



Enhancing Student's English Achievement through English Materials Development in the Form of Learning Management System (LMS)

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Abstract — This research aimed at determining the effectiveness of English materials development in the form of learning management system (LMS) implementation in increasing English achievement for elementary students in rural schools. Seventy-eight students from three public elementary schools in Buleleng Regency participated in this study. This experimental research utilized a paired samples t-test to analyze students' curriculum-based English test scores before and after the LMS intervention. Results showed that the LMS implementation had a statistically significant positive effect on students' English achievement. This was indicated by the t-test results which showed a sig. value of 0.000 and a t-count of -20.552. The sig. value below 0.05 and t-count above the critical value clearly demonstrate the significant impact of the LMS on improving students' English test scores. Thus, the LMS intervention significantly enhanced elementary students' English learning outcomes. While this study provides evidence for the benefits of LMS in elementary English instruction, some limitations exist regarding execution time and teacher workload when implementing this technology. Further research can build on these findings to develop best practices for leveraging LMS to improve English proficiency for young learners.

Keywords — Learning management system, Elementary education, English language learning, Academic achievement, Educational technology

I. INTRODUCTION

In recent years, the utilization of learning management systems (LMS) in the field of education has experienced significant growth. An LMS is a software application that serves the purpose of administering, documenting, tracking, reporting, and delivering educational courses and training programs online [1]. These systems have become a common feature in higher education institutions, enabling instructors to seamlessly share course materials, evaluate and grade assignments, facilitate online discussions and quizzes, communicate with students, and monitor student progress and performance. However, the implementation of LMSs in elementary and secondary schools has been relatively slower compared to the higher education sector. Nevertheless, research suggests that LMSs possess the potential to augment teaching and learning in K-12 settings, provided they are thoughtfully integrated [2]; [3]; & [4].

This research article focuses on the utilization of Learning Management Systems (LMS) specifically for elementary school students, with the aim of enhancing their achievement in the English language. The elementary school years play a crucial role in the development of foundational literacy skills, and the integration of technology-enabled personalized learning through LMS can effectively support students who are still in the process of developing their reading proficiency and language skills [5].

Various studies on Learning Management Systems (LMS) have indicated potential advantages for elementary school students in terms of improving their English language proficiency. Empirical research conducted by Han & Shin [6], Ja'ashan [7], Edmunds & Hartnett [8], Oguguo et al. [9], and Turnbull et al. [10] have consistently revealed that students who utilize LMS tend to outperform their peers in traditional classroom settings, both academically and in terms of test scores. These findings provide strong empirical evidence supporting the effectiveness of LMS in improving English language achievement.

Furthermore, numerous studies have demonstrated that students generally exhibit a positive attitude towards utilizing LMS for language learning. They cite increased flexibility, interactivity with their teachers and peers, as well as easy access to learning materials as key factors contributing to their positive experiences [7], [11], [12]. It is worth noting that the utilization of LMS brings forth several advantages, including the ability for students to learn at their own pace, heightened student engagement, enhanced student-teacher interaction, and the cultivation of self-directed learning skills [6], [7]. These advantages directly address the ultimate objective of enhancing English language proficiency.

However, there are notable challenges when implementing Learning Management Systems (LMS) with young learners. These challenges include technical issues such as internet connectivity, limited teacher and student training, and the need for age-appropriate platform design [7], [9], [12]. It is worth mentioning that previous research has primarily focused on the use of LMS in higher education settings, thus highlighting the necessity for further studies specifically targeting elementary-aged students [6], [7], [13]–[16]. Understanding the factors that influence students' adoption of LMS, including

technology self-efficacy, innovativeness, perceived usefulness and ease of use, as well as social pressures, is crucial, particularly in the elementary context [6]. Therefore, this study aims to bridge the existing gap by conducting an empirical investigation of LMS for English learning in elementary schools.

Multiple previous studies have provided evidence of the potential advantages of utilizing Learning Management Systems (LMSs) with young students. For instance, Lin et al. [17] and Elkaseh et al. [18] discovered that LMS features such as the ability to share lesson content, submit assignments online, automate grading, conduct online quizzes, engage in discussion forums, and facilitate teacher-student messaging contributed to a more student-centered learning environment. Emelyanova and Voronina [19] arrived at similar conclusions, demonstrating that the interactive and collaborative capabilities of LMSs supported more immersive teaching methods. Additionally, the utilization of LMSs has been associated with superior home-school communication, as it allows teachers, students, and parents to stay connected [20]. Furthermore, LMS usage has been linked to the development of early-age digital literacy and self-directed learning skills among students [21].

