RTIC Revista de Tecnologias, Informação e Comunicação
Journal of Technologies Information and Communication
2024, 4(1), 31137
e-ISSN: 2184-7665
Research Article
OPEN ACCESS

Analysis and Decision: "Educação On" Project

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Citation: Azevedo, D., Sequeira, R., Lopes, P., Guedes, D., & Lopes, C. (2024). Analysis and Decision: "Educação On" Project. *Journal of Technologies Information and Communication*, *4*(1), 31137. https://doi.org/10.55267/rtic/15724

ARTICLE INFO

Received: 28 Sep 2024
Accepted: 30 Nov 2024

ABSTRACT

In recent years, educational platforms have advanced significantly, integrating cutting-edge technologies and interactive resources that have revolutionized online teaching and learning. The proper selection of an educational platform is crucial for the successful dissemination of Massive Open Online Courses (MOOCs), as it supports efficient course implementation and ensures accessibility, flexibility, and personalized learning experiences. Advanced technologies such as Artificial Intelligence and synchronous tools enhance the student experience, offering automated feedback, content adaptation, and continuous support, allowing interaction with materials at their own pace.
In this article, we address an initial phase of the "Educação ON" project, which aims to define the IT solution, platform, and technologies for the creation of MOOCs. This process involved a literature review, analysis of MOOC characteristics, evaluation of educational platforms, identification of new trends in distance learning, and synthesis of the project requirements. The research focuses on validating a MOOC course model tailored to higher education students, tested during the academic years 2022/2023 and 2023/2024 by a multidisciplinary team of professors from a Portuguese higher education institution, with the participation of students from both Portuguese and Brazilian higher education institutions. The results lay the groundwork for the next stages of the project, fostering more interactive and collaborative learning environments.

Keywords: E-learning, MOOCs, Pedagogical Innovation, Technologies, Artificial Intelligence

INTRODUCTION

In recent years, educational platforms have evolved significantly by incorporating technologies and interactive resources that have transformed online teaching and learning (Anderson, 2018). The appropriate selection of an educational platform is essential for the success of distance education, being crucial for the effective implementation of Massive Open Online Courses (MOOCs). This selection ensures accessibility, flexibility, and personalized learning (Siemens, 2014).

The integration of technologies such as Artificial Intelligence (AI) and synchronous tools provides automated and immediate feedback, real-time interaction, and content adaptation, allowing students to access materials and

activities at their own pace (Chen & Zhang, 2023). Additionally, it contributes to the creation of an educational community, which is essential for student engagement (Garrison, Anderson & Archer, 2010).

This article explores trends in distance learning (DL) and the creation of MOOCs from both technological and pedagogical perspectives (Downes, 2012). It also examines the importance of selecting the right educational platform and the technologies applied in the MOOC context, demonstrating how this choice can impact the effectiveness and reach of online education.

The present work aims to validate a MOOC course model for higher education students, implemented and validated through a case study conducted during the academic years 2022/2023 and 2023/2024. A multidisciplinary team of professors from a Portuguese higher education institution was responsible for creating this model, with the participation of students from both Portuguese and Brazilian higher education institutions.

This article presents one of the initial stages of the "Educação ON" Research Project: Analysis and Decision, which includes a literature review and the analysis of the pedagogical and technological requirements to be implemented, identifying the practices and specifications necessary for the development of a MOOC course model adapted to higher education. This initial phase lays the groundwork for the next stages, which aim to create more interactive and collaborative learning environments.

LITERATURE REVIEW ON MOOCS AND EDUCATIONAL PLATFORMS

This section presents a literature review on MOOCs and the educational platforms that support them. It covers three main areas: the definition and historical context of MOOCs, their essential characteristics for effective design and implementation, and an analysis of the main platforms used for the dissemination of MOOCs. Additionally, it examines new trends in distance education that are shaping online teaching.

Definition of Massive Open Online Courses

MOOCs introduced a new approach to online education, aimed at facilitating access to knowledge and offering learning opportunities to a diverse audience. These courses gained prominence in 2008 with the "Connectivism and Connective Knowledge" course by George Siemens and Stephen Downes, which established the concept of an open course, available online to large audiences, based on the theory of connectivism and knowledge networks (Siemens, 2014; Downes, 2012).

