

PAPER

Evaluating the Usability of a Gamified Virtual Course Designed to Teach Cultural Heritage

Jacob Vargas-Arteaga()
Marbel Lucía Gravini-Donado

Simón Bolívar University,
Barranquilla, Colombia

[jacob.vargas@
unisimon.edu.co](mailto:jacob.vargas@unisimon.edu.co)

ABSTRACT

Virtual courses represent a major innovation in online teaching and learning, offering diverse training options tailored to individual needs and interests. Proposals have been developed in the field of didactics to provide heritage-related instruction using methodologies and strategies supported by digital sources and offered online. However, there is no comprehensive data compilation available on the evaluation of the usability of digital resources developed for imparting learning about cultural heritage. Hence, this study aims primarily to present the instructional design and usability evaluation of an expert-validated gamified virtual course titled “*Cultural Heritage Guardians*.” The study results show high usability scores for the designed course, as measured by the system usability scale. This study significantly contributes to aspects related to user evaluations of the usability experiences of virtual courses focused on pedagogy related to cultural heritage.

KEYWORDS

online courses, massive online open courses (MOOCs), e-learning, heritage education, heritage teaching, gamification

1 INTRODUCTION

The development of virtual programmes designed for educational processes encourages innovation and promotes didactic tools in all knowledge domains. Similarly, scenarios designed and implemented for collaborative work and lifelong learning aim to enhance a variety of skills and abilities to improve an individual's competitiveness in today's globalised world. Recent studies conducted in this context have investigated the relationships and interactions arising from the use of digital technologies for self-training and personal knowledge generation [1]. The contemporary interest in reconfiguring new learning scenarios has triggered the creation of digital resources designed for the content to be dynamic and offer novel pedagogical alternatives for diverse disciplines.

Vargas-Arteaga, J., Gravini-Donado, M.L. (2024). Evaluating the Usability of a Gamified Virtual Course Designed to Teach Cultural Heritage. *International Journal of Emerging Technologies in Learning (iJET)*, 19(4), pp. 48–57. <https://doi.org/10.3991/ijet.v19i04.45053>

Article submitted 2023-09-17. Revision uploaded 2024-01-26. Final acceptance 2024-01-26.

© 2024 by the authors of this article. Published under CC-BY.

Massive online open courses (MOOCs) are positioned as alternative educational programs that focus on that open, ubiquitous, networked, continuous, and task-based learning. They have solidified their performance as an effective and disruptive educational trend, especially attracting interest from youth [2], [3]. In terms of their potential, MOOCs enable greater accessibility to diverse content and provide an excellent, low-cost alternative to training programmes, offering a favourable scenario for flexible and complementary education [4]. Therefore, it is necessary to adopt a new vision of online learning processes, as MOOCs are founded on a form of distributed learning that aligns with the *Connectivism Principles* established by Siemens [5]. This approach is characterised by offering various types of interaction, active participation, and co-teaching as the basis for social and collaborative learning to achieve a greater understanding of teachable content.

The challenges of designing virtual programmes have been discussed in terms of meeting quality standards and achieving training goals. Therefore, instructional designs that adequately integrate content, resources, and activities must accompany the planning for virtual training spaces. The analysis, design, development, implementation, and evaluation (ADDIE) model is a renowned reference that outlines the essential components for designing learning environments [6]. The ADDIE offers a systematic approach that enables the integration of various resources, content, activities, and evaluations in collaborative and interactive environments to enhance learning.

Gamification represents another element that has been included in virtual learning environments. This active methodology strategically integrates elements of games to engage students in self-training and enhance their learning experiences. In doing so, it offers innovative instructional methodologies that focus on aspects such as autonomy, exploration, achievement orientation, and social interaction [7]. Recent studies have shown that gamified environments increase motivation, engagement, interactions, and performance. They contribute constructively to individual learning and teaching experiences in diverse disciplines, helping teachers and students to engage in more enjoyable and immersive educational activities [8–12].

However, teachers and instructional designers face significant challenges in categorising and promoting gamified instruction because the effectiveness of online courses often relies on users' experiences with the chosen training platforms [13], [14]. Therefore, the quality of learning environments can be improved only if the usability of a selected platform is evaluated. Such usability assessments would enable stakeholders to determine the extent to which a virtual course would be considered usable by potential users [15]. The system usability scale (SUS) represents one of the most widely used instruments for measuring the usability of a system. Numerous previous studies have utilised this scale to measure the usability of virtual courses in various environments [16–18]. Usability evaluation is often conducted by experts to identify issues in platform usage before the final product is released [19].