However, the implementation of Learning Management Systems (LMSs) with elementary-aged students faces significant challenges. It is crucial for teachers to undergo extensive professional development and training to become comfortable and competent in using the technology and adopting new pedagogical strategies [22]. Concerns regarding screen time and its potential negative effects on attention, eyesight, and cognitive load, particularly in younger users, are valid [23]. Therefore, it may be necessary to modify LMS platforms designed for higher education to ensure they are developmentally appropriate for children, with considerations for usability, readability, navigation, and accessibility [8], [11]. Additionally, maintaining close communication with parents is vital when introducing new classroom technology into students' home lives [5]. While acknowledging the existence of challenges, it is imperative to recognize the potential academic and developmental advantages of thoughtfully integrating classroom technology. As a result, further investigation into the use of Learning Management Systems (LMS) among elementary students is warranted. Notably, there is a scarcity of studies that have comprehensively assessed the quantitative impact of LMS use on English achievement scores, specifically pertaining to learners at the elementary level. This research endeavor seeks to bridge this gap by examining the influence of the implementation of a learning management system on English language proficiency. The assessment will be conducted through the analysis of test scores aligned with the curriculum across five public elementary schools. Consequently, the participating schools will be granted access to the LMS platform, teacher professional development opportunities, and supplemental digital English language activities, all delivered through the LMS. The outcomes of this investigation will furnish valuable empirical insights into the effectiveness of instruction facilitated by LMS in enhancing the English skills and knowledge of elementary school students.

II. METHODOLOGY

A. Research Design

This study employs a descriptive statistical quantitative approach with a quasi-experimental design. The quasi-experimental design involves using methodologies and processes that resemble an experiment but lack control over the circumstances and experiences of the participants due to random assignment, including comparisons or control groups [24]. Specifically, the quasi-experiment used in this study is the Quasi-Experiment: One-Group Pretest-Posttest Design, where a group is measured and observed before and after treatment administration, as illustrated in the figure1 below [25]

The dependent variable was examined as a group before (pre-test) and after (post-test) treatment was administered in the One-Group Pretest-Posttest Design. The group's scores are compared before and after therapy by comparing the two sets of results. The benefit of this experiment is that it allows us to compare data before and after therapy on the same person using the same measuring tool [25]. The participants in this study were the elementary students from three elementary schools in Banjar District, Buleleng regency. There were 78 students represented in the entire group.

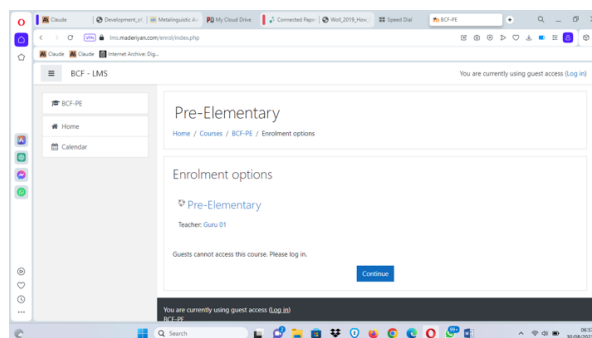


Figure 1. LMS of English Materials (Web look)

The objective of this study was to enhance the English proficiency of students by developing English language materials that are integrated with a learning management system (LMS) in web and mobile application formats. The

participants underwent pretests and posttests, which included English language assessments. The results were analyzed to determine the changes in students' English achievement. The pretest established the initial English proficiency levels of the students, which served as a benchmark for evaluating the posttest results. The posttest was conducted after the students engaged with the English teaching and learning materials, which were facilitated by the LMS-integrated platforms for web and mobile delivery. Through a comparative analysis of the pretest and posttest scores, the impact of the digitally-enabled English learning materials on students' English language attainment was measured. In conclusion, a quasi-experimental design using a pretest-posttest approach was employed to quantify the improvements in students' English achievement resulting from the integration of English learning resources with widely-accessible web and mobile LMS technologies.

B. Data Analysis Method

The assessment of English language proficiency comprised 25 items. Prior to accessing the LMS-integrated English learning materials, a pretest was administered to establish the baseline proficiency of the students. These materials, in a digital format, were implemented over the course of 12 sessions covering a wide range of topics. Following their engagement with the LMS content, the students completed the same 25-item English test as a posttest. A paired-samples t-test was used to statistically compare the results of the pretest and posttest, in order to determine whether the learning materials delivered through the LMS platform resulted in significant improvements in the students' English achievement.

