

# **ALE - ADVANCED LEARNING ENVIRONMENTS: WORK-BASED LEARNING**

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## **Abstract**

Over the years educational models have changed in step with society, adapting to the circumstances and needs of each period. This paper presents the project Advanced Learning Environments (ALE), which began recently. The aim of the project is to evaluate the impact of change, through emphasising the interrelationship of the organisation, curriculum, infrastructure, pedagogy and practices in the construction of the teaching and learning environment (TLE).

We begin with a brief review of recent developments in the education in Portugal. Next, we present the research methodology that we will use in the evaluation of learning, curricula, and some learning/teaching methods. We conclude with some questions that we intend to answer in future studies.

Keywords: Learning; Curricula; strategies; methodologies; Work-based Learning.

## **1 INTRODUCTION**

For centuries, education has been teacher-centred. All around the world, the teachers who are into the traditional way of teaching have emphasized transferring knowledge and skills from teachers to learners.

With increasing knowledge and technological progress of society, the Information Technologies (IT) in educational development has been worldwide recognized as a priority in order to support academic and scientific development to attain universal scope and to extend knowledge, as well as to facilitate education throughout life.

We have moved on from teacher-centred learning to student-centred learning by providing intuitive and engaging modern pedagogical means for students to learn by themselves.

There is, however, an essential component of knowing-how that is often acquired only in the labour market, or when teaching involves real-world practice activities, which is not common in first-cycle courses ([1], level 6).

In Portugal, under EQF level 4, equivalent to high school education, there are specialized professional courses aimed at knowing-how to train people for active professional life much earlier, without the curricular and scientific requirement which is normal in higher education.

In 2006, under the Bologna process, the Professional Higher Technical Courses corresponding to level 5 of the European Qualifications Framework (EQF) were implemented. These courses have the property of requiring a compulsory 6-month internship by the higher education institution that takes place in companies and organisations that carry out professional activities in the field for which the course prepares and which have the trainee's qualifications.

At each one of these levels of education the objectives and learning methodologies are different and therefore the results are also different (see figure 1).

Nowadays, we are trying to understand how training in real-world settings is important to improve the learning. The goal of our project is to evaluate the impact of change, through emphasising the interrelationship of the organisation, curriculum, infrastructure, pedagogy and practices in the construction of the teaching and learning environment (TLE).

This study will be based on the analysis of the curricula, methodologies, durability and competencies acquired at each of the different levels in order to evaluate the pertinence of the combination of existing strategies in the different paths, and may go through the need to reformulate the current reality either by introducing changes or increasing pedagogical methods or knowledge, with a view to a more complete and close training of the labour market without neglecting all the training essential to the individual and his professional performance.

