Vol. 15, No. 04, pp. 2294-2313, 2025 DOI: 10.23960/jpp.v15i4.pp2294-2313

Jurnal Pendidikan Progresif

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jpp.fkip.unila.ac.id/index.php/jpp/

Does Cloud-Based LMS Promote Engaging and Enjoyable Learning? Evidence from High School Accounting Education

Jarot Tri Bowo Santoso[1,*], Said Nur Octavianto[1], & Randy Joy Magno Ventayen[2]

[1]Faculty of Economics and Business, Universitas Negeri Semarang, Indonesia

[2]Faculty of Business and Management, Pangasinan State University, Philippines

*Corresponding email: jarot.tribowo@mail.unnes.ac.id

Received: 31 August 2025 *Accepted: 18 October 2025* *Published: 05 November 2025*

Abstract: Does Cloud-Based LMS Promote Engaging and Enjoyable Learning? Evidence from High School Accounting Education. Accounting is perceived as one of the most difficult subjects among many secondary school students. This problem may arise from the lack of student involvement in learning on the one hand, and from teachers' use of non-interactive teaching practices on the other. This study bridges the learning gap by using LMS-based Web Cloud Computing media in accounting as a fun and effective learning medium to improve students' learning outcomes. **Objective:** This study aims to enhance learning outcomes by creating a fun learning environment by stimulating student participation through LMS-based web cloud computing media. **Methods**: Quantitative method with quasi-experimental research design with experimental and control classes in grade XII-SMA N 14, Semarang City. Data were gathered through pre- and post-tests to find out the improvement and effectiveness of learning outcomes. A survey was administered to determine whether the media used were acceptable to the students. The data were analyzed using Independent Samples t-tests, Paired Samples t-test, and N-Gain Test. **Results**: The findings show that the Learning Management System (LMS) web-based cloud computing platform was perceived as a fun virtual learning medium for learning accounting. The findings demonstrate that over 80% of respondents were strong supporters of all indicators, including the idea that LMS-based cloud computing web media is a fun medium. **Conclusion**: the cloud-based LMS is effective in enhancing students' accounting learning achievement, at a moderate level. The article contributes to theory development by providing a framework for the rational and empirical use of LMS-supported web cloud media computing. Practical implications: This study offers practical guidance for educators seeking to create meaningful, interactive, and applicable learning media that support student learning outcomes.

Keywords: cloud computing, web, learning management system, fun learning media, learning outcomes

To cite this article:

Santoso, J. T. B., Octavianto, S. N., & Ventayen, R. J. M. (2025). Does Cloud-Based LMS Promote Engaging and Enjoyable Learning? Evidence from High School Accounting Education. *Jurnal Pendidikan Progresif*, *15*(4), 2294-2113. doi: 10.23960/jpp.v15i4.pp2294-2313.

INTRODUCTION

Many students find accounting difficult. Most get low scores in this subject (Tailab, 2013; Bosu, 2016; Olifant et al., 2024; Fatimah, Hasmidyani, Suranto, FH, & Leisthari, 2025). The poor results indicate that they have difficulty understanding accounting material. Many factors influence their ability to understand the material, such as a lack of learning motivation, static teaching methods (Hosal Akman & Simga Mugan, 2010), lack of interest in numerical learning (Franco & Roach, 2017; Olifant et al., 2024), the rarity of accounting teachers who use innovative learning media (Amadi, 2019), or the teachers inappropriately use the media (Afari, Aldridge, Fraser, & Khine, 2013; Mariati &

Saehu, 2018). That is why they consider the learning atmosphere unpleasant and boring.

Boring and unpleasant learning makes the students experience anxiety when participating in learning, and results in poor learning outcomes (Artama et al., 2020; Mazzone et al., 2007; Whitaker Sena et al., 2007). Therefore, teachers must reduce or even eliminate elements that put students under pressure. They can create or apply exciting learning (Santoso & Widiyanti, 2022). Also, in the current digital era, most students do not like indoor learning. They prefer activities that they think are fun, such as playing games (Afari et al., 2013). Enjoyable learning is characterized by a good relationship pattern between educators and students (McLure, Fraser, & Koul, 2022; Li, Bergin, & Olsen, 2022). It runs in a cheerful and enjoyable atmosphere. Enjoyable learning is a vital part of the learning process (Rodríguez-Muñoz, Antino, Ruiz-Zorrilla, & Ortega, 2021). It is because such learning can increase students' interest (Mötteli, Grob, Pauli, Reusser, & Stebler, 2023). Therefore, it will improve their learning outcomes.

Nowadays, most students prefer to spend time playing games rather than learning materials. They think learning will be fun when it is game-based, internet-based, and interactive. Using game-based learning media, students will not feel like they are learning materials; they will feel like they are playing games together. It can make learning activities more interesting and fun. Finally, the materials will be easy for students to understand, fostering their motivation and interest.

