User Experience in Cloud Computing Services-Based LMS: a Case Study

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Abstract

The impact of user experience on applications used as learning tools is particularly significant, especially in the context of information technology-based applications. Considering the limited knowledge of elementary school teaching staff in information technology, there's a likelihood that they would gravitate towards familiar or commonly used applications for teaching, especially when transitioning to online learning during the immediate challenges posed by the Corona pandemic. To understand this dynamic, this study delves into the user experience of a Learning Management System (LMS) based on Cloud Computing Services. The research focuses on one of elementary school in Bantul Regency, Indonesia, employing a mix of qualitative and quantitative techniques, comparing and referencing various user experience literature on similar platforms. Results indicate that a substantial 79.4% of users found the LMS application, particularly the Google Classroom platform based on Cloud Computing Services, easy to use. However, a portion of users opted for alternative platforms, indicating the need for varied approaches in the learning process. Overall, the LMS application proves to be effective, with its features adequately supporting the teaching and learning journey from educators to students.

Keywords: User experience, UX, LMS, Cloud Computing Service, e-Learning

1. INTRODUCTION

In 2003 Indonesia implemented a Distance Learning System regulated in Law no. 20 of 2003, which states that All lines, levels, and forms of education can be taught remotely. With the help of learning resources and services, as well as an evaluation system that guarantees graduates meet national education requirements, distance education is delivered in a variety of ways and across a range of geographic locations [1]. In general, and the priority, according to Law No. 20 2003, education is carried out face-to-face, whether it is for formal, non-formal, or informal education.

With the Corona Virus Diseases 2019 (COVID-19) finally The WHO deemed it a global public health emergency on January 30, 2020 [2]. Therefore, Circular Letter

Number 4 of 2020 concerning the Implementation of Education Policies in the Emergency Period of the Spread of COVID-19 was issued by the Minister of Education and Culture of the Republic of Indonesia on March 24, 2020. In order to give students meaningful learning experiences, the Circular explains that the learning process is carried out at home through online or distance learning [3]. However, the school's learning process is quite a hassle because there is no readiness to support knowledge for implementing the online learning process.

The online learning process using the LMS platform cannot be separated from the involvement of Cloud Computing technology. According to NIST [4], Cloud Computing definition is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources, with minimal service provider interaction.

Due to a lack of communication support during the Covid-19 pandemic, teachers are forced to use social networks or other applications that are familiar for everyday use outside of e-Learning [5]. For the online learning process, specific applications can be used, namely the Learning Management System (LMS) [6]. Teachers and students can use e-learning platforms as a flexible tool that is accessible from anywhere at any time. Students can quickly and easily contact their teacher and obtain the assistance they need without worrying about their peers thanks to the ease with which e-learning materials can be updated or rewritten [7]. In one of the elementary schools in Bantul Regency, Indonesia, namely SDIT (Integrated Islamic Elementary School) Salsabila 4 Jetis [8]. With all the limitations of technological knowledge, many teachers at SDIT Salsabila 4 Jetis use social media, one of which is by using WhatsApp chat media [9]. The limitations of technological knowledge happen due to a lack of knowledge of LMS technology, and the applications that are often used are only social media and WhatsApp chat [10]. This research aims to measure user experience on a cloud service-based learning management system (LMS).

A case study will be discussed regarding how user experience in Learning Management System Based on Cloud Computing Services within the scope of elementary school SDIT Salsabila 4 Jetis Bantul Regency, Indonesia, by the teacher, to students and parents who accompany students during the online learning process.

2. METHODS

The method used in this research is a combination of qualitative and quantitative techniques with several stages developed as shown in Figure 1.
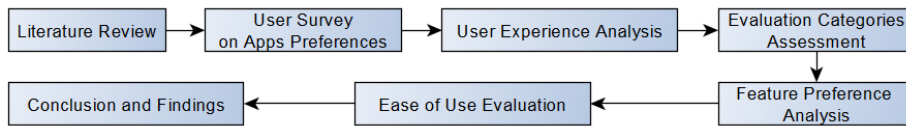
Figure 1. Research method development stages

2.1. Study Literature

Without the need to install software or buy a database server to store the data, users (lecturers or students) can access the LMS via a browser thanks to cloud-based technology [11]. Ouadoud [12] in his research explain several learning principles that exist in LMS in general, that is: 1) Describe the types of teaching and learning activities to be carried out. 2) Determining who the perpetrators are or groups of actors according to the roles and tasks to be completed. 3) Describe the media activity process in the learning system. In activities, you can take advantage of various kinds of resources such as discussion forums, materials (video, audio, wiki).

