaviors, inheritance and polymorphism, overloading and overriding, data encapsulation, and GUI’s and handling events. The marking scheme will be based on the use of the characteristics of object orientation in solving the given problems. The contest will also be able to foster teamwork, creativity, time management in completing the task.

3.2 Poster Presentation Based on Problem Scenario

Poster Presentation is a competition where students are given the topic and they need to present in the form of posters. This activity requires students to work in groups. Each group should prepare a poster in a certain period of time. Students should relate the title given to the current issues that could be obtained from a variety of sources such as news, magazines, the Internet and so on. The student’s efforts and creativity in preparing the posters are also taken into account. The course will inculcate the collaboration between students, the nature of creativity in delivering ideas, and the learning process by finding information from various sources.

Students can use software tools such as BlueJ, SmartDraw, Jeliot, DrJava during the process of completing the poster presentation. Students are also able to demonstrate skill in using software tools in a poster presentation. The students need to work together in groups. Each group must solve a given problem and each solution should show some important features of object-oriented which will be presented in the form of posters. Students are required to explain the concept of objects from basics which includes data abstraction, classes and objects, state and behavior, methods, message passing,
inheritance and polymorphism, overloading and overriding, data encapsulation, handling events, graphical user-interface. Posters that are ready could be posted on the laboratory foyer, and each group will make poster presentations. Posters will be judged by a jury consisting of lecturers from different fields. Presentation sessions, question and answer sessions could be held to test the student’s understanding of the topics given. The knowledge that they gained whilst preparing the posters will guide them in many ways.

3.3 Visualization Tools

Using visualization tools in teaching can help lecturers communicate more effectively and easily. Using visualization tools as teaching aids in programming subjects are deemed necessary in order to explain the concept of algorithm using animation techniques, an algorithm is the basic concept in programming. In these cases, the use of visualization tools in learning object-oriented concepts will be very effective because students will understand the concepts more clearly because the concepts are reflected clearly. This is because; humans are very good at processing visual information. There are many visualization tools that can be used in object-oriented learning; including BlueJ, Jeliot 3, Alice and others. Jeliot 3 is an animation program that is specifically used in teaching introductory programming. Programs are automatically animated, requiring no modifications or annotations from the user [7].

![Figure 1. First View of Jeliot 3](image1)

![Figure 2. Jeliot 3 doing Animation](image2)
Figure 2 illustrates what actually happens when a program is running. Students can see the value in a variable assignment, how the method is called and all operations that occur are displayed in the visualization on the screen. Jeliot 3 is a visualization program application which visualizes how a Java program is interpreted. Method calls, variables, operation are displayed on a screen as the animation is played, allowing the student to follow the execution of a program step by step. Programs can be created from scratch or they can be modified from previously stored code templates. The Java program being animated does not need any kind of additional coding since all the visualization is automatically generated. Jeliot 3 understands most of the Java constructs and it is able to animate them. Special effort is currently being addressed to animate object oriented features, such as inheritance [9]. Using Jeliot 3 as a teaching aid will help lecturers in teaching and learning process. Jeliot 3 can show the actual process that occurs in the program during compilation. Students will be able to see with the naked eye what actually happens from the beginning of the process until the variable output value is obtained.

BlueJ is an integrated development environment for Java, developed by Michael Kolling and John Rosenberg [10-11]. BlueJ is visualization software that can help in learning the basics of object-oriented programming. One of BlueJ’s advantages is that classes and objects could be presented in the form of graphical representation. Student can interact with the programs through a sequence of popup menus. Using the Inspect option of the pop-up menu associated with objects, student can directly see the values of the fields of an object. This allows them to immediately see the effort of a method invocation on that object and also simplifies the debugging process [10]. BlueJ has become a very popular choice of software to use and it serves as a software tool for those who are new to object oriented programming [12-13]. An examples of classes in BlueJ are shown in Figure 3.

![Figure 3. Classes in BlueJ project “Shape” Exercise [10]](image)

### 3.4 Programming Tool

Teaching Object Oriented Programming (OOP) for first year students is challenging. The lecturers need to face the task of distilling challenging programming concepts. At the same time, he must explain the mechanics involved in writing, testing, and debugging Java programs to the students. Students have to learn so many things, so the more time they spend wrestling with the mechanics, the less time they spend learning the concepts [14]. DrJava is an editor programming environment for Java that enables students to focus on designing coding, rather than learning how to use the environment. Therefore, DrJava can be used as a development environment for students to write and understand clearly the Java language for OOP subject. DrJava interface consists of windows with two panes: an interaction pane and definition pane. In the interaction pane, students can input Java expressions and statements, and then the program will run until it yields the results. Student can enter and edit class definitions with the support of brace matching, syntax highlighting and automatic indenting inside the definition pane. These two panes are linked by an integrated compiler that compiles the classes in the definitions pane for use in the interaction pane. By using DrJava, students could avoid facing problems such as text I/O, a command line interface, setting environment variables like CLASSPATH, or the complexities of the projects.
interface supported by a commercial Java development environment [14]. Here is an example using DrJava to create a new Java program.

![Figure 4. Interface of DrJava [15]](image)

After students have completed the coding in the definition pane, the program is then compiled using the compiler error window to disclose any syntax or errors along the way. The student can also use the interaction window to examine its functionality, as shown in the above figure. The user may call various methods in the program with various inputs without having to recompile the code. Students can interrelate with their Java code without ever leaving the environment, hence allowing them to focus on program design instead of manipulating a variety of tools with incoherent interfaces. In fact, through the use of the read-eval-print loop, student programs can accept input and display results without the students having to use explicit I/O or GUI facilities [14].

4. Conclusion

This paper mainly discusses the various approaches used in teaching and learning process for cadets. Therefore, it is crucial for lecturers in a military environment to use any learning methods which must be compatible with the military learning environment. In addition, this paper aims to satisfy the cadets in terms of the learning environment thus gain a lot more educational experience. Besides that, lecturers should play an important role to create an effective teaching and learning environment. This is because using effective teaching and learning in NDUM will be able to produce graduates that are well equip and are capable of being the leaders of the future.

5. References