AN APPROACH USING A LOW-CODE PLATFORM FOR RETRAINING PROFESSIONALS TO ICT

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Abstract

ICT (Information and Communications Technology) is a growing area with a growing demand for employees. However, there is a shortage of professionals in this area and integrated strategies are required to foster access to these areas and provide training to develop the necessary skills for more people. In this paper we present a short course that was designed to reskill unemployed people, mainly having already attained a higher education level in the area of the STEM (Science Technology Engineering and Mathematics), to be ICT professionals. After this training, trainees will have the opportunity to significantly increase the likelihood of being able to obtain employment in ICT areas. The course described involves public entities (including a higher education institution) and a private company, which is also a demonstration of synergies between academia and business. In the paper, the context that led to the appearance of the course, the fundamentals that supported the syllabus design, the partners involved, the objectives of the different subjects, the profile of the trainees and the results already achieved are described. To explain the fundamentals of the course syllabus we explain the most original features of the course regarding the usefulness of taking advantage of the abstraction allowed by the new low-code platforms, which seem to be appropriate and facilitator for retraining professionals from STEM to ICT. This approach, using a low-code development platform for retraining professionals to ICT, presents in our point of view, advantages over other approaches. In short, in the paper, we intend to share the work done during the design and follow-up of the course, as well as the preliminary results obtained in the meantime.

Keywords: Low-code, education, ICT, retraining.

1 INTRODUCTION

There have been many articles in the Portuguese and international press that warn of the growing need for ICT (Information and Communications Technology) professionals and the lack of professionals for the specific needs of the growing number of companies in this field.

According to an article published in HR Portugal [1] that is based on the findings in the 2014 Labour Market Guide, the Hays Consulting's annual global study of employment and recruitment trends, the ICT market is increasingly dynamic and will continue to accelerate in 2019, both in recruitment volume, recruitment trends, preferences and has a high salary pressure, whereby it is the candidate who dictates the rules, as 68% of professionals in this area usually refuse some job offers.

The same study, quoted in an article in the Expresso newspaper [2] indicates that ICT companies will be one of the big drivers for hiring in 2019, and also points out that there is a long history of shortage of profiles available in the market.

The XXI Portuguese Constitutional Government, in its National Plan of Reforms, More Growth, Better Employment, Greater Equality, of April 2016, promotes the use of Information and Communication Technologies and Electronic within the curricula, aiming at the apprehension of learning practices based on new technologies, and introducing new skills. In this scope, the National Digital Competence Initiative e.2030, Portugal INCoDe.2030 [3], intends to position Portugal and the Portuguese citizens in the top group of European countries in digital competences in a horizon that extends until 2030, identifying and tackling three major challenges: generalize digital literacy, stimulate employability and professional training and specialization in digital technologies and applications, and ensure a strong participation in international R&D networks and the production of new knowledge in the digital areas.

In the context of the first two challenges, the commitment to qualification is indispensable for the affirmation of a sustainable strategy for economic growth and social cohesion, recognizing the relevance of ICT training in the adjustment of qualifications to the requirements of a digital economy to
respond to the growing market demand and promote job qualification in a higher value-added economy, the IPCB (Instituto Politécnico de Castelo Branco) signed a protocol with the IEFP (Instituto do Emprego e Formação Profissional) and CCISP (Conselho Coordenador dos Institutos Superiores Politécnicos), in order to coordinate the Castelo Branco region network within the framework of the “Digital Competence +” partnership.

The “Digital Competence +” partnership is aimed at unemployed people with higher education who, although they have higher qualifications, they show difficulties in entering the labour market because of the lack of skills for the demands of the economy and the labour market. It includes an information technology training program, implemented through cooperation agreements with digital reference companies, in order to respond to the specific needs of the regional employment market.

Nationally, the 'Digital Skills + Partnership' will cover up to 1,500 graduates - unemployed people with higher education, registered with the employment services, whether or not receiving unemployment benefit - and will have global funding of 3.5 million euros by the IEFP until the end of 2019.

The approved project by IEFP for the IPCB is being developed in partnership with OutSystems and Proença-a-Nova Municipality. The institutions have collaborated pragmatically for the development of one of the aged regions of the country, demonstrating that education, industry and political power when side by side can boost the regional economy.

In particular, a course called Low-Code Developer, was designed with the objective of fostering the acquisition of new skills for the graduates of STEM (Science Technology Engineering and Mathematics), thus increasing not only their employability conditions, but also the improvement of the quality of life in relation to the current and future market in the areas of Information Technology.