Massive Open Online Courses (MOOC) are online courses that are publicly available and can be accessed by everyone, either free of charge or by subscription. MOOCs provide interactive courses with forums or social media discussion features for users to support among students, teaching assistants (TA), teachers, professors, practitioners, and direct evaluation in the form of assignments, quizzes, or hands-on labs. The characteristics of the MOOC as described from the results of the analysis of Mahajan [13] according to the extension of the MOOC are: Many participants, Open to the public, Digital-based (Online), and Pedagogic Concepts. There are 3 types of MOOCs seen from the structure and content of the courses delivered, specifically: 1) xMOOC: This course is related to the university, and the methods structure, and setting are similar to those found in university courses [14]. 2) cMOOC: The course structure is open, which caters for personalized training as needed. The concept of content and structure in this course is to generate learning through exchanging ideas and information and the participation of a group of people [15]. 3) Task-based MOOC: This third type of MOOC combines the two previous courses, xMOOC, and cMOOC. This course emphasizes students' skills to complete activities or solve problems by following a practice-based method [16], [17].

2.2. User Experience in LMS and MOOC

The methods for assessing satisfaction with interface design are UMUX-Lite and SUS, in the experiment conducted by Korableva [18] involves 60 respondents. The platforms' descriptive characteristics were produced using adjectives that define

how users engage with the platform, according to the interface evaluation as shown in Table 1.

Nurhudatiana [19] examined the user experiences of Coursera and Udemy, two well-known MOOC platforms, in relation to seven honeycomb user experience (UX) dimensions: usability, desirability, findability, accessibility, credibility, and value. 77 millennials in Jakarta, Indonesia were the subjects of the study. Lastly, it is suggested that the MOOC platform enhance its user interface design's learning capacity to make it easier for new users to become familiar with using the platform.

Tabel 1. User expression of interacting experience

User expression	Adjectives words
simplicity and accessibility	"helping", "understandable".
difficult and hard to understand	"visual", "simple", "easy to master", "expected", "structured".
pleasant and creative	"difficult to master", "overloaded", "unpredictable", "entangled", "complex", "incomprehensible", "incommodious".
unpleasant and outdated	"good", "reliable", "interesting", "fascinating", "welcoming", "creative", "fast", "advanced", "modern", "exciting", "attractive", "enjoyable", "innovative", "beautiful", "pleasant".

The general mechanism used to evaluate web user experience to measure user experience on MOOCs, the following tools were used to evaluate MOOC platforms: SortSite, achecker, and pigdom [17]. After obtaining the results, certain factors relevant to user experience were selected by comparing several MOOC platforms, and the results are shown in Figure 2.
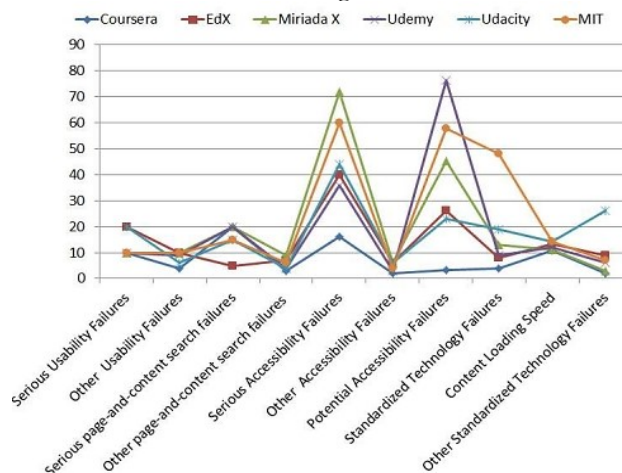

Figure 2. Comparison of parameters of user experience according to the assessment of the weighting coefficient [17]

In their study, Najafi [20] found that the learner's experience in this unique style of self-directed online learning was positive. However, even students with relatively high levels of self-efficacy and task scores tended to ignore their completion intentions in the context of on-demand MOOCs with low instructor presence and peer involvement. While tackling grade-task in on-demand MOOCs is more difficult because of the learner's desire to find courses that meet their particular learning needs, self-efficacy can still be boosted through customized instructional tactics.