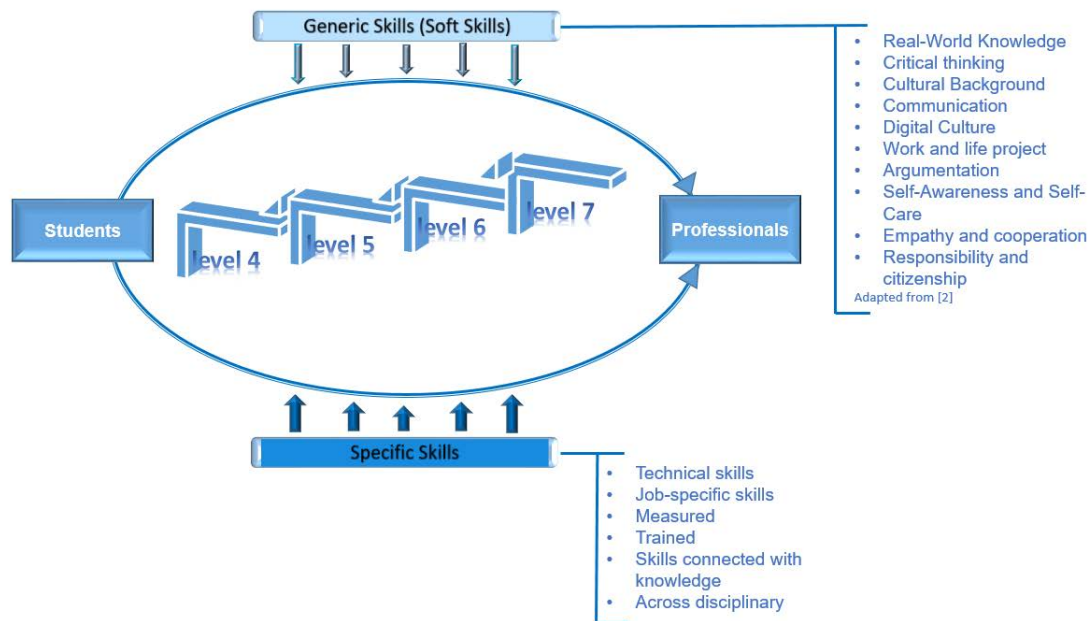


Figure 1 - Required skills in academic context and labour market

This paper is divided into four sections. After this introduction, Section 2 reviews the literature dealing with education, paying special attention to related concepts and definitions as they are understood and used in the ambit of this work.

Section 3 presents a brief description of the project Advanced Learning Environments (ALE). The section begins with the identification of the problem, followed by a description of the research lines and the general and specific aims of this work, as well as by the research strategies adopted in order to generate and analyse the empirical data that may answer the initial questions.

Finally, section 4 is devoted to listing the contributions and limitations of this research, as well as several suggestions for further research work on the subject.

## 2 THEORETICAL BACKGROUND

Over time, the evolution of education has accompanied the evolution of the market. It is the market that dictates or influences the education/teaching received by the new generations, for whom instruction has as main objective the professional insertion.

### 2.1 Education Paradigms

Nowadays, Education begins to respond to the needs of "Industry 4.0" or also called the fourth industrial revolution, with cloud computing, Internet of Things, systems integration, Artificial Intelligence and data science streamlining processes in the most diverse segments of the Industry.

Education 4.0, which is possible through technologies capable of storing and interpreting huge amounts of data, will be adaptable to student profiles, being possible to select the best methods to equip them with required skills to work and live in this century.

Figure 2 shows the evolution of education over time, between the 20th and 21st centuries.

Connectivity, video games, the logic of social networks and intelligent machines will also contribute to the development of new strategies and teaching methodologies. The central idea is to direct these resources to value the student's experience. The school needs to encourage a new culture focused on innovation, invention, problem-solving, programming, collaboration and culture-maker.

