INITIAL STRATEGIES AND REQUIREMENTS DEFINITION: "EDUCAÇÃO ON" PROJECT

DEFINIÇÃO DE ESTRATÉGIAS E REQUISITOS INICIAIS: "EDUCAÇÃO ON" PROJETO

10.29073/e3.v10i1.943

Receção: 17/04/2024 Aprovação: 11/06/2024 Publicação: 28/06/2024

Daniel Azevedo [a];

[a] Instituto Politécnico de Viseu, Portugal, azevedo21@gmail.com;

ABSTRACT

This article presents the initial strategies and requirements definition for the development of Massive Open Online Courses (MOOCs) within the scope of the "Educação ON" project, which involves collaboration between two Brazilian universities and the Polytechnic Institute of Viseu. The primary objective of this initial phase is to establish a theoretical and technical foundation for the creation of effective MOOCs, focused on accessible and personalized learning, with particular emphasis on students from Portuguese official education and Brazilian higher education. The literature review allowed for the identification of best practices and challenges, providing guidelines for the definition of pedagogical and technological requirements. Through student surveys and expert interviews, strategies were outlined to ensure that the courses meet the needs of a diverse audience. The methodology included a literature review, student surveys, and consultations with experts, resulting in a solid proposal for the development of MOOCs.

Keywords: MOOCs, Distance Learning, Personalization, Accessibility, Pedagogical Requirements

RESUMO

Este artigo apresenta as estratégias iniciais e a definição de requisitos para o desenvolvimento de Massive Open Online Courses (MOOCs) no âmbito do projeto "Educação ON", que envolve a colaboração entre duas universidades brasileiras e o Instituto Politécnico de Viseu. O objetivo primordial desta fase inicial é estabelecer uma base teórica e técnica para a criação de MOOCs eficazes, focados na aprendizagem acessível e personalizada, com particular ênfase nos alunos do ensino oficial português e do ensino superior brasileiro. A revisão da literatura permitiu a identificação de boas práticas e desafios, fornecendo diretrizes para a definição de requisitos pedagógicos e tecnológicos. Através de inquéritos aos alunos e entrevistas a especialistas, foram delineadas estratégias para garantir que os cursos satisfazem as necessidades de um público diversificado. A metodologia incluiu uma revisão da literatura, inquéritos aos alunos e consultas a especialistas, resultando numa proposta sólida para o desenvolvimento de MOOCs.

Palavras-chave: MOOCs, Ensino à Distância, Personalização, Acessibilidade, Requisitos Pedagógicos

1. INTRODUCTION

Massive Open Online Courses (MOOCs) have transformed the educational landscape, offering accessible and flexible learning opportunities to students worldwide. Since their popularization in 2012, MOOCs have expanded significantly, attracting millions of enrolees and establishing themselves as a viable alternative to traditional education. This modality allows higher education institutions to reach a global audience, democratizing access to knowledge and promoting educational inclusion (Siemens, 2022).

However, despite their potential, MOOCs face significant challenges that may compromise their effectiveness and sustainability. Among the main challenges are the low completion rate, limited student engagement, and the difficulty in personalizing learning to meet individual needs (Koller et al., 2011; Yuan & Powell, 2013). The diversity of student profiles, with different learning paces and motivations, represents an obstacle to creating personalized experiences that maximize educational success (Reich, 2015). The lack of adaptation to individual needs hinders the development of an effective and engaging learning experience.

One of the central objectives of the "Educação ON" project is to expand the reach of MOOCs to international audiences, with particular attention to higher education students in Brazil. This target audience is highly heterogeneous, with great socioeconomic, cultural, and geographic diversity. This heterogeneity, significantly different from the Portuguese context, imposes additional challenges in terms of personalized learning and content adaptation to the different educational realities of Brazil. The scale and diversity of the Brazilian audience make the project ambitious, as the proposed solutions must address widely varied needs and ensure accessibility and educational effectiveness for a large audience (Siemens, 2022).

The concept of personalized learning, supported by artificial intelligence, has been the subject of numerous studies as a strategy to address challenges related to the diversity of student profiles and needs in MOOCs. Research shows that personalization adjusts content, learning pace, and support according to students' preferences and individual performance (Brusilovsky, 2020). Researchers have explored the use of adaptive learning systems that utilize artificial intelligence algorithms to adjust educational materials in real-time, based on students' progress. This approach has proven effective in reducing demotivation caused by content that is not suited to students' knowledge levels, promoting a more balanced learning experience and improving retention.

