

Online-learning at ISCTE-IUL: towards a sustainable education paradigm

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Abstract

Online-learning platforms have long been praised for their great benefits, such as the way they contribute to long-distance students being able to overcome geographical barriers to their education, and the way they allow students to self-manage, by autonomously deciding when they enroll and complete courses. This empowers people from all over the world to engage in lifelong-learning that may have an important impact in their daily lives, especially in developing countries. Besides these benefits, there's also an important dimension that is often overlooked: the contribution that the use of online-learning platforms has in providing a sustainable environment by reducing environmentally-damaging effects and the use of scarce resources. In this paper, we present the economical and environmental impact that the use of an online-learning platform has had in a public University in Lisbon, Portugal. We first present the online-learning platform that was developed in-house and follow up by describing the positive impact that this education paradigm has had in the lives of students, in reducing costs at the University, and in contributing to a more sustainable future.

Keywords: Online-learning; Sustainable Education; Higher Education; Sustainability; Lifelong-learning;

Introduction

In the past, the access to education in general and higher education in particular was lined with geographical barriers that prevented long-distance students from accessing quality education. With the advent of the Internet, these geographical barriers disappeared and new education paradigms, such as online-learning platforms, were born and changed the way education was made available to everyone in the last decades (Bates 2005). Although these platforms make an important contribution to empowering individuals from all over the world to engage in learning activities that can change their lives (especially in developing countries), there is another aspect of this education paradigm that is often overlooked but that has a similar positive effect in the world: the contribution that the use of these platforms makes regarding a more sustainable environment (Baragash and Al-Samarraie 2018; Bosch, Mentz and Reitsma 2019). This is clear when considering, for example, the amount of scarce or environmentally-costly resources that are saved, such as, energy used in classrooms or the transportation means used to travel to the university.

This study aims to analyze the sustainable potential of blended-learning model used in a Portuguese higher education institution. Based on this objective, we formulate the following research questions: what are the main features of ISCTE-IUL online learning platform? What are the main economical and environmental impacts of using a blended-learning approach? And why should the blended-learning model be considered a sustainable teaching model?

At ISCTE-IUL, a public University in the city of Lisbon, in Portugal, the use of this kind of online-learning platforms has been present for more than a decade, with frequent evolutions and changes to further adapt to the demands of a constantly evolving and deeply web-connected student population. In the beginning, these tools were used merely as a way of providing additional resources to the on-site classes that students attended. These ranged from class slides and notes to multimedia files and other useful resources. In the last few years, however, these tools have been used to provide a way to actually replace some of the on-site classes, thus allowing students to have full autonomy regarding the time and place in which they engage in the learning process.

Our research seeks to contribute to improving the quality of future studies related to the impacts of sustainable online-learning approaches in higher education institutions as well as to the ongoing debates by scoping the concept of sustainability in blended-learning and by presenting, through a specific case, how the

blended-learning model can help institutional environments become more sustainable. This research is also relevant as it helps to develop a coherent body of knowledge about a sustainable blended-learning model.

To date, there is little research about blended-learning sustainable practices and their impacts on institutional contexts. Even though sustainable blended-learning research is recognized, it is still limited. Contributions to sustainable online-learning approaches focus more on education for sustainability assessing the level of efficacy of online-learning programs in teaching and learning for daily sustainable practices than on sustainability education and how the adoption of sustainable online-learning strategies can improve the performance of variables such as resource management, educational attainment, and professional development and innovation.

We believe that the originality of this study lies in the fact that it attempts to show how blended-learning can contribute to the sustainability of higher education institutions focusing on a real higher education institution where the impacts of using a sustainable blended-learning model have been felt.

In this paper, we start by introducing the blended-learning approach and its contributions to a sustainable education paradigm. Then we present the online-learning platform that has been in use at the University since 2015, which has contributed to reducing the number of on-site classes. We also show how this has, consequently, contributed to reduce the University's environmental impact while also helping to reduce the inherent costs of operating on-site classrooms.