The present study incorporated the mentioned considerations to design and implement a MOOC titled "*Cultural Heritage Guardians*" for dissemination on the Moodle platform. The virtual course aims to promote the interests of youth in heritage assets by enhancing their knowledge, protection, and appreciation of their legacies. It thus approached the concept of cultural heritage from an educational standpoint. The proposed course was strategically aimed at raising awareness among young people about the importance of preserving and valuing their cultural heritage. Hence, high school students attending an official school located in an urban area on the northern coast of Colombia were identified as the target users of the course.

The designed MOOC was implemented with the aim of fostering interest in heritage assets among the target group and promoting responsible and sustainable use of these legacies to facilitate their social appropriation. The virtual course is based on the premise that it is now possible to create innovative processes that facilitate the exploration, understanding, appreciation, awareness, and enjoyment of cultural heritage in various settings [20].

Thus, the present article documents the development of a MOOC with reference to the ADDIE model. The usability of the course was evaluated by experts before it was made available to end users. This research aims to provide significant insights into designing educational resources for teaching cultural heritage in virtual environments and to contribute to studies related to measuring usability among MOOCs in the educational field.

2 METHODOLOGY

The study was conducted in two stages. Initially, the proposed MOOC was designed according to the guidelines of the ADDIE model. Subsequently, the SUS was applied for the expert evaluation of the designed MOOC.

2.1 MOOC development

The ADDIE model posits five phases to enhance learning: analysis, design, development, implementation, and evaluation (Figure 1). This study followed every phase proposed by Maribe [21].

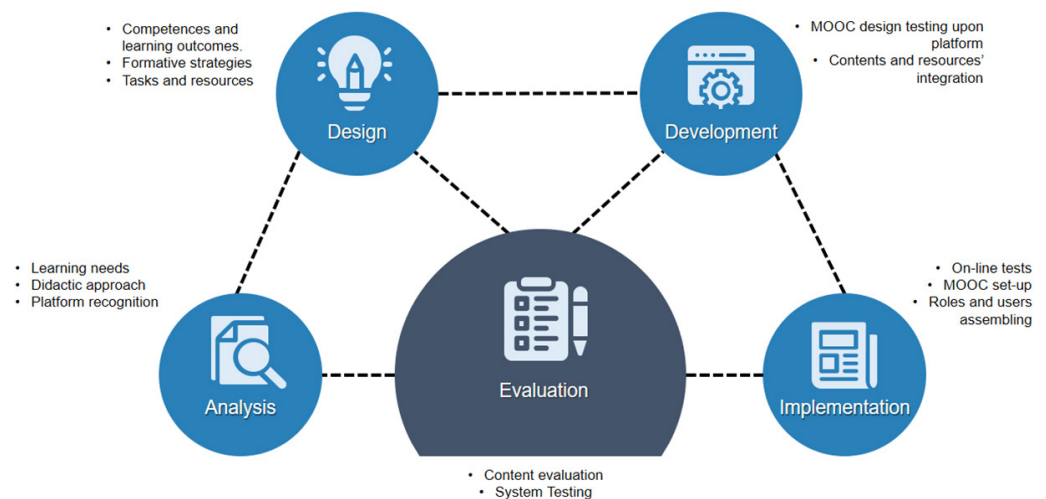


Fig. 1. Adapted from Maribe [21]

The analysis phase identified the target audience, learning needs, didactic approach, and learning platform of the course. During the design phase, the targeted competencies and learning objectives were determined, the training strategy was defined, and the resources to be used were designed. The development phase integrated the content and resources into the chosen platform. During the implementation phase, system testing was conducted, user registrations were completed, access to resources was granted, and instructions on how to use the platform

were provided. Finally, the scope of the objectives and the aspects needing improvement in each of the developed phases were reviewed, while keeping open the possibility of revisiting previous phases. The evaluation phase was formative, emphasising the importance of continuously reviewing and adjusting the product. Providing the instructional designer with resources was deemed essential to ensuring the quality of the process.

