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Linking LMS usability with critical reading intention in teacher education: a CRIS assessment (TPB-Based) on PPG PGSD students

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Article info

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Abstract

The development of critical reading and critical thinking skills is essential in teacher education, particularly for pre-service elementary school teachers who are expected to evaluate information critically and guide students in higher-order literacy practices. The increasing use of Learning Management Systems (LMS) in higher education provides opportunities to support students' engagement with academic texts. However, limited research has examined how LMS engagement relates to students' intention to participate in critical reading activities within teacher education contexts. The present study examines the relationship between LMS engagement and pre-service (PPG) students' intention to engage in critical reading, as measured by the Critical Reading Intention Scale (CRIS), based on the Theory of Planned Behavior (TPB). A quantitative survey design was employed involving 109 pre-service teacher students from three universities in Indonesia. Data were collected via an online questionnaire that measured LMS usability and critical reading intention. The data were analyzed using non-parametric statistical analysis. The results indicate a statistically significant relationship between LMS engagement and students' critical reading intention ($p < 0.05$). These findings elucidate that LMS-supported learning environments may be associated with students' attitudes, perceived norms, and perceived control regarding critical reading activities. The study highlights the potential role of LMS-based instructional design in supporting critical reading engagement in pre-service teacher education.

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1. Introduction

The development of critical literacy and critical thinking skills has become a central priority in contemporary education, particularly in teacher education programs (Negoro et al, 2023). Pre-service teachers are expected not only to master subject knowledge but also to develop the ability to critically analyze, evaluate, and interpret information in diverse learning contexts (Kurniaman et al, 2019). These competencies are essential, as future teachers must guide students in navigating complex information environments and developing higher-order thinking skills (Lai et al, 2017). Critical reading plays a fundamental role in this process, as it enables learners to examine arguments, identify assumptions, and evaluate evidence in academic texts (Facione, 2015; Paul & Elder, 2019).

The core of the discipline of critical thinking is critical reading, a crucial process for fostering it. This view is supported by Marin and de la Pava (2017), who emphasize the importance of critical reading in language learning. Critical reading is a process that uses critical thinking skills (Thistlethwaite, 1990; Douglas, 2000) and engages the reader (Marschall and Davis, 2015). According to Marschall and Davis (2015), when readers engage with a text, they will question, analyze, interpret, and evaluate its content and structure, and make connections between the text and their life experiences. Students with critical reading skills will be able to analyze, synthesize, and evaluate information in texts if they acquire these skills in the previous stage (Abd Kadir et al., 2014).

In recent years, the rapid integration of digital technologies in higher education has transformed learning environments, including the increasing use of Learning Management Systems (LMS) (Stukalo, & Simakhova, 2020). LMS platforms provide opportunities for flexible access to learning materials, interactive discussion forums, and collaborative learning activities that may support students' engagement with academic texts (Iswara et al, 2021). Several studies have reported that LMS environments can enhance student engagement and facilitate self-directed learning (Alharbi & Drew, 2014; Broadbent & Poon, 2015). However, most existing studies focus primarily on learning outcomes, usability, or student satisfaction, while relatively limited research examines how LMS use relates specifically to students' interest in critical reading, particularly among pre-service teachers who must develop advanced literacy competencies for professional practice (Marlina & Jayanti, 2019; Sutarsa & Puspitasari, 2021).

Furthermore, previous research has rarely examined students' interest in critical reading using theoretically grounded instruments, such as the Critical Reading Intention Scale (CRIS), which is based on the Theory of Planned Behavior (TPB) (Anuar et al, 2023). Within the TPB framework, reading intention is shaped by behavioral beliefs, normative beliefs, and perceived behavioral control that influence an individual's intention to perform a specific behavior. As linked to the present study, interest in critical reading is conceptualized as behavioral intention, measured by the CRIS instrument. Despite the relevance of this framework, empirical studies that apply CRIS to examine the relationship between LMS use and critical reading intention in teacher education contexts remain limited (Susanto, 2020). Strengthened by research conducted by Nasution et al. (2023), critical thinking is one of the most essential elements of scientific thinking, helping students solve challenges and problems in everyday life or the workplace by seeking answers supported by relevant evidence.