OutSystems technology is used by more than 1200 enterprise companies in 52 countries around the world, supported by a network of more than 250 partners. The demand for professionals with technical certification in OutSystems has been growing steadily and is expected to double in the course of the current year. At the moment, there are more than 1000 open employment opportunities, 300 of them in Portugal.

The remainder of this paper will be as follows: Section 2 presents background about low-code platforms and the main guidelines that support the proposed low-code developer course, which is described in section 3. Section 4 presents an ongoing edition of the course and a brief discussion of some preliminary results and finally, Section 5 presents some conclusions and outlines some open questions for future work.

2 LOW-CODE DEVELOPMENT PLATFORMS

In recent years, there has been a trend in which enterprises swapping traditional software development approaches in favour of agile and DevOps, which enable programmers to quickly build and upgrade software in coding sprints. This trend has led developers to increasingly use low-code development platforms. “Low-code development platforms are visual-based, IDEs (Integrated Development Environments) comprising many of the same tools and functionality developers and ICT teams use separately to design, code, deploy and manage an application portfolio” [4]. With these platforms, developers may still need to do some coding, for specific operations or functionalities, but a significant part of the job can be done through a drag-and-drop interface [5].

There are several advantages associated with the use of low-code development platforms, namely [6]:

- security, cross-platform support and data integration capabilities have already been built and can be customized easily;
- knowledge of specific languages is not required, nor do they have to have years of experience to use them;
- build apps for multiple platforms simultaneously;
- updates and deliver new features in short time periods.

There are several low-code platforms whose use is widespread through many companies in many countries Appian, Kony, Mendix, Microsoft, OutSystems, Salesforce are some of them that are pointed out as leaders by research from Forrester [7]. OutSystems is one of the most well-known low-code development platforms and one of the most highlighted in the report.
In fact, low-code development platforms provide intuitive and visual editors and they do not require substantial knowledge of specific programming languages nor do they have to have years of experience to use them. They have some ideal characteristics to be quickly learned by trainees with STEM technical skills, allowing them to acquire new skills and redirect their professional activity to areas of great employability.

For the design of a course for reskill professionals to ICT, we consider that the OutSystems low-code development platform fits perfectly due to the following features:

- High-productivity visual development to deploy and manage applications;
- The ability to deploy Applications and update them with one click in a cloud environment;
- Handling database scripts and deployment processes reducing the skills to develop a real application;
- Ultra-fast visual modelling mobile applications with offline data synchronization, native device access, and on-device business logic.

3 LOW-CODE DEVELOPER COURSE

This section presents the fundamentals that supported the course syllabus design and the objectives of the different subjects, the partners involved, the profile of the target trainees and the profile of the trainees. To explain the fundamentals of the course syllabus some features, regarding the usefulness of taking advantage of the abstraction allowed by the new low-code development platforms, are described and seem to be appropriate and facilitators for retraining/reskill professionals from STEM to ICT. The goal of the proposed Technical Course of Low-Code Developer is to retrain graduates in STEM so that they acquire the skills to analyse, design, plan and develop programming solutions in the OutSystems Low-Code Development Platform.

3.1 Target audience

As referred before the proposed technical course is targeted to trainees that already hold a degree in a STEM-related field. The main goal of the course is to enable these trainees to be retrained in order to acquire competencies to carry out their professional activity in areas of the great need of workers and high employability. Therefore, it is important that the course design takes into consideration the competencies that these trainees usually already acquired and hold. Since they already have a degree, and many of them already have professional experience, they are more apt for some of the skills normally associated with STEM graduates, such as [8][9]: an understanding of scientific and mathematical principles; logical reasoning and practical intelligence; Critical thinking; Problem solving; Reading comprehension; Active learning; Time management; System analysis.

They are trainees who are older than usual in higher education trainees and are expected to be 23 years of age or older, and they hold a significant set of skills. Considering this, the course design, namely the contents and duration of each subject, but also skills, knowledge, and work activities, must be adjusted.

3.2 Course Plan

The Low-Code Developer Technical Course is in the computer science area. It is designed to provide competencies within the scope of ICT, allowing, on the one hand, to acquire technical skills associated to software development, as well as to maximize the possibility of applying them in practical training in a real work context. The combination of competencies allows the trainee to work in several areas of which are the analysis and design of systems, planning and development of technology solutions and development of information systems.