Since then, MOOCs have evolved, with several platforms facilitating access to courses offered by recognized academic institutions. Their goal is to expand the reach of higher education and promote educational inclusion on a global level (Koller & Ng, 2022).

Siemens (2014) defines MOOCs as large-scale online courses designed to allow access to educational materials and resources to a large number of students. These courses aim to offer an accessible educational experience to anyone, anywhere.

Downes (2012) describes MOOCs as online courses, open to all, without enrollment restrictions or participant limits, combining asynchronous and synchronous learning. These courses use technology to facilitate interaction and collaboration among participants. In this study, Downes' definition is adopted, as it fits the context being investigated.

Characteristics of Massive Open Online Courses

Following the literature review and analysis of current practices, the main characteristics of MOOCs, necessary for their design and implementation, were identified. These characteristics are as follows:

- **Accessibility and Openness**: MOOCs are accessible to anyone with an internet connection, without admission restrictions. There are no mandatory academic prerequisites, and the courses are open to a global audience (Siemens, 2014).

- **Massiveness**: MOOCs allow the participation of a large number of students simultaneously. Unlike traditional courses, which have a limited number of spots, MOOCs can accommodate thousands of participants in a single course (Koller & Ng, 2022).
- **Asynchronous and Synchronous Learning**: MOOCs combine asynchronous learning (access to materials at any time) and synchronous learning (live sessions), providing flexibility and real-time interaction (Anderson, 2018).
- **Multimodal Resources**: They use videos, texts, quizzes, discussion forums, and practical tasks, allowing students to engage with the material in various ways (Chen & Zhang, 2023).
- **Interactivity and Collaboration**: They include discussion forums, workgroups, and collaborative tools to promote interaction between students and instructors (Garrison et al., 2010).
- **Automated Feedback**: They use systems that provide immediate feedback on student assessments, allowing them to receive real-time responses (Chen & Zhang, 2023).
- **Certification and Evaluation**: They offer completion certificates to students who meet the course requirements, with varying degrees of academic or professional recognition (Yuan & Powell, 2013).
- **Modularity and Structure**: MOOCs are organized into modules or units, allowing students to progress at their own pace (Anderson, 2018).
- **Scalability**: Thanks to digital infrastructure, MOOCs can accommodate a large number of participants without significant adjustments (Koller & Ng, 2022).
- **Flexibility and Autonomy**: Students can manage their own learning pace and schedules, balancing studies with other responsibilities (Siemens, 2014).

Understanding these characteristics is fundamental for the development of MOOCs that meet the needs of a global and diverse audience.

Platforms Used for Massive Open Online Courses

An analysis of several articles on MOOCs identifies Coursera, edX, Udacity, FutureLearn, Saylor Academy, and, in the Portuguese context, the NAU platform as the main ones used for offering MOOCs (Blanco et al., 2022).

- **Coursera**: Created in 2012, it offers courses, specializations, and degrees in partnership with higher education institutions, adopting a freemium model (Coursera, 2023).
- **edX**: Founded by MIT and Harvard, it offers free and paid courses, including micro-credentials and academic degrees with formal certification (edX, 2020).
- **Udacity**: Focused on technology courses and professional skills development, it is known for its "Nanodegrees" in partnership with tech companies (Udacity, 2020).
- **FutureLearn**: Launched in 2012, it promotes student interaction through group discussions and collaborative activities (FutureLearn, 2023).
- **Saylor Academy**: Offers free online courses and is committed to using open educational resources (Saylor Academy, 2023).
- **NAU**: A Portuguese platform offering free online courses in collaboration with universities and other institutions in Portugal (NAU, 2023).

These platforms play an important role in distance education, allowing access to educational content and qualifications on a global and national level.

Table 1 summarizes the main properties of the MOOC platforms analyzed, focusing on their characteristics, advantages, and disadvantages. This comparative analysis provides a better understanding of the differences between the platforms, as well as the benefits and limitations of each in supporting online teaching and learning.