In addition, the construct of LMS use requires clear operationalization (Muhammad, 2017). In this study, LMS use refers to students' engagement with LMS-based learning activities, including accessing learning materials, participating in online discussions, completing assignments, and interacting with digital resources provided through the platform (Rabiman et al, 2021). These activities represent forms of learning interaction that may influence students'

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engagement with reading materials and their intention to read critically (Fearnley et al, 2022). In light of the review of previous studies, a clear research gap emerges. While LMS-based learning environments have been widely studied, there remains limited empirical evidence on how LMS engagement relates to pre-service teachers' intention to engage in critical reading, particularly when measured with the CRIS instrument grounded in TPB (Rapanta et al., 2020). Addressing this gap is crucial because understanding this relationship may inform the design of digital learning environments that promote deeper literacy engagement among future teachers.

Therefore, the research purpose is to examine whether the use of a Learning Management System (LMS) influences pre-service PPG students' interest in critical reading, as measured through the Critical Reading Intention Scale. Specifically, this study addresses the following research question that 'Does the use of a Learning Management System significantly influence pre-service teachers' intention to engage in critical reading?'

The research contribution lies in three aspects. First, it provides empirical evidence regarding the relationship between LMS-based learning and critical reading intention among pre-service teachers, a population that has received limited attention in previous research. Second, the study applies the Critical Reading Intention Scale (CRIS) in a digital learning context, thereby contributing to the instrument's validation in teacher education settings. Third, the findings offer practical insights for universities and teacher education institutions in designing LMS-supported learning environments that encourage deeper engagement with academic texts and support the development of critical literacy skills among future educators.

2. Method

This study employed a quantitative survey design to examine the relationship between students' engagement with a Learning Management System (LMS) and their intention to engage in critical reading (Sugiono, 2019). The study does not aim to establish causal relationships but rather to explore associations between LMS engagement and critical reading intention among pre-service teachers. The research was conducted in three universities that implement LMS-supported learning in teacher education programs. Data were collected through an online questionnaire distributed using Google Forms.

2.1 Participant

The research participants consisted of 109 pre-service teacher students enrolled in teacher education programs at three universities in Indonesia. The respondents were selected through a voluntary response sampling technique, in which the questionnaire link was distributed online through academic communication channels commonly used by students, such as class groups and institutional learning platforms. The present study's participation was entirely voluntary, and students completed the questionnaire via Google Forms. The inclusion criteria required that participants were currently registered as students in a teacher education program and had prior experience using a Learning Management System (LMS) in their learning activities. Only responses that were fully completed were included in the analysis. The demographic information collected from participants included gender, university affiliation, year of study, and experience in using LMS for academic purposes. This information was used to describe the participant profile and to enhance the transparency and replicability of the research.

2.2 Research design and procedure

The survey research procedure, as illustrated in Figure 1, is conducted in several systematic stages to ensure the validity and reliability of the research. The study begins by identifying and

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formulating the research problem related to students' engagement with Learning Management Systems (LMS) and their intention to engage in critical reading. In light of this challenge, the researcher formulates the research objectives and research questions that guided the entire study. Thereafter, a literature review is conducted to examine relevant theories and prior studies on LMS use, critical reading, and the Theory of Planned Behavior. The results of the literature review are used to identify the research variables and their operational definitions, including measurable indicators. Herein, the present study uses the LMS to administer the USE (Usefulness, Satisfaction, and Ease of Use) instrument, while students' intention toward critical reading is measured with the Critical Reading Intention Scale (CRIS). Prior to data collection, the instruments are reviewed and adapted to ensure clarity of language and suitability for the research context (Creswell & Creswell, 2018).

