IMPROVE EDUCATION, BASED ON TECHNOLOGY, IN HIGH SCHOOLS THROUGHT AN EUROPEAN INICIATIVE

Rosa Barroso[1], Marílio Cardoso[1], António Vieira de Castro[1], Álvaro Rocha[2]

[1] *Politécnico do Porto (ISEP) - GILT (PORTUGAL)*
[2] *Universidade de Coimbra (PORTUGAL)*

Abstract

Education has evolved through times from a family-based model to a school-based model where children focus on learning important subjects in an organized and coherent way.

More than ever, education has a key role in society. It is through education that children acquire the knowledge to meet basic needs and young people acquire the knowledge that prepares them to add value to society. It is through education that society hopes to develop by creating more skilled people able to innovate and evolve.

In a globalized world where societies compete against each other in a market logic, is through education and consequent innovation that they can make difference. Thus, any new approach that leads to a better and more efficient educational process is a valuable feature for any modern society.

Looking at the contemporary school-based approach to education one can see that societies usually divide education in different building blocks, primary education where children acquire basic knowledge, secondary education where this knowledge is more clearly divided in subjects and further detailed and finally higher education where students specialize in given area of knowledge and become prepared to make valuable contributions to that area.

Due to the nature of secondary schools and higher education institutions, there is sometimes a considerable gap in between that makes more difficult the transition of students between both levels. This is due not only to admission policies but also to the different methodologies that are used.

In this paper, we detail our work in the European Project Up2U whose goal is to bridge the gap between secondary schools and universities. We start by presenting an overview of education in secondary schools in Portugal looking at its different areas and focusing on Science and Humanities which is the principal area for preparing students to access the university. We explain how this area is organized in branches and present some official statistics about the success. Finally, we propose a technological approach to close the gap between the secondary school and the university which we will apply to the Science and Humanities area and will hopefully increase the success in terms of number of students completing the secondary school and being accepted to the university. We agreed to work with several secondary schools to test our approach and achieve our goals.

Keywords: Distributed learning, Education, Technology, Formal and Informal Learning, Up2U.

1 INTRODUCTION

Society evolves through times changing its needs. Education prepares children to integrate society successfully providing them with the knowledge that will make them valuable members.

Since ancient times schools are the principal vehicle to teach children skills and socialization replacing families in this task. With the evolution in writing and printing, text books were developed and subjects organized to compose curriculums. In the middle ages, the first universities were created in Europe and the lecture style of teaching emerged supported by the invention of printing press. Education evolved in Renaissance to well defined areas of science and humanities. Until our days, it is common to use the traditional lecture model in schools of different levels.

The teaching and learning methods entered a quick changing period with the introduction of technologies which allow a more dynamic way to teach and learn.

In this section we overview education at different levels using the Portuguese case as an example.

1.1 Acquisition and knowledge transfer

Knowledge is one fundamental cornerstone for humanity[1]. Knowledge allows a better understanding of our world and raises evolution in all domains. Distributing knowledge has, thus, an important role since it provides future generations with appropriate skills to evolve. Schools are the vehicle for distributing knowledge.

Moreover, from an individual level, knowledge allows full development of the human personality and dignity raising the social status.

Thus, it is important that at the process of acquisition of knowledge and distribution (through schools) is the more effective that is possible and maximizes the use of efficient and sound methodologies.

1.2 Education in Secondary schools

The education at secondary school level in Portugal has 3 years of duration (Fig. 1) consisting in the 10th, 11th and 12th grades and is divided in several groups, the main ones are the Science & Humanities, Arts and Vocational. In this paper, we will focus in the Science & Humanities group since it is the one which students choose when they want to access to the University.

The other groups, although with different conditions, also allow the access to the University but that is not their main purpose and thus, most students in these groups don't access to the University.

