Jurnal Sains dan Teknologi
Volume 12 Number 3, Tahun 2023, pp. 865-876
P-ISSN: 2303-3142 E-ISSN: 2548-8570
Open Access: https://doi.org/10.23887/jstundiksha.v12i3.69808

Positive Impact of Using Learning Management Systems in the Higher Education Level

Lambertus J. Lokollo[1], Rudolf Kempa[2], Yance Manoppo[3*], Leny S. Latuny[4], Jitu Halomoan Lumbantoruan[5]

[1,2,3,4] Universitas Pattimura, Ambon, Indonesia
[5] Universitas Kristen Indonesia, Jakarta, Indonesia

ARTICLE INFO

Article history:
Received July 10, 2023
Accepted October 13, 2023
Available online October 25, 2023

Kata Kunci:
Learning Management Systems, *Kesulitan LMS, Pendidikan Tinggi*

Keywords:
Learning Management Systems, LMS Difficulties, Higher Education

ABSTRAK

Hampir semua perguruan tinggi di perkotaan sudah menggunakan Learning Management Systems (LMS). *Kewajiban ini memaksa dosen harus mempersiapkan materi dan menuangkannya ke dalam* Learning Management Systems (LMS). *Penelitian ini bertujuan untuk mengetahui dampak positif pelaksanaan pembelajaran di perguruan tinggi dibantu* Learning Management Systems (LMS), *penelitian ingin mengetahui hambatan dan kesulitan dalam melaksanakan pembelajaran* Learning Management Systems (LMS). *Metode penelitian yang digunakan adalah survei dengan menyebarkan instrumen. Teknik pengumpulan data, dengan menyebarkan instrumen kepada 132 orang yang terdiri dari dosen dan mahasiswa yang terlibat langsung dalam proses pembelajaran. Teknik analisis merata-ratakan instrumen yang telah dinilai oleh mahasiswa dan dosen. Hasil rata-rata, kemudian diinterpretasikan menjadi kalimat. Akibatnya, dosen menemukan kendala dan kesulitan dalam menggunakan sistem manajemen pembelajaran dalam proses pembelajaran. Kendala dan kesulitan terletak pada implementasi materi, penggunaan model belajar dan kesulitan dalam penilaian sikap dan ketrampilan mahasiswa. Ditemukan, materi tidak dituangkan dalam* Learning Management Systems (LMS) *tetap membagikan materi media yang berbeda sehingga pembelajaran kurang efektif. Indikator penilaian juga tidak diberikan kepada siswa, sehingga siswa tidak dapat mengukur kemampuannya sendiri. Kesimpulan, setiap dosen harus mempersiapkan materi, model dan instrumen penilaian sebelum menggunakan* Learning Management Systems (LMS) *sebagai alat bantu pelaksanaan pembelajaran di perguruan tinggi.*

ABSTRACT

Almost all universities in urban areas already use Learning Management Systems (LMS). This obligation forces lecturers to prepare material and put it into Learning Management Systems (LMS). But facts. There are 63% of lecturers who have difficulty compiling online material. The hope is that using Learning Management Systems (LMS) can improve student learning outcomes. This research aims to determine the positive impact of implementing learning in higher education assisted by Learning Management Systems (LMS). The research wants to find out the obstacles and difficulties in implementing Learning Management Systems (LMS) learning. The research method used is a survey by distributing instruments. Data collection technique, by distributing instruments to 132 people consisting of lecturers and students who were directly involved in the learning process. The analysis technique averages the instruments that have been assessed by students and lecturers. The average results are then interpreted into sentences. As a result, lecturers find obstacles and difficulties in using the learning management system in the learning process. Obstacles and difficulties lie in the implementation of material, the use of learning models, and difficulties in assessing student attitudes and skills. It was found that the material was not included in the Learning Management Systems (LMS) but still distributed different media materials so that learning was less effective. Assessment indicators are also not given to students, so students cannot measure their abilities. In conclusion, every lecturer must prepare materials, models, and assessment instruments before using Learning Management Systems (LMS) as a tool to help implement learning in higher education.

1. INTRODUCTION

The rapid development of technology forces everyone in education to change the way they implement learning, from face-to-face to today and tomorrow implementing learning with online assistance. This forces educators, including lecturers, to look for effective tools and methods to help deliver material to students and students. The use of technological devices as a means of conveying information on learning materials is complemented by tools or components that exist in the internet media currently used. (Gawer, 2021; Matete et al., 2023). The era of globalization where the development of information and communication technology is increasing rapidly and has penetrated into various aspects of human life,

*Corresponding author.
E-mail addresses: molucanano@yahoo.com (Yance Manoppo)

especially in the field of education where the tools used in the learning process are increasingly complete, The learning process in Indonesia currently develops a learning process with the help of learning management systems. In fact, there is great emphasis from several educational institutions to use the Learning Management System (LMS) as a tool in implementing the learning process and interacting with students in the higher education environment (Adebayo et al., 2022; Al-Mamary, 2022; Suyadi et al., 2022). The development of learning management system technology provides great opportunities for the development of education management and the learning process in tertiary institutions. The Learning Management System (LMS) is a multimedia-based educational system (a technology that includes text, images, audio and video) that is able to make the presentation of a topic interesting, not just monotonous but easier to understand (Ghani et al., 2022; Kumar et al., 2021).

The Learning Management System (LMS) is an educational management system based on multimedia technology which includes text, image, audio and video components that are able to make the presentation of a topic interesting, not just monotonous but easier for students to understand in tertiary institutions. But keep in mind that the Learning Management System (LMS) is only a tool in the learning process. There are five benefits that can be achieved in the learning process through the use of learning management systems, namely: 1) facilitating and expanding access to the implementation of education, 2) increasing equality and equity in education, 3) increasing the quality and effectiveness of learning, 4) increasing teacher professionalism and 5) increasing the effectiveness and management efficiency, governance and management of education (Behera et al., 2022; W. Wu et al., 2022). Knowing and realizing the enormous benefits of the Learning Management System (LMS) in education, UNESCO experts recommend to all countries; especially developing countries; Increasing the various resources needed for the development of information and communication technology in various policies, strategies and activities for implementing education. Currently, several tertiary institutions are focusing on implementing learning with the help of the Learning Management System (LMS) and continue to develop the tools and components provided in the management system used, especially at universities in Indonesia as the core of their education system (Mncube & Mthethwa, 2022; Ramalingam et al., 2022). In Indonesia, based on the Development Plan for the 2020-2024 National Medium Term Term (RPJM), it is emphasized that the fourth priority of the Ministry of Education and Culture is technology development. The focus of this technology is to help all humans, especially lecturers and students in the system carry out the process of implementing education and their duties better (Olan et al., 2022; Sambodo et al., 2022). The Ministry of Education and Culture in Indonesia has the same goal as higher education institutions, namely to be able to provide excellent service, one of which must be carried out is the development of information and communication technology through a Learning Management System (LMS) implemented through the use of information and communication technology in the education sector which includes the role of information and communication technology as educational materials, teaching aids, educational facilities, efficiency standards, supporting education management, management tools for educational units, and educational infrastructure. In connection with the above, the phenomenon of the use of information and communication technology in learning in educational institutions is getting better, even in the curriculum, information and communication technology plays a very important role in the implementation of learning through the Learning Management System (LMS). The curriculum shows that learning applies the principle that anyone, namely lecturers, students and anywhere, can learn just like in class. Therefore, the use of Learning Management System (LMS) is very important in terms of effectiveness and efficiency.