One of the media for supporting learning in the era of the 4.0 industrial revolution 4.0 is interactive media. They can foster better interactions or active actions between students and the media presented. Therefore, the use of interactive learning media can be one solution to overcome students' learning difficulties in accounting material. Some past empirical studies have shown that the lack of use of interactive learning media negatively affects high school students' accounting abilities (Omerèeviæ, Lary, & O'Neill, 2025; Voshaar, Knipp, Loy, Zimmermann, & Johannsen, 2023; Haryani et al., 2021; Mustamila, 2021; Salshabella et al., 2022; Taena & Karno, 2023).

The rapid development of information and communication technology is a non-negotiable factor in presenting interactive learning media at schools. It aims to make learning more efficient, effective (Zaidi et al., 2021; Santoso et al., 2023), and enjoyable. Interactive features can present two-way interactions between students and teachers. They can also strengthen learning motivation (Prahani et al., 2022; Syahputra & Maksum, 2020; Y. Jung et al., 2014), learning interest, and learning outcomes significantly (Nurkhin et al., 2022). However, many teachers have not used interactive learning media in their lessons (Désiron, Schmitz, & Petko, 2025). This is due to their limited ability to create learning materials and to provide inadequate infrastructure.

Therefore, an educator must use interactive learning media to create fun and effective learning. One of the interactive learning media for accounting in high school is Cloud Computing, Web-based on the Learning Management System (LMS). Cloud Computing is an adequate learning medium suitable for high school students. It can manage, process, and store internet-based data (Alhomdy et al., 2021; Arora et al., 2020). It also offers adjustable features, is easy to control, is dynamic, and has almost unlimited scalability (Hartanto, 2017). The use of Cloud Computing integrated with the Web system (Website) has various information content in the form of electronic or web pages (Laugi, 2018). Meanwhile, the LMS can encourage student exploration (Rezvani, Khosravi, & Dong, 2017), increase learning interactions (Zainuddin, Shujahat, Chu, Haruna, & Farida, 2019), and be highly accessible (Williams & Brown, 2018).

On the other hand, the LMS creates an interactive learning space in the form of media and instruments created together by teachers and

students (Kehrwald & Parker, 2019). It can be a medium to improve students' productivity and communication skills (Khan et al., 2019); (Kraleva et al., 2019). The integration of LMS-based Cloud Computing Web Learning Media can create a more active and interesting learning atmosphere to encourage students' ability to think creatively, innovatively, and systematically, according to the learning materials (Sodik & Wijaya, 2017)

The application of learning media based on cloud computing through a Learning Management System (LMS) is very suitable to support the scientific approach, i.e., observation, questioning, experimenting, reasoning, and communicating. Web-based LMSs provide online storage for content, forums, learning logs, quizzes, and exams, as well as computer-graded assignments with reporting capabilities, enabling students to practice independently at their own pace. According to Thorndike's Law of Exercise, synapse connections grow stronger when they are used more frequently. In an LMS environment, this is manifested in online practice problems, web-based quizzes, and automated feedback and positive reinforcement through repetition that develop students' capabilities (Schunk, 2020). The organization of a course inside an LMS with periodic practice and feedback built in is an important factor for success in asynchronous online learning (Robertson & Doloc-Mihu, 2024).

Contrastingly, constructivist theory posits that the LMS is a space where shared meaning-making occurs and knowledge is socially constructed within an authentic activity context. Vygotsky's concept of the Zone of Proximal Development (ZPD) highlights the significance of scaffolding learners to move them from their actual developmental level to reach their full potential. Through forums, peer review, and adaptive learning objects in an LMS, teachers and peers could scaffold instruction to meet learners' needs. Problem-based learning (PBL) is most effective when learners are scaffolded to engage in scientific inquiry as well as problem solving (Hmelo-Silver, Duncan, & Chinn, 2007). Moreover, an application of scaffold design in a PBL framework shows that this approach increases motivation as well as cognition (Belland, Kim, & Hannafin, 2013). Therefore, integrating a cloud-based LMS will not only encourage organized scientific learning but also merge the law of exercise (behaviorism) with scaffolding and ZPD (constructivism), thereby making the process much more meaningful and improving students' learning outcomes.