Figure 1 - Profile of Education in Portugal

In Portugal, the Ministry of Science and Education [2] which defines the subjects and their contents. Inside secondary school, there are several areas which upon completion, allow students to apply to the university. We will focus on Science and Humanities since this is the one which is focused in taking all students to the university. The remaining areas don't have the access to the University as a goal even if they somehow allow it.

The Science Humanities study plans include: a general training component, common to the four courses, aimed at building the personal, social and cultural identity of young people; a training component, without domain support; a discipline of Moral and Religious Education, which is optional.

Science and Humanities is divided in several branches which are described in the following subsections. All these branches share the following common subjects:

- − Portuguese (10th, 11th, 12th);
- − Foreign Language I, II, III - German, Spanish, French or English (10th, 11th,);
- − Philosophy (10th, 11th,);
- − Sports (10th, 11th, 12th).

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[1] http://educationalrights.weebly.com/

[2] http://www.dge.mec.pt/cursos-cientifico-humanisticos

1.2.1 Science and Technologies

The Science and Technologies branch also includes the following subjects:

- For three years (10th, 11th and 12th):
  - Math A.
- For two years (10th and 11th) - The student chooses two biennial subjects from the list:
  - Biology and Geology;
  - Physics and Chemistry A;
  - Descriptive Geometry A.
- For one year (12th) - The student chooses two annual subjects from the list:
  - Biology;
  - Physics;
  - Geology;
  - Chemistry.

1.2.2 Socioeconomics

The Socioeconomics branch also includes the following subjects:

- For three years (10th, 11th and 12th):
  - Math A.
- For two years (10th and 11th) - The student chooses two biennial subjects from the list:
  - Economy A;
  - Geography A;
  - History B.
- For one year (12th) - The student chooses two annual subjects from the list:
  - Economy C;
  - Geography C;
  - Sociology;
  - Chemistry.

1.2.3 Languages and Humanities

The Languages and Humanities branch also includes the following subjects:

- For three years (10th, 11th and 12th):
  - History A.
- For two years (10th and 11th) - The student chooses two biennial subjects from the list:
  - Geography A,
  - Latin A,
  - Foreign Language,
  - Portuguese Literature
  - Math Applied to Social Sciences
- For one year (12th) - The student chooses two annual subjects from the list:
  - Philosophy A;
  - Geography C;
  - Latin B;
  - Foreign Languages I, II or III;
  - Literature of Portuguese Language;

- o Psychology B;
- o Sociology.

1.2.4 Visual Arts.

The Visual Arts branch also includes the following subjects:

- For three years (10th, 11th and 12th):
  - o Artistic Drawing.
- For two years (10th and 11th) - The student chooses two biennial subjects from the list:
  - o Descriptive Geometry A;
  - o Math B;
  - o History of the Arts.
- For one year (12th) - The student chooses two annual subjects from the list:
  - o Arts Office;
  - o Multimedia Workshop B;
  - o Materials and Technologies.

Note that whenever a subject name includes A and B means that the B version is a simplified version usually available in branches where that subject is important but not fundamental.

