# CONTRIBUTION TO THE IMPROVEMENT OF MEANINGFUL LEARNING OUTCOMES IN PROGRAMMING SKILLS DURING SECONDARY EDUCATION

Marcos Gomez Villaverde. PhD Student
Supervised by José carlos López Ardao, Raúl F. Rodríguez Rubio
Telecommunication Engineering School. University of Vigo
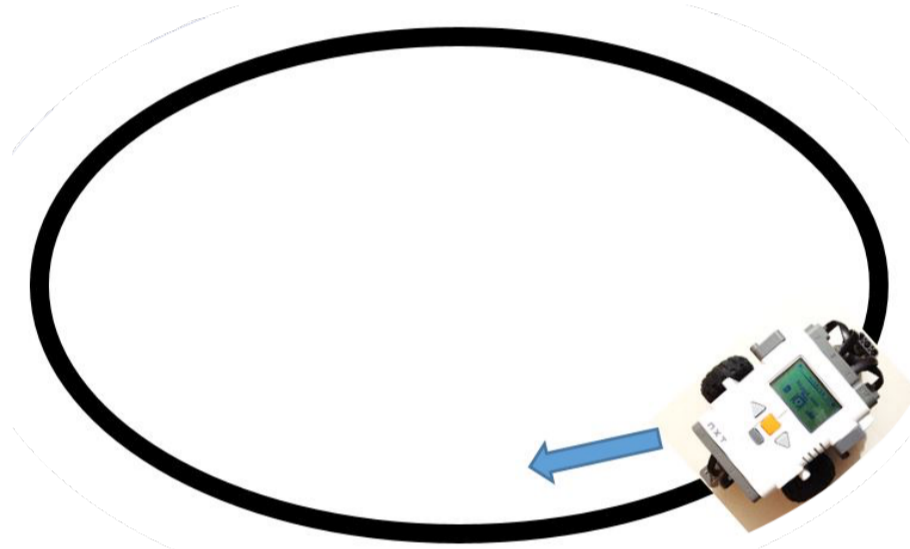
## MOTIVATION OF THE WORK

### CURRENT SITUATION

Nowadays, acquiring programming (computer systems) competences and skills during basic education -both primary and secondary school- is highly appreciated

### ISSUE

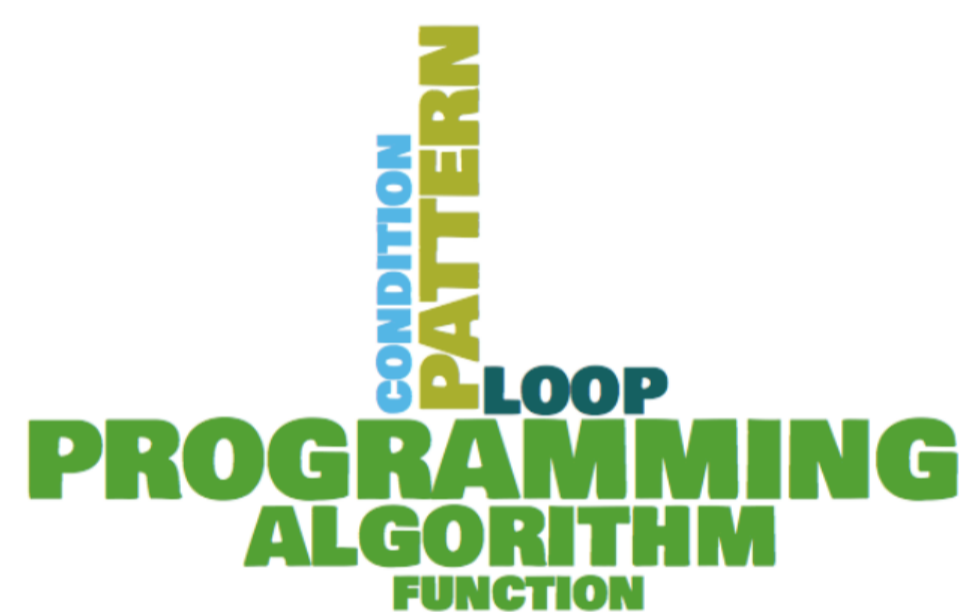teaching practices are focused on getting the system to do the task