The Learning Management System (LMS) can play two roles in learning, namely: (1) as a medium for educational presentations, for example in the form of PowerPoint slides and animations with flash programs. (ii) As an independent teaching method or e-learning, for example students are given the task of reading or searching for sources from the internet, submitting assignment answers, even trying and working on learning material. Through e-learning, learning is no longer limited by space and time. Learning can be done anytime and anywhere. This encourages students to analyze and synthesize knowledge, to explore, process and use information and to produce their own writing, information and knowledge. To help students develop and gather their own knowledge, without direct guidance from the lecturer, learning situations have been prepared beforehand (Assen & Otting, 2022; Behera et al., 2022). The role of the Learning Management System (LMS) can be maximized by activating it through learning design, learning theory, and message design so that it can produce a good learning experience for students.

However, the facts on the ground are that the implementation and use of the Learning Management System (LMS) in higher education is still in its early stages and has not been utilized optimally by lecturers and students. Constraints on the uneven distribution of use and design that supports the implementation of the Learning Management System (LMS) in the education sector and the weakness of human resources in using the Learning Management System (LMS) in the online learning process in higher education have resulted in the learning implementation process in higher education not being by what was intended

(Asamoah, 2021; Assen & Otting, 2022). The learning process has not been effective, there are 62% who think the learning process using the learning management system is not good. Apart from that, the learning process using a learning management system only has a 23% impact on the success of the learning process. And the learning management system can control the distance learning process and be effective (Díez et al., 2020; Pal & Vanijja, 2020; Shim & Lee, 2020). The use and utilization of learning management systems in learning in higher education have an impact on increasing the effectiveness of learning for students and lecturers (Elfeky et al., 2020; Mishra et al., 2020). Lecturers and students can easily interact and communicate and complete the lecture process well and effectively (Tang et al., 2021; Yuan & Wu, 2020). The learning management system is presented to expedite the learning process in higher education to improve the lecture process to be more effective (González-Zamar et al., 2020; Miranda et al., 2021).

Based on the background above, there are differences between theory, expectations, and reality in the field. The use of learning management systems in higher education often encounters obstacles and difficulties. Therefore, it is urgent to find out where the obstacles and difficulties are in using the learning management system find out the effectiveness of using the management system in the learning process, and find out the positive impact of using the learning management system in higher education..

2. METHOD

This research uses a mixed research approach with survey and interview methods (Anthony Jnr, 2020; Duan et al., 2020; Iflaifel et al., 2020; Nurse-Clarke & Joseph, 2022). This research uses survey and interview methods by distributing question instruments according to the standards and indicators in this research. The instruments that have been prepared have been validated and declared valid and can be used as a tool to measure the effectiveness of the learning process using the learning management system in higher education. The subjects of this research were students and lecturers who were used as research respondents. In this research, three universities used a learning management system, namely one from the West Java region, one from the Jakarta region, and one from Pattimura University, Ambon, Indonesia. Meanwhile, the research objects are lecturers and students who are directly involved in the utilization and learning process using learning management system tools in courses taught by lecturers. The number of lecturers and students surveyed was 132 people and 15 people were used as in-depth interview respondents from all study programs spread across various faculties and study programs that use the Learning Management System (LMS).

Data collection techniques using surveys. Instruments that have been declared valid are distributed using Google by compiling them into Google from and creating a link to share with respondents, namely lecturers and students. The instrument used is a standard instrument used to measure obstacles, difficulties, and effectiveness of the learning process using the learning management system and is prepared based on indicators of success in using the learning management system according to standard indicators (Díez et al., 2020; Pal & Vanijja, 2020; B. Wu et al., 2020). Surveys are used to find out facts and realities in the field by looking at the number of participants who provide more opinions (Degner et al., 2022; Hansen & Tummers, 2020; Meyerowitz-Katz & Merone, 2020). The research instrument was compiled on Google from to make it easier to get information from sources. By sharing the Google From link, it is hoped that sources can respond objectively without pressure from other people. The survey was conducted to 132 people consisting of lecturers and students who were randomly selected. Data from the survey do not stand alone, this study followed up on the results of the survey given to lecturers and students by conducting interviews with 15 informants with the aim of confirming the results of the instrument. The two data, namely surveys and interviews, form a single unit in drawing conclusions. The technique of data analysis is to collect data by distributing instruments, data reduction, aligning survey findings with interview data and drawing conclusions. The instruments surveyed are based on the indicators as shown in Table 1.

Table **1**. Research Indicators

No.	Indicator
1	Preparation of implementation plans
2	Preparing lecture materials (modules or teaching materials)
3	Completeness of teaching aids
4	Adjust to lecture time and planning
5	Preparation of assessment indicators and assessment rubrics
6	There is an evaluation and analysis sheet
7	Implementation of Timely Learning
8	Implementation of the material through the Learning Management System
9	Problem analysis and learning evaluation and assessment processes

Instruments in Table 1 are arranged starting from indicators of preparation and implementation of the lecture process through information and communication technology based on the Learning Management System (LMS). Each instrument was prepared according to indicators and sources of rating starting from a scale of 1 which is strongly disagree, 2 disagree, 3 quite agree, 4 agree and 5 strongly agree. The results of the instrument are tabulated and a bar graph is created. Then the research continued with interviews with question instruments based on Table 1 indicators. The results of the interviews were coded and aligned with survey data and became the final conclusion.

The data analysis technique uses SPPS Version 25. The data that has been obtained is processed and averaged, the standard deviation is measured and based on each component and indicator, bar charts and diagrams are created to determine and describe the location of obstacles, difficulties, and impacts of using learning management systems in education. tall. Each indicator is made into a bar chart and the research interprets each indicator into sentences. All indicators have previously been tested and all instruments have been standardized and are considered suitable for use as a measuring tool for the success of the learning process using the Learning Management System (LMS). Interview data was collected, reduced, and aligned with findings from the survey. Intersecting data is used as a basis for determining where obstacles are located, where difficulties lie, and concluding.