2.2 Applying the SUS

This study utilized a quantitative method that involved the participation of 15 professionals with master's degrees and experience in using and designing virtual courses. The gender distribution of the participants was equitable, with a similar proportion of men (47%; $n = 7$) and women (53%; $n = 8$). Jakob Nielsen's recommendations for the number of evaluators were followed [22].

Table 1. Translation of the SUS questionnaire

Q	Original Version	Spanish Adaptation*
1	I think that I would like to use this system frequently.	Pienso que podría utilizar este curso online con frecuencia.
2	I think that I would like to use this system frequently.	El curso online me ha parecido innecesariamente complejo.
3	I think that I would like to use this system frequently.	Considero que este curso online es fácil de utilizar.
4	I think that I would need the support of a technical person to be able to use this system.	Pienso que necesitaría la ayuda de un técnico para poder utilizar la plataforma.
5	I found the various functions in this system were well integrated.	Me parece que las distintas funciones del curso online están bien integradas.
6	I thought there was too much inconsistency in this system.	Considero que hay demasiadas inconsistencias en la plataforma.
7	I would imagine that most people would learn to use this system very quickly.	Considero que la mayoría de las personas aprendería a utilizar este curso muy rápidamente.
8	I found the system very cumbersome to use.	El curso me ha parecido muy complicado de desarrollar.
9	I felt very confident using the system.	Me sentí muy seguro utilizando el sistema.
10	I needed to learn a lot of things before I could get going with this system.	Tuve que aprender muchas cosas antes de utilizar este sistema.

Notes: *The Spanish adaptation attended to the evaluation of a virtual course. Participants scored each item on a numbered scale: (1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree and (5) Strongly agree.

All participants signed an informed consent form, affirming their voluntary participation and agreeing to test a pilot version of the MOOC to identify potential usability issues.

The SUS was originally published by John Brooke in 1986. It has been validated and successfully used in evaluating the usability of various hardware and software types, offering a high level of reliability in testing environments [15], [23].

In the present study, participants evaluated the MOOC using an adaptable and translatable Spanish version of the SUS questionnaire (refer to Table 1). Data were collected through a Google form and exported to a spreadsheet for processing in Microsoft Excel. To obtain the total score of the scale and the contribution of each item, we followed the procedure described by Lewis and Sauro [23]. Figure 2 displays the acceptance score, which was assessed using the scale proposed by Bangor et al. [24].

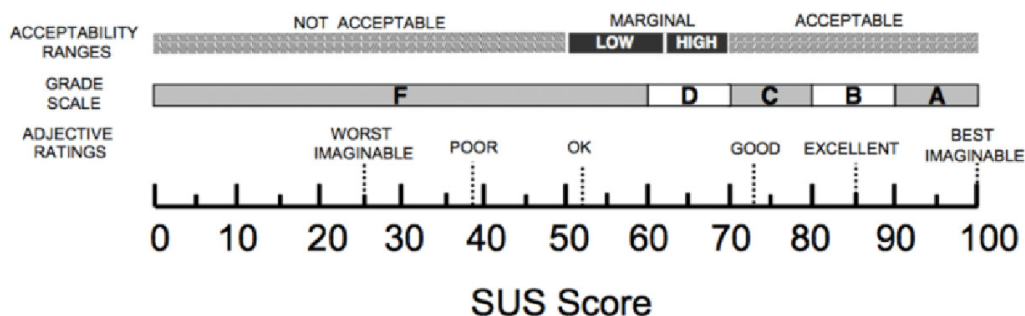


Fig. 2. Acceptance scale proposed by Bangor et al. [24]

3 RESULTS

3.1 The instructional design of the MOOC titled *Cultural Heritage Guardians*

The design of the MOOC was based on the ADDIE model because it is student-centred and iterative. Therefore, the designed learning experiences must ensure the achievement of the stated objectives.

