

Minga-Vallejo, R. E. & Ramírez-Montoya, M. S. (2022). Social construction of learning: analysis from the participants of an energy sustainability xMOOC. In *Proceedings of the 10th International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM 2021)*. Salamanca, Spain.

Social construction of learning: analysis from the participants of an energy sustainability xMOOC

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Abstract

The social construction of learning constitutes an important frame of reference in the understanding of social learning processes that take place in groups, communities, networks, through innovative training offers such as Massive Open Online Courses (MOOC). Therefore, this study analyzed the social construction of learning from the perception of the participants of an xMOOC. Using the *ex post facto* method, two validated surveys (initial and final) with a Likert scale were applied to 217 participants to analyze three variables: participant profile, social construction of learning, and communication and interaction practices. The findings suggest participants with: a) an interest in aligning the training theme with their work and study interests; b) commitment to carry out activities from previous experience; c) satisfaction of needs regardless of the heterogeneity of the profile; d) an age that did not significantly influence the development of digital skills, but did influence the use of social networks for academic purposes. The differential value of this study includes the analysis and identification of potentialities and opportunities for the social construction of learning and communication and social interaction, practices that are decisive for the development of social learning.

Keywords: Social Construction of Learning, Social Learning, xMOOC, Communication, Interaction, Educational Innovation, Higher Education.

1. Introduction

1.1. Massive Open Online Courses (MOOC) and xMOOC participants

The challenges of education invite us to be visionary and innovative in offering training actions that transform reality. In this sense, the Massive Open Online Courses (MOOC), as spaces for innovative training in higher education [1, 2] or corporate training [3], can contribute to the change and rupture of traditional educational schemes, from a training disruption that considers the heterogeneity of the participants [4]. This type of online courses, whose enrollment of participants is increasing [5], are anchored to an education [6, 7] to the extent that they integrate the benefits of technology to generate transformative learning, which allows knowledge to be transcended. purely academic and move from passive learning to a conception of learning where interaction is emphasized, as one of the key elements, to build learning among all [8]. In this way, the analysis of MOOC is of great interest as they are spaces for innovation, as long as they promote learning from a transformative action in their training processes.

One of the strategies to face this transformative action is to analyze the social construction of learning and, from this analysis, to be able to improve the results of students who access training through MOOCs. There is a variety of pedagogical approaches for MOOCs, some that are more oriented towards individual learning through interactive materials and others that focus on social learning, through communication and interaction with others [9]; Thus, for example, xMOOC, rather than creators of communities, are courses with a more didactic nature and with less emphasis on interaction [10], requiring students to be autonomous during their learning process [11]; and it is there where social support can improve the sense of community and with it, improve learning outcomes through the use of discussion forums, social networks and other collaborative activities that allow the formation of connections between the participants, so that the growing trend of integrating collaborative learning strategies in xMOOC stands out [12]. The integration of interactive practices in MOOC can boost social learning, which would open paths to transcendent learning opportunities.

1.2. The social construction of learning in MOOC

From a growing interest in involving groups and communities as vehicles of social change, it is necessary to better understand the collective dimensions of these transformation processes. In this sense, although learning processes occur internally in

the individual, their nature is determined by social relations and, consequently, learning can only be understood in the light of the social context [13]; and, therefore, social learning is an increasingly emerging topic in MOOC course research as participants prefer activities that allow them to socialize [14]. Designing and implementing quality educational activities or practices can enhance interpersonal relationships, social and communication skills in digital educational environments [15]. Consequently, analyzing social learning processes continues to be a challenge in online training offers.

With this background, social learning opportunities that occur through collaborative activities are crucial in this type of online learning environment. Hence, to understand the social construction of learning, it is necessary to analyze social learning [16–18] to better understand the nature of the learning processes that take place in groups, communities, networks, or other social systems of collective action [19], from where human interrelationships are managed [20]. Therefore, a way to promote social learning and a sense of community in MOOCs occurs to the extent that groups promote discussion and exchange among students, through discussion forums and social networks [21]. Social interaction provides opportunities for participants to discuss topics and share what they are learning with their peers.

1.3. Online communication and interaction

Online education is gaining traction in almost all parts of the world as it represents a valuable tool for peer-to-peer, collaborative, and social learning. In online education, a technological context enriched with good pedagogical practices [22] has gained increasing popularity for educational training [23]. So much so that the social construction of learning cannot be attributed exclusively to sporadic participation in the MOOC, much will depend on the active communicative and collaborative practices of the participants [24], such as conversations that allow them to expand or strengthen learning [25]. Thus, for example, MOOCs include various forms of communication, including forums, social networks, or blogs. Preferably, the forum is the main source of communication to generate interactions between the participants [18] and in fact it can be more effective for motivational purposes [26, 27] as part of the development of social learning. From this perspective of the social construction of learning, the objective of this study focuses on analyzing the perception of the participants to answer how can social learning be envisioned from the communication and interaction of the xMOOC to strengthen the social construction of learning?

