EVALUATION OF MOOCS LEARNING DESIGN BASED ON CONNECTIVISM

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Abstract: This paper reports on an evaluation and analysis of the instructional design quality of a randomly selected sample of 30 Massive Open Online Courses (MOOCs). The instructional design quality was measured by a Content Analysis Checklist (CAC), an instrument devised by the researcher and evaluated by five experts. The experts were chosen based on their expertise in the Educational Technology field of research. The CAC was derived from the principles of Connectivism Learning theory and related theories. The evaluation results show that the majority of MOOCs scored poorly on most Connectivism principles. The results also indicate that the instructional design quality is low from a connectivism perspective. The paper ends by highlighting the implications for practice and offering suggestions for further research.

Keywords: MOOCs, Instructional Design, Connectivism

INTRODUCTION

Massive Open Online Courses (MOOC) have been made available since 2008, providing opportunities for everyone to learn anything, anywhere, and anytime (Lee et al., 2021) and attracting a massive number of learners all over the world. The term MOOC was used for the first time in 2008 to refer to a large online course, 'Connectivism and Connective Knowledge' conducted by George Siemens and Stephen Downes at the University of Manitoba, attended by 2200 participants from many countries. The course aimed to apply Connectivism principles and demonstrate the 'connectivist' approach to learning, which holds that learning happens through initiating connections to people and resources in the network (Saadatmand, 2017).

The early MOOCs were network-based, with a non-centered structure, and the main activities were to explore and converse rather than rely on the instructor to provide the content. These MOOCs were termed 'cMOOCs' (Saadatmand, 2017). Another type of MOOC started to appear; it was more like an online linear course based on instructor-led content. This type traditionally focused on several short segments of video lectures, after that, learners were required to take quizzes to test their understanding of the content. This type of MOOC was called 'xMOOCs'.

Even though the classification of MOOCs into two types might be appealing, in recent years, both approaches are starting to blend. For example, xMOOCs are now emphasizing more the exchange of ideas and points of view among the community members, while course designers of cMOOCs are trying to organize activities, and resources are becoming less like open-ended seminars with a great number of discussion groups. In other words, both MOOCs are influencing each other's design. This research will avoid insisting on classifying every MOOC into one of these two types and it is important to understand now that the borders between types have increasingly become blurred.

LITERATURE REVIEW

MOOC Instructional Design

Recently, many experts criticized the MOOC's quality and the exaggeration of their impact on education in general and on online learning specifically (Jung, & Oakley, 2019). The concerns mainly highlight that MOOCs have 'high-quality content' but no proper attention to the course design and the overall learning experience. However, not many studies have assessed the learning design effectiveness of MOOCs - even though learning design is a critical part of any course development - because MOOCs call for special measurements to accommodate and engage a higher number of diverse students (Wang, et.al.,2021). In addition, no systematic analysis has been carried out of the quality of instructional design in MOOCs based on the relevant theoretical background.

Even though learning design is considered a trending subject in the MOOC literature (Zawacki-Richter, Bozkurt, Alturki, & Aldraiweesh, 2018), surprisingly few studies on MOOCs have investigated the effectiveness of the pedagogy on its quality (Margaryan et al., 2015).

In some studies, the traditional evaluation tools for online courses (Baldwin, Ching, & Hsu, 2018) were employed to assess MOOCs. In their study, Lowenthal and Hodges (2015) used Quality Matters (QM), the quality assurance framework, which is based on eight general standards. A total of six MOOCs from various providers were evaluated, and none passed the initial assessment. Many approaches can be taken to assess a MOOC's quality. Conventionally, a MOOC's evaluation would depend on the opinions of learners and other key stakeholders. At the same time, some researchers tested learners' experiences of MOOCs (for example Milligan et al., 2013, Wang et al., 2021), focused on the participants' application of learning instead of examining the quality of the learning design from a Connectivism perspective. While the opinions of MOOCs participants are undoubtedly important, the learning design quality of a course is an important aspect when considering the potential and the effectiveness of a MOOC.