Table 2. MOOC competencies, learning objectives and challenges

Title: <i>Cultural Heritage Guardians</i>		
C1: Knowledge of Cultural Heritage	C2: Valuation of cultural heritage	C3: Relationship with cultural heritage
Obj 1: Recognize the historical and cultural importance of the different elements that comprise the cultural heritage. Obj 2: Understand the various forms and manifestations of cultural heritage in the local and global environment.	Obj 3: Encourage attitudes of respect and appreciation towards cultural heritage, recognizing its importance for cultural identity and diversity. Obj 4: Appreciate the aesthetic beauty and symbolic meaning of cultural heritage elements.	Obj 5: Develop actions for the protection and conservation of heritage to raise awareness of the importance of cultural heritage. Obj 6: Use different media and technological tools to communicate and share strategies for the care, protection and dissemination of cultural heritage.
Challenge 1: A journey into the past Challenge 2: Ancient and stately cities	Challenge 1: Beyond the monuments Challenge 2: Discovering our legacies	Challenge 1: Sharing our stories Challenge 2: Protecting our treasures

The findings from the diagnostic phase of the research revealed that the students lacked sufficient knowledge about the cultural heritage of their region.

Workshops were arranged with social science teachers to determine the content and didactic strategies for the proposed course. Competencies and learning objectives

that could be targeted were identified (refer to Table 2). The MOOC design aimed to provide an interactive scenario that includes motivation, challenges, and fun as fundamental elements. This approach was intended to help students enhance their learning experience about their cultural heritage. The possibilities of gamification on the virtual platform were explored as a necessary condition for constructively influencing learning [25].

Table 3. Gamification elements integrated into the virtual programme

Mechanics	Dynamics
Missions or challenges	Rewards and achievements
Points, badges or medals	Restrictions
Leader board and progress bar	Progression
Levels	Competition
Feedback	Collaboration

Source: Adapted from varied researchers [26–29].

Table 3 describes the mechanics and dynamics incorporated into the MOOC as characteristic aspects of gamified scenarios [26–29].

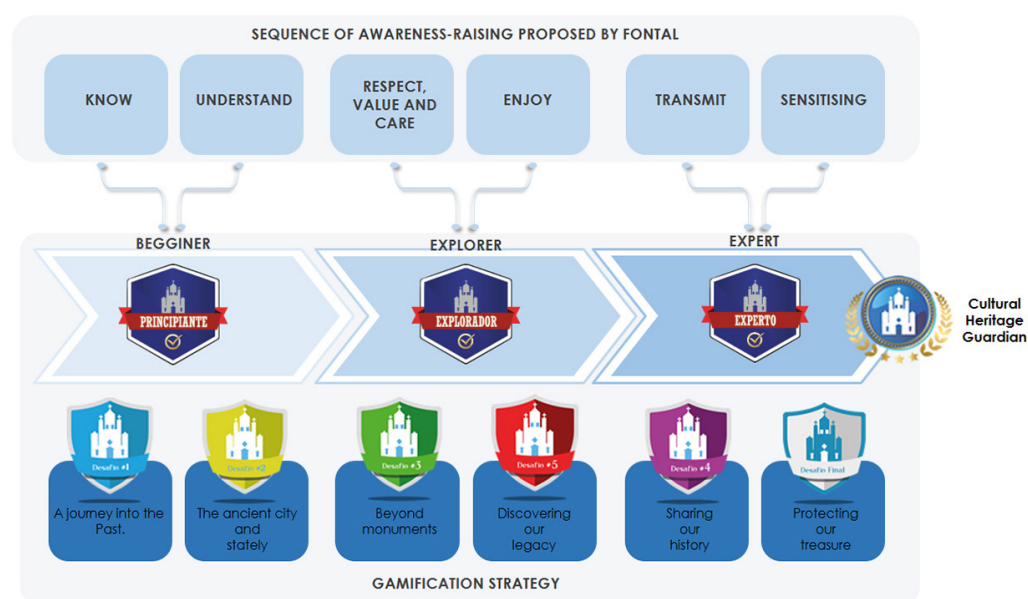


Fig. 3. Awareness sequence in the gamified environment

Fontal's model of heritage education was adopted as a didactic referential framework [30]. This model proposes a series of procedures to encourage people to care for and protect heritage assets. All the specified elements were incorporated into the gamified environment (see Figure 3).

Moodle was chosen for the implementation of the MOOC because it is one of the most widely used learning management systems (LMSs) worldwide. Moodle has received high usability and user experience scores in evaluations [31]. At a general level, the *Cultural Heritage Guardians* MOOC proposed six challenges that invited users on an adventure to discover, protect, and appreciate historical legacy artefacts (see Figure 4).