System Usability Scale: SUS is used to measure the usability of a particular system in LMS. The System Usability Survey (SUS) consists of ten basic questions that are as follows: do I enjoy using this system frequently? Is it overly complex? Is it easy to use? Do I require technical assistance to use this system? Are there too many inconsistent functions in this system? Most people would pick up on using this system very quickly. Is it very difficult to use? Do I feel comfortable using this system? Do I need to learn before I can use it? The SUS scores of 41 respondents varied. Specific SUS scores of each LMS platform are Moodle 27 (65.85%), Google Classroom 9 (21.95%), and Other 5 (12.20%) [21].

Reference [22] did a mixed methods study to investigate instructor motivations for teaching massive open online courses (MOOCs) and instructional innovations used to improve MOOC design. Using problem-based learning, service learning in MOOCs, and shortening video lengths were among the educational advances cited by MOOC instructors. The majority of these MOOC teachers were pleased with their course concepts.

2.3. LMS as Cloud Computing Service

In Opportunities and Challenges, LMS should delivering and organizing online course easily, learning materials are available to access from everywhere, make communication and interactivity in task and assignment, and possible to saving time and money for students and faculties [23]. Cloud computing services should be able to maintain privacy and security as much as possible; it is essential to get cloud computing services that provide privacy guarantees. Conceptually, an overview of Cloud Computing is shown in Figure. 3 [24]. There are five characteristics of Cloud Computing [25]:

1) On-demand self-service. Consumers can manage computing capabilities according to their needs, such as CPU specifications, memory, storage, network, and even server locations, by themself.
2) Broad network access. The service is available over the network and can be accessed through standard mechanisms from anywhere and from any device.
3) Resource pooling. The provider has pooled computing resources to serve multiple consumers using a multi-tenant model.

4) Rapid elasticity. Computing services can be provided or not used, added, or subtracted elastically and automatically to adjust the need for expansion or reduction as needed.

5) Measured service. Cloud systems automatically control and optimize resource use by measuring methods at an abstraction level appropriate to the type of service.

Figure 3. Cloud Computing architecture

There are three services models from Cloud Computing [26], specifically:

1) Software as a Service (SaaS). Consumers can use cloud-based provider applications and can be accessed from various client devices such as web browsers or program interfaces. However, the consumer cannot manage, configure or control the service system.

2) Platform as a Service (PaaS). Consumers can use cloud-based provider applications. Applications can be accessed from various client devices such as web browsers or program interfaces. Consumers can manage, configure or control the system from these services at the data and application layers for deployment needs and application-hosting environments.

3) Infrastructure as a Service (IaaS). Consumers can use cloud-based provider applications. Applications can be accessed from various client devices such as web browsers or program interfaces. Consumers can manage, configure or control the system from these services at the data and application layers for deployment needs and application-hosting environments. Furthermore, consumers can also control operating systems, storage, deployed applications; and possibly limited control of select networking components (e.g., host firewalls).

There are four deployment models of Cloud Computing [27], which are:
1) Private cloud. The Cloud Service is provided for exclusive use by a single organization consisting of multiple consumers (for example, a business unit or a not-for-profit organization).
2) Community cloud. Cloud services are provided for exclusive use by specific consumer communities of organizations that share common concerns (mission and goals, specific interests, or research).
3) Public cloud. Cloud services are provided for open use by the general public. This Service may be used, managed, and operated by a business, academic, government organizations, or a combination.
4) Hybrid cloud. Cloud services provided are a composition of two or more distinct cloud services (private, community, or public), bound together by standard or proprietary technologies that enable data and application portability.