However, although the learning design is an important aspect of the overall course, most of the course evaluations do not take account of the key principles of Connectivism in assessing course quality. Therefore, it is important to evaluate a MOOC's design quality by drawing on Connectivism principles. So far, no published studies on the learning design quality of MOOCs based on Connectivism principles are available. This research addresses this gap, by assessing the learning design quality of a sample of MOOCs (30 courses in total). The quality of these MOOCs was evaluated and analyzed from the perspective of Connectivism and the underlying theories. The study seeks to find out whether or not, and to what extent the design of these MOOCs reflects the principles of Connectivism.

The first step is to determine the key principles of MOOCs' learning design from the Connectivism perspective as the basis of the Content Analysis Checklist. Next, the methodology of the research is explained, followed by an explanation of the creation of the 'Content Analysis Checklist' instrument used to assess the design quality of the MOOCs'. In the third step, the findings of the study are presented, leading finally to an outline of the discussions and conclusions.

Theoretical Framework

Connectivism

The term "connectivism" was created by George Siemens in 2004, and it was a declaration of a new approach to online learning. The new approach relies heavily on networks and a learning community. It combines some basic aspects of network learning, and at the same time, it is a process that occurs within a learning environment. Siemens' approach was based on perceiving knowledge as something not necessarily existing within an individual learner, but likely to be existing in the community or the network itself. Therefore, learning can take place in any network, not just in the individual. This approach also sees learning as a dynamic, constantly changing process.

Connectivist Pedagogy

Connectivist learning stresses on creating and preserving connections through the network. Information is regarded as abundantly available and the learner's role is not to remember everything, but to possess the ability to search for and to apply knowledge when necessary. Connectivism assumes that many of the mental processes should be assigned to the machines rather than to the learners' brains.

Connectivist learning relies on the abundance of network connections among different entities including learners, artifacts, and content. The most important task of creating Connectivist education is to expose learners to networks and provide them with many opportunities to gain network-based skills and to help them develop their presence in the network. Connectivist learning takes place better within network contexts, unlike the individual or group contexts (Saadatmand, 2017).

In Connectivist learning, learners are knowledge producers rather than mere consumers. Learners should be encouraged to reflect and distribute knowledge through blogs, social media posts, and webcasts. Learners in Connectivist learning should be encouraged to build up their own social presence through building and maintaining

connections with current and past learners and with those who know whatever is relevant to their learning goals. Learners can create and maintain a social presence through numerous activities such as creating artifacts, leaving comments, sharing their insights. All these efforts enrich and build up useful materials for new learners. All the activities done by past users are mined through network analytics and presented as guide points and pathways of knowledge that new learners can learn from and follow (Dowens, 2017).

Learners and learning needs are changing. Course designers must shift their design strategies from designing instruction sequences to creating networks, environments, access to a rich array of resources, and activities that will help learners forage for their knowledge. Connectivist learning focuses more on creating guide points along the learning path, not forcing learners to walk through predetermined paths. A well-designed learning experience is to provide the environment in which a learner will choose to learn. The majority of learners have their self-created objectives. Hence, course objectives should not be the only focus point for learning design.

Learning designers must look at learning as a process without fixed starting or ending points. Learning needs to be designed as an activity that happens within a learning community. The designer's task is to build the right ecology for continued learning. Learners themselves will seek and acquire needed elements. The designer's focus must be widened; instead of only designing instructions, they must see the whole learning environment and accessibility to resources as important objects of the design and the strategy. Control must shift to the learner. The learning design should focus on allowing learners to choose what they think is important to them. In connectivism learning design, information retention is as important as the creating of strong and consistent connections that will be available easily whenever it is needed. In connectivism learning, teaching is the process of facilitating the connections within the whole community. It becomes the process of helping learners and the whole community to test and discover connections in their paths.

Connectivist Learning Network

Networked learning is simply the use and deployment of new technologies, with pedagogical informed strategies comprising a mixture of online and offline resources, allowing more freedom and flexibility for learners and emphasizing both informal and non-formal learning (Saadatmand, 2017). The fact is that connectivism and networked learning have so many aspects in common, and that both emphasize the significance of making and maintaining connections in the learning processes (Francis Brouns et. al, 2017).

The theory of connectivism addresses how learning occurs in today's sophisticated social environments (Francis Brouns et. al, 2017). Its foundation is based on networks and technological abundance and the fact that knowledge is growing overwhelmingly in the digital world. Connectivism also addresses the elements involved in the learning design process and how they can be used within a networked ecology (Conole, 2016). From the connectivism perspective, knowledge can be stored in a variety of digital formats and is distributed across information networks (Downes, 2017).