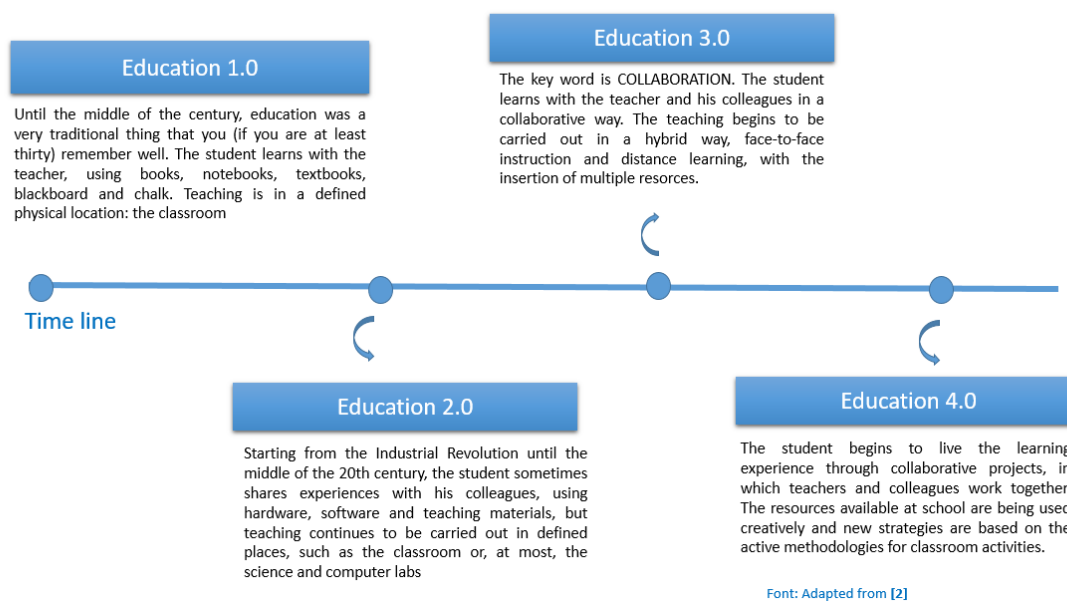


Figure 2 – Education Paradigms  
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## 2.2 The Curriculum and Educational Goals

There are many and diversified definitions that exist in the literature for curriculum. In our opinion, perhaps the most consensual is the definition presented by Ribeiro [3] when he defines the curriculum as a "structured and sequential plan of teaching and learning, which includes objectives, contents, strategies, activities and evaluation of learning, it covers different scopes (macro or micro), it relates to contexts (formal or informal) and educational experiences (explicit or implicit) in school" (our translation).

According to Kaufman et al [4], the curriculum as the core of the education system must be based on three fundamental pillars:

- Society (where it is inserted) that determines the general norms to follow;
- The individual who will be taught
- Knowledge to teach.

In view of the above, it is important that curricular projects are designed with the purpose of training citizens who are mature and socially able to think for themselves, that are autonomous, competent and that can incorporate personal fulfilment in learning. This leads us to agree with Roldão [5] when he writes that a curriculum should contribute to "the consolidation of competences indispensable to social life"(our translation).

With regard to learning objectives, it is opportune to recall a reference author on the subject. We refer to Benjamin Bloom and Bloom's Taxonomy that was created in 1956 in order to promote higher forms of thinking in education, such as analyzing and evaluating concepts, processes, procedures, and principles [6]. Later, in 2001, this technology was revised by Lorin Anderson and David Krathwohl [7]. It is most often used with designing educational, training, and learning processes ([8], [9], [10]).

With the evolution of technological progress and increasing mobility of goods and people, we are witnessing generalized globalization, to which Education cannot escape. In fact, there have been joint reflections, events and resolutions among European countries which aim at harmonizing, recognizing curricula and crediting citizens skills.

In this important process of opening, at the educational level, we remember that the idea of a European framework for higher education began to take shape long before 1992, when the Maastricht Treaty was signed. As stated in that Treaty on European Union, one of the main goals of the European Community (today European Union) was the creation of a common market with free movement of workers and students due to the equivalence of curricula. Though based on a common denominator, this system

should reflect each country's social, cultural, political, economic, religious and ethical characteristics. As a consequence of such diversity, however, the mutual recognition of qualifications and degrees among European countries has not always been straightforward, thus jeopardizing cultural exchanges within the free market.

It was, therefore, necessary to organize a European system of academic recognition by harmonizing the existing curricula, thus allowing for school exchanges as put forward by the Bologna Process. The answer to this need came through the 2010 Budapest-Vienna Declaration on the European Higher Education Area, which is to be consolidated throughout the following decade.

Competencies and Learning Outcomes (LO) have been defined more or less comprehensively by different authors ([11], [6], [1]). These two concepts, however, are closely related to what students can understand and do, once the course has been successfully completed. Each LO indicates the types of cognitive process to be shown by students in order to achieve their goals. We have therefore adopted the classification of Competency put forward by the Tuning Project [11], drawing parallelism with the definition of LO in terms of skills, competencies and knowledge, as proposed by the EQF. As shown in Figure 3, the EQF [1] may also be matched to Bloom's cognitive taxonomy, widely used to define specific skills.