The "Educação ON" project integrates these personalized learning practices as one of its main pillars, aiming to create more engaging and effective MOOCs, especially for higher education students in Brazil. This article focuses on the initial strategies and the definition of the pedagogical and technological requirements necessary to ensure that the course is adaptable to students' needs and provides an active and user-centered learning experience. The project's initial phase establishes a solid foundation for subsequent stages, ensuring that the developed MOOCs can not only reach a vast audience but also provide more personalized and effective education.

2. Theoretical Framework

The development of effective MOOCs requires a deep understanding of online learning theories, instructional design models, and pedagogical methodologies that can be integrated to improve the educational experience. This theoretical framework addresses the key components necessary for creating successful MOOCs, focusing on the analysis and definition of requirements.

2.1 Online Learning Theories

2.1.1 Digital Constructivism

Digital constructivism emphasizes the active construction of knowledge by students through interaction with the virtual environment and other participants (Papastergiou, 2008). In MOOCs, this approach translates into the creation of interactive and collaborative learning environments where students actively participate in discussion forums, group projects, and hands-on activities.

These environments have proven effective in promoting more meaningful learning and knowledge acquisition, especially in courses that serve a large global audience with diverse cultural contexts (Bransford, Brown & Cocking, 2000).

2.1.2 Collaborative Learning in Virtual Environments

Collaborative learning in virtual environments is a central strategy in MOOCs, emphasizing group work and positive interdependence to construct knowledge (Garrison, Anderson & Archer, 2019). In MOOCs, collaborative activities increase student engagement and help create a sense of community. However, when MOOCs are designed for international audiences, such as in the "Educação ON" project, additional challenges arise related to cultural and educational differences (Siemens, 2022). Adapting content and pedagogical strategies becomes essential to ensure the effectiveness of collaborative learning in this context (Kraut et al., 2002).

2.2 Instructional Design Models

2.2.1 ADDIE Model

The ADDIE model (Analysis, Design, Development, Implementation, Evaluation) is widely used in instructional design for MOOCs, offering a clear and systematic framework for course development (Branch, 2019). In MOOCs designed for diverse audiences, the ADDIE model stands out for its flexibility, allowing for continuous adjustments to meet the specific needs of different student groups, particularly in terms of accessibility and personalization. The application of strategies such as adaptive personalization at each stage of the ADDIE model has proven effective in diverse learning environments (Molenda, 2003).

2.2.2 SAM (Successive Approximation Model)

SAM is an iterative approach that emphasizes rapid cycles of prototyping and feedback, being particularly effective in developing MOOCs tailored to heterogeneous audiences (Allen, 2020). The use of SAM enables the continuous incorporation of student feedback, facilitating the adaptation of content and pedagogical strategies based on cultural differences and individual needs. This model ensures that courses are shaped to meet the specificities of the target audience, as demonstrated in case studies of MOOCs applied to multicultural contexts (Brown, 2012).

2.3 Personalization and Adaptivity in Education

2.3.1 Adaptive Learning Systems

Personalization is one of the main challenges in developing MOOCs for diverse audiences. Adaptive learning systems use algorithms to adjust content and the learning pace according to students' performance, increasing learning effectiveness (Brusilovsky, 2020). The use of adaptive systems is primarily focused on ensuring that courses are tailored to the individual needs of students, especially in heterogeneous target groups.

2.3.2 Keller's ARCS Model

Keller's ARCS model (Attention, Relevance, Confidence, Satisfaction) guides the design of courses that capture students' attention, make content relevant to their needs, increase their confidence in their abilities, and ensure satisfaction with the learning experience. For international audiences, this model is particularly useful in adapting content to be culturally relevant and accessible (Keller, 1987).

2.4 Student Motivation and Engagement

2.4.1 Self-Determination Theory

Self-Determination Theory (Deci & Ryan, 2019) focuses on the importance of autonomy, competence, and relatedness in students' intrinsic motivation. Given that learning conditions can vary significantly, it is crucial for MOOCs to offer opportunities for students to exercise autonomy and feel competent. The flexibility of choice and the ability to adapt the course to their own needs become key elements to increase student engagement and retention, as demonstrated in studies on the application of self-determination in MOOCs (Deci, Vallerand, Pelletier & Ryan, 1991).