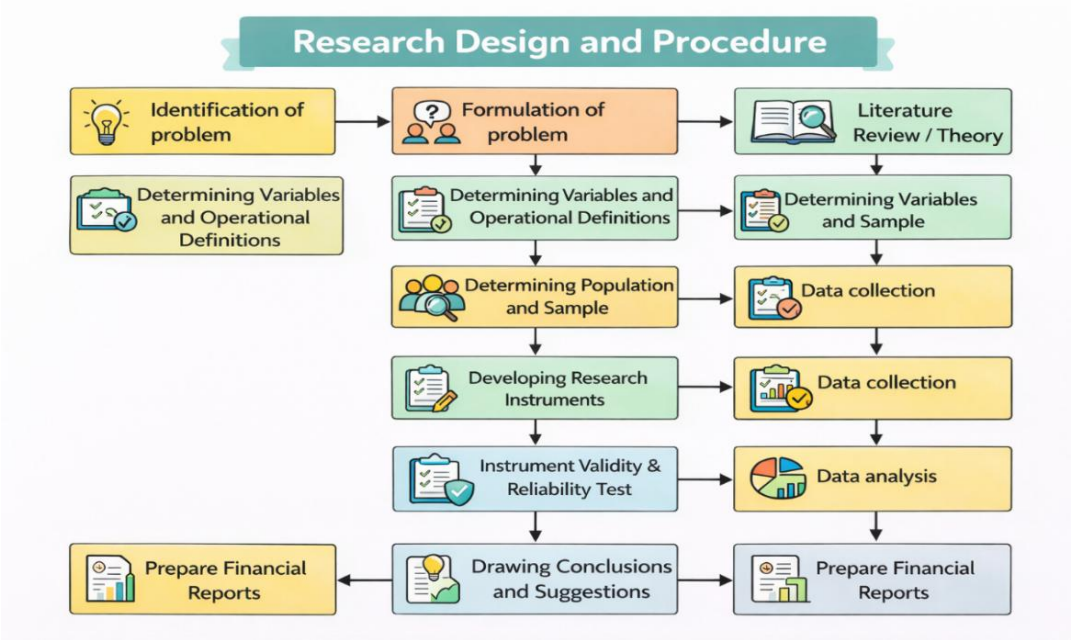


Figure 1. Research design and procedure

A pilot test was conducted with a small group of students to evaluate the clarity of the questionnaire items and assess the instruments' preliminary reliability. In light of the findings, several items were revised to improve readability and consistency. After the instrument refinement process was completed, the study population and sample were determined. The participants consisted of pre-service teachers from three universities who met the inclusion criteria of being actively enrolled in teacher education programs and having prior experience using an LMS in their learning activities. Data were collected during the academic semester through an online questionnaire distributed using Google Forms. Research participation was voluntary, and informed consent was obtained from respondents before they completed the questionnaire. To ensure data confidentiality, no personal identifying information was collected. The online form was configured to prevent multiple submissions by the same respondent, and responses were screened for potential duplicates.

After completing data collection, the responses were downloaded and organized using Microsoft Excel before being analyzed using SPSS version 26. During the data preparation stage, the dataset was checked for incomplete responses, inconsistent answers, and potential outliers.

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Questionnaires with substantial missing data were excluded from the analysis, while minor discrepancies were handled through appropriate statistical procedures. Descriptive statistics were conducted primarily to summarize respondents' characteristics and the distribution of the research variables. Subsequently, inferential statistical analysis was performed to examine the relationship between LMS use and students' critical reading intention. Furthermore, the analysis results were interpreted to answer the research questions and to provide conclusions and recommendations based on the empirical findings (Sugiyono, 2022).

2.3 Instrument

The present study involved two main variables. Learning Management System (LMS) use as the independent variable and critical reading intention as the dependent variable. LMS use refers to students' engagement with LMS-based learning activities during their coursework. LMS use was, moreover, operationalized through students' perceptions of the platform's usability, including perceived usefulness, ease of use, ease of learning, and satisfaction with the system. These aspects were measured using items adapted from the USE Questionnaire developed by Lund (2001). Respondents rated each statement on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The overall LMS score was calculated as the composite score of all items, representing the level of students' engagement and perceived usability of the LMS in their learning activities.