By administering identical English tests before and after the 12-session LMS intervention, it was possible to quantify the extent of the learning gains that could be attributed to the digitally-enabled English language resources. Through a comparative analysis of the pretest and posttest data using the paired t-test, the significance of the improvements in students' English proficiency after completing the LMS-supported English learning materials was determined. In summary, this pre-experimental one-group pretest-posttest design provided empirical evidence of the changes in English competence resulting from the technologically-mediated language learning materials. The utilization of instruments in this study involved thorough evaluations of their validity and reliability. Validity assessment is a crucial step in determining if the test items accurately measure the desired construct. In order to establish validity, the English test scores were correlated with the individual test questions at a significance level of 5% ($p \leq 0.05$). Test items that showed a significant correlation were considered to be valid predictors of English proficiency. On the other hand, reliability analysis was conducted to measure the consistency and stability of the instruments using Cronbach's alpha. Values close to 1 indicate higher internal consistency and reliability. By employing this method, it was ensured that the English test and questionnaires would yield consistent results if administered repeatedly [26].

To summarize, the validity of the instruments was assessed by examining the correlations between the test and item scores, while reliability analysis using Cronbach's alpha evaluated the internal consistency prior to the implementation of the research. These analyses were crucial in ensuring that the instruments accurately measured the intended constructs in a stable and reproducible manner.

III. FINDINGS AND DISCUSSION

A. Findings

The paired samples t-test is used to examine the findings of the analysis performed using the SPSS 25 program to determine if the English materials developments integrated in LMS based has an effect on improving student's English achievement.

Table 1 Descriptive statistics of pre-test and post-test

	N	Minim um	Maxim um	Mean	Std. Deviation
pretest	78	40,00	90,00	60,32	11,403
posttest	78	60,00	95,00	77,99	5,054
Valid N (listwise)	78				

Source: Processed data, 2023

A quantitative analysis was conducted on the pretest and posttest data to gain insights into the students' self-efficacy in English speaking before and after using the e-portfolio based learning materials. The sample consisted of 78 students, and the mean pretest self-efficacy posttest mean increased to 77.99. The deviation was used to measure. A smaller standard deviation indicates that the scores are closely clustered around the mean, indicating that the students have similar levels of the measured attribute. In this study, the posttest standard deviation (5.054) was smaller than the pretest value (11.403). This reduction in standard deviation suggests that the students' scores became less dispersed and more consistent after using the learning materials. Therefore, the descriptive statistics indicate an increase in average English speaking self-efficacy and greater consistency among students following the use of the e-portfolio supported content. These findings

provide a data-driven overview before conducting inferential analysis to determine the statistical significance of the pre/post differences.

Table 2 Analysis result of Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 pretest & posttest	78	0,857	0,000

Source: Processed data, 2023

Table 3 Data interpretation result from Correlation Coefficient

Correlation coefficient, r (positive/negative)	Interpretation
0,001-0,200	Very weak/Low correlation
0,201-0,400	Weak/Low Correlation
0,401-0,700	Correlation is quite strong/High
0,701-0,900	Strong/High correlation
0,901-1,000	Very strong/High correlation

Source : Guilford J.P, *Fundamental Statistics in Psychology and Education*

An investigation was conducted to evaluate the strengths and weaknesses of the association between pre and post-participation in e-portfolio based learning. The findings of the investigation uncovered a correlation coefficient (R) of 0.857. Based on the established criteria for evaluating correlation strength, a value of 0.857 falls within the range of 0.701-0.900, indicating a strong/high correlation. Moreover, the probability value (p-value) of the analysis is less than 0.05, specifically 0.000. This indicates that there is a statistically significant positive relationship between the participants' performance before and after engaging in LMS English Materials.

Table 4 Paired Samples Test

Pair 1	pretest - posttest	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
		-17,663	7,557	0,862	-19,378	-15,948	-20,552	77	0,000

Source: Processed data, 2023

This study is conducted to assess the presence of a substantial discrepancy in the means of two correlated groups of samples. The objective is to compare the effects of two treatments on a sample. More specifically, the test endeavors to ascertain the influence of incorporating an electronic module with genuine content and a digital platform into the process of classroom learning. Below are the sequential procedures entailed in executing the statistical test:

1. Hypothesis Formulation

H0: it indicates that there is no significant difference between before and after receiving an English materials LMS.