Table 1. Comparative Analysis of MOOC Platforms: Characteristics, Advantages, and Disadvantages

Platform	Characteristics	Advantages	Disadvantages
Coursera	Courses, specializations, and degrees. Freemium model.	Partnerships with prestigious institutions. Wide variety of courses.	Paid certificates and degrees. Variable course quality.
edX	Free and paid courses, micro-credentials, certified academic degrees.	Partnerships with prestigious universities. Offers micro-credentials and degrees.	Complex interface. High cost for advanced programs.
Udacity	Technology courses and professional skills. "Nanodegrees" with companies.	Focus on practical skills. Partnerships with tech companies.	High cost. Limited to technology areas.
FutureLearn	Free and paid courses with emphasis on collaborative learning.	Offers collaboration and interaction. Free course access.	Some paid certificates and resources. Less focus on technical areas.
Saylor Academy	Free online courses. Open educational resources.	Free courses and certificates.	Fewer available courses. Less specialized courses.
NAU	Free courses in collaboration with Portuguese universities.	Free access in Portuguese. Partnerships with national institutions.	Less course diversity. Paid certificates for some courses.

Own source

New Trends in Distance Learning

This section presents the main trends identified in the literature review on distance learning. The trends analyzed reflect the impact of emerging technologies on online education and include:

- **Adaptive Learning and Personalization**: Use of Artificial Intelligence algorithms to adjust content and course pace according to individual student needs (Chen & Zhang, 2023).
- **Micro-Credentials and Specialized Certifications**: Expansion of short-term credential offerings for developing specific skills applicable in the job market (Blanco et al., 2022).
- **Competency-Based Learning**: Focus on developing specific skills, with progression based on demonstrating acquired knowledge or abilities (Udacity, 2020).
- **Integration with Collaboration Tools**: Use of platforms that facilitate student collaboration and team project development (FutureLearn, 2023).
- **Virtual and Augmented Reality**: Implementation of virtual and augmented reality technologies to create immersive learning environments in areas like medicine and engineering (Chen & Huang, 2024).
- **Data-Driven Education**: Use of data analytics to monitor student progress and optimize course design based on performance patterns (Anderson, 2018).
- **Blended Learning**: Combination of online teaching with in-person or synchronous components, providing flexibility in learning (Garrison et al., 2010).

These trends indicate the continuous evolution of distance learning, with the incorporation of new technologies and approaches aimed at improving the effectiveness of online teaching and learning.

METHODOLOGY

This article is part of the "Educação ON" research project, which aims to validate a MOOC course model adapted to higher education, ensuring its effectiveness and adaptability to the context of distance learning. To achieve this, several stages were followed, aimed at analyzing and defining the essential requirements for the

implementation of MOOCs. The target audience involves around 800 students from universities in Brazil and at the Polytechnic Institute of Viseu (IPV). The development team includes IPV faculty members and specialists in technology and educational design.

The research methodology followed in the project was structured into the following phases:

1. **Literature Review and Analysis**

   The process began with a literature review on MOOCs, online learning, and pedagogical methodologies. This analysis made it possible to identify best practices and challenges associated with the development of online courses and served as a foundation for the definition of the subsequent steps.
2. **Student Surveys and Expert Consultations**

   Next, surveys were conducted with 50 students from Portugal and Brazil, and consultations were held with 8 experts, to validate the pedagogical and technological strategies to be implemented in the project. This data provided a clear understanding of the expectations and needs of the end users.
3. **Definition of Pedagogical and Technological Requirements**

   Based on the literature review and surveys, the necessary pedagogical and technological requirements for the development of MOOCs were defined, with a focus on active and personalized learning.
4. **Creation and Configuration of the Technical Platform**

   In this project phase, the technical platform required for the development of MOOCs was created and configured. This process included selecting the appropriate IT solution and technologies, implementing a Learning Management System (LMS), and integrating collaborative tools. The full technical configuration of the platform ensured that it met the pedagogical and technological requirements defined previously.

   However, this article focuses exclusively on the analysis and decision-making portion of this process. The main educational platforms, such as Coursera, edX, Udacity, FutureLearn, Saylor Academy, and NAU, were evaluated through a SWOT analysis. The analysis aimed to identify the strengths, weaknesses, opportunities, and threats of each platform to select the most suitable one for the project, considering criteria such as scalability, flexibility, and integration with emerging technologies.