Copy-Paste habits

Bad coding practices



### ALTERNATIVES

We believe that we need a different and specific learning methodology for these educational levels, which must also be accompanied by adequate resources to achieve meaningful learning,

## THESIS OBJECTIVES

### MAIN GOAL

To propose a methodological alternative to improve the acquisition of programming skills and competences In secondary school

To identify the weak points of the current teaching methodology through the collection of real tests and evidences

To define the necessary tools and resources to effectively change the methodology that allows a more effective learning.

To experiment and analyze the impact on the students of the proposed alternative learning methodologies.

## NEXT YEARS PLANNING

| | 2016-2017 | 2017-2018 | 2018-2019 | 2019-2020 | 2020-2021 |
|---|---|---|---|---|---|
| Deep analysis of the state of the art by searching for research papers and relevant articles | | | | | |
| Selection of the context where the research will be carried out | | | | | |
| Search of congresses related to the topics of study | | | | | |
| Analysis of current teaching methodology and resources | | | | | |
| Search and development of new resources and tools | | | | | |
| Participation in international congresses | | | | | |
| Elaboration and publication of articles in conferences | | | | | |
| Proposal of alternative learning methodologies | | | | | |
| Elaboration and publication of articles in scientific journals and conferences | | | | | |
| Experimentation and analysis of the impact on students of the proposed alternative learning methodologies | | | | | |
| Writing and reading the thesis | | | | | |
| Elaboration and publication of articles in scientific journals and conferences | | | | | |

## RESEARCH PLAN

- Exhaustive search and analysis of the state of the art
- Elaboration of a study on the methodologies and resources currently used

↓

- To define and implement the right procedure and tools to conclude which are the programming skills of a sample of students

↓

- Search and development of new learning tools
- Propose, test and analyze the impact of different elements and methodological alternatives

- Elaboration of documentation that can be included in the thesis report
- Publication of studies, partial results or key aspects of the thesis in magazines or congresses of recognized international prestige

## REFERENCES

[1] J. Shim, D. Kwon and W. Lee, "The Effects of a Robot Game Environment on Computer Programming Education for Elementary School Students", IEEE Transactions on Education, May 2017
[2] A. Kelliher, "Technology and the Arts: Educational Encounters of the Third Kind", IEEE MultiMedia, July-Sept 2016
[3] D. Kwon, H. Kim and J. Shim, "Algorithmic Bricks: A Tangible Robot Programming Tool for Elementary School Students", IEEE Transactions on Education, Nov 2012
[4] B. Tangney, E. Oldham and C Conneely, "Pedagogy and Processes for a Computer Programming Outreach Workshop—The Bridge to College Model", IEEE Transactions on Education, Feb 2010
[5] a. Merkouris, K. Chorianopoulos and A. Kameas, "Teaching Programming in Secondary Education Through Embodied Computing Platforms: Robotics and Wearables", ACM Transactions on Computing Education, May 2017
[6] V. Chaudhary, V. Akgrawal and P. Sureka, "An Experience Report on Teaching Programming and Computational Thinking Ph Elementary Level Children Using Lego Robotics Education Kit" International Conference on echnology for Education (T4E), 2016 8th. IEEE
[7] A. Karoulis, "Usability Evaluation of the LEGO Interface" International Conference on Advanced Learning Technologies, 2006 6th. IEEE
[8] A. Rao, "The application of LeJOS, Lego Mindstorms Robotics, in an LMS environment to teach children Java programming and technology at an early age" Integrated STEM Education Conference (ISEC), 2015 IEEE
[9] L. Coravu, M. Marian and E. Ganea, "Scratch and recreational coding for kids" RoEduNet International Conference - Networking in Education and Research (RoEduNet NER) 2015 14th. IEEE