The Connectivist Learning Environment

MOOCs have changed the way we perceive of online learning. We now look at learning in MOOCs as "ecologies" and communities rather than as classrooms. It has changed the structure of the content from hierarchical to distributed (Saadatmand, 2017). MOOCs are evolving "digital learning environments". MOOCs as a new form of digital learning ecology is often seen as technologically based innovation (Conole et al., 2008), changing the common understanding of learning environments.

A great number of research studies have outlined characteristics of connectivist learning environments. For example, Siemens stated that learning environments have many components (Siemens, 2003): They are not structured but informal. Participants must be allowed to create their own objectives and own learning pathways according to their needs. It is tool-rich, meaning that it should provide many options for users to reach information resources and connect with them. It is consistent, meaning that discussions and activities should not fade away in time. Participants need to see a consistently evolving environment, a trusted and safe environment. This means that even though it is online, it is timely, and a synchronous connection between the learning community should be available. It is needed to give the feeling of trust and comfort. It must have a high tolerance for experimentation and failure. The learning environment is simple and balanced. The tools for social interaction and course content should reflect the simplicity of the learning environment. Even the greatest ideas can fail because of complexity.

The learning environment must be decentralized and connected instead of being centralized and isolated. The learning environment of MOOCs also must have a space for learners to express themselves, through blogs or journals. It must have a space for discussion and dialogue. It is important also to have a space where learners can learn in a structured manner (e.g., videos, tutorials). From the point of view of this research, this ecological perspective that blends learning and technology gives a remarkable insight into how learning designers can think of learning in MOOC environments. Social and cultural change should be linked with ecology-designed learning. This will remove boundaries and open up new possibilities for creating integrated, relevant learning.

Characteristics of Connectivist learning

1. It is **Diverse**. This is one of the main concepts of connectivist learning. Diversity includes many aspects, such as the diversity of people, geographical location, and culture. Learning styles can also consider one aspect of diversity (Downes, 2013). While the resources offered in the traditional LMS online learning are standardized, connectivist learning encourages the concept of diversity of resources, numerous educational styles, and more. Hence, the diversity concept is not confined to only the members of a learning network but also encompasses the use of diverse resources and technologies.
2. It is **Autonomous.** It means that learners can control and direct their own learning: what to learn, when and how, with the instructor's guidance (Amaya et.al., 2013). They select from connections and resources. Learners are encouraged to choose, act and decide on their learning freely. They can also choose whether or not to participate in an activity. Learners need to feel that they are acting voluntarily and participating in an activity of their own free will, instead of being forced into it. However, autonomy does not mean that guidance from instructors is not needed at all. Barnett et al. (2013) stated that it was a mistake when the instructors stood too far from the students; while it was intended to emphasize student autonomy, it increased the feeling of inequality instead, as students felt that their teachers were keeping knowledge and information from them. Therefore, they suggested that instructors should be active members of the learning network.
3. It is **Interactive**. As MOOCs rely on the abundance of networks, the content is not centralized, it does not exist or occur at one place or in one direction. Hence, network nodes are in a constant interactive state. Different contents are being conveyed from many distinct sources (Downes, 2017).
4. It is **Open.** The term "openness" in MOOCs refers mainly to the accessibility to free and open-licensed resources. It also refers to its being open for enrolment for everyone without prerequisites. (Sadatmand 2017, Dowens 2013). Openness also includes the availability of many varieties of applications and tools that allow access to new educational information, such as videos, textbooks, and other online courses. One of the main advantages of openness in MOOCs is the availability of great opportunities for interaction among participants in the learning environment (Sharov et., el. 2020, Woon, 2019).
5. It is **Online**: This part of the MOOC means that the course is fully online. The entire content and activities are online – which is an exclusive feature of MOOCs. Moreover, a MOOC should not be attached to any physical location (Woon, 2019, Downes, 2013; Siemens, 2013).
6. It is **Decentralized**. The MOOC learning networks are decentralized. This gives learners the flexibility to select what information and resources to connect. Therefore, the learning network is always in a dynamic state, where some nodes in the network will have many links while the majority will have only a few. This also includes unbundling of educational services, therefore educational institutions are forced to make their delivery models more flexible and accessible in response to learners' demands (Saadatmand 2017, Yuan & Powell, 2013).
7. It is **Distributed**. From a learning design standpoint, a MOOC's design ought to be distributed, hence, the activities and interactions will happen regardless of time or space obstacles and across different contexts. In distributed learning, learners are able to reach network nodes located in different physical locations and have access to knowledge not necessarily related to the same field of the MOOC (Saadatmand, 2017; Bates, 2014). The rapid and constant development of information technology and new learning forms have emerged, offering universal learning, and putting the responsibility on educational institutions to come up with open and distributed learning interventions (Saadatmand, 2017; deWaard et al., 2011; Kop & Fournier, 2011). MOOCs have changed the view of the learning process from taking place only in classrooms to "ecologies", and the content is distributed rather than hierarchical. Hence, it is more accessible to learners (Saadatmand & Kumpulainen, 2014).
8. It is **Dynamic.** The MOOC network is in a constantly changing state, as students keep producing new knowledge and contributing new products to the learning environment. This results in a dynamic, constantly changing network and content. Therefore, learners should have the ability to interact, create and share new content in the network. The flexibility and the constantly changing nature of knowledge need a learning