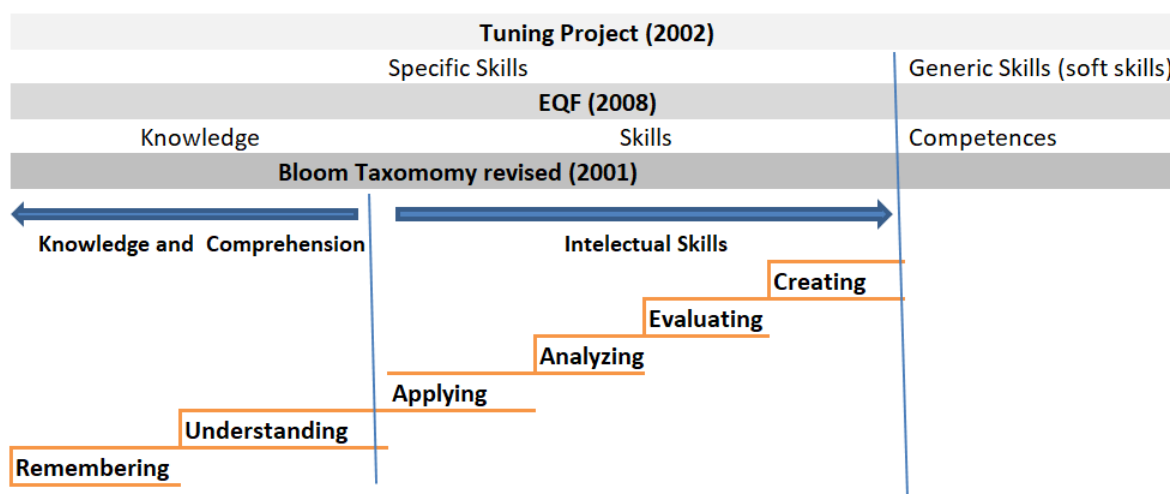


Figure 3 - Concept of Learning Outcomes

## 2.3 Education in Portugal

It is not our goal to trace the evolution of education in Portugal, which beginning some authors associate with a generalized movement of creation of the universities in Europe, and in the Portuguese case, with the installation of the first university in Coimbra in 1308 [12].

Many changes have been introduced over the course of these centuries, highlighting the reduction of illiteracy, through the democratization of education. There has also been growing access to instruction by a greater number of citizens, the progressive extension of compulsory schooling (currently 12 years), as well as an increase of graduates.

For a better contextualization of our study, through a presentation of the current education system in Portugal, we cite a reference document, Quadro Nacional de Qualificações (QNQ) - National Qualifications Framework, created within the scope of the process of reform of professional training and the creation of the National System of Qualifications [13]. This framework covers the basic, secondary and higher education, professional training and the processes of recognition, validation and certification of competences obtained by individuals through non-formal and informal ways.

The framework QNQ integrates eight levels of qualification, namely: i) Level 1 - 2nd cycle of basic education; ii) level 2 - 3rd cycle of basic education obtained in basic education or by dual certification courses; iii) level 3 - secondary education aimed at pursuing higher education; iv) Level 4 - Secondary education obtained by dual certification courses or secondary education aimed at pursuing studies of higher education plus professional internship - minimum of 6 months; v) level 5 - Post-secondary

qualification not higher with credits for pursuing higher education studies; vi) level 6 - Bachelor's degree; level vii) - Master; viii) Level 8 – PhD [13].

According to the General Directorate of Higher Education (DGES, in Portugal), we have two groups of levels: non-higher education (level 1 to 4) and higher education (level 4 to level 8) [14].

We will next characterize three of the existing courses in Portugal, of a professional character; the Professional Courses, the Technological Specialization Courses- Cursos de Especialização Tecnológica (CET) and the Professional Higher Technical Courses - Cursos Técnicos Superiores Profissionais (CTeSP).

The Secondary Professional Courses have a strong connection with the professional world, aiming to develop personal and professional skills in the students who have the 9th grade, preparing them for the exercise of a profession, in articulation with the needs of the local and regional business sector. In addition, they allow access to post-secondary education or higher education if students wish to pursue studies.

The curricular structure of this training is organized by modules, allowing greater flexibility and respect for the students' learning rhythms. The syllabus of this course includes three training components - Sociocultural, Scientific and Technical, lasting for three years (from the 10th grade to the 12th grade) and a total of 3100 hours. A Professional Aptitude Test (in Portuguese, PAP) is required for completion, in which the skills and knowledge developed during the training must be demonstrated. Students who are approved in these courses get secondary education and professional certification.