This research aims to analyze student acceptance of using LMS-based cloud Computing Web media in accounting subjects as a fun learning medium. It is also necessary to analyze the effectiveness of LMS-based cloud computing web media in improving high school students' accounting learning outcomes. The novelty of this study is that, to date, no research has used Cloud Computing Web-based learning media via a Learning Management System (LMS) in accounting instruction in high school. The application of cloud-based learning media via Learning Management Systems (LMS) is limited to private universities or general courses. However, its application in high school accounting education has not been studied. Cloud-based Learning Management Systems (LMS) are productive in improving student engagement and learning outcomes, especially in mathematics, science, and language domains. A gamified, Mobile, Cloud-Based Learning Management System (GMCLMS) is reported to not only produce a significant increase in learners' academic performance on the final test but also promote higher engagement than a traditional LMS with incorporated gamification, online quizzes, and cloud-based availability (Ahmed, El-Sabagh, & Elbourhamy, 2025). Learner engagement in LMS activities has been reported

to positively relate to learning satisfaction, which ultimately enhances English performance, according to other scholars (H. Li & Ni, 2024). These findings validate that online LMSs (cloud, interactive testing, and virtual collaboration) are positively associated with greater student participation and better academic outcomes. However, to the best of my knowledge, no study has examined accounting education at the high school level in Central Java Province regarding the use of cloud-computing-based learning media, which makes this work unique.

The use of a cloud computing LMS for high school accounting learning in this study, at least, has its own novelty. First, an LMS may offer an enjoyable learning experience, such as interactive quizzes, discussion boards, and transaction recording simulations, thereby lessening the rigidity and monotony of accounting. Second, access through a cloud-based model enables ongoing active student engagement, together or solo, outside of face-to-face hours. Third, the principles of the law of exercise (reinforcement through repeated practice) and scaffolding within the ZPD can be theoretically enhanced by real-time feedback and learning analytics to improve students' understanding of accountancy concepts and procedural knowledge. The study makes a conceptual contribution by addressing a gap in empirical research on accounting learning at the high school level. It suggests that integrating a cloud-based LMS would yield more enjoyable, participatory, and applicable improvements in learning outcomes than similar research in other contexts.

METHOD

Participant

The population in this research consisted of 12th-grade students in the Social Science Department at SMA Negeri 14 Semarang, specifically, economics students (accountancy with an emphasis on adjustment journals for trading companies). The census of inference for this study comprised three groups: 12th-grade Social Studies 1 (34 students); 12th-grade Social Studies 2 (34 students); and 12th-grade Social Studies 3 (36 students). Sample selection based on the similarity of each class (control and experiment) was considered in this study. That included an equivalent average mark of 81 for economics at the end of the second semester, when all students were still enrolled. A non-equivalent control group design was used in the sampling plan. The sample includes 34 students in the content-related group, Social Studies 1, and 34 students in the non-content control group, Social Studies 2. In the meantime, class XII Social Sciences 3 students, totaling 36 students, whose economics final average score in the second semester was 84, were not sampled and were tested only on the pre-test and post-test of the research instruments.

Research Design and Procedures

This research employed a quantitative, quasi-experimental design. The experimental group is chosen to define the group exposed to elicitation free of interference, and the control group serves as a comparison group devoid of stimuli.

Table l. Research design

Class	Number of Students	Pre Test	Stimulus	Post Test
Experiment (E) XII IPS 1	34	O_1	X_1 (Cloud Learning Media and Scientific Approach)	O_2
Control (K) XII IPS 2	34	O_1	X_2 (Scientific Approach)	O_2

Table Description
E : Experimental class
K: Control class
X1: Learning with Cloud Media and Scientific Approach
X2: Learning with a Scientific Approach
O_1 : Pre-test
O_2 : Post-test

A stimulus-based Learning Management System (LMS) in the Cloud Computing Web Media was used in an experimental class to integrate with a scientific approach. In the control class, only the scientific approach was used, without LMS media. The learning was done in two meetings. The scientific approach used in the experimental class has a specific syntax: revealing the digital learning media to be used and providing 15 question sheets for students to answer before the test. For this case, implementation of the scientific approach has been modified according to the topic, and it refers to the exposure of Scientific Learning Syntax (SLS), i.e., (1) observing; (2) asking; (3) information collecting process; (4) association; (5) Communication. The observation stage involved instructing students to quickly read and understand the material presented in the Learning Management System (LMS) using Cloud Computing Web Learning Media. Questioning is carried out by giving students a chance to ask questions about the material and by adjusting the journals of trading companies studied before in the learning media. The information collection process was carried out with four groups of 8-9 students each. Each team worked on the "game" menu in section 4 of the adjusting journals for trading companies shown in the learning media. The association phase includes the practice step-by-step instructions for completing in independent student task section 5 learning media. The final stage was communicating. In this stage, the practice question in section 5 of the learning media was studied, and students were expected to provide explanations for their case study examples for that question. In the second, a similar syntax was used, followed by a post-test on the learning media.