H1: it signifies that there is a substantial difference between English materials LMS.

2. Decision Making

The following is the decision-making framework:

a) Based on the comparison of t count and t table

- If t-count < t-table or -t-count < -t-table then H0 is accepted
- If t-count > t-table or -t-count > -t-table then H0 is rejected

The significance level was determined using a 95% confidence level, which corresponds to a 5% error rate ($\alpha = 0.05$). With a 95% confidence level, the value of significance (α) is set at 0.05. The degrees of freedom (df) for this test is calculated by subtracting 1 from the sample size (n), which in this case is 78, resulting in 77 degrees of freedom. The

test is conducted on both sides to determine whether the average pretest result is equal to the post-test result or vice versa. Therefore, the result can either be greater (+) or smaller (-).

The One-Group Pretest-Posttest Design		
<i>O</i>	<i>X</i>	<i>O</i>
Pretest	Treatment	Posttest

Figure 2. Testing area

The analysis using the SPSS 25 statistical program at a 95% confidence level revealed that the calculated t-value of -20.552 exceeded the critical t-value of -1.991673. This finding supports the rejection of the null hypothesis (H_0), which assumes no significant difference between the groups before and after using LMS English materials. Consequently, there is compelling evidence to indicate a substantial disparity between the groups prior to and following the implementation of the LMS English materials.

b) Based probability value

For the side test using a 2-sided test, the test criteria are seen from the sig (α) value where:

- If the value of sig (α) < 0.05, then H_0 is rejected.
- If the value of sig (α) > 0.05, then H_0 is accepted.

Based on the aforementioned findings, the obtained p-value of 0.000, which is below the threshold of 0.05, indicates a significant difference. Consequently, the null hypothesis (H_0) is rejected, while the alternative hypothesis (H_1) is supported. These results imply that there is a substantial disparity in the educational experience within the classroom setting prior to and following the implementation of LMS English materials.

According to the two assessments presented in the results section, it can be deduced that the integration of an electronic module, based on authentic materials, with a digital platform has a positive effect on students' English proficiency. This is supported by the significant value of 0.000 and the t-score of -20.552. These findings strongly suggest that the utilization of LMS English resources significantly influences students' English achievement. Additionally, the use of genuine digital media can aid students in expanding their vocabulary and boost their motivation to learn English.

B. Discussion

The implications of this study highlight the impact of utilizing English learning management systems (LMS) on students' English proficiency. The results of the paired sample t-test indicate that the LMS of English materials significantly affects students' English achievements. The use of LMS in both online and offline class settings proves its effectiveness in dynamic learning environments. By incorporating modern media and platforms into the LMS, students are able to better grasp English materials compared to traditional teaching materials. This finding aligns with Panergayo's [14] assertion that students are more engaged when exposed to blended learning situations through LMS-based learning, as it allows them to interact with authentic language.

Furthermore, the findings of this study underscore the significant impact of using the Learning Management System (LMS) to deliver English materials in improving students' proficiency in English, as evidenced by the results of the paired samples t-test. This aligns with previous research conducted by Han and Shin [6] and Ja'ashan [7], which also demonstrated improved academic outcomes and test scores when using LMS compared to traditional classroom methods. The blended learning approach facilitated by the LMS, which combines online and offline activities, proved to be effective in dynamic class environments. As highlighted in Ja'ashan's study [7], the self-paced and interactive nature of the LMS may have been particularly beneficial for students performing below their grade level, as it helped them strengthen their English skills.

Moreover, the incorporation of contemporary digital media and platforms on the Learning Management System (LMS) likely facilitated students' understanding of English materials, aligning with the research of Sinaga and Pustika [12] that indicates enhanced engagement and attitudes through LMS utilization. Blended LMS environments enable students to interact more intimately with language learning resources compared to solely relying on traditional teaching materials. The crucial aspect lies in the ability to integrate authentic multimedia content and technology in a meaningful manner through the LMS, a design consideration emphasized by Ja'ashan [7] in terms of appropriateness for the students' age.

The statistically significant improvement in English achievement observed in this study conducted in a rural elementary school is consistent with previous research that emphasizes the effectiveness of Learning Management Systems (LMS) in promoting student-centered and individualized learning. This finding is in line with the views expressed by Ja'ashan [7], who stresses the importance of thoughtful implementation of LMS with adequate teacher training and technical support. It is evident that LMS holds great potential for enhancing the development of English proficiency in young learners. Future research should focus on identifying the best practices for employing LMS-based instruction in various educational settings.