Fig. 4. The MOOC interface on the Moodle platform

The interactive activities aimed to strengthen the connections between heritage assets and individuals, helping them develop a sense of belonging to a social group and ultimately contributing to the formation of their cultural identity.

3.2 Usability evaluations based on the SUS

Experts were invited to evaluate the MOOC when the testing environment was prepared. They were asked to complete a Google form using the SUS items, along with an additional field for comments or suggestions. The data obtained from the expert evaluations was organised in a spreadsheet to determine the total scores and contributions for each item. The formula suggested for the SUS was applied to calculate the recorded scores [15], [23].

Table 4. SUS scores and results

Distribution of the SUS Score											
Evaluators	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS SCORE
Evaluator 1	4	2	5	2	4	2	4	2	4	2	77.5
Evaluator 2	5	1	4	1	5	1	4	1	5	1	95.0
Evaluator 3	4	1	5	1	5	1	5	1	5	1	97.5
Evaluator 4	5	5	5	1	5	1	5	1	5	1	90.0
Evaluator 5	5	5	5	2	5	1	5	1	5	2	85.0
Evaluator 6	4	1	5	2	5	1	5	1	4	2	90.0
Evaluator 7	5	2	5	1	5	1	5	2	5	1	95.0
Evaluator 8	3	1	4	1	5	1	4	2	4	2	82.5
Evaluator 9	4	2	5	1	5	1	5	1	5	1	95.0
Evaluator 10	4	4	5	1	5	2	5	2	1	1	75.0
Evaluator 11	4	2	3	1	5	2	4	1	4	3	77.5

(Continued)

Table 4. SUS scores and results (*Continued*)

Distribution of the SUS Score											
Evaluators	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS SCORE
Evaluator 12	5	1	5	1	4	1	4	1	5	1	95.0
Evaluator 13	5	2	4	2	4	3	4	2	4	2	75.0
Evaluator 14	4	1	5	1	5	1	5	1	5	1	97.5
Evaluator 15	5	1	5	1	4	2	4	1	5	2	90.0
Total											87.8

The scoring results presented in Table 4 reveal that the mean SUS score of the *Cultural Heritage Guardians* MOOC was calculated at 87.8, indicating a high level of acceptability. This places the MOOC at level B on the scale, with an adjective rating of “excellent” (see Figure 2).

The expert evaluations conducted in test environments revealed that it was feasible to publish the MOOC for use by the target audience. Improvements recommended for the MOOC before its launch focused on aspects beyond usability. Specifically, the suggested enhancements relate to a section of the course content, competencies that should be incorporated, and resources that could be integrated into the platform. All comments made by the evaluators were considered before the virtual course was put into production.

4 CONCLUSION

This study aimed to develop a gamified MOOC using the ADDIE model as a reference. It also aimed to determine the usability level of the designed course through expert evaluations. Each development phase aimed to achieve a final product that would meet the challenge of designing high-quality virtual courses, enabling the accomplishment of learning objectives set in the field of cultural heritage education. The proposed phases were methodologically completed before a gamified MOOC was developed on the Moodle platform. Virtual courses provide a conducive environment for cultural heritage education, enabling users to learn, discover, protect, and appreciate their historical heritage from an academic perspective. This study obtained usability results that were similar to and aligned with previous studies conducted on LMS platforms with a similar objective [18], [19]. However, the present study deployed a larger number of evaluators in the interest of greater rigour.

Finally, this research initiative provides pertinent data for designing virtual resources to educate about cultural heritage. It thus contributes significantly to studies that measure the usability of MOOCs in educational environments.

5 REFERENCES

- [1] J. Vargas-Arteaga, M. Gravini-Donado, and L. Zanello-Riva, “Digital technologies for heritage teaching: Trend analysis in new realities,” *Int. J. Emerg. Technol. Learn.*, vol. 16, no. 21, pp. 132–148, 2021. <https://doi.org/10.3991/ijet.v16i21.25149>
- [2] M. H. Baturay, “An overview of the world of MOOCs,” *Procedia – Soc. Behav. Sci.*, vol. 174, no. 12, pp. 427–433, 2015. <https://doi.org/10.1016/j.sbspro.2015.01.685>

