

e-Campus: concept and design of a virtual campus to support Distance Learning in a Polytechnic Institute

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Abstract — The decision to conceive, design, develop and implement a virtual campus in a Higher Education Institution (HEI) stem from the desire to open up and share our training offer with a wider public, while at the same time responding to national and international demands. The team of the Distance Learning axis of the #eCapacitar project designed and developed the proposal of this virtual campus, called *e-Campus*. It was conceived and designed in the light of the *Pedagogical Model for Distance Learning*, also designed by the same team. In order to familiarise the teaching staff with good teaching practices (face-to-face, online and hybrid) in aspects such as learning environments, pedagogical planning or assessment, the development of this virtual campus was based on the reports prepared by the *Portuguese National Agency for Assessment and Accreditation of Higher Education (A3ES)*. The *e-Campus* will integrate different areas that will allow distance students to have access to all the essential features for an effective and successful learning and monitoring of the courses. This paper presents the stages of development of this virtual campus, explaining all the steps taken to implement it, all the areas that make it up, as well as the future plans for its continuous development and improvement.

Keywords — *e-Learning, Virtual campus, Distance learning, Higher education, Development model, #eCapacitar*

I. INTRODUCTION

Distance learning, according with the *Portuguese National Agency for Assessment and Accreditation of Higher Education (A3ES)* [1], refers to learning that is predominantly delivered with physical separation between the participants in the educational process, namely teachers and students, where:

- interaction and participation are technologically mediated and supported by online academic and technological support teams;
- The curricular design is oriented to allow access without limits of time and place to the contents, processes and contexts of teaching and learning;
- The pedagogical model is specially designed for teaching and learning in virtual environments.

In that sense, distance learning programmes [1] must have a set of material and technological means, including a virtual

campus with pedagogical interaction functionalities, permanently accessible to all participants in the educational process, in particular teachers and students, and complying with information security requirements, as well as a student-oriented website that ensures permanent access to digital libraries, repositories, digital material lending services and virtual laboratories, connected to an integrated academic management system that ensures the dematerialised processing of all academic processes.

In this paper we will describe the virtual campus, called *e-Campus*, conceived by the #eCapacitar project team (DL axis). This virtual campus will support and sustain, from a technological point of view, the pedagogical model for distance learning and teaching of the *Polytechnic Institute of Santarém (IPSantarém)*.

II. BACKGROUND AND THEORETICAL FRAMEWORK

The virtual campus arises from the need felt in the IPSantarém to provide distance learning programmes, in order to innovate and diversify its training offer, thus reaching different audiences. Back in 2015, IPSantarém published the Regulation of Functioning, Attendance and Evaluation of E-learning Courses of the School of Education [2], assuming distance learning (DL) as a strategy for the diversification of its training offer the focus on training processes in e-learning/b-learning format. However, and due to the lack of regulation at national level for this matter, the training offer of fully distance-learning courses has not experienced marked developments. In fact, it was only in 2019 that the government approved the legal framework for distance higher education, through Decree-Law no. 133/2019 of September 3rd [1]. According with it, distance learning should be seen as a high-quality alternative to face-to-face learning and not merely a reproduction or parallel of it. The flexibility of time and place offered by distance learning ensures that students can develop their educational pathway at the pace that best matches their personal and professional lives. It is also important to note that technologically mediated teaching and learning has experienced a marked expansion in Portugal, as part of the response of Higher Education Institutions (HEIs) to the pandemic crisis, so the A3ES issues the Administrative Order 16/2022, with criteria for the evaluation of proposals for study programmes with non-face-to-face teaching components [3].

Given the national context, we can then perceive, in the Strategic Plan 2019-2022 of IPSantarém (in Axes 1, 4 and 5, based on actions 6, 8 and 11), a continuity regarding the maintenance and reinforcement of institutional strategies to develop distance education in the HEI [4]. It should also be noted that the SAMA #eCapacitar project - Empowering for digital inclusion in IPSantarém's business areas, approved by the Administrative Modernisation Agency (AMA) and funded by COMPETE, has been the main driver, among other axes, of the DL axis in HEI. It is also essential that IPSantarém meets the Strategic Plan 2021-2024 issued in 2022 by A3ES, namely with regard to the new challenges for HEIs and the generalisation of distance learning that includes pedagogical mechanisms, methodologies, resources, timetables and monitoring and evaluation systems different from the face-to-face modality [5].