The dependent variable in the present study was critical reading intention, defined as students' intention to engage in critical reading when interacting with academic texts. This construct was measured using the Critical Reading Intention Scale (CRIS), developed by Anuar et al. (2023) and based on the Theory of Planned Behavior (TPB). The instrument measures three key components that influence behavioral intention. Those are attitudes toward critical reading, subjective norms, and perceived behavioral control. Participants responded to each item using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). In addition, the CRIS scores were analyzed as a composite total score representing the overall level of students' intention to engage in critical reading activities.

Table 1. Critical reading intention scale (CRIS) research instrument (Anuar et al, 2023)

No	Aspects	Items
1.	Behavioral Beliefs	My general knowledge increases when I read. My Indonesian level improved when I participated in reading activities. My creative thinking improves when I participate in critical reading. My concentration level increases when I participate in read.
2.	Attitude	Participating in critical reading is beneficial. Participating in critical reading is very useful. Participating in critical reading is important. Participating in critical reading is boring. Participating in critical reading is difficult. Participating in critical reading is a waste of time.
3.	Normative Beliefs	My parents thought that I should participate in critical reading. My friends think that I should participate in critical reading. My lecturers will approve my participation in critical reading. My lecturer will approve my participation in activities. My friends participate in critical reading when they read texts.

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No	Aspects	Items
4.	Subjective Norms	Most people who are important to me think that I should participate in critical reading I am expected to participate in critical reading. Most people who are important to me want me to participate in critical reading.
5.	Trust Control	I hope that I will be very motivated when I participate in reading. I hope my Indonesian will improve when I participate in reading. I become mentally exhausted when I participate in critical reading. I hope that my fear of negative feedback will prevent me from participating in critical reading. I hope that the fear of being wrong will prevent me from participating in critical reading.
6.	Perceived Behavioral Control	I am confident that I can participate in critical reading. I find it easy to participate in critical reading. Participating in critical reading is within my control. Participating in critical reading is completely up to me.
7.	Objective	I will strive to participate in critical reading when I read academic texts. I intend to participate in critical reading when I read academic texts. I plan to participate in critical reading when I read academic texts.

This study employs two instruments, as seen in Table 1, the Critical Reading Intention Scale (CRIS) and the USE Questionnaire. The CRIS instrument is adapted from Anuar et al. (2023), which is grounded in the Theory of Planned Behavior (TPB). Conversely, the USE questionnaire, developed by Lund (2001), measures students' perceptions of LMS usability. As the participants are Indonesian university students, the instruments are administered in Bahasa Indonesia. The original English items are translated into Indonesian using a forward–backward translation procedure to maintain semantic equivalence. First, the items are translated from English into Indonesian by the researcher. Furthermore, an independent bilingual reviewer translates the items back into English to verify the consistency of meaning. Minor revisions are made to improve clarity and readability for the respondents.

All questionnaire items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Negatively worded items were reverse-coded during data analysis to maintain consistency in scoring. Higher scores indicate a stronger intention to engage in critical reading. Prior to the main survey, a pilot test was conducted to assess item clarity and the reliability of the measurement scales. The reliability of the instruments was assessed using Cronbach's alpha, with $\alpha \geq 0.70$ considered acceptable for internal consistency. Construct validity was examined referring to the established factor structure of the CRIS instrument based on TPB constructs, including behavioral beliefs, attitude, normative beliefs, subjective norms, trust control, perceived behavioral control, and intention. The USE questionnaire served as the operational measure of LMS use, capturing students' perceptions of system usefulness, ease of use, ease of learning, and satisfaction. The scores from the USE instrument were used to describe students' engagement with LMS platforms and were subsequently analyzed alongside CRIS scores to examine the association between LMS engagement and students' critical reading intention. Details of the usability testing instrument grid are presented in Table 2.

