# COMPUTER PROGRAMMING
## A Framework Learning Proposal

Martinha Piteira, MSc and Carlos Costa, PhD
IUL—Instituto Universitário de Lisboa, Portugal
m870@iscte.pt, carlos.costa@iscte.pt

## ABSTRACT

Programming is a skill that is very required in ours days. However novice students often revealed a dislike to this subject. Motivated by this issue, we started to study this subject.

The aim for this work is to study the difficulties in learning programming in order to propose solutions, to improve learning and students motivation.

In order to answer this question, three approaches were used: it was asked to students, what were their difficulties; it was asked to the teachers, what were the main difficulties of their students and finally, exams were analysed.

Finally we present a learning framework proposal.

## OBJECTIVES

The main objectives for undertaking this research are the following:

1. Identify the main difficulties perceived by students in learning computer programming;
2. Identify the main difficulties of the students perceived by their teachers;
3. Propose a learning framework to allow a better computer programming concepts understanding, a better engagement and motivation in learning process.

## SURVEY DESIGN AND METHODOLOGY

An online questionnaire was designed and adapted from literature. The questionnaire has five sections: profile, professional experience, computer program experience, course contents and learning aspects. This presentation shows the results from course contents . Section course contents was divided into two sub-sections: programming issues and programming concepts.
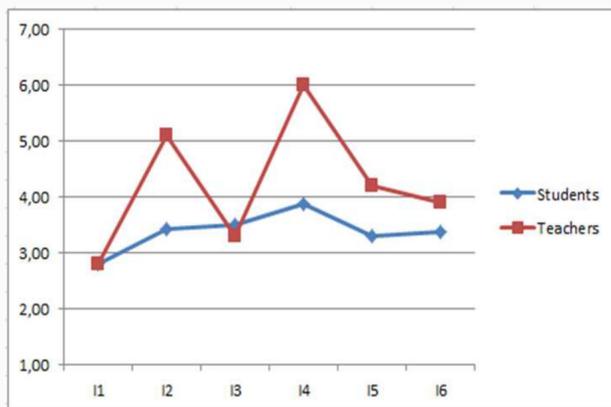


Programming Issues
1– (easy to learn) to 7 - (difficulty learn)

| Using program development environment | I1 |
|---|---|
| Understanding programming structures | I2 |
| Learning the programming language syntax | I3 |
| Designing a program to solve a certain task | I4 |
| Dividing functionality into procedures | I5 |
| Findings bugs from my own program | I6 |
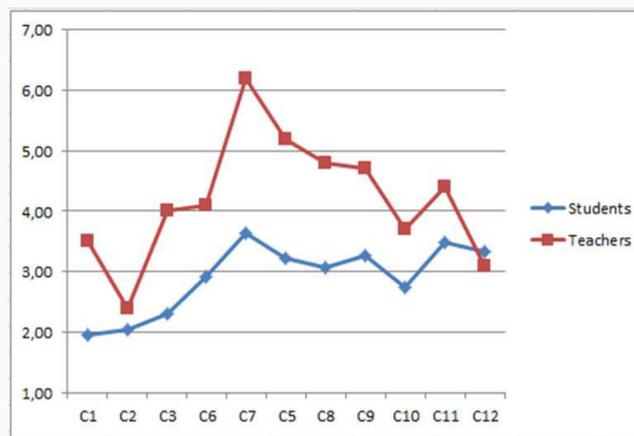


Programming Concepts
1– (easy to learn) to 7 - (very difficulty to learn)

| Variables | C1 |
|---|---|
| Selection structures | C2 |
| Loop structures | C3 |
| Arrays | C6 |
| Pointers, References | C7 |
| Parameters | C5 |
| Structured Data Types | C8 |
| Abstract Data Types | C9 |
| Input/Output Handling | C10 |
| Error Handling | C11 |
| Using language libraries | C12 |
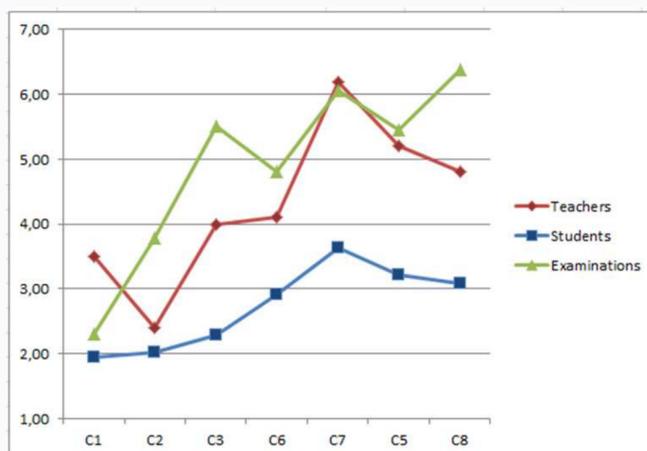


Comparative students and teachers perceptions to examinations results

| Variables | C1 |
|---|---|
| Selection structures | C2 |
| Loop structures | C3 |
| Arrays | C6 |
| Pointers, References | C7 |
| Parameters | C5 |
| Structured Data Types | C8 |
| Abstract Data Types | C9 |
| Input/Output Handling | C10 |
| Error Handling | C11 |
| Using language libraries | C12 |

## FRAMEWOK LEARNING PROPOSAL

Many strategies have been used to engagement and improve motivations students'. One of them is robots usage in classroom. It's accepted in the literature review that these strategies could improve the motivation.(McGill, M. 2012)

Based on that we propose a learning framework to arduino[1] platform.

The learning framework is composed by:

- **Library to encapsulte arduino technical aspects**
  - the aim is students learn programming concepts rather than robotics aspects
- **Educational Library**
  - Set of programming exercises
    - Sequentials Instructions
    - Conditional Instructions
    - Repeat Instructions
    - State Instrutions
    - Memory Instructions
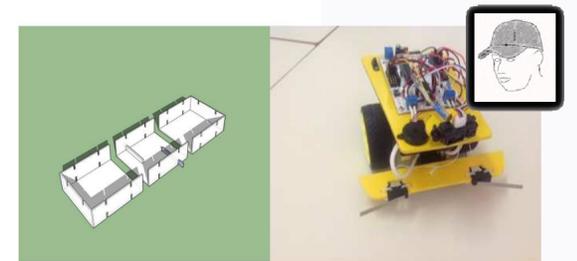


Learning environment will be developed based on a Urban Myth. Robot will be a Kid in the city and must overcome the Urban Myths. Exercises are related with diferent stages of humam developement:

- Sequential Instructions –> **ACT**
- Conditional Instructions –> **REACT**
- Looping Instructions –> **INSIST**
- State Instructions –> **EVOLVE**
- Memory Instructins –> **LEARN**

## PUBLICATIONS

- Piteira, Martinha; Costa, Carlos; Haddad, Samir R. 2012. "**Educational Computer Programming Tools**". In Proceedings of the Workshop on Open Source and Design of Communication - OSDOC '12, Lisboa, Portugal. doi: 10.1145/2316936.2316947

- Piteira, Martinha; Costa, Carlos. "**Learning Computer Programming- study of difficulties in learning programming**". In Proceedings of the Workshop on Open Source and Design of Communication - OSDOC '13, Lisboa, Portugal.

13.º CONFERÊNCIA Associação Portuguesa Sistemas de Informação
4 e 5 OUTUBRO 2013 UNIVERSIDADE DE ÉVORA

1) Arduino is an open-source electronics prototyping platform. It's allow to create interactive objects or environments