In this sense, it became crucial to formalise, in IPSantarém, a support unit for the implementation of distance education, as well as the definition of a pedagogical model suitable for distance learning and the design and development of a virtual campus. The study programmes taught at a distance must have, cumulatively, certain material and technological means, which include a virtual campus with pedagogical interaction functionalities, permanently accessible to all participants in the educational process, especially teachers and students, and complying with information security requirements; as well as a student-oriented website that ensures permanent access to digital libraries, repositories, digital materials lending services and virtual laboratories; that is connected to an integrated academic management system that ensures the dematerialised processing of all academic processes [1].

Thus, in order to respond to the aforementioned Decree Law [1], the team of the DL axis of the #eCapacitar project conceived and developed the proposal for a virtual campus, called e-Campus. This virtual campus will support and sustain, from a technological point of view, the Pedagogical Model for Distance Learning, also designed by the same team. The Pedagogical Model for Distance Learning of IPSantarém [6] was designed to promote the acquisition of knowledge and the development of skills for meaningful and transformative learning by students, taking into account the advantages, characteristics and potentials of online education. The success of an e-learning system involves a systematic process of planning, designing, evaluating and implementing online learning environments where learning is actively encouraged and supported [7]. Therefore, the aim to develop a solid, meaningful virtual campus, to respond to the call to open up the institutional academic offer, started with the understatement of national and international strategies and goals, as well as the knowledge of already existing best practices of distance learning models [8, 9, 10, 11] and virtual campuses [12, 13, 14, 15, 16].

III. DESIGN OF THE *E-CAMPUS*

IPSantarém's distance learning offer will be delivered through online platforms and with the use of different digital tools and applications, in e-learning and b-learning modalities. Although distance learning is a broad and evolving field, with different perspectives and approaches to its definition, all emphasise the use of technology to facilitate learning and the potential of e-learning to provide flexible, accessible, engaging

and space- and time-independent learning experiences. Having that in mind, the virtual campus was grounded on certain foundations and principles considered essential by the development team: Quality and Learning Experience; Digital Inclusion and Accessibility; Ubiquity and Flexibility; Interaction; Open Science and Environmental Sustainability; Ethic and Academic Integrity [6]. The design of a virtual campus raises issues of pedagogy and how the design of physical and virtual spaces differs. When designing a virtual learning environment, we think about how to present lecture notes and assignments online, and how to develop a learning environment in which students can access learning materials and interact with peers and teachers. The focus is as much on the interaction between students and teachers in a virtual place as it is on the information provided.

The quality, and therefore the effectiveness, of a virtual campus has, in itself, an impact on the quality of student learning in distance education. In order to guarantee this quality, the virtual campus has been designed according to several models and approaches to the instructional design.

The *Rapid Prototyping* model [17], commonly used in software engineering, we believe is a viable model for instructional design, particularly for computer-based instruction, given the similarities between software design and instructional design. Rapid prototyping requires a design environment that makes it practical to quickly synthesise and modify instructional artefacts. In order for prototyping to be efficient and effective, a number of prerequisites are needed, such as certain types of media and the availability of tools (mainly computer software) that offer modularity and plasticity.

The ADDIE approach “describes a process applied to instructional design in order to generate episodes of intentional learning” [18]. Briefly, the stages of the model are: analysing for the purpose of identifying the possible causes of a performance gap; designing for the purpose of verifying the desired performances and the appropriate testing procedures; developing for the purpose of generating and validating the learning resources required during the life of the learning units; implementing for the purpose of preparing the learning environment and engaging the students; evaluating for the purpose of assessing the quality of the learning products and processes, both before and after implementation.

The *Conditions of Learning Theory* [19] specify a sequence of nine events that enhances the learning process and promotes effective teaching, providing a framework for designing and delivering instruction in a structured and systematic manner. The focus of the theory is on intellectual skills, although Gagne's theoretical framework covers all aspects of learning. In its original version, particular attention was given to military training environments. The theory has had applications in the instructional design in all fields.