In the control class, learning was not delivered through LMS-based Cloud Computing Web Media material, but rather involved carrying out the scientific approach taught. A pre-test was given before the control class received the learning implementation. Implementing the scientific approach begins with the observation stage. Students are given a copy of the material to be studied. The next stage was questioning. In this stage, students can ask or clarify questions and engage in discussion. In the "Collecting Information" phase, students are given time to solve questions posted on the board in groups of four, with 8 to 9 students per group. The association phase is implemented by having students work on practice items of the material to be learned, with distributed printouts, individually. In the second stage, students were instructed to provide examples of personality case studies they had learned. The presentation of conclusions is also an opportunity for researchers to develop the material, with a view to increasing student comprehension and ability. Students then receive a post-test in the next phase.

Instruments

This study used tests and questionnaires, with the instruments measuring student learning outcomes administered as pretests and posttests. The survey was designed to collect data on students' acceptance of media. The instrument stimulant of research, which was in the form of three objective cognitive assessment levels, namely C4 (analyze), C5 (evaluate), and C6 (create/making), was built into the Higher Order Thinking Skills (HOTS) question base to encourage accounting students to improve their skills by strengthening students' critical thinking ability. The C4, C5, and C6 (HOTS) question types have been selected to provide 21st-century learning that includes character-building and

literacy skills, as well as the 4Cs: Critical, Creative, Communicative, and Collaborative. Before the pre-test, validity and reliability tests are conducted on the proposed questionnaire. The pre-test and post-test each consist of 15 questions. They have the same characteristics and difficulty level. Tables 2 and 3 below present the results of the pre-test and post-test validity tests. Meanwhile, Table 4 displays the reliability test results.

Table 2. Validity test of pre-test question instrument

Total Items	R count	R table	*Sig.*	Criteria
1	.692	.329	.000	Valid
2	.656	.329	.000	Valid
3	.666	.329	.000	Valid
4	.668	.329	.000	Valid
5	.755	.329	.000	Valid
6	.803	.329	.000	Valid
7	.666	.329	.000	Valid
8	.778	.329	.000	Valid
9	.818	.329	.000	Valid
10	.696	.329	.001	Valid
11	.847	.329	.000	Valid
12	.768	.329	.000	Valid
13	.642	.329	.000	Valid
14	.692	.329	.000	Valid
15	.795	.329	.000	Valid

Table 3. Validity test of post-test question instruments

Items	R count	R table	*Sig.*	Criteria
1	.548	.329	.001	Valid
2	.692	.329	.000	Valid
3	.668	.329	.001	Valid
4	.778	.329	.000	Valid
5	.648	.329	.001	Valid
6	.778	.329	.000	Valid
7	.692	.329	.000	Valid
8	.702	.329	.000	Valid
9	.778	.329	.000	Valid
10	.666	.329	.000	Valid
11	.795	.329	.000	Valid
12	.778	.329	.000	Valid
13	.732	.329	.000	Valid
14	.663	.329	.000	Valid
15	.615	.329	.000	Valid

Table 4. Reliability test of pre-test and post-test questions

Alpha Coefficient		Criteria	
Pre Test	***Post Test***	***Pre Test***	***Post Test***
.897	.819	Good Reliability	Good Reliability

Tables 2 and 3 indicate that all questions are valid and suitable for use in data collection. Reliability values for the pre-test and post-test items are 0.897 and 0.819, respectively, as indicated in Table 4. Reliability of the value should be over 0.70 as a result of the Cronbach's alpha calculation. Thus, the reliability of pre-test and post-test questions is accepted.

Questionnaire Instrument

A questionnaire was administered to examine students' opinions on media use in the experimental class. Question items addressed to students were analyzed for students' responses to the u,se of Learning Management System (LMS)-based Web Cloud Computing Media. The data collection tool used a questionnaire that was pretested before the actual data collection, as presented in Tables 5 and 6.

Table 5 also reveals that the p-values are smaller than 0.05 for all questionnaire items, indicating that the entire questionnaire is valid and can be used to collect data. As indicated in Table 6, the Cronbach's alpha for all questionnaire items is greater than 0.700, indicating that these can be used as a reliable measurement tool in the data collection process.

Table 5. Validation test of acceptability question form for learning media tool as fun learning media

Question Item	Significant Value	Criteria
The learning media can make me excited to be fully engaged in learning	.000	Valid
The learning media makes me highly concentrated but not anxious	.001	Valid
The learning media is interesting, so I am enthusiastic about participating in the learning	.000	Valid
The learning media have high interactivity to raise learning interest	.002	valid
The learning media makes learning more relaxed, but can also improve my accounting skills	.000	Valid

Table 6. Reliability test of the acceptability question form for learning media tool as fun learning media

Question Item	Cronbach Alpha Value	Criteria
The learning media can make me excited to be fully engaged in learning	.883	reliable
The learning media makes me highly concentrated but not anxious	.938	reliable
The learning media is interesting, so I am enthusiastic about participating in the learning	.762	reliable
The learning media have high interactivity to raise learning interest	.895	reliable
The learning media make learning more relaxed, but can also improve my accounting skills	.917	reliable

Data Analysis

The hypothesis testing for this study takes two forms. The first factor used the Independent

Samples t-test, a statistical test used to calculate differences in means between two independent groups or classes. The Independent Samples t-test was used to compare the mean values of two specified samples. The classes are divided into an experimental and a control class based on post-test results in thermodynamics courses. The results of the analysis can determine whether the ability of the learning media (a Learning Management System (LMS)-based Cloud Computing Web) to improve accounting intelligence can be demonstrated scientifically. Second, the Paired Samples t-test was employed to compare the means before and after the treatment in the experimental class, yielding two data sets: pre-test and post-test.