The course has a duration of 515 hours and is organized into two parts (see Fig. 1). In the first part, which includes 8 school subjects, trainees learn the fundamentals associated with software development and information systems (305 hours), acquiring at this stage many of the technical skills. In the second part, internship, trainees will have practical training in real context working in companies that are specialized in using low-code platforms (210 hours).
The identification of the school subjects that make up the school modules, as well as their teaching hours, is shown in Fig. 2.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Description and goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algorithms</td>
<td>structure and prioritize the different tasks needed to solve problems</td>
</tr>
<tr>
<td>Data Structures</td>
<td>promote systemic and structured thinking</td>
</tr>
<tr>
<td>Methodological Principles of Programming</td>
<td>implement and test solutions to problems, using programming</td>
</tr>
<tr>
<td>Systems Analysis</td>
<td>gain perception between the mapping of the discourse universe and the modelling languages and database management systems</td>
</tr>
<tr>
<td>SQL Programming</td>
<td>query and manipulate data stored in a database</td>
</tr>
<tr>
<td>OutSystems Web</td>
<td>develop web applications with server-side integration, full stack, from web</td>
</tr>
</tbody>
</table>

Figure 1. Course organization.

The course curriculum was designed to fit the characteristics and skills of the trainees. Considering the profile of the trainees, described in 4.1, the course plan is designed to include a set of subjects to provide them with the fundamental concepts and techniques for software development and a set of subjects to familiarize them with the Low-code platform. The course plan does not include subjects related to Mathematics and Statistics because trainees are supposed to have this knowledge and related skills. The first set of subjects provides trainees with the needed general skills to develop software applications. It comprises 175h of teaching and it includes 5 subjects to provide trainees with the fundamental concepts and skills for software development. The second set of subjects includes 3 subjects (OutSystems Web Fundamentals, OutSystems Mobile Fundamentals; Architecture, Performance & Troubleshoot) related to the familiarization and use of the OutSystems Low-code platform. A brief description of each subject can be seen in table 1.
Fundamentals | application architecture, data modelling, user interface standards as well as create and integrate with web services and external systems

OutSystems Mobile Fundamentals | develop mobile applications by designing a high-end experience for the end user, develop components and offline support mechanisms for users, embed sensors and device features in mobile applications

Architecture, Performance & Troubleshoot | architect sustainable web and mobile applications with performance and scalability, develop applications preventing performance problems, identify and correct application problems.

Internship | promote practical training and gain work experience

3.3 Partners

The Low Code Developer course is developed in partnership between IPCB, OutSystems, and Proença-a-Nova Municipality. These institutions represent the higher education, industry and political power working together fostering the acquisition of new skills for STEM graduates and improving employability in companies in the ICT area, which have a significant presence in this region.

The IPCB integrates public higher education. It integrates this partnership through its school of technology, and it is responsible for teaching the 5 subjects to provide trainees with the fundamental concepts and skills for software development.

OutSystems is a global enterprise software company. It owns the OutSystems low-code development platform. It participates in this partnership through its offices in Proença-a-Nova and is involved in the teaching of the 3 subjects related to the OutSystems low-code development platform. The internship of the trainees is assured by two other companies, also located in Proença-a-Nova, that develop software using the OutSystems low-code development platform.

The Proença-a-Nova Municipality provided logistical support for the course promoting the improvement of the employability conditions and the development of the economy in a low-density population region.

4 RESULTS AND DISCUSSION

In the following sections, we present some of the results of the first edition of the course. The results are preliminary because at this date we finish the 305 hours of the school subjects but there are still in progress 210 hours of the internship.

4.1 Trainees

The first edition of the course is in progress. The course is comprised of 21 trainees with a STEM degree in the following areas (see Fig. 3).

![Figure 3. Trainees' academic qualification area.](image-url)
From this universe of trainees, 20 were successful in all the 8 school subjects. One of the trainees dropped out of the course in the second week. This trainee was from the architecture or construction background.

An important issue was the fact that during the 305 hours of school subjects, trainees have almost always been present. The absenteeism rate was practically nil (in a total of 20x305 = 6100 hours, only two trainees were absent 10 hours (one was absent 3 hours and another 7 hours). This may be related to the interest and maturity of the trainees (75% of the trainees are 30 years of age or older), but also to the fact that the trainees in the course receive financial support for their participation.