Therefore, concerning the campus design, the first step was to collect and then analyse the needs of the potential users of the campus (students and teachers). This was followed by exploratory research into other existing campuses to understand the choices made in terms of layout, structure, navigation and functionality, as well as the range of interaction elements available to users. That is, after the conception and design by the

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pedagogical instructional design team, the moments of development and implementation of the campus by the technical team will be followed by the evaluation of its effectiveness for distance teaching and learning. Each of these moments is carried out in a systematic way, identifying options for improving the effectiveness of the resource whenever it is verified that this is necessary.

Given the foundations of this model, its application is not limited to the design of the campus, but also to the Open Educational Resources (OER) that will be designed and developed, as well as to the courses and curricular units that will be implemented based on innovative pedagogical practices.

In an attempt to represent the design model adaptation used, a representative diagram of the steps and considerations that allowed the development and implementation of the *e-Campus* is presented here. (Fig. 1).

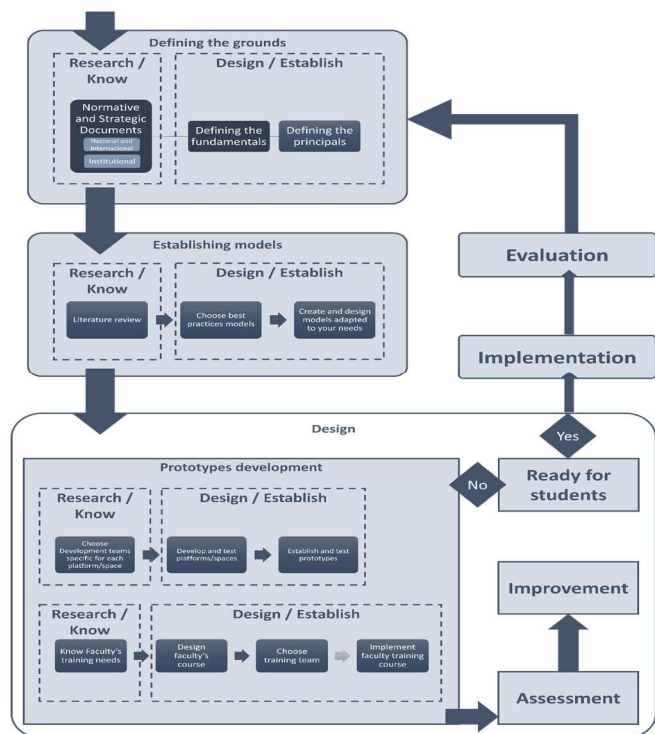


Fig. 1. IPSantarém's virtual campus design model

IV. INTERFACE OF THE *E-CAMPUS*

Virtual campus applies advanced information technology and tools to realise digitisation from environment (like equipment and classrooms), resources (like books and lectures), activities (like management and services). In order to expand the functions of the traditional campus and improve its efficiency, it builds a digital space based on the traditional campus to extend the time and space dimension of the real campus. Therefore, the *e-Campus* will integrate different spaces that will allow distance learning students to have access to all the essential functionalities for an effective and successful follow-up of the courses. It has been decided to give these spaces a name (acronym) that is universal and easy to understand and recognise by both national and international students (and teachers). The *e-Campus* will provide the

following spaces: online teaching and learning (*e-Learn*); initiation and ambience (*e-Welcome*); interaction and socialisation (*e-Lounge*); training and capacity building (*e-Train*); videoconferencing (*e-Meet*); digital educational applications and tools (*e-Tools*); scientific information management (*e-InfoHub*); technical support (*e-Help*); as well as access to the academic portal and other university services. The following is a description of the different spaces that form the interface of the IPSantarém virtual campus.

a) *e-Learn*

Teachers and students have at their disposal an online teaching and learning space, developed from the LMS Moodle, where they can access all the study programmes in force at IPSantarém. In addition to the tools for designing activities and learning resources of Moodle itself, there will also be available (among others that can be integrated): tools that allow teachers to create interactive digital educational resources; an evaluation and testing system and a statistical analysis system (qualitative and quantitative).

b) *e-Meet*

The videoconferencing system integrated in the IPSantarém *e-Campus* is the one that has been officially adopted by the institution to date, through a protocol established with the FCCN, which allows the use of other tools in addition to the Colibri Zoom, such as the Videocast video streaming service and the Filesender file sending service. The online videoconferencing system can be accessed by direct dialing so that students can attend scheduled meetings, either as part of the courses they are attending or for meetings with teaching staff.