Pre- and post-treatment scores were evaluated using the N-Gain test. The N-Gain Test was conducted to measure the effectiveness of using a Learning Management System (LMS)-based Cloud Computing Web learning media through a scientific approach to improve students' accounting skills. Table 7 shows the classifi cation result of the calculation of N-Gain. Descriptive statistics were used to analyze data on the acceptability of the LMS-based Cloud Computing Web as a fun learning medium.

Table 7. Classification of N-Gain calculation results

Coefficient Interval	Criteria
N – Gain < 0.3	Low
0.3 ≤ N - Gain ≤ 0.7	moderate
N – Gain > 0.7	High

Source: (Ramdhani, Khoirunnisa, & Siregar, 2020)

The test results can be a benchmark for hypothesis testing. The hypotheses in this study are:

H1: The Cloud Computing Web media based on the Learning Management System (LMS) is a fun learning medium for students.

H2: The use of Cloud Computing Web media based on a Learning Management System (LMS) is effective in improving accounting learning outcomes of Class XII Social Studies Students of SMA Negeri 14 Semarang.

■ RESULT AND DISCUSSION

The results of this study are of two types: qualitative descriptive results on the acceptability of the media as a fun learning medium, and quantitative data on the effectiveness of the media used. However, before the Paired Samples t-Test is carried out, the data must undergo prerequisite tests to meet its requirements. These tests include Normality and Homogeneity tests.

Table 8 shows students' acceptance of the learning media used. In the statement "The learning media can make me excited to be fully engaged in learning," 90% of students answered

Table 8. Acceptance questionnaire for the use of learning media as a fun learning medium

Question	Strongly Agree	Agree	Less Agree	Disagree	Strongly Disagree
The learning media can make me excited to be fully engaged in learning	90%	10%	-	-	-
The learning media makes me highly concentrated but not anxious	88%	12%	-	-	-

The learning media is interesting, so I am enthusiastic about participating in the learning	88%	12%	-	-	-
The learning media have high interactivity to raise learning interest	86%	14%	-	-	-
The learning media makes learning more relaxed, but can also improve my accounting skills	85%	15%	-	-	-

'strongly agree' and 10% said 'agree.' In the statement "The learning media makes me concentrate highly but not anxious," 88% of respondents strongly agree and 12% agree. In the statement "The learning media is interesting, so that I am enthusiastic about participating in the learning," 88% of respondents strongly agree and 12% agree. In the statement "the learning media has high interactivity to raise learning interest," 86% of respondents strongly agree, and 14% agree. In the statement "The learning media makes learning more relaxed but can also improve my accounting skills," 85% of respondents strongly agree, and 15% agree. It means most respondents strongly agree that the Cloud Computing Web media based on the Learning Management System (LMS) provides a fun learning experience.

Before performing the Paired Samples t-test, the data must undergo prerequisite tests for normality and homogeneity. The data are pre-test and post-test results in each experimental and control class. Table 9 presents the results of the normality test.

Table 9. Pre-test and post-test normality test (experiment and control)

Tests of Normality							
		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Students' accounting learning outcomes	Pre-Test Experiment	.132	34	.141	.941	34	.065
	Post Test Experiment	.124	34	.200*	.946	34	.091
	Pre Test Control	.142	34	.080	.955	34	.167
	Post Test Control	.129	34	.162	.946	34	.095
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

Table 9 shows that the Sig-value in the Kolmogorov-Smirnov column and the Sig-value in the Shapiro-Wilk column are greater than 0.05. The Sig-value in the Kolmogorov-Smirnov column of the experimental class pre-test data (0.141), the experimental class post-test (0.200), the control class pre-test (0.080), and the control class post-test (0.162) are higher than 0.05. Meanwhile, the Sig-value in the Shapiro-Wilk column for the experimental class pre-test data (0.065), the experimental class post-test (0.091), the control class pre-test (0.167), and the control class post-test (0.095) is greater than 0.05. In other words, the pre-test and post-test scores in both classes are normally distributed and have met the normality assumption.