- [3] M. Zalli, H. Nordin, and R. Awang Hashim, "Online self-regulated learning strategies in MOOCs: A measurement model," *Int. J. Emerg. Technol. Learn.*, vol. 15, no. 8, pp. 255–263, 2020. <https://doi.org/10.3991/ijet.v15i08.12401>
- [4] A. García and L. Atiaja, "Methodology for the development of massive open courses online," *Rev. Cuba. Educ. Super.*, 2022. [Online]. Available: <https://bit.ly/3pHUiJ8>.
- [5] G. Siemens, "Connectivism: Learning theory or pastime for the self-amused?" 2006. [Online]. Available: <http://altamirano.biz/conectivismo.pdf>.
- [6] I. Chen, "Instructional design methodologies," in *Instructional Design: Concepts, Methodologies, Tools and Applications*, New York: Information Resources Management Association (IRMA), 2011, pp. 80–94. <https://doi.org/10.4018/978-1-60960-503-2.ch108>
- [7] A. Sobodic, I. Balaban, and D. Kermek, "Usability metrics for gamified e-learning course: A multilevel approach," *Int. J. Emerg. Technol. Learn.*, vol. 13, no. 5, pp. 41–55, 2018. <https://doi.org/10.3991/ijet.v13i05.8425>
- [8] A. Torres-Toukoumidis, L. M. Romero-Rodríguez, M. A. Pérez-Rodríguez, and S. Björk, "Integrated theoretical gamification model in e-learning environments (E-MIGA)," *Rev. Complut. Educ.*, vol. 24, no. 1, pp. 35–52, 2018. <https://doi.org/10.5209/RCED.52117>
- [9] M. Sailer and L. Homner, "The gamification of learning: A meta-analysis," *Educ. Psychol. Rev.*, no. 32, pp. 77–112, 2019. <https://doi.org/10.1007/s10648-019-09498-w>
- [10] A. Lutfi, F. Aftinia, and B. E. Permani, "Gamification: Game as a medium for learning chemistry to motivate and increase retention of students' learning outcomes," *J. Technol. Sci. Educ.*, vol. 13, no. 1, pp. 193–207, 2023. <https://doi.org/10.3926/jotse.1842>
- [11] C. Chung and Y. Y. Lin, "Online 3D gamification for teaching a human resource development course," *J. Comput. Assist. Learn.*, vol. 38, no. 3, pp. 692–706, 2022. <https://doi.org/10.1111/jcal.12641>
- [12] M. T. Cheng, H. C. She, and L. A. Annetta, "Game immersion experience: Its hierarchical structure and impact on game-based science learning," *J. Comput. Assist. Learn.*, vol. 31, no. 3, pp. 232–253, 2015. <https://doi.org/10.1111/jcal.12066>
- [13] A. G. Sidhawara, D. B. Setyohadi, L. T. Dewi, and K. Sri, "E-learning's usability measurement toward students with myopia visual impairment," in *3rd Int. Conf. Energy, Environ. Inf. Syst. (ICENIS 2018)*, vol. 73, pp. 1–5, 2018. <https://doi.org/10.1051/e3sconf/20187312004>
- [14] F. Grünewald, C. Meinel, M. Totschnig, and C. Willems, "Designing MOOCs for the support of multiple learning styles," in *Scaling up Learning for Sustained Impact. EC-TEL 2013. Lecture Notes in Computer Science*, D. Hernández-Leo, T. Ley, R. Klamma, and A. Harrer, Eds. Berlin: Springer, 2013. https://doi.org/10.1007/978-3-642-40814-4_29
- [15] J. Brooke, "SUS: A quick and dirty usability scale," *Usability Eval. Ind.*, vol. 189, no. 11, 1995. [Online]. Available: <https://bit.ly/47YthIT>.
- [16] A. Gracia, E. Burhan, and D. Gea, "Usability analysis on MOOC platform," *J. Theor. Appl. Inf. Technol.*, vol. 101, no. 8, pp. 3152–3161, 2023. [Online]. Available: <https://bit.ly/3sGnS2M>.
- [17] A. Hidayat, P. Santosa, and I. Hidayah, "Usability testing of MOOC prototype using SUS (System Usability Scale) method," in *International Conference on Electrical and Information Technology (IEIT)*, IEEE, 2022, pp. 290–294. <https://doi.org/10.1109/IEIT56384.2022.9967901>
- [18] J. Galindo *et al.*, "A usability-focused method to design a cybersecurity MOOC for children," in *2022 Third International Conference on Information Systems and Software Technologies (ICI2ST)*, Quito, Ecuador: IEEE, 2022, pp. 130–137. <https://doi.org/10.1109/ICI2ST57350.2022.00026>
- [19] O. Daramola, O. Oladipupo, I. Afolabi, and A. Olopade, "Heuristic evaluation of an institutional e-learning system: A nigerian case," *Heuristic Eval. an Institutional E-learning Syst. A Niger. Case.*, vol. 12, no. 3, pp. 26–42, 2017. <https://doi.org/10.3991/ijet.v12i03.6083>