This study presents a novel contribution to the existing literature of Learning Management Systems (LMS) in rural elementary schools. While previous research has primarily focused on the use of LMS in higher education and adult learning contexts, our study aims to fill this gap by exploring its implementation in primary school settings. Most of the existing research on LMS has centered around undergraduate populations [6], [7]. Additionally, the limited studies conducted on

LMS in K-12 settings have predominantly concentrated on secondary schools, with minimal research at the primary school level [7].

Moreover, the unique rural school setting of this investigation sets it apart from previous research on Learning Management Systems (LMS), which has primarily focused on urban areas and larger institutions with well-established technology infrastructure. The rural education environment presents its own unique set of challenges, limited resources, and support needs that must be addressed in order to successfully implement LMS in underserved rural elementary schools [7]. Consequently, this study offers valuable insights into how LMS can be effectively utilized to enhance the teaching and learning of English in these neglected rural settings.

Furthermore, this study adopts a rigorous quantitative methodology to assess the impact of LMS usage on English proficiency, using curriculum-aligned pre- and post-tests. Unlike much of the previous research that relied on self-reported measures of perceived learning gains, this study utilizes an experimental design, generating empirical evidence and effect size data on the tangible benefits of using LMS to improve English achievement.

In essence, this study makes a significant contribution to the LMS literature by focusing on rural elementary students who are often underrepresented in existing studies. With its experimental methodology, it not only fills critical gaps in the current understanding of the potential of well-implemented LMS, but also offers practical insights to guide future research and practice in this field.

IV. CONCLUSION

In summary, this study underscores the positive impact of Learning Management Systems (LMS) on enhancing English proficiency, particularly in rural elementary schools. The research confirms significant improvements in English achievement through LMS usage, aligning with previous studies. The integration of modern media and platforms within the LMS enriches learning experiences and engagement, as noted by prior research. This study's contribution to rural education literature fills a vital gap, shedding light on LMS benefits in underserved settings. The study's quantitative approach provides robust evidence of LMS efficacy, offering practical insights beyond self-reported measures. By highlighting LMS's potential to address challenges in rural schools and stressing thoughtful implementation, the research contributes to both theory and practice. In conclusion, this study advances our understanding of LMS's role in enhancing English education, offering valuable guidance for educators and policymakers seeking effective strategies to improve learning outcomes.

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REFERENCES

1. F. Ferdianto, "Learning Management System (LMS) schoology: Why it's important and what it looks like," in *Journal of Physics: Conference Series*, IOP Publishing, 2019, p. 12034.
2. S. R. Malikowski, "Factors related to breadth of use in course management systems," *Internet High. Educ.*, vol. 11, no. 2, pp. 81–86, 2008.
3. E. W. Black, K. Dawson, and J. Priem, "Data for free: Using LMS activity logs to measure community in online courses," *Internet High. Educ.*, vol. 11, no. 2, pp. 65–70, 2008, doi: <https://doi.org/10.1016/j.iheduc.2008.03.002>.
4. W. Watson and S. L. Watson, "An argument for clarity: What are learning management systems, what are they not, and what should they become.," 2007.
5. I. Blau and T. Shamir-Inbal, "Digital technologies for promoting 'student voice' and co-creating learning experience in an academic course," *Instr. Sci.*, vol. 46, pp. 315–336, 2018.
6. I. Han and W. S. Shin, "The use of a mobile learning management system and academic achievement of online students," *Comput. Educ.*, vol. 102, pp. 79–89, 2016.
7. M. M. N. H. Ja'ashan, "Perceptions and attitudes towards blended learning for English courses: A case study of students at University of Bisha.," *English Lang. Teach.*, vol. 8, no. 9, pp. 40–50, 2015.
8. B. Edmunds and M. Hartnett, "Using a learning management system to personalise learning for primary school students," *J. Open, Flex. Distance Learn.*, vol. 18, no. 1, pp. 11–29, 2014.
9. B. C. E. Oguguo, F. A. Nannim, J. J. Agah, C. S. Ugwuanyi, C. U. Ene, and A. C. Nzeadibe, "Effect of learning management system on Student's performance in educational measurement and evaluation," *Educ. Inf. Technol.*, vol. 26, pp. 1471–1483, 2021.
10. D. Turnbull, R. Chugh, and J. Luck, "Learning Management Systems, An Overview," *Encycl. Educ. Inf. Technol.*, pp. 1052–1058, 2020.
11. C. R. Greenwood, C. Arreaga-Mayer, C. A. Utley, K. M. Gavin, and B. J. Terry, "Classwide peer tutoring learning management system: Applications with elementary-level English language learners," *Remedial Spec. Educ.*, vol. 22, no. 1, pp. 34–47, 2001.
12. R. R. F. Sinaga and R. Pustika, "Exploring STUDENTS' ATTITUDE towards English online learning using moodle during COVID-19 pandemic at smk yadika bandarlampung," *J. English Lang. Teach. Learn.*, vol. 2, no. 1, pp. 8–