The following prerequisite listed in Table 10 is the homogeneity test. The Sig-value in the F-test column (Levene Statistic) and the Based on Mean row are 0.874 and 0.456, respectively. It means the pre-test and post-test scores of the experimental class and control class come from homogeneous groups with the same data variance.

Table 10. Pre-test and post-test homogeneity test (experiment and control)

Test of Homogeneity of Variance					
		Levene Statistic	**df1**	**df2**	**Sig.**
Students' accounting learning outcomes	Based on Mean	.874	3	132	.456
	Based on Median	.854	3	132	.467
	Based on the Median and with adjusted df	.854	3	125.223	.467
	Based on the trimmed mean	.896	3	132	.445

Table 11. Paired samples t-test for equality of means

Paired Samples Test									
		Paired Differences							
		Mean	**Std. Dev.**	**Std. Error Mean**	**95% Confidence Interval of the Difference**		**t**	**df**	**Sig. (2-tailed)**
					Lower	**Upper**			
Pair 1	*Pre-Test* Experiment - *Post-Test* Experiment	-23.618	18.405	3.156	-30.039	-17.196	7.483	33	.000
Pair2	*Pre-Test* Control - *Post-Test* Control	-7.853	18.622	3.194	-14.351	-1.355	2.459	33	.019

Paired Samples t-Test average similarity test results are depicted in Table 11, including the Sig. (2-tailed) = 0,000 or 1.694). In the control class, as seen in Table 11, the P value (2-tailed) is 0.019 or t table (2.459>1.694). These observations show a statistical difference between the experimental and control class average values. The Mean value of the experimental class is -23.618, and the control class is -7.853. The value of the Average (Mean) in the table shows that the average increase in science learning outcomes in the experimental class is greater than that in the control class, as the study using Cloud Computing Web Media based on an LMS with a Scientific approach in the experimental class achieved better results than the control class. However, the control team students' accounting learning efficiency will also improve through scientific learning, though not as significantly as that of the experimental team. One reason is that in the control class, Scientific Learning can be delivered through drill-and-practice methods, thereby improving students' accounting learning outcomes. The value in the Mean column shows that the average increase in learning outcomes in the experimental class is higher than in the control class. Therefore, the Cloud Computing Web Media, based on an LMS with a scientific approach in the experimental class, produces better results than in the control class. Table 12 below shows the results of the paired-samples statistical test.

Table 12 shows that the post-test value for the experimental class (75.88) is higher than that for the control class (66.47). Therefore, the hypothesis H_a is accepted and H_0 is rejected, indicating that the use of Media Cloud Computing Web-based on a Learning Management System

Table 12. Paired sample statistical test

Paired Samples Statistics					
		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	*Pre-Test* Experiment	52.35	34	22.185	3.805
	Post Test Experiment	75.88	34	17.037	2.922
Pair 2	*Pre Test* Control	58.63	34	18.750	3.216
	Post Test Control	66.47	34	18.588	3.188

(LMS) with a scientific approach is effective in improving students' accounting skills. It is based on a significant difference between the post-test values of the experimental and control classes. Visually, Figure 1 shows the differences in learning outcomes between the control and experimental classes at the cognitive levels C4, C5, and C6.

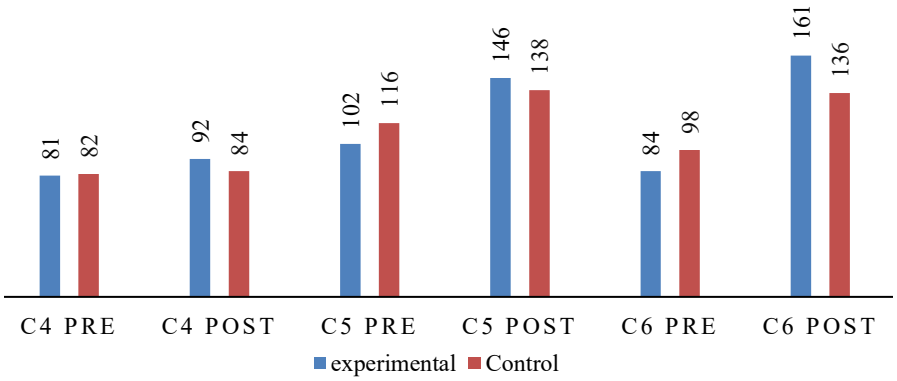

Figure 1. Comparison of learning outcome improvements at the cognitive level

Figure 1 shows that, in aggregate, the scientific approach improved students' accounting learning outcomes across all cognitive levels in both the experimental and control classes. However, when examining improvement across cognitive levels, the experimental class showed significantly higher learning outcomes than the control class. This indicates that the scientific approach, combined with a cloud-based web learning management system (LMS), was more effective in enhancing students' accounting learning outcomes across all cognitive levels.