2. Method

This study is quantitative, using the ex post facto method [28, 29] and was carried out based on the results of two surveys: initial and final; whose validity and reliability of the instruments were evidenced by exploratory and confirmatory psychometric strategies carried out in previous studies [30–32]. These surveys contemplated a Likert scale with four categories: strongly agree, agree, disagree, and strongly disagree. The profile of the participants was analyzed in relation to the interests and motivations and previous and acquired knowledge in the development of the MOOC, where the analysis of results involved the inferential study of the variables related to the profile of the participants, the social construction of learning, communication, and interaction (Table 1).

Table 1. Study variables.

Survey	Survey areas	Variables/Indicators
Initial	Interests and motivations to study the MOOC	<ul style="list-style-type: none"> • Participants profile Gender. Occupation. MOOC experience. Studies. Age. • Social construction of learning Interests in the course. Commitment level. Training needs.
	Prior knowledge	
Final	Interests and motivations for having studied the MOOC	<ul style="list-style-type: none"> • Communication and interaction practices Skills in digital tools. Skills in social networks for academic purposes.
	knowledge acquired	

2.1. Participants

This study included 217 participants, aged between 16 and 69 years, who completed the initial survey and the final survey of the xMOOC: The new electrical industry in Mexico, which is part of the Binational Laboratory for the Intelligent Management of Energy Sustainability and Technological Training, a project financed by CONACYT-SENER; this project included the subproject of open, interdisciplinary and collaborative innovation to train in energy sustainability through MOOCs, in which this research is framed. This xMOOC, given in 2017, had 2,763 registered participants, 474 participation certificates were delivered, and had a completion efficiency of 17% [33]. Creating a more sustainable world implies taking specific actions and that is where higher education institutions can offer their contribution through training proposals in the field of energy sustainability.

2.2. Data collection

2.2.1. Profile of the participants and experience with MOOCs for the social construction of learning

Within the scope of interests and motivations to study the MOOC, the contrast results with the profile of the participants (Table 2) show that the interest in the course depends on the occupation and completed studies, considering that the p-value of both variables regarding interest in the course is less than 5.0%.

Table 2. Chi-square test of interest in the course and profile of the participants.

Contrast between interest in the course and participant profile	Number of valid cases	Pearson's Chi-square value	df	Asymptotic significance (bilateral)
Gender	216	11,304	7	0,126
Occupation	212	157,341	63	0,000
MOOC experience	213	38,180	28	0,095
Studies	215	96,290	28	0,000

Based on these results, the value for educational practice was to identify the indicators of the profile with the greatest relationship (occupation and studies), as well as those with the least relationship, such as gender characteristics and previous experience in MOOCs.

On the other hand, regarding the level of commitment and the profile, no dependency was found between this indicator and those that correspond to gender, occupation and completed studies, but dependency was detected with previous experience in MOOCs (Table 3).

Table 3. Chi-square contrast test level of commitment and profile of the participants.

Contrast between commitment level and participant profile	Number of valid cases	Pearson's Chi-square value	df	Asymptotic significance (bilateral)
Gender	217	3,382	4	0,496
Occupation	213	23,402	36	0,948
MOOC experience	214	31,759	16	0,011
Studies	216	14,903	16	0,532

Therefore, a greater relationship is identified between the level of commitment of the participants to carry out activities (e.g. discussion forums) and previous experience; results that are interesting for educational practice.

Regarding of training needs, considering that the analysis of this indicator at the beginning and at the end of the course did not show significant variability, most of the participants were satisfied with the formation. In addition, according to the contrast test, it is observed that the training needs of those who enrolled in the MOOC are not influenced by factors such as: gender, occupation, MOOC experience and completed studies (Table 4).

Table 4. Chi-square contrast test, training needs and profile of the participants.

Contrast between training needs and participant profile	Number of valid cases	Pearson's Chi-square value	df	Asymptotic significance (bilateral)
Gender	217	1,631	2	0,442
Occupation	213	16,763	18	0,539
MOOC experience	214	8,099	8	0,424
Studies	216	5,515	8	0,701

The results of the training needs are independent of the indicators: gender, occupation, MOOC experience and completed studies.