Blended-Learning as a sustainable learning paradigm

Blended-learning (also referred to as “b-learning”) was initially defined as a way to “blend text-based asynchronous Internet technology with face-to-face learning” (Garrison 2004) and, since then, has been touted as an approach that challenges the traditional classroom paradigm by combining the best of on-site classes with online-based classes and that positively contributes to improve information retention (Sembiring 2018), learning performance (Baragash 2018), learner motivation (Bosch 2019), learner satisfaction (Kintu 2017) and sense of empowerment (Owston 2018).

On one hand, online-based learning, which is mainly used for theoretical exposition, is very important to enable students to autonomously manage the time they dedicate to learning (especially if they have to do it while working part or full-time). On the other hand, on-site laboratory, practical and group discussion classes contribute to

providing students with a medium to further explore a specific topic from the online classes or simply engage in meaningful interactions with their colleagues to enhance the learning experience.

What makes blended-learning particularly effective is its ability to balance the open communication and the synchronicity of on-site classes with the limitless access to all kinds of information and media formats of the internet. In essence, students make use of online resources to bootstrap their learning processes while being a part of a community of learners that can also engage in on-site classes with instructors prepared to guide them through the learning process.

While all of this is clearly important as a way to improve the learning process, the benefits of this kind of learning approach that is based on online tools extends to more than increasing learning performance, motivation and satisfaction. An online-based learning environment is in its essence an eco-friendly learning environment, by helping to construct a resource-saving and resource-optimizing society (Yao 2019).

The increasing interest on distance learning programs has emerged not only as a response to the rapid evolutions of Information and Communication Technology (ICT) in the field of education but also as a partial solution to the unsustainability of Higher Education sector that constantly has to deal with external drivers, such as societal and technological changes, quality standards by ensuring efficient and effective teaching and learning, and financial issues (Stewart and Khare 2014). Thus, the success of those programs and their sustainable design are concerns for educational institutions regarding the achievement of quality management and cost-effectiveness.

The issue of sustainability in education has developed around two approaches: education for sustainability and sustainability of education. In this paper, the main focus is on the latter approach, which is based on the implementation of sustainable practices through educational development, leadership, and innovation (Davies & West-Burnham 2003).

According to Sahid, Endut and Peng (2003), sustainability reflects a practice which supports long-term innovation processes and at the same time benefits people, the economy and the environment. However, the implementation of a sustainability paradigm also causes social, technological and organizational changes influencing the way people work, the economic dynamics and the environmental impacts. Although there is some diversity of definitions around the concept of sustainability, there is also common agreement about its continuity over time maintaining the same degree of efficacy and the long-term viability and stability of online learning programs (Casanova and Price 2018).

In order to ensure the sustainability of learning innovation, such as in the blended-learning model, one must guarantee that it should be designed according to a macro institutional level with a governance that provides a top-down approach; an appropriate financial support; a stakeholder-focused perspective; an institutional strategy based on teaching excellence and promotion of its adoption providing technical and pedagogical support. Thus, it is necessary to ensure that these conditions are met before, during and after the implementation phase of the online-learning projects while contributing to improve students' satisfaction with learning processes and their learning outcomes as well as responding to the expectations of the remaining stakeholders, such as staff and faculty (Chipere 2017). At the same time, it also needs to address other issues, such as the broadening of the scope of the online-learning projects and supporting their implementation through institutional processes and policies; the stakeholders' acknowledgement of their relevance in their day-to-day procedures, and an institutional culture oriented towards continuous improvement and recognition of the benefits of personal development (Bates 2005; Price, Casanova and Orwell 2017). Otherwise, the success and sustainability of online projects will be compromised.