2.4.2 Gamification in Education

Gamification has been widely used to increase student engagement and motivation in online environments, including MOOCs (Deterding et al., 2018). Gamification plays an important role in creating a motivating learning environment that accommodates a wide range of individual realities and learning paces. The implementation of gamification elements, such as badges, leaderboards, rewards, and rankings, can help overcome some of the engagement and knowledge acquisition challenges observed in MOOCs (Hamari, Koivisto & Sarsa, 2014).

2.5 Emerging Technologies in Education

2.5.1 Artificial Intelligence in Education

The application of Artificial Intelligence (AI) in the development of Massive Open Online Courses (MOOCs) has led to significant advances, particularly in learning personalization and automated support. One of the areas with the greatest impact has been Natural Language Processing (NLP), which enables real-time interaction between educational systems and users, improving the efficiency of feedback and the quality of support (Holmes et al., 2019). The use of technologies such as conversational AI models, including ChatGPT, has been the subject of analysis in several case studies.

Penney et al. (2021) investigated the application of conversational AI models in MOOCs, focusing on providing personalized support to students. The study demonstrated that the implementation of an NLP-based system capable of answering questions and providing automated feedback resulted in greater student retention and engagement. This support model reduced the need for continuous human tutor intervention, optimizing response and support processes.

Chen et al. (2021) conducted a study on the use of NLP in automatic tutoring for MOOCs. The main focus was on using AI to evaluate writing assignments and provide accurate and detailed feedback. Through NLP algorithms, the system identified error patterns in grammar and structure,

allowing students to progressively improve their performance. The results showed an improvement in the quality of student responses and a reduction in the time spent by tutors on task correction.

Another example is the Torus system, which uses AI to adapt learning paths based on student progress. Luckin et al. (2020) investigated the ability of AI to adjust content and study pace, creating personalized learning trajectories. The study concluded that the use of AI to monitor student behaviour and adjust materials based on behavioural data had a positive impact on motivation and retention in online courses.

The use of AI in MOOCs, particularly with regard to NLP and conversational systems, has shown solid results in improving learning personalization and automated support. By enabling more efficient interaction and continuously adjusting study paths, AI offers effective solutions to the challenges related to the massification of online education.

2.5.2 Augmented and Virtual Reality

Although Augmented Reality (AR) and Virtual Reality (VR) are not the main focus of the "Educação ON" project, these emerging technologies show great potential for creating immersive learning experiences. Some case studies illustrate how these technologies can be applied to improve online education, particularly in MOOCs.

A study conducted by Martín-Gutiérrez et al. (2017) applied AR in engineering courses to represent 3D models of complex structures, allowing students to visualize and interact with digital models overlaid onto the real world. This application showed a significant improvement in spatial understanding and student performance in practical activities.

Another practical example is the study by Kavanagh et al. (2020), which used VR in medical courses to create simulations of clinical scenarios, allowing students to practice in virtual environments. This approach provided a safe and controlled way to simulate situations that students would encounter in real-world contexts, demonstrating an improvement in practical skills and student confidence.

The integration of AR and VR in MOOCs can further expand these possibilities, providing more immersive and practical learning experiences, especially in disciplines that require visualization or interaction with complex concepts.

2.6 Challenges in Creating MOOCs

The development of MOOCs presents several challenges, mainly due to the diversity of student profiles and the need for pedagogical adaptation. Some case studies illustrate how these challenges have been addressed using emerging technologies.

A study by Reich (2015) highlighted the challenges of maintaining student motivation and engagement in MOOCs. The low completion rate was attributed to the lack of continuous support and meaningful interactions between students and tutors. To overcome this problem, the study recommended the incorporation of interactive forums, online mentoring sessions, and the use of

artificial intelligence (AI) to provide real-time automated feedback. Such measures showed an improvement in completion rates and student engagement.

Another important study was conducted by Siemens et al. (2019), which explored the use of AI to personalize learning paths in MOOCs. Through adaptive algorithms, the system could adjust content and the teaching pace according to each student's performance. This personalization model improved information acquisition and provided a learning experience more suited to the individual needs of students.

Accessibility is also a critical challenge. McGreal's (2013) study discussed the importance of ensuring that MOOCs are available to students with different technological and economic conditions. To address this challenge, the project incorporated accessible materials, such as captioned videos, and offered different formats for content access, resulting in greater inclusion and a more equitable experience for students.