1.3 Access to the University

To access the University, students must apply for national exams. They are ranked according to their results in such examinations and their grades in the different subjects from the secondary school. The most recent data available from the Ministry of Science and Education, shows that 99893[3] students completed the secondary school and universities had 50555[4] places available. Students in the 12th grade from Science and Humanities were 63214 where 44049 completed the secondary school with success. The number of students completing the 12th grade with success in the Science and Humanities area is 70% of the total as it can be seen in Figure 1. When looking at the global data one can see that, from the total of students of all areas that completed the 12th grade only 44% were accepted at university as it can be seen in Figure 2.
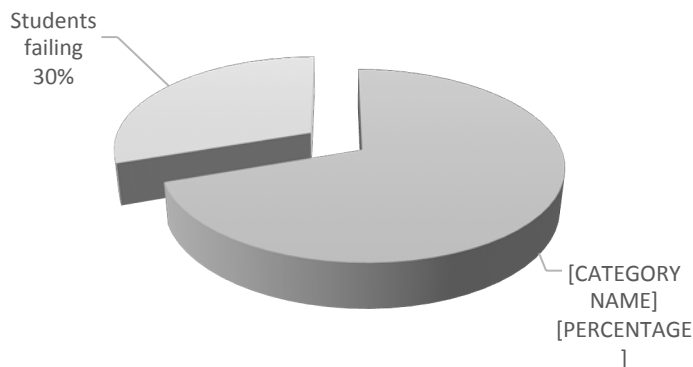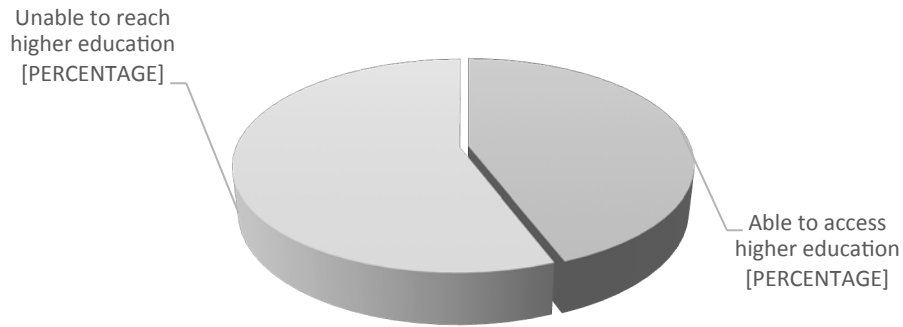

Figure 2. Science and Humanities - 12th grade

Figure 3. Students that completed 12th grade accepted at University

2 THE PROBLEM

As one can see in the previous section, there are still a considerable number of students unable to access the higher education. We believe that this has a lot to do with learning methodologies and that closing the gap between secondary schools and the universities can be done by applying new approaches that will increase the number of students prepared to access the higher education level.

2.1 The gap between secondary education and universities

The differences between secondary schools and the university could be shorter if typical learning scenarios from the higher education level could be smoothly integrated in secondary school. We will adapt and apply learning scenarios in schools that will be useful when attending the university, experimenting with informal learning spaces and promoting technology in the classroom.

2.2 Learning Technology

Technology for educational purposes is available with many different approaches from software such as LMS [1] to hardware such as Smart Boards [2]. The use of this technologies in secondary schools contributes to the implementation of new teaching approaches such as E-Learning [3], B-learning [4] and M-learning [5].

2.3 Up2U (Up to University) project

According the Up2U portal[5], the main objective of Up2U (Up to University) is to bridge the gap between secondary schools and higher education by research better ways to integrate formal and informal learning scenarios and adapting both technology and methodologies that students will probably be facing in universities.

Up2U focus the context of "secondary schools", often referred as "high schools", which provide secondary education between the ages of 11 and 19 depending on the country, after primary school and before higher education.

The initiative aims to respond to the requirements of a clear mandate from the European Commission allied with the provision of new cloud-based tools and services to enhance primary and secondary education in Europe.

Up2U is a 36-month collaborative project that kicked off in January of 2017 and gathers 18 partners from 12 countries across Europe including National Research and Education Networks (NRENs), traditional and open universities, infrastructures providers and commercial partners.

3 CONTRIBUTION

With our work, we hope to bridge the gap between secondary schools and universities by using learning technologies and applying new methodologies. We started by contacting several secondary schools to learn from them what they use in term of methodology and technology in their everyday

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[5] Available on https://up2university.eu/overview/

work. We will use such information to define what methodologies and technologies can be introduced and measure if they bring this gap closer.

3.1 Preliminary analysis and contacts with Secondary Schools

Up2U pilot countries must work with some secondary schools to provide a better understanding of the process and serve as a mean to research how the gap between secondary education and Higher education can be reduced.

Portugal is one of Up2U pilot country so, some secondary schools identified as potential schools.