- [20] K. Chng and S. Narayanan, "Culture and social identity in preserving cultural heritage: An experimental study," *Int. J. Soc. Econ.*, vol. 44, no. 8, pp. 1078–1091, 2017. <https://doi.org/10.1108/IJSE-10-2015-0271>
- [21] R. Maribe, *Instructional Design: The ADDIE Approach*. Springer New York, NY, 2009.
- [22] J. Nielsen, "Why you only need to test with 5 users," Nielsen Norman Group, 2000. [Online]. Available: <https://bit.ly/3R9F4be>.
- [23] J. Lewis and J. Sauro, "The factor structure of the system usability scale," in *Proceedings of International conference (HCII 2009)*, San Diego, CA, 2009. https://doi.org/10.1007/978-3-642-02806-9_12
- [24] A. Bangor, P. Kortum, and J. Miller, "Determining what individual SUS scores mean: Adding an adjective rating scale," *J. User Exp.*, vol. 4, no. 3, pp. 114–123, 2009. [Online]. Available: <https://bit.ly/3syhF8U>.
- [25] C. H. Chung and H. L. W. Pan, "Assessing the effects of flow, social interaction, and engagement on students' gamified learning: A mediation analysis," *Sustain.*, vol. 15, no. 2, p. 983, 2023. <https://doi.org/10.3390/su15020983>
- [26] Bunchball, *Gamification 101: An Introduction to the Use of Game Dynamics to Influence Behavior*. Paper White, 2010.
- [27] K. M. Kapp, *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education*. Pfeiffer, 2012. <https://doi.org/10.1145/2207270.2211316>
- [28] K. Werbach and D. Hunter, *How Game Thinking Can Revolutionize Your Business*. Wharton Digital Press, 2012.
- [29] G. Zichermann and C. Cunningham, *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*. O'Reilly Media, 2011.
- [30] O. Fontal-Merillas, S. García-Ceballos, and B. Aso, "Development of teaching skills in heritage education through 2.0 platforms and digital environments as a learning tool," *Rev. Investig. e Innovación Educ.*, no. 101, pp. 1–14, 2020. <https://doi.org/10.12795/IE.2020.i101.01>
- [31] A. M. Saleh, H. Y. Abuaddous, I. S. Alansari, and O. Enaizan, "The evaluation of user experience of learning management systems using UEQ," *Int. J. Emerg. Technol. Learn.*, vol. 17, no. 7, pp. 145–162, 2022. <https://doi.org/10.3991/ijet.v17i07.29525>

6 AUTHORS

Jacob Vargas-Arteaga holds a Bachelor's degree in Computer Science and Audiovisual Media and Master's in Education from the University of Córdoba, Colombia, besides completing Doctorate in Educational Sciences at the Simón Bolívar University, Colombia. Jacob Vargas-Arteaga is a consultant and researcher in ICT applied to education, knowledge management and technological and pedagogical innovation, and their impact on the quality of learning.

Marbel Lucía Gravini-Donado is Research Training Unit Group Director at Simón Bolívar University, Barranquilla, Colombia is a psychologist from the Universidad Metropolitana de Barranquilla, has completed Master in Education from Fundación Universidad del Norte, Colombia, and has been awarded with a Doctorate in Education from the Universidad Autónoma de Madrid, Spain. Senior Researcher for Colombian Ministry of Science and Technology. Marbel Lucía Gravini-Donado is author of publications and lecturer in the field of educational psychology, particularly in areas of learning problems, learning styles, teaching strategies and student retention.