2.2.2. Communication and interaction practices in relation to the age of the participants

Unlike the analysis of the variables associated with the social construction of learning, which were evaluated with respect to the profile of the participants at the end of the course, the variable of communication and interaction practices with the age indicator are analyzed at two different times, considering the Initial Survey (IS) and the Final Survey (FS), because their perception before and after the MOOC showed an important change (Table 5).

Table 5. Fisher's F hypothesis test between communication and interaction practices and age

Indicators		Sum of squares	gl	root mean square	F	Next.
IS: Competencies to use digital tools: Web browsers, email, Office tools, etc.	between groups	11,734	43	,273	1,071	,370
	within groups	42,808	168	,255		
	Total	54,542	211			
IS: Competencies to use social networks for academic purposes	between groups	16,113	43	,375	1,341	,098
	within groups	47,518	170	,280		
	Total	63,631	213			
FS: Improve the digital skills you already had.	between groups	15,562	43	,362	1,115	,308
	within groups	54,191	167	,324		
	Total	69,754	210			
FS: Development of skills to use social networks for academic purposes	between groups	15,654	43	,364	,904	,642
	within groups	67,643	168	,403		
	Total	83,297	211			

The Table 5 present the contrast between the indicators of the communication and interaction practices variable with the age of the participants at the beginning and end of the MOOC. It is observed that age does not influence the perception of digital

tool skills. However, a significant difference is detected between having the necessary skills to use social networks for academic purposes and the age of the participants, which opens up areas of opportunity for research.

3. Discussion of results

The human being as a social agent seeks training offers in accordance with their academic, work, and personal interests. The main reason why the participants enrolled in the MOOC was that the topic was aligned with their work interests (occupation) and their academic program; however, they do not sign up to establish social relationships, bonds of friendship or contact with other participants interested in energy sustainability (Table 2). MOOCs, characterized by their massive and open nature, attract a large number and diversity of participants [11] who usually self-organize their participation based on their skills, objectives, prior knowledge and shared interests [19, 20]. The participants who sign up for a MOOC find interest in topics related to their profession, personal activities, and they also feel familiar with topics related to the field of energy.

The forum constitutes a source of communication in the MOOC, where a large number of interactions between students take place. The results indicate that the participants, regardless of the profile, were committed to the activities developed in the course, among which it is necessary to highlight the commitment to the fulfillment of the activities that evidenced social interaction such as networking activities or discussion forums. (Table 3), but there was a relationship between this commitment and previous experience in the MOOC, both for those who had already followed a course and for those who took it for the first time. The forum is a usual means of communication for participation in learning conversations, although social networks, blogs and other tools are also used [18]; this social interaction, especially for those who already have this experience, can impact student retention, preventing or reducing feelings of isolation, a perceived problem in online distance courses [10]. Social learning is an essential element in MOOCs to support their impact on the social construction of learning.

Goal setting and strategic planning can be good predictors of goal achievement in the MOOC. Regarding training needs, the participants were satisfied with the training and there was no influence of the profile characteristics (Table 4). Some key elements of the MOOC are in the way in which the participants self-regulate their learning processes, the establishment of objectives, planning and follow-up in the development of activities with interaction, as a more effective way of solving learning problems [27]. ; hence the need for an innovative look to apply learning processes in different social contexts [17], as a way to maintain training satisfaction, through communication networks with mutual support. Planning and self-regulation of learning are essential aspects when setting learning goals, and this is where interaction practices play an important role in meeting the training needs of the participants.

MOOC can be a magnificent opportunity to take advantage of the endless possibilities offered by technologies for the development of digital skills. The age of the MOOC participants did not present significant differences with the development of digital skills; however, this indicator presents significant differences compared to the use of social networks for academic purposes (Table 5). MOOCs offer unique learning experiences [26] through activities, which due to the online nature of the course can help generate the development of digital skills [24]; In addition, through social interaction, participants can network and create professional connections, learn and develop technological skills, taking advantage of the contributions of others [21], which opens the way to create new knowledge, reach a common understanding and encourage collaborative action [12], hence the importance of social interaction processes in learning [13]. In the academic field, online platforms have promoted the development of digital skills and interaction through the use of networks social or discussion forums, which are opportunities to strengthen social learning.

4. Conclusions

The social construction of learning from the perception of the xMOOC participants was based on the interest shown in the topic of energy sustainability, aligned with work interests and academic programs, which could contribute to better job and learning opportunities. In this sense, the commitment of the participants in carrying out activities was independent of the profile, but a greater link was found between the commitment and the previous experience of the participants, which accounts for the interest in carrying out, for example, activities that can enhance social learning such as discussion forums, both for those who have already enrolled in other MOOCs, as well as for those who enroll for the first time.