c) *e-InfoHub*

The scientific information management space of IPSantarém is an interface that aggregates several platforms of scientific information resources, integrating, to date, the Scientific Repository of the Institution (RCIPS), the Institute's Library Portal, B-on, RCAAP, EBSCO, Arquivo.pt and Educast. It is also planned to integrate the Digital Base of Knowledge (DBK) and other services that may arise in the context of scientific information management. We highlight the DBK because this platform will provide all the Open Digital Educational Resources (OER) that have been, are or will be developed in IPSantarém. Furthermore, teachers and students will be able to receive customised online training on the resources available in the field, by appointment.

d) *e-Welcome*

This will be the first space that students of IPSantarém's distance learning courses will visit. Here, the whole process of initiating and setting up the use of not only the Moodle LMS (*e-learning* space), but also all the other spaces of the IPSantarém Virtual Campus will be carried out. The aim is to anticipate any doubts or technical difficulties that could jeopardise the smooth running of teaching and learning activities. The tutorials and user guides of Moodle and of the spaces that are part of the *e-Campus* and the specific tools to be used during the courses will be available here. Initially, for a more structured environment, this space will be supported by mentors (students with more than one enrolment) who will accompany the new students, guiding them in the first steps of using the Campus and helping them to

clarify any doubts that may arise (in a peer mentoring logic). This space, designed and developed by the Distance Learning Unit team, includes various activities designed to encourage interaction between students and teachers, with the technological interface and with the content. The initiation and development of the space is dynamised by the course coordinators in partnership with the mentors. This space has the following goals:

- Introduce students to the virtual campus environment;
- Promote socialisation between students;
- Promote socialisation between students and course coordinators;
- To develop students' technical skills in the use of the main tools available in the different spaces of the virtual campus and to make them aware of the importance of good time management in online distance learning;
- Present the rules and standards for online communication and interaction.

e) *e-Lounge*

In order to develop class and community spirit and to promote group cohesion, a space for online interaction and socialisation is provided. In DL environments it is essential for student motivation and involvement to create a sense of belonging to the learning community, where peer-to-peer dialogue exists beyond the moments provided by the learning activities. Thus, it is intended that students have an immersive three-dimensional place (virtual world / metaverse) where they can interact and socialise, where the exchange of knowledge and experiences is autonomous and active. To support synchronous lecturing and collaborative learning, the virtual world will provide different spaces such as a shared student campus, collaborative zones, lecture rooms and lounge areas. It will also be equipped with support tools to enable navigation between multimedia content for students and teachers. Moodle plug-ins could be developed and integrated to enhance the environment with LMS services in a natural way. This 3D world could be used to increase the interaction and communication opportunities between teachers and students, and between students themselves, especially to encourage planned and unplanned social encounters. Virtual worlds allow for first-person learning, for experiencing and learning (through text and voice chat; role-playing; simulations; emulations; presentations), and thus for building knowledge more effectively, making them an alternative way of presenting content, and thus of capturing and holding students' attention [20]. Virtual worlds, as immersive environments, support flexible learning as online sessions can be set up at a time and (virtual) place that is free from restrictions and can be adapted, allowing for more effective student participation. Nevertheless, the opportunity offered by the technological revolution needs to be explored in order to achieve a simple, low-cost setup immersive environment that is affordable for everyday use.

f) *e-Train*

In this space, it is intended to offer training courses of different types, with different topics and with the aim of empowering different target groups (students, faculty; internal

and external to the IPSantarém community), in order to promote lifelong learning, allowing the (re)qualification and recycling of skills. These courses can be, for example, MOOCs, micro-credits, short courses, among others. In fact, as for the concern of faculty in the immediate aftermath of the COVID-19 pandemic, UNESCO [21] presents a guide for teachers to assist in the digital transformation of teaching and learning. They point to the need to guide and train teachers to understand the main issues related to distance learning, recognising the complementary relationship between formal and non-formal education. For quality online education, they identify a number of teacher competencies as essential: creating distance learning environments; emotional support and being a learning partner; micro-curriculum planning; instructional design planning; and tutoring. The impact of the COVID-19 pandemic on education and the adequate preparation of teachers is also reflected in the UNESCO [22] document Transforming education from within. It highlights the need to create conditions for the development of teacher competencies that will enable them to respond adequately to similar situations in the future, where the integration of digital technologies and innovative pedagogical practices will be essential.