3. RESULT AND DISCUSSION

Result

The survey results obtained found and described the Learning Management System (LMS) learning process that had been carried out, but there were several obstacles and had to be corrected immediately and developed management and preparation for the learning process through the Learning Management System (LMS). The following are survey results from respondents' responses to the process of using the Learning Management System (LMS)

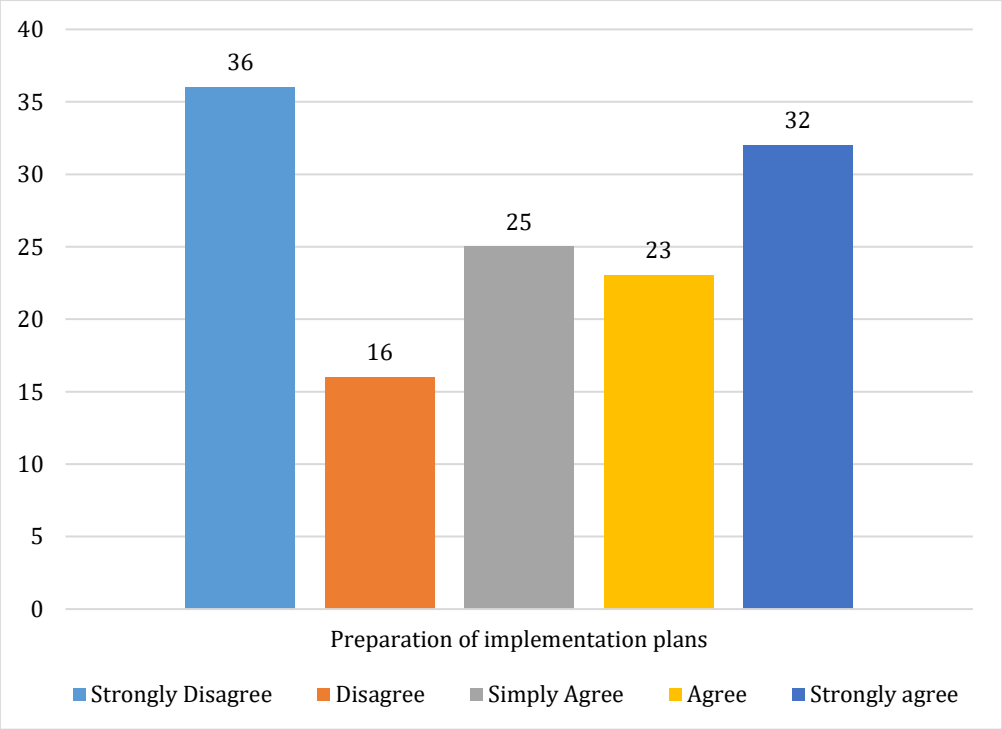

Figure 1. Preparation of Implementation Plans

Based on Figure 1, it can be seen that of the 132 respondents consisting of lecturers and students who answered, there were 36 people who answered that they strongly disagreed with the preparations made in learning and with the use of learning management systems as a tool in delivering material and communication in tertiary institutions, and 16 people answered disagree.

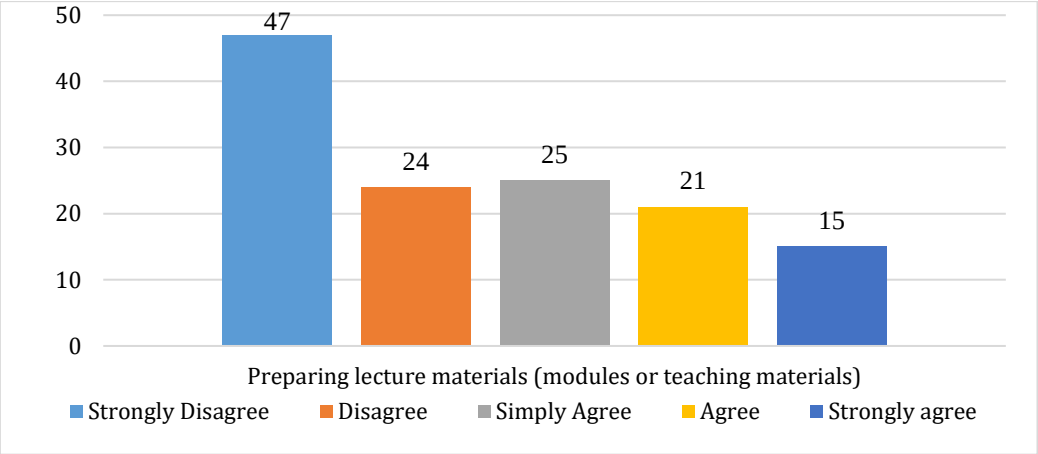

Figure 2. Preparing Lecture Materials (Modules or Teaching Materials)

Figure 2 it can be seen that not all of the material in the courses taken by students has prepared material preparation according to the requirements in the features and components in the Learning Management System. Learning Management System (LMS) tool.

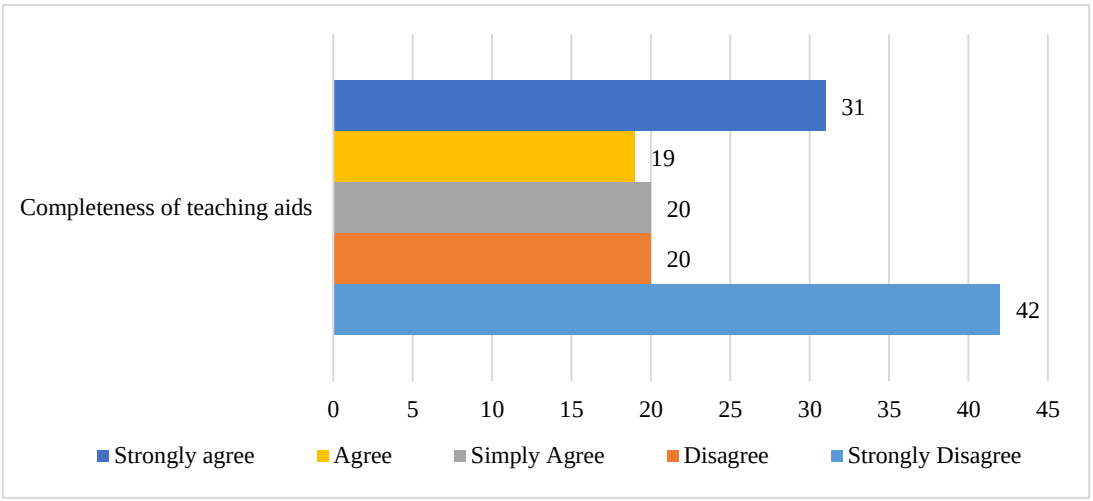

Figure 3. Completeness of Teaching Aids

Based on Figure 3, many respondents disagree with the tools used with learning management systems as tools for the learning process. Respondents also disagreed with the teaching aids used in the Learning Management System media, such as incomplete materials and inaccurate models. There were 42 people who strongly disagreed and 19 people who disagreed with the assistance provided.