In addition, the satisfaction of the training needs was evident, regardless of the heterogeneity of the participants' profile, in this way, the innovative projection in the social learning processes could give the MOOC strengths, from the mutual support of the participants, which would give greater value to the educational practice to take advantage of the online nature of the MOOC. Finally, regarding communication and interaction practices, the age of the participants did not significantly influence the development of digital skills, but it did influence the use of social networks for academic purposes. Consequently, in order to understand social learning and strengthen the social construction of learning, it is necessary to promote communication and interaction practices in the xMOOC, considering interests, motivations, as well as previous and acquired knowledge of its participants.

On the other hand, from a theoretical perspective, the main contribution of this study has been to analyze social learning through communication and interaction, which are promoted through practices of dialogue and mutual collaboration, such as discussion forums, for the construction of social learning. On a practical level, this article provides a detailed description of how participants are involved in the

social construction of learning based on their interests and motivations, as well as their previous knowledge and knowledge acquired in the xMOOC.

Regarding the limitations, only the participants who completed the initial and final surveys and who had completed all the activities of the course were considered, so there may be a bias. In addition, studies that investigate the impact of the participants' profile on the social construction of learning would be particularly useful. For future research, additional confirmatory studies are required from the perception of the teaching team that developed the course; and, continue with the analysis of the social construction of learning that contributes new studies towards the design and enhancement of activities or practices, from the generation of innovative responses to the current challenges of social learning and communication and interaction in MOOCs.

Acknowledgments

The present investigation is part of the Doctorate Program on Education in the Knowledge Society, of the University of Salamanca (Spain). The Universidad Técnica Particular de Loja (UTPL) is also thanked for the support of this research. In addition, this work is the result of project funding by CONACYT-SENER (Mexico) through the 'Binational Laboratory for Intelligent Management of Energetic Sustainability and Technological Formation' project (Ref.266632).

References

1. Goglio V, Parigi P (2018) The social dimension of participation and completion in MOOCs. *IEEE*, pp 85–89
2. Guajardo-Leal BE, Gallardo Córdova KE (2021) Engagement, motivation and persistence of xMOOC participants. *Rev Educ Distancia RED* 21:. <http://dx.doi.org/10.6018/red.440241>
3. Shah D (2019) Year of MOOC-based degrees: A review of MOOC stats and trends in 2018. *CI Cent*
4. García-Peñalvo FJ, Fidalgo-Blanco Á, Sein-Echaluce ML (2018) An adaptive hybrid MOOC model: Disrupting the MOOC concept in higher education. *Telemat Inform* 35:1018–1030. <https://doi.org/10.1016/j.tele.2017.09.012>
5. Seaman JE, Allen IE, Seaman J (2018) Grade increase: Tracking distance education in the United States. Babson Surv Res Group
6. Carrera J, Ramírez-Hernández D (2018) Innovative education in MOOC for sustainability: Learnings and motivations. *Sustainability* 10:. <https://doi.org/10.3390/su10092990>
7. Ramírez-Montoya MS, Martínez-Pérez S, Rodríguez-Abitia G, Lopez-Caudana E (2022) Digital accreditations in MOOC-based training on sustainability: Factors that influence terminal efficiency. *Australas J Educ Technol* 164–182. <https://doi.org/10.14742/ajet.7082>
8. UNESCO (2016) *Innovación educativa: Herramientas de apoyo para el trabajo docente*. Cartolan, Lima