g) *e-Tools*

This space will contain the applications and digital tools available to support students and teachers. The applications and tools that are acquired or developed, either as part of specific courses or for self-study, will also be made available in this area in the form of direct links.

h) *e-Help*

Since support and assistance to users is fundamental in any system, we had to consider including in e-Campus a space dedicated to this purpose. The students' support system should include the resources available to them to engage in the learning process (learning materials, library, teacher/facilitator) and the resources related to the mediation of the communication process (media and technology). Thus, by accessing the e-Help, users will have at their disposal a set of FAQs (Frequently Asked Questions), divided into categories covering different technical aspects. If the user does not find a solution to his doubt or difficulty, he can also fill in an incident form, selecting (from a drop-down list) the service he wishes to contact and which will receive the message.

i) *Academic Portal*

From the e-Campus, students can directly access the IPSantarém Academic Portal (through a direct link) and thus access the other services integrated in it.

The *e-Campus* will be accessed from the home page of the IPSantarém's website (see Fig. 2) [23] through a single sign-on (SSO). Once registered, the user will enter the *e-Campus* area directly. From there, students will be able to access all the above-mentioned areas.

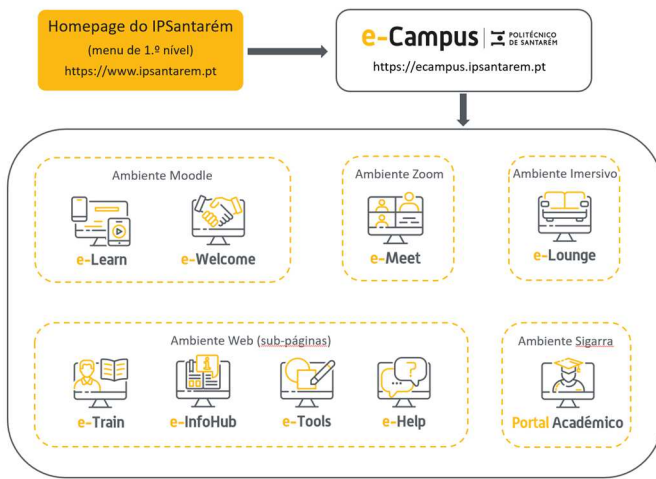


Fig. 2. IPSantarém's virtual campus access model

It will also be possible to access the virtual campus through smartphones by installing the IPSantarém *e-Campus* application on these devices. It is intended that the notification system of activities under development will contribute to the motivation and involvement of students in their learning, as well as helping them to manage their time effectively.

HEIs are reviewing their teaching practices, integrating more and more offline and online e-learning opportunities, and striving to incorporate students' digital skills acquired through the use of the Internet and smart devices. The widespread use of smartphones and mobile devices, the shift in methodology, methods and ways of learning from traditional to blended to digital, as well as the shift in learning from offline to online platforms is undeniable not only in individual learning but also in organisational frameworks. Students are increasingly using massive online learning platforms and self-directed learning through their own smart and mobile devices.

V. CONCLUSION AND FURTHER WORK

The *e-Campus* will enable the HEI to offer quality distance learning courses through an up-to-date, inclusive, student-centred technological support infrastructure. The CoViD-19 pandemic and emergency remote teaching have been a boost for HEIs, accelerating the development of pedagogical practices using active and innovative methodologies. Distance learning in Portugal, being now duly legislated, has room to grow and diversify the training offer, reaching different audiences, not only with regard to undergraduate courses, but also advanced training courses, micro-credit programmes and lifelong learning.

The development and consequent implementation of this virtual campus was only possible with the active participation of the institution and the funding of the *#eCapacitar project*. The funds from this project made it possible to hire companies, through national and international external tenders, that are currently developing all the spaces designed for the *e-Campus* of the IPSantarém, according to the development guidelines previously established by the project's team of experts in DL.

After the implementation of the *e-Campus*, there will be an analysis of the technology acceptance and the use and acceptance of e-learning. The *Technology Acceptance Method* (TAM) will be the basis for the understanding of the acceptance of the virtual campus among the users. The method will be justified by *Structural Equation Modelling* (SEM) using AMOS software.

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