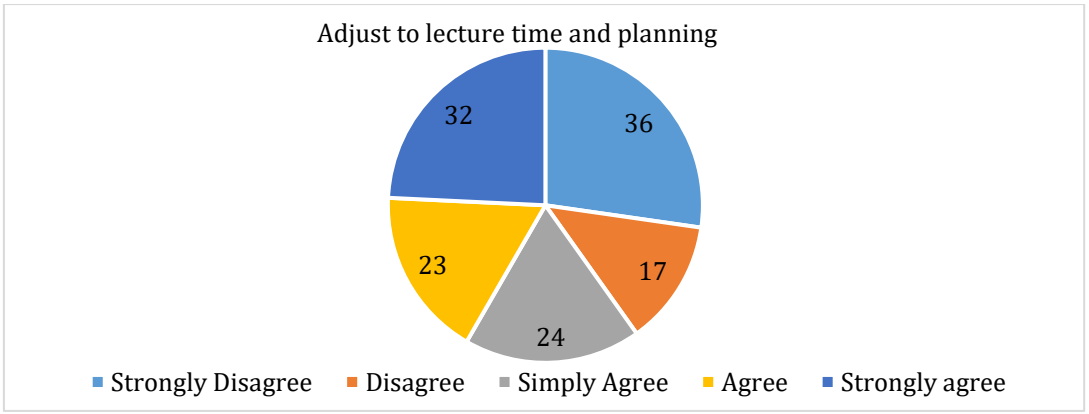

Figure 4. Adjust to Lecture Time and Planning

From Figure 4 it can be seen that not all lecturers have prepared indicators, rubrics, assessment instruments and placed them in the components in the Learning Management System. This can be seen from the respondents' responses, there were 36 people who strongly disagreed and 17 people who disagreed in terms of indicators, rubrics and lecturer assessment instruments. If a total of 53 respondents expect the instrument to be in a learning management system that is used as a tool for the lecture process.

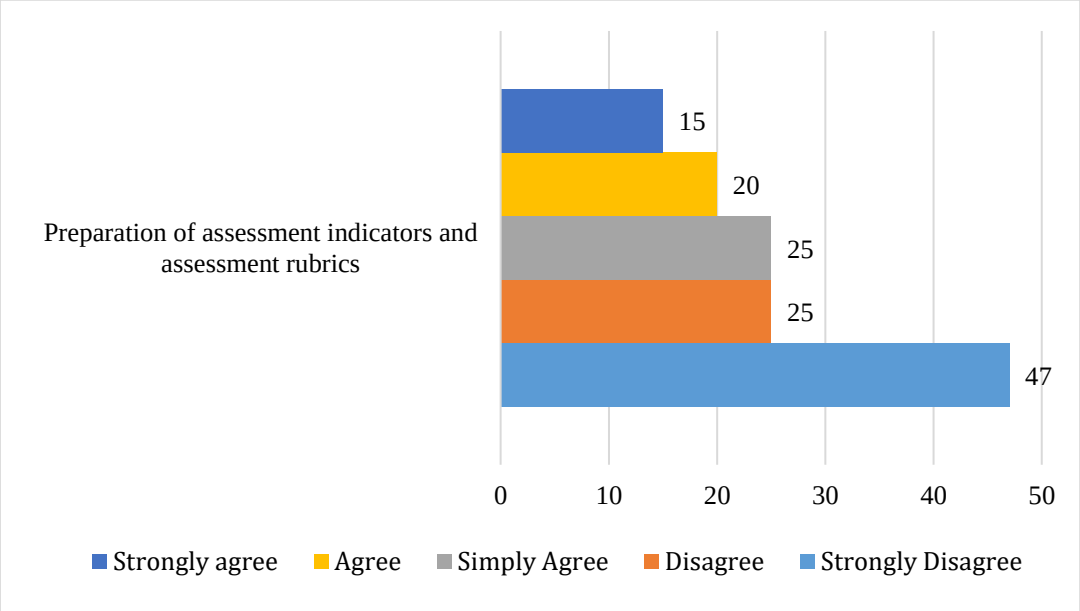

Figure 5. Preparation of Assessment Indicators and Assessment Rubrics

Figure 5 shows the expectations and desires of the respondents for each material taught, there is an evaluation form used by the instructor in the Learning Management System course. From Figure 5 it can be seen that there were 47 people who strongly disagreed and 20 people who disagreed in the form of evaluations carried out by lecturers during the learning process and during the final assessment process of learning.

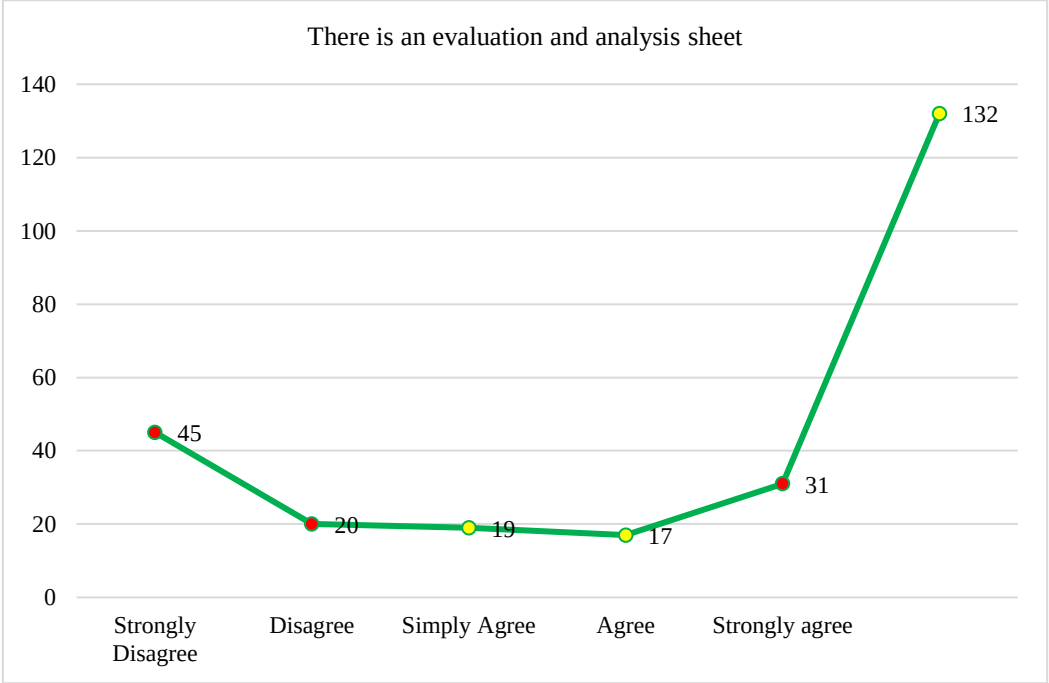

Figure 6. There is an Evaluation and Analysis Sheet

Based on Figure 6 it can be seen that respondents considered timeliness to be very necessary in the Learning Management System. Respondents assessed that currently 45 people strongly disagree and 20 people disagree with the management of time management in the Learning Management System.