3. RESULTS AND DISCUSSION

3.1. Evaluation and Assessment

In the research conducted, two applications were used for the learning process at SDIT Salsabila 4: Google Classroom and WhatsApp; this was obtained from a survey conducted on 20 teachers, shown in Figure 4. The WhatsApp application is also partially used by teachers. We will analyze the types of applications from these two applications by comparing the characteristics of cloud computing-based applications, shown in Table 2. It can be concluded that the Google Classroom application as an LMS and the WhatsApp application as a chat application for communication are included in the criteria for a Cloud Computing-based application.

In this study, the user experience of Google Classroom as a Cloud Computing Services-Based Learning Management System will be examined. The WhatsApp application was not included in the user experience analysis, because it is a communication application and is not an LMS.

Based on the synthesis of literature from LMS and MOOC, it is found that the Google Classroom application is included in the category of LMS. The case study in this research is limited to the scope of one institution to focus more on the user experience per individual. In this research, the institution used as a case study is SDIT Salsabila 4 Jetis Bantul Regency, Indonesia. The school has 3 class groups for each generation. Each class group consists of 15-20 students. According to data from the Minister of Education and Culture (2021), with the 2019-2020 data input period, there are 17 permanent teachers and 11 non-permanent teachers. The total number of male students is 174 people, while the total number of female

students is 134. The primary curriculum used is K-13, with full-day school implementation in 5 effective days starting from Monday to Friday.
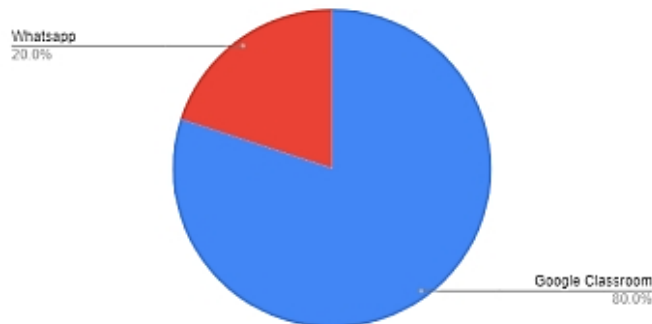

Figure 4. Use of applications for online learning media

Tabel 2. User expression of interacting experience

User expression	Adjectives words	
Broad network access	Yes	Yes
Resource pooling	Yes	Yes
Multi-platform	Yes (Web & Mobile app)	Yes (Web & Mobile app)
Service Provided	Software as a Service	Software as a Service
Application Installation	Yes (only for user interface)	Yes (only for user interface)
Native application	No	No
Online processing	Yes	Yes
Model deployment	Public	Public

The survey analysis found that 56% of teachers use the web-based Google Classroom LMS application, while 44% use mobile-based applications (android/iPhone). Next step, we will analyze the evaluation categories to be used as an assessment of several functions used for learning. User experience assessment indicates difficulty, which has a value between 1 to 5. A value of 1 indicates the most difficult, and 5 indicates the most accessible value. After the assessment, conclusions were drawn from several categories as follows, as many as 50% of the teachers stated that the Display Menu was very easy to understand. As for Class/Lesson Grouping, 50% said they were young. As many as 75% of teachers stated that the Communication Process / Information Delivery was easy to use. In using the Assignment Feature, 62.5% of teachers stated that it was easy to use. When giving a Quiz/test in the Feature Evaluation, 50% of teachers get convenience. For Grade/Scoring, 56.2% of teachers felt it was easy. For the last category, 56.2% of teachers think it is easy to manage. The overall picture of user experience information can be seen in Figure 5, which is plotted in a histogram.
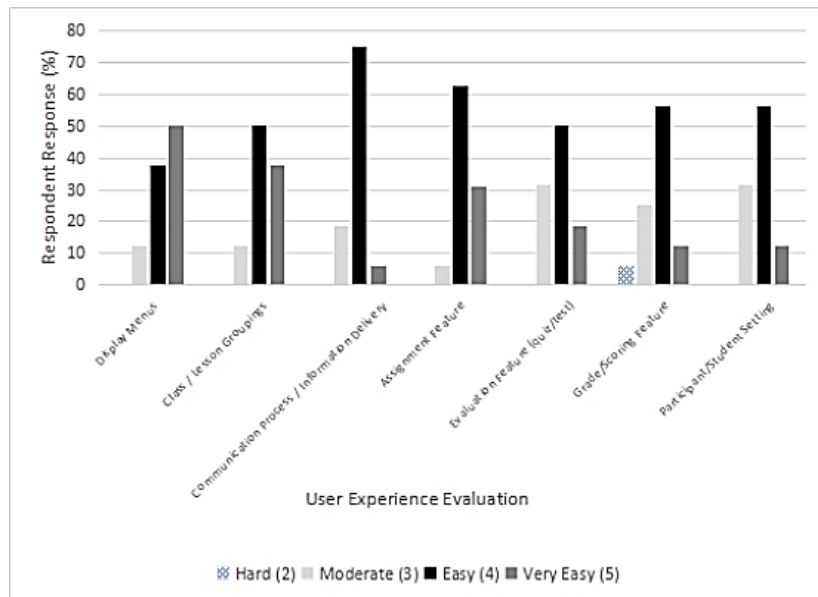
Figure 5. Use of applications for online learning media