   Following the analysis, a decision was made regarding the most suitable platform, with the technical configuration and implementation following this decision. Although the creation and configuration of the technical platform are essential to the project, this article focuses on the analysis and selection process that laid the foundation for the implementation.
5. **Analysis of Pedagogical Methodologies**

   The pedagogical methodologies applied to the development of MOOCs were analyzed, with a focus on promoting active and personalized learning, aiming to maximize student engagement.
6. **Development of the MOOC Course Prototype**

   Based on the defined requirements, a prototype of the MOOC course was developed, allowing continuous adjustments to the design and functionalities before the final implementation.
7. **Development of Digital Educational Resources**

   Digital educational materials were created to complement the course content, aligned with the pedagogical practices established in the previous phases.
8. **Implementation and Monitoring**

   The course will be implemented on the chosen platform and continuously monitored, ensuring the quality of the learning experience and identifying possible improvements.
9. **Final Evaluation of Results**

   After the implementation, a final evaluation of the results will be carried out based on collected data, to measure the course's effectiveness and propose adjustments for future improvements.

SWOT ANALYSIS

The selection of Moodle and StreamYard platforms for the "Educação ON" project resulted from a detailed analysis of the pedagogical and technological needs identified in the previous phases. This process was based on a comparative evaluation of the main educational platforms available, as described in the literature review. To ensure the effectiveness of the choice, a SWOT analysis was conducted, considering the key technological and

functional aspects of these platforms. This analysis allows us to assess the ability of the selected tools to meet the demands of creating and implementing MOOCs, in line with the trends in distance education discussed in the theoretical framework.

Table 2. Comparative Analysis of MOOC Platforms: Characteristics, Advantages, and Disadvantages

SWOT Analysis	Description
Strengths	
Flexibility and Personalization	Moodle allows courses to be adapted to the specific needs of students and instructors, providing a versatile platform for content development.
Tool Integration	Combining asynchronous features (Moodle) with synchronous tools (StreamYard) facilitates real-time interaction and promotes collaboration among participants.
Scalability	Moodle supports a large number of simultaneous users, which is essential for the reach of massive courses.
Diversity of Educational Resources	Moodle offers various modalities for presenting content, such as videos, forums, quizzes, and other interactive activities.
Weaknesses	
Technical Setup	The initial implementation requires advanced technical knowledge, which can increase the time and resources needed.
Infrastructure Requirements	Effective operation depends on robust infrastructure, which may incur additional costs, including servers and stable networks.
Learning Curve	Fully utilizing the features of Moodle and StreamYard requires specific training, which may slow down the initial implementation.
Opportunities	
Growing Demand for Distance Education	The expansion of distance education opens new possibilities for the implementation of MOOCs, especially in areas like AI and content personalization.
Technological Innovation	The continuous development of technologies allows the integration of advanced tools, such as AI, to enhance the learning experience.
Academic Partnerships	Establishing collaborations with other higher education institutions can increase the range of courses and expand the project's impact.
Threats	
Competition	The presence of well-established platforms like Coursera, edX, and Udacity presents a competitive challenge, as they have a consolidated audience.
Data Security	Protecting user data and complying with regulations such as GDPR pose a risk if proper measures are not implemented.
Technological Barriers	Limited infrastructure in some regions may hinder access for certain student groups, compromising the inclusion and effectiveness of the courses.
Resistance to Change	The adoption of new technologies and pedagogical methodologies may encounter resistance from institutions or individuals.

Own source

This SWOT analysis reflects the initial experience with the Moodle and StreamYard platforms and confirms their suitability for the pedagogical and technological needs of the "Educação ON" project. Moodle's flexibility in personalizing courses and its scalability are considered strengths, as well as StreamYard's ability to support effective synchronous interactions. However, technical setup and infrastructure requirements represent challenges that need to be carefully managed. The growing demand for distance education and technological evolution present significant opportunities for the project, while competition and technological barriers in less developed regions may pose threats to its success.

DECISION ON THE "EDUCAÇÃO ON" PROJECT INFRASTRUCTURE

Based on the SWOT analysis, the trends discussed in the theoretical framework, and the methodological steps implemented in the project, decisions regarding the infrastructure of the "Educação ON" project were grounded in the identified pedagogical and technological needs. The Moodle and StreamYard platforms were selected to ensure flexibility, scalability, and efficient integration of synchronous and asynchronous features, essential for creating MOOCs tailored to a global audience. However, to ensure more efficient implementation, some improvement suggestions follow, including the integration of new technologies such as Natural Language Processing (NLP), which can enhance the project's effectiveness and adaptability.

