



Study of the impact of collaboration among learners during the learning of "Object-Oriented Programming"

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Topic: e-learning.

**Study of the impact of collaboration among learners during the learning of
“Object-Oriented Programming”**

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Introduction

As in many fields, the field of education has undergone substantial transformations with the spread of Information and Communication Technologies (ICT). These changes can be clearly seen through the huge breakthrough achieved in remote education field. From now on, not only the content of the courses is adapted to the needs of each individual learner, but also the way in which it is served. Not only that but also specific characteristics of each taught subject is taken into account. Computer Science was among the first disciplines involved in e-learning, considering the ability of its learners to comfortably assimilate the use of this new learning form. Within this scope, several e-learning approaches and systems were developed to support different computer science topics from Logic and Algorithmics to Programming through its different paradigms (such as Object Oriented Programming (OOP)) (Djelil et al., 2015; Yoke Seng et al., 2018; Yan, 2009).

This concept (object-oriented) is often seen by many students as problematic, as they fail to come up with a good object-oriented designs of a given problem. Some scientists believe that the problem is the shift of the problem modeling vision from one that students were familiar with, to a different one that is object-oriented. Other scientists see that it is not the object-oriented paradigm itself that is causing the problem, but rather the existing tools (languages and environments) available to teach it.

So, how can we make better use of technology in teaching Object-Oriented Programming (OOP)? Can a collaborative learning strategy improve this line of learning? These two questions are the main focus of this research work. To answer all these questions we will present a new approach called LISA that relies on collaboration between learners to learn the concepts of Object Oriented Programming (OOP).

Methodology

The purpose of this work is to propose a new collaborative learning method suitable for OOP learning (or any other concepts with a similar pedagogical structure). It is with this vision in mind that we propose to define a new approach that will allow learners to deal with many of the difficulties experienced when learning this paradigm. In order to test this approach, we propose a remote learning system that will embody the proposed approach.

First, we conducted a literature review on collaborative learning. We also conducted a research about the already existing systems that have been developed to enhance learning of the OOP concept. Next, we conducted a field study that aimed to identify the different learning difficulties of OOP among new programmers or university students.

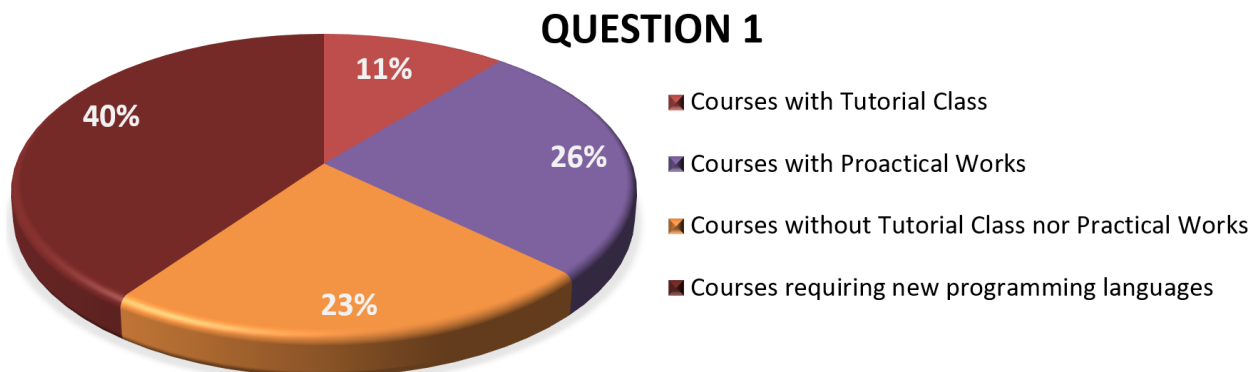
Our work plan was simple:

1. Conduct a case study of university students in Computer Science, in order to uncover some common difficulties encountered in learning OOP.
2. Propose a new collaborative learning approach to make OOP learning much easier.
3. Design and implement a system that adopts this new method, which must offer a simple interface, and that uses a collaborative learning solution.
4. Test the prototype developed with students from the computer science department.

1. Students' Perceptions of Object-Oriented Programming

In order to understand the difficulties encountered by Computer Science students when learning Object-Oriented Programming (OOP), we prepared a survey (both on-line and handwritten) to gather data. As we were preparing this survey, we followed the Likert Scale guidelines for the majority of our questions, using precise and well nuanced answers in order to obtain the most reliable answers possible.

In this section, we present our findings regarding some of the interesting questions asked in this survey. For example, for the question: What courses do you find difficult to study? We have obtained the following results:



2. Analysis of the obtained statistics:

By analyzing obtained results of this survey among 91 university Computer Science student, we can see the following facts:

- In general, the majority of students have difficulties mastering courses that require new paradigms and new programming languages.
- In particular, the majority of students have difficulties studying the Object Oriented Programming (OOP) paradigm.
- 68% of the students did not manage to understand explanations given in the OOP course.
- 41% of the students believe that there is a problem in the selection of teaching tools for the OOP course.
- Regarding the pace of teaching in the OOP course, 64% of the students confirm that it is faster than their own pace.
- As for the main problem in learning OOP, 51% of the students see that the problem is not learning the basic concepts of OOP, but understanding statements of the problems posed in this module, as well as arriving at an object-oriented design to these problems.

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- As for the use of a collaborative solution (teamwork), most students (61%) think that it can be effective in the OOP module. While 49% saw that the right method of grouping learners is the one of teacher-determined grouping.

- Concerning the question about existing OOP's e-learning platforms effectiveness, 49% of the students think that they are useful.

3. Description of the LISA Approach: Learn, Imagine, Share and Approve

Our approach has been designed to be suitable for university students seeking to master Object Oriented Analysis and Design (OOAD), which is the core of OOP rather than teaching object-oriented implementation in a particular programming language. It is essentially Collaborative Learning based solution. This new approach, called LISA, is composed of four learning stages :

- L (Learn): is to collaboratively learn (with a co-learners) basic concepts of a studied course module (in our case the OOP), through a pedagogical content in the form of a set of chapters composed of concepts, within the framework of Collaborative Learning.

- I (Imagine): is to master the use of imagination in performing a particular task in the studied course. In the case of OOP, this step will be carried out during the Analysis and Design phase, where it consists of using imagination to derive the objects that form part of a given problem and to determine the relationships between them, and then represent them with the right object-oriented concepts.

- S (Share): In this step each learner shares his own design with his group colleagues. This step aims in one hand to inspire colleagues who are at a deadlock and in another hand will allow group members to evaluate each group's member solution.

- A (Approve): in this step each group members should select one of the proposed solutions to be approved as the best solution to the given problem.

Conclusion (Summary)

In this paper, we have presented a new approach for learning object-oriented concepts. This method has been applied to a system called POOLISA. The POOLISA system (an abbreviation to the procedure for learning OOP by our new LISA method). This system is in the form of an e-learning platform.

In the final version of the article, we will present the design of our learning platform through one of the Unified Modeling Language (UML) diagrams, which is the UseCase diagram. This is in order to identify the different actors interacting with our platform, to present their roles, as well as the nature of the relationships between them. In addition, our system is currently being tested by students of the Computer Science Department of the University of Guelma (Algeria). The results obtained are encouraging and very promising.

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