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Table 2. Usability test Instrument

No	Indicators	Items
1	Usefulness	Using the system helps me to be more effective
		Using the system makes me more productive
		The system is useful for my learning activities
		The system gives me greater control over my learning tasks
		The system makes it easier for me to accomplish my learning goals
		Using the system saves me time
		The system meets my learning needs
		The system performs the functions that I expect
2	Ease of Use	The system is easy to use
		The system is practical to use
		The system is user-friendly
		Only a few steps are required to complete tasks using the system
		The system is flexible in supporting different learning activities
		Using the system is simple and straightforward
		I can use the system without written instructions
		I did not notice any inconsistencies while using the system
		Both occasional and regular users can use the system easily
		I can quickly recover from mistakes when using the system
		I can use the system successfully every time
3	Ease of Learning	I learned to use the system quickly
		I can easily remember how to use the system
		Learning to operate the system is easy for me
		I quickly became proficient at using the system
4	Satisfaction	I am satisfied with the system
		I would recommend the system to others
		The system is enjoyable to use
		The system works as I expect it to
		The system is impressive
		I feel that this system is important for my learning activities
		I enjoy using the system

The usability of the Learning Management System (LMS), as seen above, is measured using the USE Questionnaire developed by Arnold M. Lund. The USE instrument evaluates system usability across four dimensions: usefulness, ease of use, ease of learning, and satisfaction. As the participants of this study are Indonesian students, the original English instrument is translated into Indonesian using a forward–backward translation procedure. Primarily, the items are translated from English into Indonesian by two bilingual researchers. The translated version is subsequently back-translated into English by an independent translator to ensure semantic equivalence. Any discrepancies between the original and back-translated versions are discussed and resolved to maintain conceptual consistency. Before collecting the primary data, the instrument is pilot-tested with a small group of students to ensure the clarity, readability, and relevance of the statements. Based on the pilot results, minor revisions are needed to improve wording and grammatical consistency. All items are measured using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate a higher perceived usability of the LMS. Reliability analysis is conducted using Cronbach's alpha coefficient to assess the internal consistency of each dimension. Construct validity is examined by referring to

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the established factor structure of the USE questionnaire and confirming that items load appropriately on their intended dimensions.

2.4 Data analysis

After collecting the data, the responses from the online questionnaire were primarily recorded and organized in Microsoft Excel to ensure the accuracy and completeness of the dataset for the research sample. The dataset was subsequently imported into Statistical Package for the Social Sciences (SPSS) version 26 for further statistical analysis.

The data analysis was conducted in several stages. First and foremost, descriptive statistical analysis was conducted to summarize respondents' characteristics and describe the distribution of responses for each research variable. In addition, a normality test using the Kolmogorov–Smirnov test was conducted to determine whether the data distribution met the assumptions required for parametric statistical analysis. Furthermore, the reliability of the research instruments was evaluated using Cronbach's alpha coefficient to assess the internal consistency of the measurement scales.

To examine the relationship between the research variables, correlation analysis was conducted. When the data did not meet the assumption of normality, the Spearman rank correlation test was used to assess the strength and direction of the relationship between LMS use and students' critical reading intention. In addition, simple linear regression analysis was conducted to explore whether LMS use significantly predicts students' intention to engage in critical reading. The level of statistical significance used in this study was $p < 0.05$.

3. Results

Research data were collected through random sampling via a Google Form distributed to PPG Pre-service students from three universities. This research aims to examine the effect of using the LMS in PPG Pre-service students' lectures. They are given a CRIS questionnaire, which has been tested and is widely distributable. To determine the effect, several stages of research data analysis were carried out. After obtaining the data, it was analyzed in SPSS version 25 to assess normality, as shown in Table 3.