design that can accommodate learners' needs, integrating technology, using an appropriate pedagogical approach connected to learners' physical and digital worlds across multiple locations and networks. Dynamic learning is based on connections between things, learners, activities, and locations. Learning designs should orchestrate the employment of technology to serve the learning purpose (Esposito et al., 2015).

METHOD

Instrument Creation

To evaluate the intended sample of MOOCs, the researcher had to create the Content Analysis Checklist (CAC) based on the Connectvism principles and the characteristics of Connectivsit learning mentioned in the previous sections. After a thorough review of the related literature, a list comprising 46 items was made to be included in the CAC. The CAC was validated after that by conducting the CVI analysis.

For the content validation, the first thing to do was to create the content validation form to make sure that the panel of experts would understand the task clearly. The second step was to select the panel of experts. The selection criteria were based on individual expertise. All the chosen experts in the validation panels should have at least 5 years of field experience in instructional design and must have completed at least a postgraduate degree in instructional design or any related field of study.

Table 1
The Panel of Experts

#	Degree	Department	Years of Ex.	Institution
Exp 1	PHD	Educational Technology	20	Cairo University
Exp 2	PHD	Educational Technology	20	Cairo University
Exp 3	PHD	Educational Technology	15	Cairo University
Exp 4	PHD	E-Learning	15	Institute of Public Administration
Exp 5	Masters	E-Learning	10	Institute of Public Administration

The third step was sending the validation form to the panel along with clear instructions. The experts were expected to review the instrument items and provide a score on each item. The experts were encouraged to give comments on each item to suggest any improvements or changes needed to achieve relevance and clarity.

Table 2
The Measures That the Experts Used to Review the Instrument Items

Are the items relevant to the concept/construct being measured?	Is the wording of the item clear? (i.e., easy to understand?)
1- Not relevant	1- Unclear / Not easy to understand
2- Somewhat relevant	2- Somewhat clear / Somewhat easy to understand
3- Quite relevant	3- Quite clear / Quite easy to understand
4- Highly relevant	4- Highly clear / Very easy to understand

The last step was calculating the I-CVI, S-CVI/AVE, and the S-CVI/UA. The S-CVI/AVE was calculated for both relevance and clarity and scored 0.970 and 0.974 respectively. The S-CVI/UA for both domains were 0.852 and 0.870 respectively, which means that the instrument was valid for measuring the extent to which connectivism principles are presented in today's MOOCs.