From the higher education institutions standpoint, a sustainable blended-learning model can provide a quality, lifelong education and flexible, cheaper and richer resources than those used in the traditional classroom. Besides improving an institution's profit by using low-cost technology and reducing the costs associated with teaching and learning initiatives, this learning model reduces the ecological impacts of education as it saves time and resources, including physical, energy and human resources, and it contributes to significantly decrease the need for printing through digitization of documents, module study guides, lecture notes, papers and other support material or making them available through online tools and platforms (Sofiadin 2014; Ahmad et al. 2018; Casanova and Price 2018).

As Sofiadin (2014) pointed out, the possibility to reuse, transfer and share learning contents is one of the characteristics of online-learning projects. In the case of the blended-learning model, these actions are complemented by classroom lessons which allow personalized clarification of questions, queries and feedback as interaction between teacher and students contributing to reinforce this relationship.

According to the study conducted by Stepanyan, Littlejohn and Margaryan (2013), sustainable online programs can be analyzed through three domains: resource management, educational attainment, and professional development and innovation. In resource management's domain, the costs of online learning programs as well as return on investment are relevant topics. Factors like the quality of teaching/learning, the number of students, and

technical and pedagogical innovation are useful to assess the level of cost-effectiveness of online learning programs, such as e-learning or blended-learning. In order to save resources, Littlejohn (2003b) advocated the reuse principle in order to produce an economy of scale of reusable educational resources as an approach to reduce staff time.

While some authors recognize the importance of a set of measures such as retention rates, students' achievement, skill acquisition, personal development, evidence of benefits, and perceptions of quality to achieve more sustainable online learning programs, other authors focus on the institutional adaptation to the external constraints, the need for culturally and physically institutional restructuring, and a shared vision as facilitators of sustainable practices in higher education institutions (De Freitas & Oliver 2005; Gunn 2010).

Online-Learning Platform

The online-learning platform in use at ISCTE-IUL was developed by the in-house information systems development team at the University and aims to provide a way for teachers to have part of their classes (in particular, the ones with theoretical exposition) taught through an online medium. As depicted in Figure 1, the platform is responsive and adapts to different types of devices (with varying dimensions), allowing students to take the online classes on whatever device they have on them at the time.