Table 13. N – Gain test result

Class	**Mean**		**N – Gain Score**	**Criteria**
	Pre Test	**Post Test**		
Experiment	52.35	75.88	0.483	Medium
Control	58.63	66.47	0.076	Low

The N-Gain aims to determine changes or increases in pre-test and post-test scores in the experimental class as supporting data for the results of the previously conducted hypothesis test. The N-Gain test also evaluates the effectiveness of Media Cloud Computing Web-based learning using a Learning Management System (LMS) through a scientific approach in the experimental class. Table 10 shows an increase in the average post-test score relative to the pre-test score in the experimental class, which is higher than in the control class. The N-Gain score in the experimental class is 0.483, which falls into the "moderate" increase category.

Meanwhile, the N-Gain score in the control class is 0.076, which is in the "low" category. It means the increase in the post-test score relative to the pre-test score in the experimental class is greater than that in the control class.

Cloud Computing Web Media Based on Learning Management System (LMS) As a fun media for learning accounting

In this study, the LMS web cloud computing media was reported to be a fun medium for learning accounting. The results show that more than 80% of respondents strongly agree with all indicators of LMS-based Cloud Computing Web Media as a fun medium. This means the LMS-based Cloud Computing Web Media is a suitable medium for students' learning. This is because LMS-based Cloud Computing Web Media presents the material complexity by using the checkpoint feature to help students study trading company adjustment journals. Therefore, the learning process can run systematically in a directed manner. Armed with the Interactivity principle, this media provides an interactive website that guides students through practice questions on trading company adjustment journal case studies. The use of LMS-based Cloud Computing Web Media based on this high principle of interactivity can attract students' attention, interest, and motivation to get involved in the learning process.

Also, the LMS-based Cloud Computing Web Media presents game features and practice questions that can increase students' curiosity and enthusiasm for learning. The game focuses on the material on trading company adjustment journals, prompting students to study it repeatedly. The games presented in the Learning Management System (LMS) - based Cloud Computing Web Media consist of (1) Augmented Reality Fun (ARF); (2) Game Map; (3) Find the Words; and (4) Crossword. These games provide a distinctive experience for students learning about trading company adjustment journals. Although the LMS-based Cloud Computing Web Media used presents practice questions that require high concentration, students remain relaxed while working on them. It is because they go through interactive and engaging game features. They do not feel they are learning difficult material; instead, they feel like playing a game.

The LMS-based Web Cloud Computing Media also provides case study questions in three types: multiple-choice, incomplete-sentence, and true-false. They provide feedback on the answers given, whether correct or incorrect. Each question contains a case study problem using the same material. These different question types can encourage students' curiosity and enthusiasm for learning and increase their competitiveness with others. It is due to the accumulation of assessment listed in the "Summary & Submit" feature. This can encourage students' participation and activeness during the learning process.

This finding supports previous studies that the use of LMS is more interesting (Kraleva et al., 2019; S. Jung & Huh, 2019) and increases learning motivation (Kehrwald & Parker, 2019), create a more active learning atmosphere (Sodik & Wijaya, 2017), increases learning interactions (Zainuddin et al., 2019), thus encouraging student involvement in the learning process (Al-Fraihat et al., 2020; Harandi, 2015); (Samson & Yango, 2023) and learning motivation (Huda et al., 2018; Le & Do, 2019).

The Effectiveness of LMS-Based Web Cloud Computing Media in Improving Students' Accounting Learning Outcomes

The results conclude that the LMS-based Web Cloud Computing Media is effective in improving the accounting learning outcomes of Class XII Social Studies Students of SMA Negeri 14 Semarang. The Sig-value on the pre-test and post-test data of the experimental class is 0.000 or lower than 0.05. Meanwhile, the t-test value in the experimental class is 7.483, which is higher than the t-table value (7.483 > 1.694). Therefore,

the LMS-based Web Cloud Computing Media can improve the accounting learning outcomes of Class XII Social Studies Students of SMA Negeri 14 Semarang. Also, to strengthen these results, a Paired Samples t-test is used to determine the average pre-test and post-test scores in the experimental and control classes. The post-test score in the experimental class is 75.88. It is higher than the post-test score in the control class (66.47). It means that using LMS-based Web Cloud Computing Media with a scientific approach is more effective at improving students' accounting learning outcomes in the experimental class than in the control class. Meanwhile, applying the scientific approach to the control class can also improve students' understanding of the trading company's adjustment journals. This can be seen in the development of the control class's post-test learning outcomes compared to its pre-test. Furthermore, the application of the scientific approach, combined with a cloud-based learning management system (LMS), significantly improved students' accounting learning outcomes compared to the control class at cognitive levels C4, C5, and C6. This means that the use of a scientific approach combined with cloud computing web media based on a LMS is more effective in improving students' accounting learning outcomes not only at a certain cognitive level, but at all cognitive levels studied, thus further strengthening the belief that the use of cloud computing web media based on a LMS is more effective in improving students' accounting learning outcomes.