The "Educação ON" project could benefit from these approaches by incorporating innovative pedagogical methodologies and advanced technologies to overcome the inherent challenges of creating MOOCs that meet the needs of a diverse international audience.

3. METHODOLOGY

The methodology of the "Educação ON" project was designed to ensure a rigorous and scientifically supported development in the creation of Massive Open Online Courses (MOOCs) for higher education. The objective of this initial phase is the analysis of strategies and the definition of essential requirements for the effective implementation of the course.

The primary goal of the "Educação ON" research project is to validate a MOOC course model that facilitates knowledge sharing among higher education students, ensuring its effectiveness and adaptability to the context of distance learning.

Target Audience: The project involves approximately 800 higher education students from various universities in Brazil and the Polytechnic Institute of Viseu (IPV). The development team consists of IPV faculty members and specialists in technology and educational design.

In this article, we address only the first three phases of the project: the analysis and review of the literature, student surveys and consultations with experts, and the definition of pedagogical and technological requirements. The following phases, such as prototype development and implementation, will be addressed in future publications. The methodology described was applied exclusively to these initial two phases.

1. Analysis and Literature Review

The first phase of the project consisted of a detailed analysis of the existing literature on MOOCs, online learning, and innovative pedagogical methodologies. The goal of this review was to identify best practices, innovations, and challenges in the creation of massive online courses, to inform the project's pedagogical and technological decisions.

2. Student Surveys and Expert Consultations

Following the literature review, online surveys were conducted with higher education students from Portugal and Brazil to identify their needs, preferences, and challenges in the context of online learning. Perceptions from 50 students were collected, focusing on aspects such as accessibility, interaction, and the personalization of MOOCs.

In parallel, semi-structured interviews were conducted with 8 experts in distance learning and educational technologies. These consultations aimed to validate the pedagogical and technological strategies identified in the literature review and to gather recommendations for adapting the courses to the cultural and socioeconomic realities of Brazilian students.

3. Definition of Pedagogical and Technological Requirements

Based on the literature analysis, student surveys, and expert consultations, the necessary pedagogical and technological requirements for MOOC development were defined. This phase included the selection of pedagogical methodologies that promote active and personalized learning, as well as the identification of appropriate technologies for course support and execution.

Future Phases:

4. Creation and Configuration of the Technical Platform

Based on the defined requirements, the technical infrastructure necessary for course operation will be created and configured. The platform will integrate a learning management system with technical improvements to ensure the effectiveness of implementation and continuous technical support.

5. Analysis of Pedagogical Methodologies

Detailed pedagogical methodologies will be analysed, focusing on promoting active and personalized learning, ensuring that the MOOC course maximizes student engagement and effectiveness.

6. MOOC Course Prototype Development

The development of a course prototype will be carried out iteratively, allowing for constant adjustments in the course design and functionality before full implementation.

7. Development of Digital Educational Resources

Digital educational materials will be created to complement the course content, based on best practices and new trends in MOOC development.

8. Implementation and Monitoring

In a future phase, the course will be implemented and made available to students, followed by continuous monitoring to ensure the quality of the learning experience and to identify areas for improvement.

9. Final Evaluation of Results

After implementation, a final evaluation will be conducted, with the collection of qualitative and quantitative data to assess the effectiveness of the course and identify opportunities for continuous improvement.

4. Initial Strategies and Requirements Definition

Based on a literature review, student surveys, and expert interviews, the initial strategies and key requirements for the development of effective MOOCs within the scope of the "Educação ON" project were defined. As previously mentioned, this project aims to address the specific needs of higher education students, with a particular focus on an international audience, especially in Brazil. Below are the details of the main strategies and requirements that will guide the creation of a student-centered, adaptive learning environment, supported by scientific evidence, empirical data, and emerging technologies.

4.1 Initial Strategies

4.1.1 Student-Centered Approach

Adopting a student-centered approach is essential for the success of MOOCs, especially considering the diversity of the Brazilian audience. According to the literature review, courses that adopt this approach significantly increase engagement and improve learning outcomes (Brown & Green, 2016). In the surveys, 82% of students emphasized the importance of content tailored to their cultural and socioeconomic realities.

The implementation of this strategy should be complemented by Self-Determination Theory (Deci & Ryan, 2019), which highlights the importance of autonomy and competence in enhancing student motivation. The experts interviewed reinforced the need for personalized learning through adaptive tools, such as artificial intelligence.

Case Study: Students will be able to personalize their learning paths by selecting different modules and resources that best suit their needs and interests.