3.2. Discussion

From the 17 users in this study, the preferred features users in the Google Classroom application were found, as the reason why these users prefer to use the Google Classroom application. The preferred features are Media upload, Google form, Assignment Scheduling, General, Quiz, and Grading. Of the 17 users, they are spread over the Preferred feature, each of which is of interest to several people. Most of the Preferred Features are General features, while the least is for Media Upload. The interest graph of the user's preferred feature is shown in Figure 6.

This study also analyzed the ease of users in using the Google Classroom application, which is shown in Figure 7, and it was found that 20% of users still experience difficulties as follows, Lack of effective communication between teachers and students in utilizing the comment feature, because so far they are accustomed to using WhatsApp. Sometimes it is more difficult if students want to upload media in voice and video formats. An unstable internet network causes the application not to run correctly.

By evaluating the chart obtained in Figure 6, there are features that have not been utilized optimally, as a result, features that should be very essential are actually considered less attractive. These features are assignment scheduling and quizzes. The evaluation chart in Figure 6 can also be used as a training recommendation

for teachers for the use of applications on the assignment scheduling and quiz features to make it more optimal in using the application.
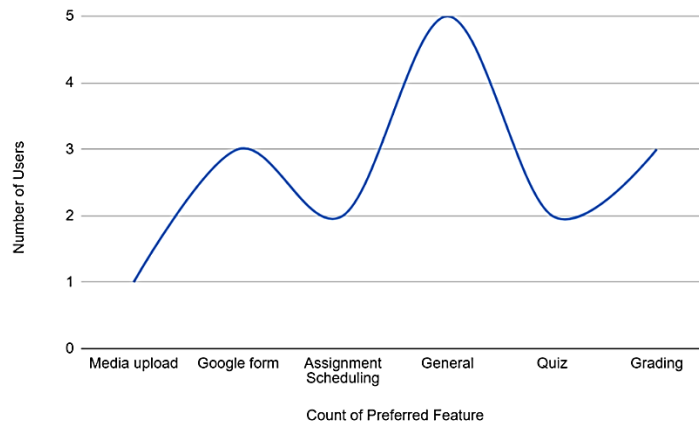

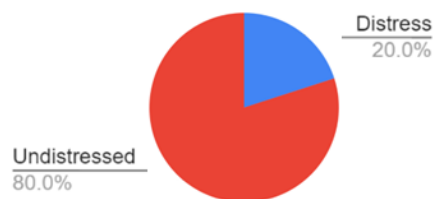**Figure 6.** Preferred Feature user in Google Classroom application

Figure 7. Ease of using LMS application

4. CONCLUSION

This This research was carried out to analyze the behavior and user experience of using the LMS application, as well as how the level of convenience exists in the LMS application for the learning process. From the user experience, the user can determine which parts need to be studied more deeply in using the LMS application. Features In general, the LMS application is sufficient to help the learning process from teacher to student; this is shown in Figure 7, where most users are motivated to use the LMS application because of its overall features. Furthermore, most of the users stated that the use of the LMS application provides convenience and benefits in the teaching process, as shown in Figure 7. This research was supported by all teachers at SDIT Salsabila 4 Jetis Bantul Regency, Indonesia during user survey and assessment activities. This research is only limited to one school agency and may not be representative for all elementary schools in Bantul district.