Table 3
The Responses of the Experts and The Calculation of The I-CVI and S-CVI for The Relevance of the Instrument Items Are Based On the Experts' Review

	Relevance						
	R1	R2	R3	R4	R5	Number of agreements	I-CVI
Item 1	4	4	4	4	4	5	1
Item 2	4	4	4	4	4	5	1

Item 3	4	4	4	4	4	5	1
Item 4	4	4	4	4	4	5	1
Item 5	4	4	4	4	4	5	1
Item 6	4	4	4	4	4	5	1
Item 7	4	4	4	4	4	5	1
Item 8	4	4	4	4	4	5	1
Item 9	4	4	4	4	4	5	1
Item 10	3	4	4	4	4	5	1
Item 11	4	4	4	4	4	5	1
Item 12	4	4	4	4	4	5	1
Item 13	3	4	4	4	4	5	1
Item 14	4	4	4	4	4	5	1
Item 15	4	4	4	1	4	4	0.8
Item 16	4	4	4	4	4	5	1
Item 17	4	4	4	4	4	5	1
Item 18	4	4	4	4	4	5	1
Item 19	4	4	4	4	4	5	1
Item 20	4	4	4	4	4	5	1
Item 21	4	4	4	4	4	5	1
Item 22	4	4	4	4	4	5	1
Item 23	4	4	4	4	4	5	1
Item 24	4	4	4	4	2	4	0.8
Item 25	4	4	4	4	2	4	0.8
Item 26	4	4	4	4	4	5	1
Item 27	4	4	4	4	4	5	1
Item 28	4	4	4	4	4	5	1
Item 29	4	4	4	4	4	5	1
Item 30	4	4	4	4	4	5	1
Item 31	4	4	4	4	4	5	1
Item 32	4	4	4	4	4	5	1
Item 33	4	4	4	4	4	5	1
Item 34	4	4	4	4	4	5	1
Item 35	4	4	4	4	4	5	1
Item 36	4	4	4	4	4	5	1
Item 37	4	4	4	4	2	4	0.8
Item 38	4	4	4	4	2	4	0.8
Item 39	4	4	4	4	2	4	0.8
Item 40	4	4	4	4	2	4	0.8
Item 41	4	4	4	4	4	5	1
Item 42	4	4	4	4	4	5	1
Item 43	3	4	4	4	4	5	1
Item 44	4	4	4	4	4	5	1
Item 45	4	4	4	4	4	5	1
Item 46	4	4	4	4	4	5	1

Item 47	4	4	4	4	4	5	1
Item 48	4	4	4	4	4	5	1
Item 49	4	4	4	4	4	5	1
Item 50	4	4	4	4	4	5	1
Item 51	4	4	4	4	4	5	1
Item 52	4	4	4	4	4	5	1
Item 53	4	4	4	4	4	5	1
Item 54	4	4	4	4	2	4	0.8
						S-CVI/Ave	0.970
						total agreement	46
						S-CVI/UA	0.852

Table 4
The Responses of the Experts and The Calculation of The I-CVI and S-CVI for The Clarity of the Instrument Items Are Based On the Experts' Review

	Clarity						
	R1	R2	R3	R4	R5	number of agreements	I-CVI
Item 1	4	4	4	4	4	5	1
Item 2	4	4	4	4	4	5	1
Item 3	4	4	4	4	4	5	1
Item 4	4	4	4	4	1	4	0.8
Item 5	4	4	4	4	4	5	1
Item 6	4	4	4	4	4	5	1
Item 7	4	4	4	4	4	5	1
Item 8	4	4	4	4	4	5	1
Item 9	4	4	4	4	4	5	1
Item 10	4	4	4	4	4	5	1
Item 11	4	4	4	4	4	5	1
Item 12	4	4	4	4	4	5	1
Item 13	4	4	4	4	4	5	1
Item 14	4	4	4	4	4	5	1
Item 15	4	4	4	1	4	4	0.8
Item 16	4	4	4	4	4	5	1
Item 17	4	4	4	4	4	5	1
Item 18	3	4	4	4	2	4	0.8
Item 19	4	4	4	4	4	5	1
Item 20	4	4	4	4	4	5	1
Item 21	4	4	4	4	2	4	0.8
Item 22	4	4	4	4	4	5	1
Item 23	4	4	4	4	4	5	1
Item 24	4	4	4	4	2	4	0.8
Item 25	4	4	4	4	1	4	0.8
Item 26	4	4	4	4	4	5	1
Item 27	4	4	4	4	4	5	1
Item 28	4	4	4	4	4	5	1