4.2 Success rate

Undoubtedly one of the most relevant metrics are the success rates of these trainees. On the other hand, due to the existence of several areas of origin of the course trainees, one of the aspects about which we initially had some expectations was to observe what would be the ability to adapt to the new subjects vs. their respective STEM area.

The competency evaluations of the trainees consisted in the accomplishment of written tests at the end of the period of the respective modules (essentially in the first more theoretical modules), but in several modules, practical work was also evaluated. Also, in the majority of the modules there was also a consideration for a continuous evaluation, where they were considered parameters such as: Application of knowledge acquired in exercises or concrete cases is applied; Transfers or generalizes the acquired knowledge to new situations; Shows interest and collaborates in the dynamization of the training activities; Responsibility in terms of compliance with the times and activities proposed; communication with colleagues, trainers, and others, demonstrating tolerance and team spirit.

The following chart (see Fig. 4) allows concluding that in general there has been widespread success for the 8 modules, namely those where the low-code platform is the core, regardless of the source STEM area.

Fig. 4 shows the trainees’ final grades (average of the 8 school subjects) grouped by the trainees’ academic qualification area.

![Figure 4. Trainees’ final grades (school subjects).](image)

Globally, results are very positive. The trainee with the best overall performance in all modules is in the area of life sciences, with a degree in Biology. This trainee, in the last three modules, where software development in the low-code platform was the core, had an average of more than 19 values (on a scale of 0 to 20). This indicates that, using this approach, even trainees from STEM areas can reach levels of significant performance in ICT.

In terms of the average results of each trainee, there are no major differences and a generalized good performance was noticed.
4.3 Feedback from trainees

At the end of the 8 school subjects, we conducted a survey of the trainees to obtain feedback on the 305 hours of training that they had done so far. The most relevant results of this survey are presented below.

About the course plan, 4 questions were asked of the trainees. To rank, each of the issues ranges from 1 (insufficient) to 4 (very good)). The results are in the next chart (see Fig. 5). Globally, the results are positive. However, there are some opinions that pointed out to the need of changes in the duration of some modules. These answers relate to the fact that a considerable number of trainees understand that the modules of the low-code development platform should last more time.

![Figure 5. Trainees' opinions about the course structure.](image)

About the experience lived in the 305 hours already elapsed of the course, 8 questions were also asked, using the same scale as in the previous questions. Results are presented in the following chart (Fig. 6). Here the comparatively low value of the question about practical exercises is also related to the trainees' opinion that the three more practical final modules should in future editions gain more temporal weight in the course so that they can further exercise the development in the low-code platform.

![Figure 6. Trainees' opinions about the course functioning.](image)

In fact, in free writing fields, one of the suggestions that were most expressed by the respondents was that the three modules, where low-code development platform is core, should have a longer duration, mainly because they need more practical experimentation. In addition, some trainees also mentioned that it would be useful to have in the first modules additional teaching of CSS, HTML and JavaScript.

In terms of the overall assessment, 90% of the trainees say they have enjoyed the course or enjoyed it very much.
5 CONCLUSIONS

In the paper, we presented the context that led to the appearance of the course, the fundamentals that supported the syllabus design, the partners involved, the objectives of the different subjects, the profile of the trainees and the results already achieved. In short, we share the work done during the design and follow-up of the course, as well as the preliminary results achieved so far.

The successful results lead to conclude that the abstraction allowed by the new low-code development platforms, in this case, OutSystems, is appropriate and a facilitator for reskill professionals from STEM to ICT. This approach, using a low-code development platform for retraining professionals to ICT, presents in our point of view, advantages over other approaches to this type of short courses for retraining professionals to ICT.

It also appears to us that the basis for the recruitment of trainees for this type of course from STEM is adequate, given the good adaptation that these trainees demonstrated in this edition of the course.

The feedback observed to date also leads to the conclusion that some adjustments should be considered in future editions of this course. The duration of the modules, in which the low-code platform OutSystems is core, should be increased and it should be considered the reinforcement of practical exercises and some other languages (JavaScript, HTML, CSS) useful for the web and mobile development.

Currently, the trainees are performing the 210 hours of practical training in a work context, in companies that develop software using the OutSystems low-code development platform. One of the objectives of the host companies is to employ the trainees that show good performance, which, considering the results achieved so far, we hope to be a significant percentage of these trainees.

REFERENCES