For future research development, statistical data will be expanded again by taking samples from several institutions, and then research will be conducted on the learning curve of using LMS. The results of the research that has been carried out can be used as the basis for recommendations to provide training to teachers related to the use of features that exist in the LMS. Recommendations can be given to institutions to provide intensive training needed by teachers, from the use of features in the LMS that are poorly understood including Evaluation Feature (quiz/test), Grade/Scoring feature, Participant/Student Setting, Communication process / Information Delivery.

REFERENCES

[1]   President RI, *UU No 20 Tahun 2003, Tentang Undang-undang (UU) tentang Sistem Pendidikan Nasional.* 2003. Accessed: Apr. 24, 2021. [Online]. Available: https://peraturan.bpk.go.id/Home/Details/43920/uu-no-20-tahun-2003

[2]   Didier Houssin, "World Health Organization (WHO): COVID-19 IHR Emergency Committee." Accessed: May 30, 2021. [Online]. Available: https://www.who.int/groups/covid-19-ihr-emergency-committee

[3]   Mendikbud, *Surat Edaran Mendikbud No 4 Tahun 2020, Tentang Pelaksanaan Kebijakan Pendidikan Dalam Masa Darurat Penyebaran Corona Virus Disease (Covid-19).* 2020. Accessed: Mar. 24, 2021. [Online]. Available: https://pusdiklat.kemdikbud.go.id/surat-edaran-mendikbud-no-4-tahun-2020-tentang-pelaksanaan-kebijakan-pendidikan-dalam-masa-darurat-penyebaran-corona-virus-disease-covid-1-9/

[4]   P. M. Mell and T. Grance, "The NIST definition of cloud computing," Gaithersburg, MD, 2011. doi: 10.6028/NIST.SP.800-145.

[5]   G. E. Zgheib and N. Dabbagh, "Social media learning activities (Smla): Implications for design," *Online Learning Journal*, vol. 24, no. 1, pp. 50–66, 2020, doi: 10.24059/olj.v24i1.1967.

[6]   M. Ouadoud, A. Nejjari, M. Y. Chkouri, and K. E. El-Kadiri, "Learning Management System and the Underlying Learning Theories," *Lecture Notes in Networks and Systems*, vol. 37, pp. 732–744, 2018, doi: 10.1007/978-3-319-74500-8_67.

[7]   R. Kraleva, M. Sabani, and V. Kralev, "An analysis of some learning management systems," *Int J Adv Sci Eng Inf Technol*, vol. 9, no. 4, pp. 1190–1198, 2019.

[8]   Dapodikbud, "SEKOLAH KITA - (20403526) SD IT SALSABILA JETIS," 2021. Accessed: Feb. 02, 2021. [Online]. Available: https://sekolah.data.kemdikbud.go.id/index.php/chome/profil/9026bd5c-2ef5-e011-94e4-8139dfcf6d0f

[9]   Z. Z. A. Thaariq, "The Use of Social Media as Learning Resources to Support the New Normal," *Teknodika*, vol. 18, no. 2, p. 80, 2020, doi: 10.20961/teknodika.v18i2.42181.

[10]   J. A. N. Ansari and N. A. Khan, "Exploring the role of social media in collaborative learning the new domain of learning," *Smart Learning Environments*, vol. 7, no. 1, 2020, doi: 10.1186/s40561-020-00118-7.

[11]   C. K. Chen and M. N. Almunawar, "Cloud learning management system in higher education," in *Opening Up Education for Inclusivity Across Digital Economies and Societies*, IGI Global, 2019, pp. 29–51.

[12]   M. Ouadoud, A. Nejjari, M. Y. Chkouri, and K. E. El Kadiri, "Educational modeling of a learning management system," in *2017 international conference on electrical and information technologies (ICEIT)*, IEEE, 2017, pp. 1–6.