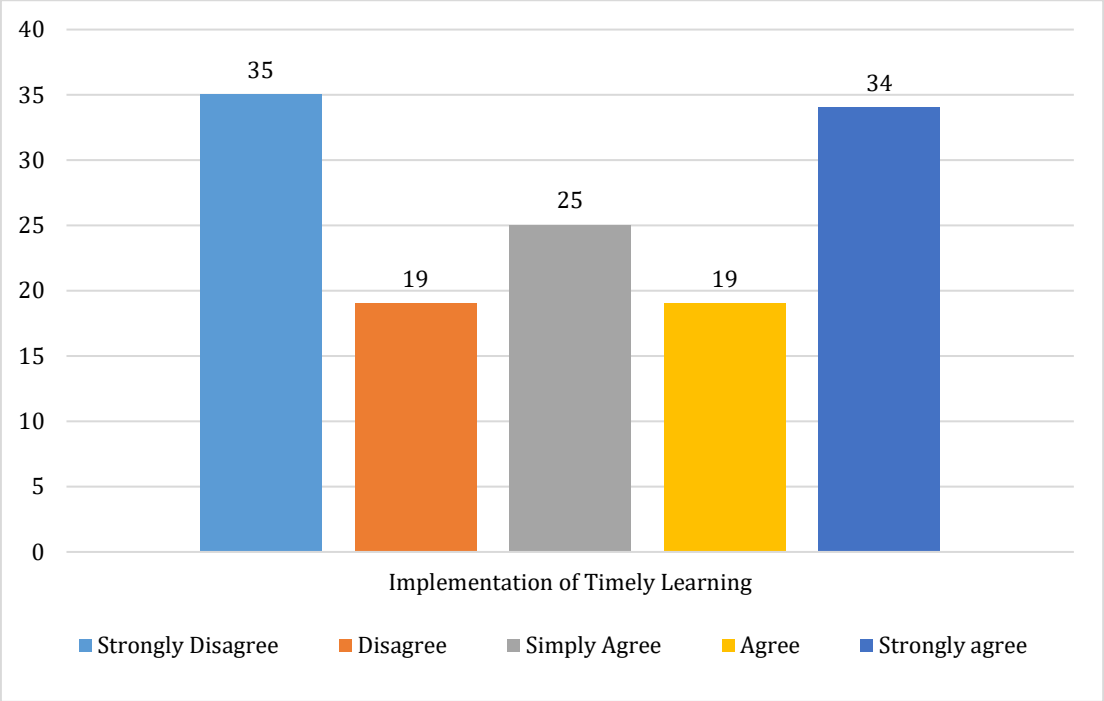

Figure 7. Implementation of Timely Learning

Figure 7 shows that respondents assess the process of implementing learning using the Learning Management System is not optimal. The respondents gave an assessment, of the 132 people who gave responses there were 35 people who strongly disagreed and 19 people said they did not agree with the implementation process. Implementation constraints arise because the preparation process is not carried out thoroughly and contains all the learning tools that will be used in the Learning Management System.

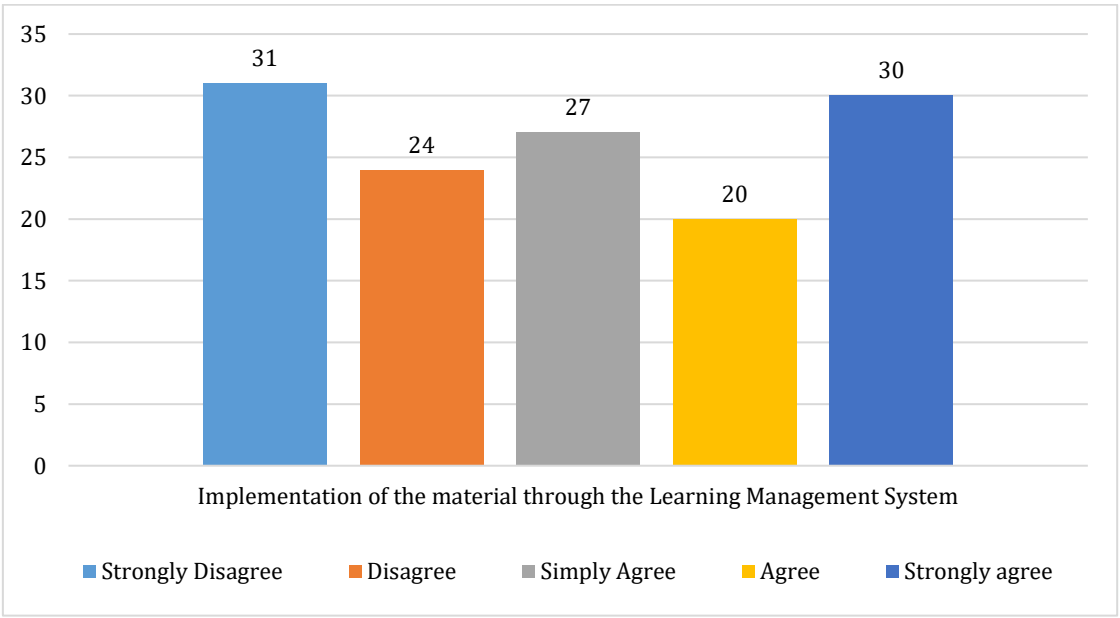

Figure 8. Implementation of the Material through the Learning Management System

Respondents argued that the implementation of course materials through the help of learning management systems used was less efficient. Based on Figure 8, it can be seen from the 132 respondents,

there are 31 people who strongly disagree and 24 people who do not agree if the implementation of lecture material and communication through the media learning management system is used.

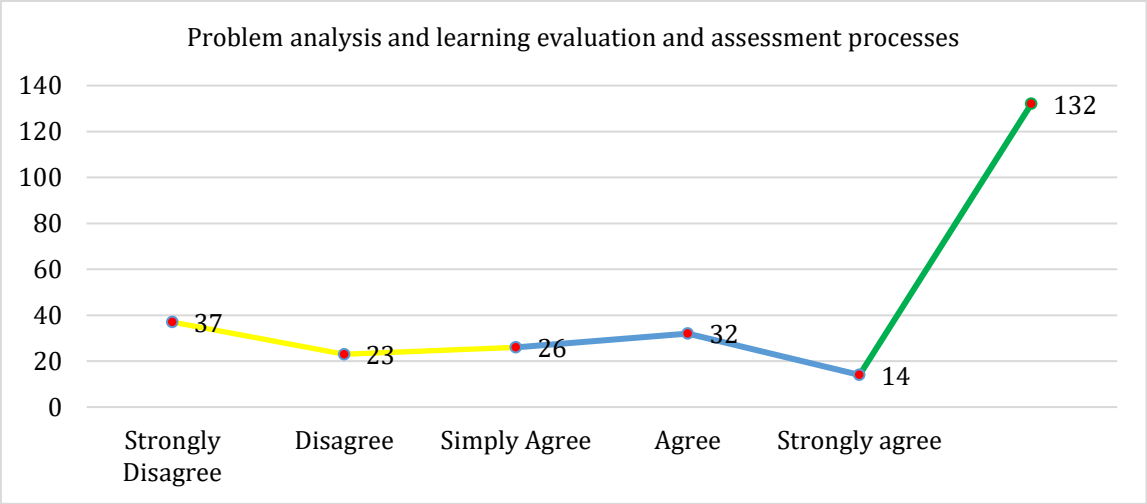

Figure 9. Results of Forms of Analysis and Evaluation

The form of analysis and evaluation in the learning process does not work as expected. This is because the form of analysis used and the form of evaluation used are not visible in the Learning Management System (LMS) system. Based on Figure 9, there are 37 people and 23 people who strongly disagree and disagree with the form of analysis and evaluation carried out by the lecturer through the Learning Management System (LMS). Furthermore, the results of coding and interview interpretation is presented in Table 2.