Item 29	3	4	4	4	4	5	1
Item 30	4	4	4	4	4	5	1
Item 31	4	4	4	4	4	5	1
Item 32	4	4	4	4	4	5	1
Item 33	4	4	4	4	4	5	1
Item 34	4	4	4	4	4	5	1
Item 35	4	4	4	4	4	5	1
Item 36	4	4	4	4	4	5	1
Item 37	4	4	4	4	4	5	1
Item 38	4	4	4	4	4	5	1
Item 39	4	4	4	4	4	5	1
Item 40	4	4	4	4	4	5	1
Item 41	4	4	4	4	4	5	1
Item 42	4	4	4	4	4	5	1
Item 43	4	4	4	4	4	5	1
Item 44	4	4	4	4	4	5	1
Item 45	4	4	4	4	4	5	1
Item 46	4	4	4	4	4	5	1
Item 47	3	4	4	4	4	5	1
Item 48	4	4	4	4	4	5	1
Item 49	4	4	4	4	4	5	1
Item 50	4	4	4	4	4	5	1
Item 51	4	4	4	4	4	5	1
Item 52	4	4	4	4	4	5	1
Item 53	4	4	4	4	4	5	1
Item 54	4	4	4	4	1	4	0.8
						S-CVI/Ave	0.974
						total agreement	47
						S-CVI/UA	0.870

Data Collection Procedure

Data was collected between June and December 2020. An in-depth examination was earlier made of each of 30 MOOCs in the sample, carefully studying all the course elements such as, materials, and resources, learning activities, submissions, and also the discussions that took place in the course forums. Hence, all the course modules were examined in detail.

The Content Analysis Checklist is based on Connectivism principles. The full Content Analysis Checklist instrument is enclosed in Appendix A. The Content Analysis Checklist has 4 sections: 1) Course Details; 2) Course pedagogy; 3) Course network; 4) Course learning Environment. Part 1 consists of open-ended questions about the course (such as course title, course dates, name of course instructor). Parts 2, 3 and 4 contain both dichotomous (Yes/No) and four-point Likert-scale items (None-0; To some extent-1; To a large extent-2; To a very large extent-, 3). 'No information' is provided where relevant.

Sampling

This Content Analysis Checklist aimed to answer these questions:

1. To what extent are the Cconnectivism principles applied in the design of present-day MOOCs?

2. To what extent are the networked learning principles applied by instructional designers in the design of present-day MOOCs?
3. To what extent are the digital learning environment principles applied by instructional designers in the design of present-day MOOCs?

Three key criteria for the inclusion of MOOCs were in the research. First, courses must be in English, which is the second language of the researcher. Second, the course platform had to be open for free, and available within the timeframe of the research. Thirdly the MOOC must be open for enrolment for free. After examining the different MOOC providers and various platforms, only MOOCs from three MOOCs platforms were chosen (Coursera, EDX, and Future Learn). These three platforms have the highest enrolment worldwide compared to other MOOC providers. A total of 30 courses were chosen randomly from each platform: 11 courses from Coursera, 11 courses from EDX, and 8 courses from Future Learn.

RESULTS

The majority of MOOCs scored a low score on including most of the connectivism principles (Table 4.3) For each course, the range of possible scores was 0-144, with 0 indicating that none of the Connectivism principles and criteria were reflected in the course, and 144 indicating that all principles and criteria were reflected a very high standard. The researcher found that for the overall sample of 30 MOOCs, the range of scores was 0-100 points with a mean value of 84.36 and (STD 6.50). Detailed findings are outlined in the appendix. The results are summarized and discussed below.

1. To what extent are the connectivism principles applied in the design of present-day MOOCs?
   Questions 7 to 19 aimed at identifying to what extent the MOOC's instructional design reflected the Connectivism pedagogy. The majority of MOOCs attained low scores in this domain. Out of the full score of 36 points in this domain, the average score was 20.76. Although most of the MOOCs were open for enrolment, only half of the MOOCs included activities outside of the MOOC platform. In addition, 93.33% of the MOOCs did not allow learners to key in their own objectives to address the autonomous principle. Furthermore, where the diversity principle was concerned, the majority of MOOCs (76.67%) did not allow peer assessment nor any effective contribution from learners that would change the MOOC content dynamically with learners' contribution. The findings are shown in Table 2 in the appendix.