Improvements to the Main Educational Platform

Moodle, widely recognized for its flexibility and massiveness, can be optimized to personalize the learning experience through the application of NLP. NLP algorithms can be integrated to analyze students' textual interactions in forums, quizzes, and messages, allowing for personalized learning paths based on their needs and behavior. This application of NLP will also enable real-time performance reporting, facilitating instructor monitoring.

Enhancing the Efficiency of the Synchronous Communication Tool

StreamYard was chosen to facilitate synchronous communication in the "Educação ON" project, ensuring real-time interaction. To maximize the efficiency of this tool, NLP integration can be explored to create bots that automatically respond to frequently asked questions during live sessions. This automation will allow instructors to focus on more complex issues while the system addresses common student queries, promoting smoother communication.

Expansion of Server Infrastructure

The server infrastructure for the "Educação ON" project needs to ensure scalability to support a large number of simultaneous users. To meet this requirement, progressive server expansion is recommended through cloud computing services such as AWS or Google Cloud. Additionally, continuous monitoring should be performed to identify potential bottlenecks and ensure the system maintains efficient performance as the number of users grows.

Enhancing Data Security and Protection Capabilities

User data protection is a priority, as identified in the SWOT analysis. To ensure compliance with GDPR and increase security, it is recommended to implement multi-factor authentication (MFA) and adopt more rigorous encryption and access control practices. These measures are essential to protect student data and maintain the integrity of the platform.

Continuous Training and Technical Support

The learning curve identified as a weakness in the SWOT analysis can be mitigated by creating a continuous training program for students and instructors. NLP integration in this context can be useful for creating virtual assistants that provide 24/7 automated technical support, addressing recurring technical and administrative questions. This automation will make technical support more agile, ensuring users can resolve simple issues immediately.

Integration of Emerging Technologies

In addition to NLP implementation, other emerging technologies can be integrated into the infrastructure of the "Educação ON" project, such as augmented reality (AR) and virtual reality (VR). The application of AR and VR in more technical or practical courses can provide a more immersive and interactive learning experience. These technologies can be gradually implemented, starting in areas of study where the simulation of practical environments brings clear benefits to the teaching-learning process.

The decision to adopt Moodle and StreamYard for MOOC implementation was based on a detailed analysis of the pedagogical and technological needs of the project, the emerging trends discussed in the theoretical framework, and the weaknesses and opportunities identified in the SWOT analysis. The inclusion of NLP, as well as the exploration of other emerging technologies such as AR and VR, strengthens the project's infrastructure, allowing for greater personalization, automation, and security. The suggestions presented aim to ensure that the "Educação ON" project is prepared to meet the challenges of distance education, ensuring flexibility, scalability, and continuous innovation.

CONCLUSION

The analysis and decision-making phase of the "Educação ON" project was crucial for choosing the technological platforms that best suited the identified pedagogical and technological needs. After a thorough evaluation of the main options available in the market, Moodle and StreamYard were selected due to their flexibility, scalability, and ability to integrate synchronous and asynchronous tools.

The SWOT analysis confirmed that Moodle provided a solid foundation for the development of MOOCs, allowing for course customization based on user needs. StreamYard, in turn, was selected as a complementary tool, enabling real-time interactions essential for promoting a more collaborative and dynamic learning environment.

Although no prototype or platform has been implemented yet, this initial decision phase provided a clear understanding of the capabilities and limitations of the chosen platforms. It became clear that the technical infrastructure required to support MOOC development will depend on robust configuration and continuous support, particularly regarding user training and digital infrastructure management.

In summary, the decisions made in this phase have prepared the ground for the subsequent stages of the project, ensuring that the selected technological foundation aligns with the demands of modern distance education. The next phases will involve implementing and configuring these platforms, as well as developing educational content, always considering emerging trends and the needs of the students.

ACKNOWLEDGMENT

This work is funded by National Funds through the FCT – Foundation for Science and Technology, I.P., within the scope of the project Ref. UIDB/05583/2020. Furthermore, we would like to thank the Research Centre in Digital Services (CISeD) and the Instituto Politécnico de Viseu for their support CISeD) and the Instituto Politécnico de Viseu for their support.

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