Table 2. Coding and Interview Interpretation Results

No.	Indicator	Interpretation
1	Preparation of implementation plans	Lecturers and students are less prepared in using the learning management system. The lecturers are still adjusting their competency skills, preparing the learning tools used in the learning management system. Lecturers and students need special training in using the learning management system.
2	Preparing lecture materials (modules or teaching materials)	Lack of preparation in material such as the absence of modules or teaching materials prepared by lecturers. This has a negative impact on the smoothness of the course learning process.
3	Completeness of teaching aids	The equipment is also incomplete. Such as the use of writing tools that can be used by lecturers to explain material (Pen Tablet).
4	Adjust to lecture time and planning	The learning process often experiences delays. Factors are an unstable internet network, problematic computers and lack of mastery of the use of learning management systems
5	Preparation of assessment indicators and assessment rubrics	Not all educators have prepared assessment indicators and learning process evaluation sheets. This obstacle has an impact on the difficulty of lecturers giving assessments to students
6	There is an evaluation and analysis sheet	Obstacles in conducting learning evaluations and impacts. Difficulties in ensuring students' knowledge and understanding of learning
7	Implementation of Timely Learning	There is often a delay in the implementation process of the learning process due to incomplete learning tools and learning preparation.
8	Implementation of the material through the Learning Management System	Difficulty in delivering material through the learning management system, learning resources only using power

No.	Indicator	Interpretation
		points and not preparing complete material sources has an impact on the learning process being less effective
9	Problem analysis and learning evaluation and assessment processes	It is difficult to find out students' understanding in courses because there is no evaluation and analysis process in the learning implementation process

Discussion

The findings from the results of this study are in line with the findings of previous research, the use of the learning implementation process with the help of learning management systems has not been maximized in higher education (Alturki & Aldraiweesh, 2021; Matete et al., 2023). Figure 1 shows that of the total respondents, 52 respondents thought that the learning implementation plan had not been prepared properly and correctly with the help of the Learning Management System. Lack of preparation in developing a Learning Management System has an impact on structuring and managing the learning process so that it runs more smoothly. Another impact is that students cannot achieve what is expected from the material taught, this creates new problems and results in less-than-optimal achievement and learning outcomes. In the interview session, the informant thought that the time needed to prepare a learning implementation plan was very limited and lecturers had limitations in utilizing information and communication technology in the learning process in system management learning. This becomes an obstacle in the learning process using the Learning Management System. This is in accordance with the theory Al-Mamary, (2022); Raković et al., (2022), The lack of thorough preparation has an impact on the readiness of implementing learning in learning management systems. Lecturers are expected to prepare materials, modules, or teaching materials to support the learning process through media. However, the findings from the survey results in this research in Figure 2 are that 47 people strongly disagree and 24 people disagree. This became controversial because the number of participants who disagreed was greater than respondents who agreed with the preparation of the material carried out by the teaching staff. When confirmed by sources through interviews, respondents admitted that when teaching students they did not fully understand the material in the courses they were taking, all the material was included in the Learning Management System. This is one of the reasons why the course learning process does not run smoothly and hurts lecturers' achievement and class management. Inadequate material preparation creates new problems for students' ability to understand and obtain learning outcomes in courses (Ariono et al., 2022; Tao & Gao, 2022).

Based on the results of interviews with informants, they hope that there will be tools in the Learning Management System such as videos that can be accessed by students and other colleagues. Inappropriate visual aids can be an obstacle in the implementation of course material. The lack of precise tools used in implementing learning has a negative impact on understanding and improving student learning outcomes. With the assessment instrument in the media used, it can be accessed by students in the Learning Management System and makes it a measuring tool for measuring student personal abilities and success. During interviews with informants, many found it difficult to measure their abilities because the measuring instruments used in the material presented by the lecturers were not in the Learning Management System. Rubrics and assessment instruments must be prepared before the implementation of learning begins. The results of the interviews intersect with the results obtained in Figure 5. The respondents hoped that the teaching staff would make an evaluation form and an analysis process for the abilities of students who did not understand the material provided in the Learning Management System. This aims to support and develop the learning improvement process so that it is more effective and more efficient and easily understood by students in the subjects being studied. Evaluation is a way to find out the obstacles and difficulties in understanding the material studied in courses that have been taken by students. Respondents hoped that there would be a time sharing system and timeliness in the Learning Management system and that it would be accessible to students. The time that is set and used in the system will have an impact on student learning discipline (Akeed et al., 2022; McComb & Jablokow, 2022). From the results of interviews with the informants, they argue that the current system is not in accordance with what is expected. Lecturers are not yet perfect in using and preparing the Learning Management System for the learning process. Teachers still don't have modules, teaching materials or materials outlined in the Learning Management System. This is deemed necessary for the smooth implementation of learning through the media.

The learning model used is also not perfect and has not attracted students' interest to study more actively. The material studied by students is still in the difficult category to understand and consequently has an impact on the smooth running of the learning process which is not effective. The media used must also continue to be developed (Assen & Otting, 2022; Lumbantoruan, 2022). When the research conducted

interview sessions, the respondents actually had no objection to learning using a learning management system. However, the informants believed that they hoped that the material being studied would have been included in the system management learning media before the lectures began. The interviewees during the interview hoped that there would be a process of analyzing the system and developing the use of the system to make it better. Respondents also hoped that lecturers would be able to put evaluation forms into the Learning Management System (LMS) with the aim that students could measure and prepare themselves for what they did not know or had not mastered. This is in line with the opinion Abd. Syakur et al., (2020); Harpe, (2015) that every lesson must be evaluated and analyzed for its constraints and difficulties by preparing measuring instruments.