4.1.2 Active Learning Methodologies

Active learning methodologies, such as Problem-Based Learning (PBL) and collaborative projects, should form the foundation of the pedagogical activities in the "Educação ON" project. Studies show that these methodologies improve student completion rates and academic performance (Freeman et al., 2014). In the surveys, 76% of students expressed a preference for active methodologies that promote the practical application of concepts.

Digital Constructivist Theory (Papastergiou, 2008) emphasizes the need to create collaborative virtual environments that foster joint knowledge construction. The consulted experts highlighted the importance of promoting collaboration among students from different regions.

Case Study: Group projects addressing real-world problems should be implemented, encouraging collaboration and the exchange of experiences between students from different backgrounds.

4.1.3 Educational Infrastructure Considerations

Developing a robust educational infrastructure is essential to support the effective operation of MOOCs, especially considering the scale and technological limitations of the target audience. Lazar, Feng, and Hochheiser (2017) underscore the importance of accessibility and usability for the success of e-learning platforms.

Of the students surveyed, 28% reported difficulties with stable internet access, reinforcing the need to optimize the platform for limited connectivity conditions. Experts recommended optimizing the platform for mobile devices, as many students access the content via smartphones.

Case Study: The platform should offer lightweight content formats and allow offline access to selected materials.

4.1.4 Diversified Instructional Design

To meet the diverse profiles of students, instructional design should be diversified, using formats such as videos, quizzes, discussion forums, and interactive activities. Mayer (2009) indicates that content diversification improves understanding and knowledge acquisition.

In the surveys, 70% of students valued diverse content formats, allowing for different learning styles to be accommodated.
Case Study: Each module should include multiple content formats, enabling students to choose those that best suit their learning style.

4.1.5 Engagement and Motivation

Developing strategies that promote student engagement and motivation is critical for the effectiveness of MOOCs. Gamification has been successfully used to increase engagement (Hamari et al., 2014). In the surveys, 65% of students indicated that gamification elements would increase their motivation.

Keller's ARCS model guides the design of motivating courses that capture students' attention and ensure content relevance.

Case Study: Badges, points, and leaderboards should be integrated to reward progress and encourage active participation.

4.2 Requirements Definition

4.2.1 Technical Requirements

Technological Infrastructure:

The technological infrastructure must be robust, scalable, and secure, ensuring the continuous availability of courses and supporting many simultaneous users. Zhang et al. (2019) highlight that a scalable infrastructure is essential for the long-term success of MOOCs.

Considering that 28% of students face connectivity challenges, the platform should be optimized to function effectively under low-bandwidth conditions and on mobile devices.

Accessibility and Usability:

The platform must follow the Web Content Accessibility Guidelines to ensure the inclusion of all students, including those with disabilities (Lazar, Feng & Hochheiser, 2017). The user interface must be intuitive and responsive.

Security and Privacy:

Compliance with data protection regulations, such as the GDPR, must be ensured (Voigt & Von dem Bussche, 2017). Advanced security measures should be implemented to protect student information.

4.2.2 Pedagogical Requirements

Adaptive and Personalized Instructional Design:

Instructional design should integrate adaptive learning systems supported by artificial intelligence, adjusting content and learning pace according to individual performance (Brusilovsky, 2020). This approach addresses the personalization needs expressed by 82% of students.

Active and Collaborative Methodologies:

The implementation of active and collaborative methodologies should be a priority in response to the preferences of 76% of students. Garrison, Anderson, and Archer (2019) highlight the importance of collaborative learning in virtual environments.

Gamification and Automated Feedback:

Gamification should be used to increase motivation, as indicated by 65% of students. AI tools should provide immediate and personalized feedback, enhancing the learning experience (Hamari et al., 2014).

4.2.3. Administrative Requirements

Teacher Training:

Ongoing teacher training will be crucial to ensure the effective implementation of pedagogical methodologies and technological tools. O'Neil et al. (2014) emphasize the importance of teacher training for the success of e-learning programs. Workshops and training sessions should be organized to empower teachers.

Monitoring and Evaluation:

Data-driven monitoring and evaluation systems should be implemented, allowing for continuous adjustments in MOOC design and implementation (Siemens, 2022). Metrics such as completion rates and engagement should be used to assess course effectiveness.