We started by contacting and selecting secondary schools that will collaborate with us by providing data and a test environment for us to use. The selected schools which agreed to test our methodology are presented in Table 1. These schools teach grades from 5th to 12th and we will particularly focus on the interval from 10th to 12th grade which has students that already decided if they want to go to the university or not. We believe that these schools will provide a good environment engaging their teachers and students in this project.

Table 1. *Test schools*

Name of School	Web Address
Agrupamento de Escolas António Sérgio	http://www.antoniosergio.pt/
Agrupamento de Escolas Gaia Nascente	http://gaianascente.ccems.pt/
Escola Secundária Dr. Joaquim Gomes Ferreira Alves	http://www.esdjgfa.org/
Escola Secundária de Almeida Garrett	http://esagarrett.com.pt/joomla/
Colégio Internato dos Carvalhos	http://www.cic.pt

The "Agrupamento de Escolas António Sérgio" and the "Agrupamento de Escolas Gaia Nascente" are two groups that includes several schools physically separated and from several education levels but with a common management unit.

All the schools in these groups can be included in our tests. The "Escola Secundária Dr. Joaquim Gomes Ferreira Alves" and "Escola Secundária de Almeida Garret" are secondary schools offering courses in the 7th to the 12th grades. All the previously mentioned are public schools. The "Colégio Internato dos Carvalhos" is a private school offering courses in the 5th to the 12th grade range.

During the Up2U Porto meeting (Fig. 3) some principals of the mentioned secondary schools were invited to present their schools, identifying their potential and constrains.

Figure 4 - Principals of Secondary Schools of the Up2U pilot country, Portugal

After each presentation Up2U researchers could make some questions related with the project objectives.

It was also invited a psychologist that work with students that entered on the first year at ISEP (Superior School of Engineering of Porto from the Polytechnic of Porto) that put on the process other aspects as student's motivation, family, economic issues, distance, student's objectives, and so on.

This intervention was very useful considering that technology can take a prominent place in the social relationship between school, learning, student, families and motivation. It can naturally take on a facilitating and integrative role that will help students realize what they want to help them achieve their goals.

Figure 5 - ISEP psychologist that work with students just entered on the first year at ISEP

On the meantime, a survey is being prepare in Italy but involving all the partners of the pilot countries to trace a profile of secondary education (teachers, schools, infrastructures) that will be distributed on the next month.

To better prepare Up2U ecosystem its necessary to identify some needs.

3.2   Identifying needs

A preliminary work to identify school needs will be done to define stereotypes and adequate approaches to each one of them. These approaches will be built upon Moodle since it is a modular LMS that can be easily adapted to different needs. There will be a mix of formal learning and informal learning strategies supported by the LMS we mentioned before.

The goal is to develop an open, effective, and efficient framework to enable co-design and co-creation of digital content directed to students of secondary schools. The digital content can be adapted for personalised, collaborative, or experimental learning.

3.2.1   Formal learning

Formal learning programs are typically built upon full-scale learning management systems (LMS), with courses and curricula mapped in a high structured way. Content and learning materials can be delivered via a traditional class room training model with lectures and examinations. Live webinars and screen-sharing technology can also be used so that remote learners can attend the sessions.

3.2.2   Informal learning

With informal learning programs content can be produced and consumed by the same actors in a collaborative process usually integrating some type of social networking tools that eases social sharing and interactions.

3.3   Planning a Technological Toolbox

In the Up2U project, the main development will be a flexible, integrated application toolbox supporting student-driven, personalized, dynamic, interactive, rich multimedia learning path creation with social sharing and interactions (project based and peer-to-peer learning and assessment) on top of a public and private cloud-based service infrastructure.

4   CONCLUSIONS AND FUTURE WORK

In this paper, we detail our role in the Up2U project. We overview education at the secondary school level which is considerable different from the higher education level which discourages students from pursuing education at a higher level. We propose the application of learning technologies along with formal and informal learning to bridge the gap between the two levels of education. We already selected several secondary schools which agreed to act as test schools for our approach and we are now in the process of applying it.

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