The use of Learning Management System (LMS) by combining several learning models has not been effective and efficient. Although in the findings the material prepared by the lecturer can be accessed easily by students. However, the teacher must validate the learning tools in the Learning Management System, namely by preparing a structured learning process plan that is easy for students to understand. This has not been fully assessed by students. The lecturer also assessed that students had not prepared lecture material and presented it in the Learning Management System in the form of teaching modules. Students also assessed that setting lecture times and being consistent with the implementation of the time specified in the Learning Management System was mandatory. all, both students and lecturers, lecturers have not prepared assessment indicators and assessment rubrics in the Learning Management System, lecturers have not prepared evaluation forms, Exact Learning Implementation has not been carried out with Time, it has warped. Material Learning Implementation through the Learning Management System (LMS) and Problem analysis as well the process of evaluation and assessment of learning has not been carried out properly. This is considered very necessary if using the Learning Management System as a tool in the learning process. The assessment process and evaluation process must be prepared properly and correctly before implementing learning to students (Abd. Syakur et al., 2020; Elfeky et al., 2020). However, the facts in this study found that the assessment process was not well prepared and the form of evaluation was not in the learning management system used. This finding contradicts previous findings which said the assessment and evaluation process was optimal.

4. CONCLUSION

The In conclusion, the obstacle in implementing the use of the Learning Management System (LMS) is the lack of readiness of learning tools. Preparation of learning tools must be prepared as much as possible, starting from the learning implementation plan, teaching aids, assessment instruments and assessment rubrics, material in the form of modules or teaching materials and evaluation forms and everything is contained in the Learning Management System (LMS). Lecturers must also make learning projects and videos related to the subjects being taught. The lecturers also have to make an evaluation form in the form of an instrument in measuring the learning process using the Learning Management System (LMS) for each material being taught. This study suggests that each lecturer is able to prepare measuring instruments in the form of instruments in analyzing students' comprehension abilities and difficulties during the learning process by using the Learning Management System (LMS).

5. ACKNOWLEDGE

We thank our respective institutions for being willing to collect data on lecturers and students

6. REFERENCES

Abd. Syakur, Sugirin, & Widiarni. (2020). The Effectiveness of English Learning Media through Google Classroom in Higher Education. *Britain International of Linguistics Arts and Education (BIoLAE) Journal*, *2*(1), 475–483. https://doi.org/10.33258/biolae.v2i1.218.

Adebayo, T. S., Agyekum, E. B., Altuntaş, M., Khudoyqulov, S., Zawbaa, H. M., & Kamel, S. (2022). Does information and communication technology impede environmental degradation? fresh insights from non-parametric approaches. *Heliyon*, *8*(3), 1-13. https://doi.org/10.1016/j.heliyon.2022.e09108.

Akeed, M. H., Qaidi, S., Ahmed, H. U., Faraj, R. H., Mohammed, A. S., Emad, W., Tayeh, B. A., & Azevedo, A. R. G. (2022). Ultra-high-performance fiber-reinforced concrete. Part IV: Durability properties, cost assessment, applications, and challenges. *Case Studies in Construction Materials*, *17*(May), e01271.1-20. https://doi.org/10.1016/j.cscm.2022.e01271.

Al-Mamary, Y. H. S. (2022). Understanding the use of learning management systems by undergraduate

university students using the UTAUT model: Credible evidence from Saudi Arabia. *International Journal of Information Management Data Insights*, *2*(2), 1-11. https://doi.org/10.1016/j.jjimei.2022.100092.

Alturki, U., & Aldraiweesh, A. (2021). Application of learning management system (Lms) during the covid-19 pandemic: A sustainable acceptance model of the expansion technology approach. *Sustainability (Switzerland)*, *13*(19), 1-16. https://doi.org/10.3390/su131910991.

Anthony Jnr, B. (2020). Examining the role of green IT/IS innovation in collaborative enterprise-implications in an emerging economy. *Technology in Society*, *62*(June), 101301.1-15. https://doi.org/10.1016/j.techsoc.2020.101301.

Ariono, B., Wasesa, M., & Dhewanto, W. (2022). The Drivers, Barriers, and Enablers of Building Information Modeling (BIM) Innovation in Developing Countries: Insights from Systematic Literature Review and Comparative Analysis. *Buildings*, *12*(11), 1-22. https://doi.org/10.3390/buildings12111912.

Asamoah, M. K. (2021). ICT officials' opinion on deploying Open Source Learning Management System for teaching and learning in universities in a developing society. *E-Learning and Digital Media*, *18*(1), 18–38. https://doi.org/10.1177/2042753020946280.

Assen, J. H. E., & Otting, H. (2022). Teachers' collective learning: To what extent do facilitators stimulate the use of social context, theory, and practice as sources for learning? *Teaching and Teacher Education*, *114*(6), 103702.1-11. https://doi.org/10.1016/j.tate.2022.103702.

Behera, R. K., Bala, P. K., Rana, N. P., & Kayal, G. (2022). Self-promotion and online shaming during COVID-19: A toxic combination. *International Journal of Information Management Data Insights*, *2*(2), 100117.1-15. https://doi.org/10.1016/j.jjimei.2022.100117.

Degner, M., Moser, S., & Lewalter, D. (2022). Digital media in institutional informal learning places: A systematic literature review. *Computers and Education Open*, *3*(December 2021), 100068.1-11. https://doi.org/10.1016/j.caeo.2021.100068.

Díez, F., Villa, A., López, A. L., & Iraurgi, I. (2020). Impact of quality management systems in the performance of educational centers: educational policies and management processes. *Heliyon*, *6*(4), 1-7. https://doi.org/10.1016/j.heliyon.2020.e03824.

Duan, L., Shao, X., Wang, Y., Huang, Y., Miao, J., Yang, X., & Zhu, G. (2020). An investigation of mental health status of children and adolescents in china during the outbreak of COVID-19. *Journal of Affective Disorders*, *275*(April), 112–118. https://doi.org/10.1016/j.jad.2020.06.029.

Elfeky, A. I. M., Masadeh, T. S. Y., & Elbyaly, M. Y. H. (2020). Advance organizers in flipped classroom via e-learning management system and the promotion of integrated science process skills. *Thinking Skills and Creativity*, *35*(March 2020), 100622.1-32. https://doi.org/10.1016/j.tsc.2019.100622.

Gawer, A. (2021). Digital platforms' boundaries: The interplay of firm scope, platform sides, and digital interfaces. *Long Range Planning*, *54*(5), 1-16. https://doi.org/10.1016/j.lrp.2020.102045.

Ghani, N. A., Teo, P. C., Ho, T. C. F., Choo, L. S., Kelana, B. W. Y., Adam, S., & Ramliy, M. K. (2022). Bibliometric Analysis of Global Research Trends on Higher Education Internationalization Using Scopus Database: Towards Sustainability of Higher Education Institutions. *Sustainability (Switzerland)*, *14*(14), 1-15. https://doi.org/10.3390/su14148810.

González-Zamar, M. D., Abad-Segura, E., López-Meneses, E., & Gómez-Galán, J. (2020). Managing ICT for sustainable education: Research analysis in the context of higher education. *Sustainability (Switzerland)*, *12*(19), 1–25. https://doi.org/10.3390/su12198254.