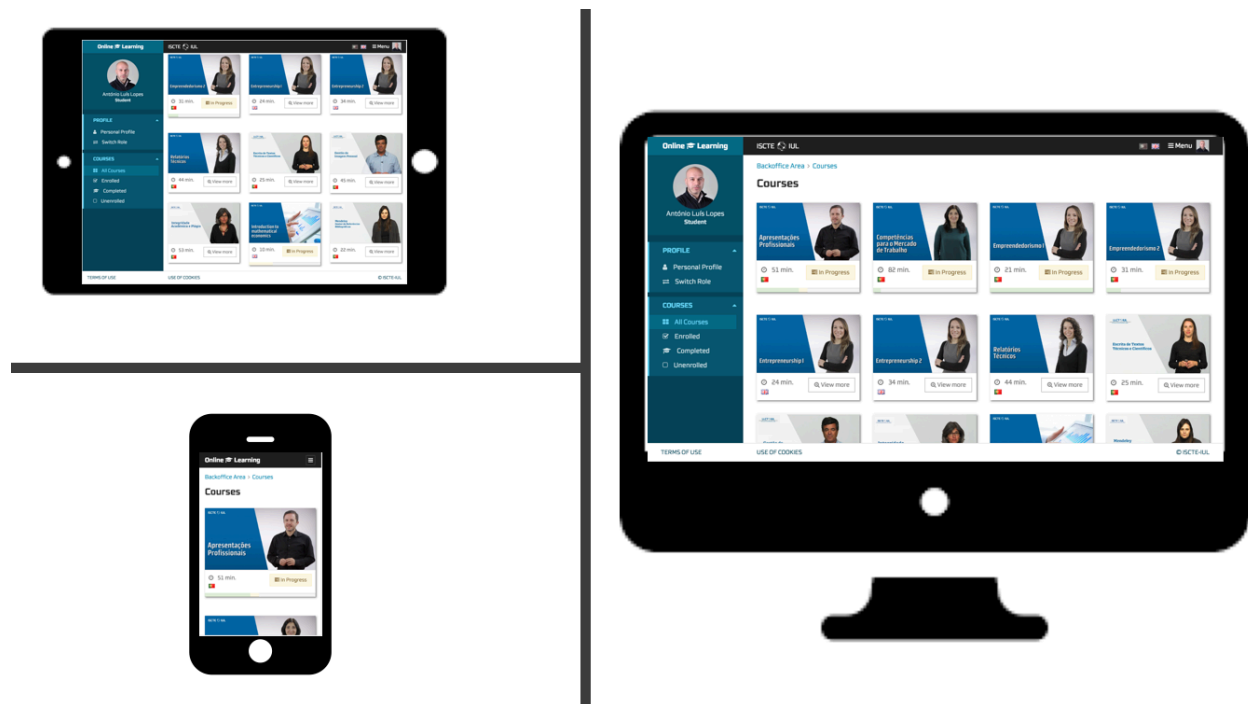


Fig. 1. The online-learning platform in use at ISCTE-IUL adapts to different types of devices

Each course is composed of a set of modules in which each module features a video and an online quiz that students use to gauge their understanding of the module's content. Teachers can decide if a passing grade on the online quiz of a particular module is necessary to go through on to the next module.

There are several types of online courses at the platform and their aims differ depending on the goals that each teacher has set for their courses at the University:

- **Mandatory online courses:** these are the online courses that act as a basis or an introduction for a particular course at the University. Students have to complete the online classes in order to attend on-site classes or complete the actual course at the University.
- **Complementary online courses:** these are online courses that complement the on-site classes of a particular course at the University but that are not mandatory. Students use these online courses to explore some extra details of the on-site classes or to simply leverage the online quizzes as a studying tool.
- **Online-only courses:** these online courses do not have a corresponding course at the University. They are merely used as an isolated (usually general-purpose) course that students can enroll to enhance their knowledge at different areas.

At the time of this study (March 2019), there were 13 courses at the platform taught in Portuguese and 4 courses taught in English. These courses' themes are mostly related to soft-skills such as learning how to do presentations, write scientific documents and develop entrepreneurship and communication skills but there are also technical courses such as mastering Microsoft Excel, mathematical economics and human resources management. Of the 6641 students that enrolled in some online course (since 2015), 81% (5381 students) have completed the courses so far. The average age of the students enrolling in these online courses is 19 years old.

Of the total of 6641 students, 2145 have answered an online survey after the completion of the course. This sample is characterized as follows:

- 52% are female (and 48% are male)
- 99% are actual students at the university (the remaining 1% are alumni, staff, researchers and others)
- 96% are Portuguese (the remaining 4% are from other nationalities from more than 10 other countries)
- 8% of the students are also are working full or part-time

- 6% of the students attend night classes

The survey's results allow us to assess their opinion regarding the usefulness, efficacy and importance of using the online-learning platform and the blended-learning model. The answers are measured in a scale of 1 (fully disagree) to 5 (fully agree) regarding their agreement to a set of statements.

Regarding the online classes and the online-learning platform, the students agree that these are important (4.3) and useful (4.6) in the learning process, especially due to the given autonomy to decide when and where (4.6) to take these online classes. Regarding the on-site classes, the students also agree that these are important (4.2) and useful (4.2) in the learning process. When referring to the possibility of applying the blended-learning model to other courses in the University, the students agree (3.9) that this should be extended to the totality of their courses.

Results and Discussion

In this study, we seek to determine the economical and environmental impact of using an online-learning platform in the context of a blended-learning model. The period to which the study refers to is between September 2015 and July 2018 (comprising the academic years from 2015/2016 to 2017/2018), but we also include the period regarding the academic year for 2018/2019 even though this is still ongoing (the value for the reduction of teaching time for this period is therefore planned – the number of enrollments is real because this has already taken place in the beginning of the academic year).