According to Decree-Law no. 88/2006) [15], which regulates CET, these courses are non-higher post-secondary professional courses and they last approximately one year (between 1200 hours and 1560 hours). In this case, qualification level 5 is obtained by combining secondary education (general or vocational) with high-level, post-secondary technical training. This type of training integrates higher-level knowledge and skills; not being generally required to master the scientific fundamentals of the different areas and allows students to assume, in a generally autonomous way, responsibility for design, management or management. Among other cases, these courses may be open to students who have completed secondary education or to students who have completed the 10th and 11th grade and have enrolled in the 12th grade.

The training plan of CET integrates three training components: i) general and scientific; ii) technological; iii) training in the work context. This last component aims to apply knowledge and know-how acquired by students in practical tasks, of professional scope, and to carry out activities, under guidance, using techniques, equipment and materials used in the processes of production of goods or provision of services.

Training in a work context is developed in partnership between the training institution and companies, other employers, business or socio-professional associations, among others, and can be carried out through different modalities, such as internships. These courses can be taught in public, private and cooperative educational establishments, in Professional Training Centers of the Institute of Employment and Professional Training (IEFP); among other institutions. The duration of this training component may not be less than 360 hours nor more than 720 hours.

The approval in a CET corresponds to level 5 of the QNQ and a diploma of technological specialization (DET), is conferred after the fulfilment of a training plan, with 60 to 90 ECTS. With this diploma, it is possible to compete for enrollment in higher education through a special competition.

Concerning Technical Higher Professional Courses (CTeSP), and according to Decree-Law nº 43/2014 [16] they are training of higher education, taught in polytechnic higher education, with a duration of two academic years corresponding to 120 ECTS. These courses do not confer a degree but they confer a diploma of a professional superior technician at level 5 of the National Qualification Framework in the different scientific areas in which they exist. Like CET, the curriculum is divided into three areas: general (theoretical), technological (practical) and work-related training. This last training lasts at least one semester and may be distributed throughout the course.

Next, we highlight, among others, some cases of conditions for access to CTeSP: i) students must have Secondary Education, ii) students of the regime + 23 Years, iii) students with a CET diploma, and iv) students with diplomas of higher education, students with diplomas of higher education, of technological specialization or of superior professional technician, who wish their professional requalification.

Finally, according to reference documents ([1], [13], [14]), we will highlight the learning outcomes of levels 4 and 5 of [1]. We will make a comparative exercise among three of the courses to study, since there are differences between them, at this level.

Thus, for each level, the corresponding learning outcomes integrate three aspects: knowledge, skills and attitudes.

For Professional courses (level 4), the knowledge students are expected to obtain are described as factual and theoretical in broad contexts in a study or work area; the skills are characterized as cognitive and practical, necessary to design solutions for specific problems in an area of study or work. Already in describing attitudes, it is expected that students will be able to manage their own activity within the framework of the guidelines established in work or study contexts, usually predictable but likely to change. They are also expected to be able to supervise the third-party routines, by assuming certain responsibilities in the assessment and improvement of activities in study or work contexts.

Regarding CET and CTeSP courses, students are expected to obtain comprehensive, specialized, factual and theoretical knowledge in a particular area of study or work and they must be aware of the limits of this knowledge. In the area of aptitudes, it is recommended that students, comprehensively, possess the cognitive skills and practices necessary to devise creative solutions to solve abstract problems. Finally, students are expected to adopt attitudes in order to manage and supervise in study or work contexts subject to unpredictable changes. They should also be able to review and develop their performance and that of third parties [16].

In conclusion, according to this comparative analysis and as expected, it's verified a greater requirement and complexity of the results of the students, attending level 5 courses, compared to those attending the level 4 courses.

The following table briefly presents the courses covered in this project.