Hansen, J. A., & Tummers, L. (2020). A Systematic Review of Field Experiments in Public Administration. *Public Administration Review*, *80*(6), 921–931. https://doi.org/10.1111/puar.13181.

Harpe, S. E. (2015). How to analyze Likert and other rating scale data. *Currents in Pharmacy Teaching and Learning*, *7*(6), 836–850. https://doi.org/10.1016/j.cptl.2015.08.001.

Iflaifel, M., Lim, R. H., Ryan, K., & Crowley, C. (2020). Resilient Health Care: A systematic review of conceptualisations, study methods and factors that develop resilience. *BMC Health Services Research*, *20*(1), 1–21. https://doi.org/10.1186/s12913-020-05208-3.

Kumar, A., Krishnamurthi, R., Bhatia, S., Kaushik, K., Ahuja, N. J., Nayyar, A., & Masud, M. (2021). Blended Learning Tools and Practices: A Comprehensive Analysis. *IEEE Access*, *9*(4), 85151–85197. https://doi.org/10.1109/ACCESS.2021.3085844.

Lumbantoruan, J. H. (2022). Pengembangan Modul Matematika Materi Turunan. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(4), 2593–2609. https://doi.org/10.24127/ajpm.v11i4.5716.

Matete, R. E., Kimario, A. E., & Behera, N. P. (2023). Review on the use of eLearning in teacher education during the corona virus disease (COVID-19) pandemic in Africa. *Heliyon*, *9*(2), e13308.1-13. https://doi.org/10.1016/j.heliyon.2023.e13308.

McComb, C., & Jablokow, K. (2022). A conceptual framework for multidisciplinary design research with example application to agent-based modeling. *Design Studies*, *78*(1), 101074.1-13.

https://doi.org/10.1016/j.destud.2021.101074.

Meyerowitz-Katz, G., & Merone, L. (2020). A systematic review and meta-analysis of published research data on COVID-19 infection fatality rates. *International Journal of Infectious Diseases*, *101*(12), 138–148. https://doi.org/10.1016/j.ijid.2020.09.1464.

Miranda, J., Navarrete, C., Noguez, J., Molina-Espinosa, J. M., Ramírez-Montoya, M. S., Navarro-Tuch, S. A., Bustamante-Bello, M. R., Rosas-Fernández, J. B., & Molina, A. (2021). The core components of education 4.0 in higher education: Three case studies in engineering education. *Computers and Electrical Engineering*, *93*(February.1-13.). https://doi.org/10.1016/j.compeleceng.2021.107278.

Mishra, L., Gupta, T., & Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International Journal of Educational Research Open*, *1*(August), 100012.1-8. https://doi.org/10.1016/j.ijedro.2020.100012.

Mncube, L. S., & Mthethwa, L. C. (2022). Potential ethical problems in the creation of open educational resources through virtual spaces in academia. *Heliyon*, *8*(6), e09623.1-8. https://doi.org/10.1016/j.heliyon.2022.e09623.

Nurse-Clarke, N., & Joseph, M. (2022). An exploration of technology acceptance among nursing faculty teaching online for the first time at the onset of the COVID-19 pandemic. *Journal of Professional Nursing*, *41*(October 2021), 8–18. https://doi.org/10.1016/j.profnurs.2022.04.002.

Olan, F., Ogiemwonyi Arakpogun, E., Suklan, J., Nakpodia, F., Damij, N., & Jayawickrama, U. (2022). Artificial intelligence and knowledge sharing: Contributing factors to organizational performance. *Journal of Business Research*, *145*(February), 605–615. https://doi.org/10.1016/j.jbusres.2022.03.008.

Pal, D., & Vanijja, V. (2020). Perceived usability evaluation of Microsoft Teams as an online learning platform during COVID-19 using system usability scale and technology acceptance model in India. *Children and Youth Services Review*, *119*(September), 105535.1-12. https://doi.org/10.1016/j.childyouth.2020.105535.

Raković, M., Bernacki, M. L., Greene, J. A., Plumley, R. D., Hogan, K. A., Gates, K. M., & Panter, A. T. (2022). Examining the critical role of evaluation and adaptation in self-regulated learning. *Contemporary Educational Psychology*, *68*(1), 1-14. https://doi.org/10.1016/j.cedpsych.2021.102027.

Ramalingam, S., Yunus, M. M., & Hashim, H. (2022). Blended Learning Strategies for Sustainable English as a Second Language Education: A Systematic Review. *Sustainability (Switzerland)*, *14*(13), 1–17. https://doi.org/10.3390/su14138051.

Sambodo, M. T., Yuliana, C. I., Hidayat, S., Novandra, R., Handoyo, F. W., Farandy, A. R., Inayah, I., & Yuniarti, P. I. (2022). Breaking barriers to low-carbon development in Indonesia: deployment of renewable energy. *Heliyon*, *8*(4), e09304.1-11. https://doi.org/10.1016/j.heliyon.2022.e09304.

Shim, T. E., & Lee, S. Y. (2020). College students' experience of emergency remote teaching due to COVID-19. *Children and Youth Services Review*, *119*(October), 105578.1-7. https://doi.org/10.1016/j.childyouth.2020.105578.

Suyadi, Nuryana, Z., Sutrisno, & Baidi. (2022). Academic reform and sustainability of Islamic higher education in Indonesia. *International Journal of Educational Development*, *89*(3), 102534.1-11. https://doi.org/10.1016/j.ijedudev.2021.102534.

Tang, Y. M., Chen, P. C., Law, K. M. Y., Wu, C. H., Lau, Y. yip, Guan, J., He, D., & Ho, G. T. S. (2021). Comparative analysis of Student's live online learning readiness during the coronavirus (COVID-19) pandemic in the higher education sector. *Computers and Education*, *168*(November 2020), 1-17. https://doi.org/10.1016/j.compedu.2021.104211.

Tao, J., & Gao, X. (2022). Teaching and learning languages online: Challenges and responses. *System*, *107*(May), 102819.1-9. https://doi.org/10.1016/j.system.2022.102819.

Wu, B., Widanage, W. D., Yang, S., & Liu, X. (2020). Battery digital twins: Perspectives on the fusion of models, data and artificial intelligence for smart battery management systems. *Energy and AI*, *1*(8), 100016.1-12. https://doi.org/10.1016/j.egyai.2020.100016.

Wu, W., Zhu, D., Liu, W., & Wu, C. H. (2022). Empirical research on smart city construction and public health under information and communications technology. *Socio-Economic Planning Sciences*, *80*(9), 100994.1-40. https://doi.org/10.1016/j.seps.2020.100994.

Yuan, C. H., & Wu, Y. J. (2020). Mobile instant messaging or face-to-face? Group interactions in cooperative simulations. *Computers in Human Behavior*, *113*(July), 106508.1-9. https://doi.org/10.1016/j.chb.2020.106508.