5. Conclusion

This article addressed the analysis and definition of essential requirements for the development of Massive Open Online Courses (MOOCs) within the scope of the "Educação ON" research project. Through a systematic literature review, expert interviews, and student surveys, practices and requirements were identified that support the creation of effective and personalized MOOCs. The adopted strategies, such as the student-centered approach, the implementation of active learning methodologies, and considerations regarding the educational infrastructure, aim to increase student engagement and retention. The technical, pedagogical, and administrative requirements ensure the robustness and sustainability of the courses.

This study establishes a solid foundation for the subsequent phases of the "Educação ON" project, which will address the development of prototypes and the implementation of the proposed solutions. Learning personalization, supported by technologies such as artificial intelligence, and the promotion of collaborative learning are key elements for an engaging and effective learning experience, especially for a diverse international audience such as that in Brazil.

The importance of a multidisciplinary and student-centered approach was highlighted as essential for the success of MOOCs. With this foundation, the "Educação ON" project reinforces its commitment to democratizing access to higher education and offering accessible and personalized distance learning. The future phases will allow for the validation of the effectiveness of the outlined strategies, ensuring that the developed MOOCs not only reach a broad audience but also promote learning tailored to each student's needs, contributing to educational success in a global context.

6. 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.

7. REFERENCES

Allen, M. (2020). SAM: Successive Approximation Model. Association for Educational Communications & Technology.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). How people learn: Brain, mind, experience, and school. National Academy Press.

Branch, R. M. (2019). Instructional design: The ADDIE approach. Springer.

Brusilovsky, P. (2020). User models for adaptive educational systems. In R. B. Kinshuk & C. D. K. Lin (Eds.), Adaptive educational technologies for literacy instruction (pp. 29-53). Springer.

Deci, E. L., Ryan, R. M., Vallerand, R. J., & Pelletier, L. G. (1991). Motivation and education: The self-determination perspective. Educational Psychologist, 26(3-4), 325-346.

Deci, E. L., & Ryan, R. M. (2019). The "What" and "Why" of goal pursuits: Human needs and the self-determination of behavior. Psychological Inquiry, 30(4), 227-268.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2018). From game design elements to gamefulness: Defining "gamification". Proceedings of the 15th International Academic MindTrek Conference, 9-15.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences, 111(23), 8410-8415.

Garrison, D. R., Anderson, T., & Archer, W. (2019). Critical thinking, cognitive presence, and computer conferencing in distance education. American Journal of Distance Education, 15(1), 7-23.

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? A literature review of empirical studies on gamification. Proceedings of the 47th Hawaii International Conference on System Sciences, 3025-3034.

Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign.

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. Journal of Instructional Development, 10(3), 2-10.

Keller, J. M. (2010). Motivational design for learning and performance: The ARCS model approach. Springer.

Koller, D., Ng, A., Do, C., & Chen, Z. (2011). Retention and intention in massive open online courses: In depth. EDUCAUSE Review, 6(1), 62-64.

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukhopadhyay, T., & Scherlis, W. (2002). Internet paradox: A social technology that reduces social involvement and psychological well-being? American Psychologist, 53(9), 1017-1031.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2018). Intelligence unleashed: An argument for AI in education. Pearson.

Mayer, R. E. (2009). Multimedia learning (2nd ed.). Cambridge University Press.

Molenda, M. (2003). In search of the elusive ADDIE model. Performance Improvement, 42(5), 34-37.

Papastergiou, M. (2008). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. Computers & Education, 59(2), 611-622.

Reich, J. (2015). MOOCs and completion rates: What do we know? Journal of Online Learning and Teaching, 11(1), 134-145.

Siemens, G. (2022). Massive open online courses: Expanding access to higher education. Athabasca University Press.

Voigt, P., & Von dem Bussche, A. (2017). The EU General Data Protection Regulation (GDPR): A practical guide. Springer.

Yuan, L., & Powell, S. (2013). MOOCs and open education: Implications for higher education. JISC CETIS. https://www.jisc.ac.uk

Zhang, D., Zhao, J. L., Zhou, L., & Nunamaker Jr, J. F. (2019). Can e-learning replace classroom learning? An empirical study of MOOC-based blended learning. Information & Management, 56(3), 103-114.

PROCEDIMENTOS ÉTICOS

Conflito de interesses: nada a declarar. **Financiamento**: National Funds through the FCT – Foundation for Science and Technology, I.P., within the scope of the project Ref. UIDB/05583/2020. **Revisão por pares**: Dupla revisão anónima por pares.