- 15, 2021.
13. A. Aldiab, H. Chowdhury, A. Kootsookos, F. Alam, and H. Allhibi, "Utilization of Learning Management Systems (LMSs) in higher education system: A case review for Saudi Arabia," *Energy Procedia*, vol. 160, pp. 731–737, 2019.
 14. A. A. Panergayo, "Students' Behavioral Intention to Use Learning Management System: The Mediating Role of Perceived Usefulness and Ease of Use," *Albert Andry E. Panergayo John Vincent C. Aliasas, "Students' Behav. Intent. to Use Learn. Manag. Syst. Mediat. Role Perceived Useful. Ease Use," Int. J. Inf. Educ. Technol.*, vol. 11, no. 11, pp. 538–545, 2021.
 15. S. A. Raza, W. Qazi, K. A. Khan, and J. Salam, "Social isolation and acceptance of the learning management system (LMS) in the time of COVID-19 pandemic: an expansion of the UTAUT model," *J. Educ. Comput. Res.*, vol. 59, no. 2, pp. 183–208, 2021.
 16. V. M. Bradley, "Learning Management System (LMS) use with online instruction.," *Int. J. Technol. Educ.*, vol. 4, no. 1, pp. 68–92, 2021.
 17. C.-C. Lin, Z. Ma, and R. C.-P. Lin, "Re-examining the Critical Success Factors of e-learning from the EU perspective," *Int. J. Manag. Educ.*, vol. 5, no. 1, pp. 44–62, 2011.
 18. A. Elkaseh, K. W. Wong, and C. C. Fung, "A review of the critical success factors of implementing E-learning in higher education.," *Int. J. Technol. Learn.*, vol. 22, no. 2, 2015.
 19. N. Emelyanova and E. Voronina, "Introducing a learning management system at a Russian university: Students' and teachers' perceptions," *Int. Rev. Res. Open Distrib. Learn.*, vol. 15, no. 1, pp. 272–289, 2014.
 20. N. Sclater, "Web 2.0, personal learning environments, and the future of learning management systems," *Res. Bull.*, vol. 13, no. 13, pp. 1–13, 2008.
 21. Z. Lassoued, M. Alhendawi, and R. Bashitialshaer, "An exploratory study of the obstacles for achieving quality in distance learning during the COVID-19 pandemic," *Educ. Sci.*, vol. 10, no. 9, p. 232, 2020.
 22. C. De Smet, J. Bourgonjon, B. De Wever, T. Schellens, and M. Valcke, "Researching instructional use and the technology acceptance of learning management systems by secondary school teachers," *Comput. Educ.*, vol. 58, no. 2, pp. 688–696, 2012.
 23. A. J. Delgado, L. Wardlow, K. McKnight, and K. O'Malley, "Educational technology: A review of the integration, resources, and effectiveness of technology in k-12 classrooms.," *J. Inf. Technol. Educ.*, vol. 14, 2015.
 24. G. J. Privitera and L. A. Delzell, "Quasi-experimental and single-case experimental designs," *Res. methods Educ.*, pp. 333–370, 2019.
 25. and H. H. H. J. R. Fraenkel, N. E. Wallen, *How to Design And Evaluate Research In Education*, 8th ed. New York: Mc Graw Hill, 2012. [Online]. Available: https://saochhengpheng.files.wordpress.com/2017/03/jack_fraenkel_norman_wallen_helen_hyun-how_to_design_and_evaluate_research_in_education_8th_edition_-mcgraw-hill_humanities_social_sciences_languages2011.pdf
 26. S. Sugiyono, "Metode penelitian kuantitatif, kualitatif, dan r & d," *Bandung Alf.*, 2016.

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