We analyzed ten courses from the soft skills area on this study. All of these courses are taught in the blended-learning model as mandatory online courses, *i.e.* students must complete the online modules and attend the on-site classes in order to pass the entire course at the University. The number of hours that were reduced in classes (and their corresponding percentage of the total teaching time for those courses) as a result of applying the blended-learning model is presented in Table 1. These hours reflect the number of hours that would be necessary for teaching the same modules that are present in the online classes but in on-site classes with theoretical exposition for all enrolled students.

Table 1. Reduction of teaching time in hours and percentage of total teaching time from 2015/2016 to 2018/2019

	2015/2016	2016/2017	2017/2018	2018/2019
Teaching time reduction (in hours)	619	725	808	802
Time reduction as percentage of total teaching time	46%	46%	46%	44%

The courses in this study involved 6231 enrollments in the period under analysis. The distribution of enrollments per academic year is presented in Table 2:

Table 2. Enrollments in the courses in the study from 2015/2016 to 2018/2019

	2015/2016	2016/2017	2017/2018	2018/2019
Enrollments	1383	1498	1606	1744

In the four academic years under analysis, the online courses that were analyzed were responsible for a reduction of 2954 hours (the sum of the values in Table 1's Teaching time reduction row) of teaching time in on-site classes. That is a reduction of 46% of the total teaching time – if we consider the courses were taught in a traditional model of on-site classes only. In order to calculate the impact in actual cost reduction, we used the following assumptions:

- The hourly cost of a classroom in terms of occupancy and the consumption of resources (energy, cleaning, maintenance, user support) is estimated at 25€ (value provided by the infrastructure and maintenance team at the University). For the total of 2954 hours in this study, this means a cost reduction of 73 850€.
- The hourly cost of the teacher is calculated by dividing the average gross income of an Assistant Professor (including paid vacation, taxes and other income elements) with the total of contractualized hours. To that effect, we also consider that one hour of teaching that was reduced includes 3 additional hours of preparation of the subject. This amounts to an hourly cost of 140€, which for the 2954 hours of the study means a cost reduction of 413 560€.

In total, it is estimated that the savings achieved with the reduction of the use of classrooms and teaching time, in the period under analysis, amount to **487 410€**, close to half a million Euros.

Besides the economic impact revealed by the results shown above, it is clear that the reduction of face-to-face classes also produces environmental benefits. These are caused by the lower consumption of energy in on-site classes and by the reduction of the damaging gas emissions as a consequence of having fewer commutes to and from the University by the students and the corresponding teachers. Quantifying this kind of indirect benefits is very difficult and would require having concrete information regarding the energy consumption in the University campus and traveling habits of students and teachers.

Therefore, we can only estimate these values based on some assumptions. Consider the following:

- Based on recent surveys to the students, the average distance that ISCTE-IUL students travel from and to the University is 12.5km (per commute), in which 70% use public transportation, 17% use their own car, 12% use bicycles or on foot and 1% use motorbikes;
- Based on information from the European Environment Agency (2016) and considering the survey results depicted on the previous point, the average emissions for a student to commute to the University and back to their residency is 1.51 Kg CO²;
- If each face-to-face class has an average of 20 students and a duration of 1.5 hours, the total CO² emissions that are saved per 1.5 hours of classes is 30.2 Kg;
- Therefore, for the entirety of the period of the study, the reduction in emissions amounts to almost a total of **60 tons of CO²**.

According to these results, we conclude that blended-learning is a sustainable learning approach concerning money and time savings, hence being more cost effective than face-to-face learning and has some positive environmental benefits. This evidence was acknowledged by Bartley and Golek (2004) who pointed out the ability of online learning programs to reduce costs as well as to transfer material in an efficient way. However, organizations should assess the costs of online learning programs as it helps to decide what kind of models are more appropriate for them and which implementation will be aligned with institutional learning strategies.

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