*Table 1- Qualification of courses that give access to the labour market*

<b>COURSE</b>	<b>DESCRIPTION</b>	<b>DURATION</b>	<b>LEVEL EQF/QNQ</b>	<b>QUALIFICATION</b>
<b>Professional Courses</b>	A training plan with three components: <ul style="list-style-type: none"> <li>• Sociocultural</li> <li>• Scientific</li> <li>• Technique</li> </ul> Professional aptitude test	3 years (3100h) 10th grade to 12th grade	4	Secondary education obtained by dual certification courses or secondary education aimed at pursuing higher education studies plus professional training (minimum of 6 months)
<b>Courses of Technological Specialization (CET)</b>	A training plan with three components: <ul style="list-style-type: none"> <li>• general and scientific formation;</li> </ul>	1 year (1200 to 1560 hours) between 60 and 90 ECTS	5	Post-secondary qualification of the non-higher level, with credits for pursuing higher education studies
<b>Professional Technical Higher Education Courses (CTeSP)</b>	<ul style="list-style-type: none"> <li>• technological formation;</li> <li>• work-related training</li> </ul>	2 years 120 ECTS		
<b>Bachelor</b>	Bachelor (first cycle)	180 ECTS 3 years	6	Higher education ( <b>Licenciatura</b> )
<b>Master</b>	Master (second cycle)	120 ECTS 2 years	7	Higher education ( <b>Mestrado</b> )

Font: Adapted from [13]

In conclusion, regardless of the cycle of studies that students conclude, through the adoption of strategies, methodologies and techniques of education convenient to their age and the learning context, it is necessary that they acquire the appropriate skills to perform professional functions in 21st-century companies.

### 3 METHODOLOGY

Advanced Learning Environments (ALE) is an innovative project in the area of education which seeks to understand whether the skills acquired by students during their training are aligned with market needs in different study cycles, from Professional Courses, Courses of Technological Specialization (CET) (CET), Professional Technical Higher Education Courses (CTeSP) to graduate courses. It is important to emphasize that the students start their active life after completing these courses.

The project began in December 2018. So, this is a project in progress.

The objectives of ALE are:

- 1 Identify, by study area, the study cycles that are being taught in Portugal and which prepare students for an active professional life
- 2 Systematize the main differences in the various study cycles, namely Professional Courses, CET, CTeSP, Bachelor's and Master's, according to the European Qualifications Framework
- 3 Identify strategies, techniques and educational environments adopted in the different study cycles.
- 4 Check if the curricula of the courses are aligned with the needs of the market.
- 5 Replicate the study in other European Union countries and third countries.

The methodology used to achieve the proposed objectives includes several models and techniques, implemented in different stages.

Firstly, we intend to review the literature in the area, including the legislation in force in Portugal. We will then analyze the websites of official institutions related to secondary and higher education. The data obtained with the use of these techniques will allow the achievement of objectives (1, 2, 3 and 4).

Then, at a later stage than this one reported in that paper, we will conduct semi-structured interviews. Interviews will be applied to those responsible for the management of different educational institutions, employers, and professional associations. We also plan to bring together panels of experts. We will apply validated questionnaires to the Alumni. The results obtained will achieve the objectives 3 and 4.

Case studies will be performed to meet objective 3.

### 4 CONCLUSIONS AND FUTURE WORK

In a global society, with the competitive and constantly changing labour market and taking into account that it is the responsibility of the education system to prepare students for an active professional life, we intend, with this work, to contribute to a broad analysis of the education system in Portugal and to improve the curricula of the courses.

As strengths, it is important to highlight the relevance and timeliness of the topic.

As weaknesses, we highlight the fact that this project is at an embryonic stage, which prevents us from presenting conclusive results regarding all the defined objectives

As future work we propose to implement the mentioned methodology, reaching more results, and answering the following questions: (1) Are the methodologies used in the teaching/learning process adequate to the level of education? (2) Is the education system responding to market needs? (3) Is the education system training professionals at the appropriate levels at different levels of education (levels 4,5,6 and 7, according to The European Qualifications Framework for Lifelong Learning)? (4) Given that some of the current professions will be extinguished, students will be prepared to perform functions within the new professions that will emerge with industry 4.0?

Finally, we intend to extrapolate the study to other countries.

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