Table 3. Normality test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		109
Normal Parameters[a,b]	Mean	,0000000
	Std. Deviation	9,24180473
Most Extreme Differences	Absolute	,103
	Positive	,103
	Negative	-,087
Test Statistic		,103
Asymp. Sig. (2-tailed)		,006[c]

In light of the One-Sample Kolmogorov–Smirnov Test for normality, the total number of research samples is 109 respondents. The mean residual value obtained is 0.0000000, and the standard deviation is 9.24180473. Furthermore, in the Most Extreme Differences section, the absolute value is 0.103, the positive value is 0.103, and the negative value is -0.087. The Test Statistic value in the Kolmogorov–Smirnov test is 0.103, with an Asymp. Sig. (2-tailed) value of

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0.006. Based on the normality testing criteria, if the significance value (Sig.) is greater than 0.05, the data are considered to be normally distributed. Conversely, if the significance value is less than 0.05, the data are considered not normally distributed. The test results reveal that the Asymp. Sig. The value is 0.006 < 0.05, indicating that the residuals in this study are not normally distributed. Thus, the research data model does not meet the normality assumption. Therefore, in the subsequent analysis stage, the researcher may consider using non-parametric statistical methods or applying data transformations to make the data distribution more normal. This condition is crucial to consider, as the normality assumption is a basic requirement for using parametric statistical analyses in quantitative research.

Table 4. Homogeneity test

Test of Homogeneity of Variances			
Levene Statistic	df1	df2	Sig.
8.462	1	216	.004

Regarding the homogeneity of variances test using Levene's Test above, the Levene Statistic value is 8.462, with df1 = 1 and df2 = 216, and a significance value (Sig.) of 0.004. The homogeneity test is conducted to determine whether the variances of the data across groups in the study are equal (homogeneous). According to the homogeneity testing criteria, if the significance value (Sig.) is greater than 0.05, the data are considered to have homogeneous variances. Conversely, if the significance value is less than 0.05, the data are considered to have non-homogeneous variances. The test results indicate a significance value of 0.004 < 0.05, suggesting that the variances of the data in this study are not homogeneous. Therefore, the research data do not meet the assumption of homogeneity of variances, which is typically required for parametric statistical analyses. Consequently, in the next stage of analysis, the researcher may use non-parametric statistical methods that do not assume homogeneity of variances, such as the Mann–Whitney test, to assess effects or differences between variables in the study.

Table 5. Effect test using mann-whitney

Test Statistics[a]	
	Questionnaire Results
Mann-Whitney U	4125,000
Wilcoxon W	10120,000
Z	-3,902
Asymp. Sig. (2-tailed)	,000

Derived from the Mann–Whitney test in the Test Statistics table above, the Mann–Whitney U value is 4125.000, the Wilcoxon W value is 10120.000, and the Z value is -3.902. The Mann–Whitney test is a non-parametric statistical test used to determine whether there is a difference between two groups of data when the data do not meet the assumptions of normality and homogeneity of variance. The most essential value in this test is the Asymp. Sig. (2-tailed), which is 0.000. According to the hypothesis testing criteria, if the significance value is less than 0.05, then the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. The test results elucidate that 0.000 < 0.05, indicating a statistically significant effect or difference. Therefore, the analysis indicates that the variable under study has a significant influence on respondents' questionnaire results. In the context of the present study, the use of the Learning Management System (LMS) significantly influences interest in critical reading among Pre-service PPG PGSD students. These findings emphasize that using an LMS in the learning process can

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increase students' engagement in critical reading activities and support the development of their critical thinking skills.

4. Discussion

The findings of the present study indicate a statistically significant association between students' engagement with the Learning Management System (LMS) and their intention to engage in critical reading among pre-service PPG students (Rahardhian, 2022). The non-parametric analysis using the Mann–Whitney test yielded a p-value < 0.05, indicating that differences in LMS engagement are associated with variations in students' critical reading intention. Since this study employed a survey design, these findings should be interpreted as indicating an association rather than a causal relationship (Vacek, 2009). From a theoretical perspective, the findings can be interpreted within the framework of the Theory of Planned Behavior (TPB) underlying the Critical Reading Intention Scale (CRIS). According to TPB, behavioral intention is shaped by three key components: attitudes toward the behavior, subjective norms, and perceived behavioral control (Anuar et al., 2023). Students' engagement with LMS-supported learning activities may help shape these components (Kealey, Holland & Watson, 2005). LMS environments provide structured access to academic texts, opportunities for interaction through discussion forums, and mechanisms for submitting assignments and receiving feedback. Such learning environments may support students' attitudes toward critical reading by framing reading as a meaningful academic activity, while collaborative discussion spaces may reinforce subjective norms that value analytical engagement with texts (Kurniaman et al, 2024). Additionally, accessible digital resources and structured learning activities may enhance students' perceived behavioral control when engaging in critical reading tasks (Rofi'uddin et al, 2022).