[13]   R. Mahajan, P. Gupta, and T. Singh, "Massive Open Online Courses: Concept and Implications," *Indian Pediatr*, vol. 56, no. 6, pp. 489–495, 2019, doi: 10.1007/s13312-019-1575-6.

[14]   L. McLoughlin and F. Magnoni, "The Move-Me project: reflecting on xMOOC and cMOOC structure and pedagogical implementation," in *Beyond the language classroom: researching MOOCs and other innovations*, 2017, pp. 59–69. doi: 10.14705/rpnet.2017.mooc2016.671.

[15]   R. Montes-Rodríguez, J. B. Martínez-Rodríguez, and A. Ocaña-Fernández, "Case study as a research method for analyzing MOOCs: Presence and characteristics of those case studies in the main scientific databases," *International Review of Research in Open and Distance Learning*, vol. 20, no. 3, pp. 59–79, 2019, doi: https://doi.org/10.19173/irrodl.v20i4.4299.

[16]   J. Koskinen, A. Kairikko, and M. Suonpää, "Hybrid MOOCs Enabling Global Collaboration Between Learners," in *Proceedings of the Seventh European MOOC Stakeholder Summit (EMOOCs 2021)*, 2021, pp. 35–48. doi: https://doi.org/10.25932/publishup-51030.

[17]   J. P. Espada, C. C. Rodríguez, V. García-Díaz, and R. G. Crespo, "Method for analysing the user experience in MOOC platforms," in *2014 International Symposium on Computers in Education (SIIE)*, IEEE, 2014, pp. 157–162.

[18]   O. Korableva, T. Durand, O. Kalimullina, and I. Stepanova, "Studying user satisfaction with the MOOC platform interfaces using the example of coursera and open education platforms," in *ACM International Conference Proceeding Series*, 2019, pp. 26–30. doi: 10.1145/3322134.3322139.

[19]   A. Nurhudatiana and A. S. Caesarion, "Exploring User Experience of Massive Open Online Courses (MOOCs) A Case Study of Millennial Learners in Jakarta, Indonesia," in *Proceedings of the 2020 9th International Conference on Educational and Information Technology*, 2020, pp. 44–49.

[20]   H. Najafi, C. Rolheiser, L. Harrison, and W. Heikoop, "Connecting learner motivation to learner progress and completion in massive open online courses," *Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie*, vol. 44, no. 2, 2018.

[21]   P. Kaewsaiha, "Usability of the learning management system and choices of alternative," in *International Conference on Education, Psychology, and Social Sciences*, 2019, pp. 252–259.

[22] M. Zhu, C. Bonk, and A. Sari, "Massive open online course instructor motivations, innovations, and designs: Surveys, interviews, and course reviews," *Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie*, vol. 45, no. 1, 2019.

[23] T. Snoussi, "Learning Management System in Education: Opportunities and Challenges," *International Journal of Innovative Technology and Exploring Engineering*, vol. 8, no. 12S, pp. 664–667, 2019, doi: 10.35940/ijitee.l1161.10812s19.

[24] M. Abdel-Basset, M. Mohamed, and V. Chang, "NMCDA: A framework for evaluating cloud computing services," *Future Generation Computer Systems*, vol. 86, pp. 12–29, 2018.

[25] E. A. Fadhil and S. Toker, "Cloud Computing Applications in Social Work and Education," in *Handbook of Research on Cyber Approaches to Public Administration and Social Policy*, IGI Global, 2022, pp. 28–54.

[26] A. Rashid and A. Chaturvedi, "Cloud Computing Characteristics and Services A Brief Review," *International Journal of Computer Sciences and Engineering*, vol. 7, no. 2, pp. 421–426, 2019, doi: 10.26438/ijcse/v7i2.421426.

[27] P. R. Kumar, P. H. Raj, and P. Jelciana, "Exploring Data Security Issues and Solutions in Cloud Computing," in *Procedia Computer Science*, 2018, pp. 691–697. doi: 10.1016/j.procs.2017.12.089.