2. To what extent are the network learning principles applied in the design of present-day MOOCs?
   The third domain aimed to identify to what extent the MOOC instructional design reflected the network principles to connect learners with the knowledge and with their instructors. Most MOOCs obtained low scores in this domain with an average score of 17 out of 42 points. For example, the weight of connections in 90% of the MOOCs and the flow of information were not distributed among the course networks. In addition, 83.33% of the MOOCs had particular connections magnate all the connections which consider against the proper formation of MOOCs networks. In addition, there were single points of failure of the MOOC, which defies the purpose of the MOOC's existence as a community of knowledge. Therefore, the majority of MOOCs needed major infrastructure, such as powerful servers, large bandwidth, and massive storage. Moreover, the majority of MOOCs did not use the learner's digital footprint to give constant feedback to increase the learner's knowledge acquisition or feedback on activities performed. The findings are shown in Table 3 in the Appendix.

3. To what extent are the digital learning environment principles applied in the design of present-day MOOCs?
   The fourth domain aimed to identify to what extent the instructional design of MOOCs used the concepts of the learning environment. In this construct, the majority of MOOCs obtained low scores. Out of a possible 66 points, the average score was 46.6 with an SD score of 3.69. For example, 86.67% of the MOOCs did not have any live events and in 90% of the MOOCs, the instructor did not provide video updates to summarize comments. Also, 93.33% of the MOOCs did not have any synchronous communication tools with learners or with instructors. None of the MOOCs had any identification mechanism to promote experienced learners in the learning environment. The findings are shown in Table 4 in the Appendix.

DISCUSSION

This research has provided a critical and systematic analysis tool based on the Connectivism learning theory to evaluate the learning design quality of MOOCs. The researchers also validated this instrument using the Content Validity Index analysis. A total of five experts participated in evaluating this instrument. The researchers analyzed the quality of the learning design of 30 randomly selected Massive Open Online Courses (MOOCs), including courses from three main platforms: Coursera (11 MOOCs), EDX (11 MOOCs), and Future Learn (8 MOOCs). The researcher found limited evidence of the use of Connectivsm principles in the design of these MOOCs.

Even though the majority of the courses applied some of the principles, most of them scored low on the extent to which the Connectivism principles were employed. In addition, there were no courses that appeared to have implemented all of the connectivism principles. This result was supported by the fact that out of 144 points that could be scored by each course in the Content Analysis Checklist, the highest score for one MOOC was only 100 points. The findings indicate that from the Connectivism perspective, the learning design quality of MOOCs is essentially low.

This study uses Connectivism principles to highlight a number of important aspects which could improve the learning design of these courses. In massive online courses, implementing some of the principles, for example, providing learners with feedback, is an important task. Universities and educational institutes must redesign their offerings of MOOCs and implement new models that can foster connectivism principles for their education to become more effective. Many learners sign up to attend MOOCs by the 'reputation' of the universities, hoping for high quality education that is normally linked to these institutions. However, what learners encounter in a MOOC is not always as good as expected.

The reasons for the lack of Connectivism principles in the learning design of MOOCs can be speculated upon, and the reasons for the limited implementation of the Connectivism principles in the instructional design principles within MOOCs can be explained. For example, lecturers, teachers and designers of the MOOCs may lack knowledge of the Connectivism principles. In addition, changes need to be made to the contemporary instructional design principles to accommodate the new nature of MOOCs. Even though some designers are aware of the principles in their normal teaching and design practices that they routinely use in their classroom teaching, they seem to forget to apply those in their MOOCs. And most importantly, few studies have reported effective connectivism learning design approaches for MOOCs.

This study has highlighted some of the basic principles of connectivism for course designers and MOOC creators. The results of this study can be used to guide further research in creating new designs and frameworks for MOOCs. In addition, this study opens the door for further studies to develop actual MOOCs using the Content Analysis Checklist generated for this study to guide the MOOC creation. This CAC can also be used in other studies to create a Connectivism-based Instructional design model or framework. The new model or framework can be used in creating a MOOC. The CAC could possibly be used to evaluate other MOOCs and it can be further refined based on the findings of other studies.

Further research is also recommended in the use of the Content Analysis Checklist to evaluate more MOOCs. The CAC was the first evaluation tool with the proper theoretical foundation to evaluate MOOCs. The CAC can be further adapted and modified according to the needs of each study. Using the evaluation results as a guide, both instructional designers and learners in distance learning programs will find this study useful for improving the design of MOOCs.

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