The findings are consistent with previous research highlighting the role of digital learning environments in supporting students' engagement with academic materials (Sari, 2012). Broadbent and Poon (2015) emphasize that online learning environments can support self-regulated learning by providing flexible access to learning resources and enabling students to manage their learning activities independently. Similarly, Fearnley et al. (2022) report that well-designed online learning environments can influence students' perceived learning and engagement with course materials. Within teacher education contexts, LMS platforms may therefore serve as structured learning environments that facilitate students' interaction with academic texts and reflective learning processes (Kurniaman et al, 2025).

In addition, previous studies have highlighted the relationship between digital learning environments and the development of higher-order thinking skills. Rofi'uddin et al. (2022), for instance, found that blended learning approaches can support the development of critical and creative thinking by combining online learning with collaborative and reflective activities. Similarly, Camelia et al. (2023) reported that multimedia-supported learning environments can support pre-service teachers' critical thinking through interactive learning modules and discussion-based learning activities. The present findings complement these studies by suggesting that LMS engagement is associated with students' intention to engage in critical reading activities, an essential component of critical thinking development (Lukitasari et al., 2020).

In the context of pre-service teacher education, the development of critical reading competencies is particularly crucial (Kurniaman et al, 2024). Pre-service teachers are expected to critically evaluate information, interpret educational texts, and guide their future students in developing higher-order thinking skills (Negoro et al., 2023). The LMS environment may provide a

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practical platform for integrating these competencies into teacher education programs (Mahdum, 2019). LMS-supported learning activities, for instance, can include structured critical reading assignments, guided discussion prompts that encourage students to evaluate arguments within academic texts, and collaborative analysis of educational cases (Mahmud & Warto, 2022). Lecturers may also utilize rubrics and formative feedback mechanisms within the LMS to help students reflect on their analytical reading strategies and improve their reasoning processes (Ramdani et al., 2021). Such pedagogical practices can strengthen the integration of digital learning environments with the development of critical literacy among future elementary school teachers (Luzyawati et al, 2025).

Despite these contributions, several limitations should be considered when interpreting the present findings (Kurniaman et al, 2020). First, the research employed a survey design, which limits the ability to draw causal conclusions about the relationship between LMS engagement and critical reading intention (Mukhlis, Dafik, & Hobri, 2018; Nurdiansyah, Sundayana, & Sritresna, 2021). Second, the study used a voluntary response sampling technique, which may introduce self-selection bias and limit the sample's representativeness (Wahid et al., 2024). Third, the sample size was relatively modest and limited to students from three universities, which may restrict the generalizability of the findings. In addition, the study relied on self-reported questionnaire data, which may be influenced by subjective perceptions and social desirability bias (Agoestanto et al., 2017; Salwah et al., 2020). Lastly, the analysis did not include additional control variables such as students' prior reading proficiency, digital literacy levels, or academic achievement, which might also influence critical reading intention (Kurniaman et al., 2020).

Future research may address these limitations by employing larger, more diverse samples from multiple teacher education institutions (Awang et al., 2023). Longitudinal or experimental designs may also provide deeper insights into how specific LMS-based instructional strategies influence students' critical reading engagement over time (Nurhasanah & Dafit, 2023). Additionally, combining survey instruments such as CRIS with performance-based measures of critical reading may provide a more comprehensive understanding of how digital learning environments support the development of higher-order literacy skills in teacher education (Ni'matuzahroh, 2015; Sukma & Haryadi, 2016; Ganing & Wulandari, 2023).

Overall, the findings underscore that LMS-supported learning environments are associated with pre-service teachers' intention to engage in critical reading. These results highlight the importance of designing LMS-based learning activities that intentionally support analytical reading, structured discussion, and reflective engagement with academic texts in teacher education programs.