9. Conole G (2016) MOOCs as disruptive technologies: strategies for enhancing the learner experience and quality of MOOCs. *Rev Educ Distancia RED*. <https://doi.org/10.6018/red/50/2>
10. Swinnerton B, Hotchkiss S, Morris NP (2017) Making comments in MOOCs: Who is doing all the talking and does it help? *J Comput Assist Learn* 33:51–64. <https://doi.org/10.1111/jcal.12165>
11. Alonso-Mencia ME, Alario-Hoyos C, Maldonado-Mahauad J, et al (2020) Self-regulated learning in MOOCs: lessons learned from a literature review. *Educ Rev* 72:319–345. <https://doi.org/10.1080/00131911.2019.1566208>
12. Krasny ME, DuBois B, Adameit M, et al (2018) Small Groups in a Social Learning MOOC (sIMOOC): Strategies for Fostering Learning and Knowledge Creation. *Online Learn* 22:119–139. <https://doi.org/10.24059/olj.v22i2.1339>
13. Illeris K (2018) An overview of the history of learning theory. *Eur J Educ* 53:86–101. <https://doi.org/10.1111/ejed.12265>
14. Askeroth JH, Richardson JC (2019) Instructor Perceptions of Quality Learning in MOOCs They Teach. *Online Learn* 23:. <https://doi.org/10.24059/olj.v23i4.2043>
15. Muñoz-Rodríguez JM, Torrijos Fincias P, Serrate González S, Murciano Hueso A (2020) Entornos digitales, conectividad y educación. Percepción y gestión del tiempo en la construcción de la identidad digital de la juventud. *Rev Esp Pedagog* 78:. <https://doi.org/10.22550/REP78-3-2020-07>
16. Crane RA, Comley S (2021) Influence of social learning on the completion rate of massive online open courses. *Educ Inf Technol* 26:2285–2293. <https://doi.org/10.1007/s10639-020-10362-6>
17. Kaliisa R, Rienties B, Mørch AI, Kluge A (2022) Social learning analytics in computer-supported collaborative learning environments: A systematic review of empirical studies. *Comput Educ Open* 3:100073. <https://doi.org/10.1016/j.caeo.2022.100073>
18. Moreno-Marcos PM, Alario-Hoyos C, Munoz-Merino PJ, et al (2019) A Learning Analytics Methodology for Understanding Social Interactions in MOOCs. *IEEE Trans Learn Technol* 12:442–455. <https://doi.org/10.1109/TLT.2018.2883419>
19. Liyanagunawardena TR, Lundqvist K, Mitchell R, et al (2019) A MOOC Taxonomy Based on Classification Schemes of MOOCs. *Eur J Open Distance E-Learn* 22:85–103. <https://doi.org/10.2478/eurodl-2019-0006>
20. Walji S, Deacon A, Small J, Czerniewicz L (2016) Learning through engagement: MOOCs as an emergent form of provision. *Distance Educ* 37:208–223
21. Laurillard D (2016) The educational problem that MOOCs could solve: professional development for teachers of disadvantaged students. *Res Learn Technol* 24:29369. <https://doi.org/10.3402/rlt.v24.29369>
22. Sánchez-Rojo A, Martín-Lucas J (2021) Onlife selfhood and intrinsic characteristics of digital technologies: an educational approach. In: Ninth International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'21). ACM, Barcelona Spain, pp 419–422
23. Palvia S, Aeron P, Gupta P, et al (2018) Online Education: Worldwide Status, Challenges, Trends, and Implications. *J Glob Inf Technol Manag* 21:233–241. <https://doi.org/10.1080/1097198X.2018.1542262>
24. Knox J (2018) Beyond the “c” and the “x”: Learning with algorithms in massive open online courses (MOOCs). *Int Rev Educ* 64:161–178. <https://doi.org/10.1007/s11159-018-9707-0>
25. Cruz-Benito J, Borrás-Gene O, García-Penalvo FJ, et al (2017) Learning Communities in Social Networks and Their Relationship With the MOOCs. *IEEE Rev Iberoam Tecnol Aprendiz* 12:24–36. <https://doi.org/10.1109/RITA.2017.2655218>
26. Littlejohn A, Hood N, Milligan C, Mustain P (2016) Learning in MOOCs: Motivations and self-regulated learning in MOOCs. *Internet High Educ* 29:40–48. <https://doi.org/10.1016/j.iheduc.2015.12.003>
27. Min L, Foon HK (2019) Self-Regulated Learning Process in MOOCs: Examining the Indicators of Behavioral, Emotional, and Cognitive Engagement. In: Proceedings of the 2019 4th International Conference on Distance Education and Learning. ACM, Shanghai China, pp 99–105

28. Creswell JW (2002) Educational research: Planning, conducting, and evaluating quantitative. Prentice Hall Upper Saddle River, NJ
29. Creswell JW, Creswell JD (2017) Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications
30. Valdivia Vázquez JA (2017) Encuesta inicial sobre intereses, motivaciones y conocimientos previos en MOOC: Reporte de validación y confiabilidad
31. Valdivia Vázquez JA, Ramírez-Montoya MS, Valenzuela González JR (2018) Motivation and Knowledge: Pre-Assessment and Post-Assessment of MOOC Participants From an Energy and Sustainability Project. *Int Rev Res Open Distrib Learn* 19:. <https://doi.org/10.19173/irrodl.v19i4.3489>
32. Valdivia Vázquez JA, Ramírez-Montoya MS, Valenzuela González JR (2021) Psychometric assessment of a tool to evaluate motivation and knowledge of an energy-related topic MOOC. *Educ Media Int* 58:280–295. <https://doi.org/10.1080/09523987.2021.1976827>
33. Farías Gaytán SC, Ramírez Montoya MS, Aldape P, et al (2017) Estadísticas de Impartición de MOOC's en abril 2017