5. Conclusion and implications

This study examined the relationship between Learning Management System (LMS) engagement and pre-service PPG students' intention to engage in critical reading as measured using the Critical Reading Intention Scale (CRIS). The statistical analysis indicates that LMS engagement is significantly associated with variations in students' critical reading intention. These findings emphasize that students who report higher engagement with LMS-supported learning activities also tend to report stronger intentions to engage in critical reading when interacting with academic texts. Because the study employed a survey design and non-experimental data, the findings should be interpreted as indicating an association rather than a causal effect.

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Within the framework of the Theory of Planned Behavior that underlies the CRIS instrument, LMS-supported learning environments may help shape students' attitudes toward critical reading, reinforce normative expectations through collaborative learning spaces, and support perceived behavioral control when engaging with academic texts. In teacher education contexts, these elements are relevant because pre-service teachers are expected to develop the ability to analyze and evaluate educational information critically before guiding their future students in similar practices. However, several limitations should be acknowledged when interpreting the findings. Primarily, the study used a voluntary response sampling approach, which may introduce self-selection bias and limit the representativeness of the participants. Furthermore, the sample size was relatively modest and limited to students from three universities, which may restrict the generalizability of the results to broader teacher education populations. Moreover, the study relied on self-reported questionnaire data, which may be influenced by subjective perceptions and potential reporting bias. In addition, the operationalization of LMS engagement in this study focused primarily on students' perceived usability of the system rather than direct observation of their learning behaviors within the platform. These limitations indicate that the findings should be interpreted with caution and may benefit from further validation using complementary research designs.

Despite these limitations, the findings offer several practical implications for the design of LMS-supported learning in pre-service elementary teacher education (PPG PGSD). First, LMS platforms can be used to structure critical reading activities by integrating guided reading tasks that prompt students to identify arguments, evaluate evidence, and connect theoretical concepts with classroom practice. Second, structured discussion prompts within LMS discussion forums may encourage collaborative interpretation of academic texts and promote reflective dialogue among pre-service teachers. Third, the use of analytic rubrics and formative feedback in LMS-based assignments may help students develop clearer expectations for critical reading practices and monitor their progress. Lastly, integrating reflective tasks such as short analytical responses or case-based reading activities within LMS environments may help strengthen students' engagement with educational literature relevant to elementary teaching practice.

Future research may extend this work by employing larger, more diverse samples across teacher education institutions and by incorporating mixed-methods approaches that combine survey data with observational or performance-based assessments of critical reading. Such approaches may provide a more comprehensive understanding of how LMS-supported learning environments contribute to the development of critical literacy competencies among pre-service elementary school teachers.

Credit authorship contribution statement

OK: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Supervision. **BGF:** Conceptualization, Methodology, Validation, Writing – review & editing. **EN:** Investigation, Data curation, Project administration, Writing – review & editing. **M:** Investigation, Data collection, Validation, Writing – review & editing. **G:** Investigation, Data collection, Resources, Writing – review & editing. **NS:** Methodology, Validation, Writing – review & editing. **Y:** Formal analysis, Visualization, Writing – review & editing. **R:** Data curation, Investigation, Resources. **BAF:** Data curation, Visualization, Writing – review & editing.

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Declaration of competing interest
The authors declare that there are no conflicts of interest regarding the publication of this article. The research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability Statement
The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request. Due to ethical and privacy considerations involving student participants, the data are not publicly archived.

Ethical Declaration
This study complies with ethical standards for research involving human participants. Participation in the survey was voluntary, and respondents were informed of the study's objectives before completing the questionnaire. Informed consent was obtained from all participants. The questionnaire was administered anonymously, and no personal identifying information was collected to protect participants' privacy. All data were handled confidentially and used solely for academic research purposes.

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Declaration of AI statement
Artificial intelligence (AI) tools were used solely to support language editing and improve the manuscript's readability. AI was not used in the design of the study, data collection, data analysis, or interpretation of results. The authors take full responsibility for the accuracy, integrity, and originality of the work.

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