The N-Gain score aims to support the findings on the effectiveness of using an LMS-based Media Cloud Computing Web platform with a scientific approach in the experimental class. The N-Gain Test score in the experimental class is 0.483. There is an increase in the learning outcomes in the "medium" category. Meanwhile, the N-Gain Test score in the control class is 0.076, classified as the "low" category. These results show that the accounting learning outcomes in the experimental class with the LMS-based Media Cloud Computing Web treatment using a scientific approach are higher than those in the control class (without learning media). The combination of learning using the media and approaches is a strategic step that teachers can take to help students understand the material in trading company adjustment journals.

The results support Thorndike's (1874 - 1949) behaviorist learning theory, as stated in the "Law of Exercise." He said the learning process will be effective and optimal if students repeat the material given and increase practice. This is accommodated in the LMS-based Media Cloud Computing Web feature, which offers various practice question types for students to work on. Different practice question models can help students to understand the material more easily, effectively, and efficiently. Also, the LMS-based Media Cloud Computing Web provides practice questions in the form of games, accessible via the "Games" feature. The learning media combines various game models such as Augmented Reality (AR) which displays questions that students must work on immediately after scanning certain symbols prepared in advance, carrying out Game Map work sequentially and in stages according to the learning flow of the trading company adjustment journal material, determining the choice of words related to the eight elements of trading company adjustments through the Find The Words game, to filling in the blank words in the Crossword game to encourage basic materials related to the trading company adjustment journal.

The game not only provides practice questions in the form of case studies but also theoretical models and reading materials that students can summarize and re-read to increase their interest in trading company adjustment journals. The students can assess the game feature in the learning media in Section 4. They can later do the practice questions in sections 5 and 6 to

increase their practice, in the form of case studies and theories, using the same material. Meanwhile, in support of the student assessment process, section 7 displays a recap of scores under "Summary & Submit." It includes the results of the practice questions to assess the student's level of participation and engagement during the learning process. The results display each question that students worked on in the reading material. Students get a score of 1 for a correct answer, 0 for a wrong answer, and zero if they do not fill in the question. Each score is accumulated in the final section, "Summary & Submit," to display the total score for student learning outcomes. The assessment system can increase students' motivation and enthusiasm to learn, deepen their understanding of the available material, and foster their curiosity about the case study exercises.

Also, the Media Cloud Computing Web-based Learning Management System (LMS) uses a cloud system in its implementation. Cloud features can enhance learning effectiveness by offering advantages. The advantages and characteristics of the cloud features are (1) On-Demand Self-Service; the students can freely access and use the available learning media without having to interact with teachers or media managers; (2) Broad Network Access; the students can access learning media with wider scalability through various learning support platforms supported by the presence of an internet network, either using a thin client, thick client, or other system media such as a smartphone; (3) Resource Pooling; the cloud feature has a multi-tenant nature so that students can access learning media together with all requests for material and practice questions that they want to learn can be displayed by the learning media; (4) Rapid Elasticity; the students are free to access learning media flexibly, dynamically, and quickly. The teachers can get convenience as management users to create, update, or delete learning materials adjusted to learning achievements; and (5) Measured Service; the use of the cloud can provide flexibility related to the learning process that will be carried out. Thus, the learning media can be adjusted to the specified subjects, learning objectives, and students' characteristics.

On the other hand, to support the learning process of the trading company adjustment journal material (especially to encourage students' cognitive abilities), this research used a scientific approach. One of the learning methods in constructivism learning theory is problem-based learning (Waseso, 2018). This statement is the same as the learning method used, which emphasizes examples of questions in the form of case studies based on facts or actual conditions of the trading company's business activities. In addition, the learning process is carried out according to the theory described by Lev Vygotsky (1896-1934), namely the "sociocultural constructivist theory," which emphasizes scaffolding and emphasizes students' learning styles by providing freedom to think and determine solutions to problems. This is also supported by Piaget's theory (1896 -1980), which emphasizes human cognitive development and rational thinking aligned with its goals. Learning methods based on case studies require students to analyze and classify problems, and to determine solutions. The problem-based learning method focuses on how students address problems by analyzing them, classifying them, and determining alternative solutions to achieve effectiveness and efficiency in solving them.

The learning process, using a scientific approach by presenting many examples or real case studies in trading companies, also requires students to learn something repeatedly. The constructivist learning theory assumes that students will carry out the learning process by activating what is remembered in previous sessions, along with the assimilation and accommodation of new information (Jackson & Otaki, 2023). The constructivist learning theory emphasizes efforts to help students develop skills in critical thinking,

be able to solve problems, and improve cooperation to create learning goals (Chen & Lertamornsak, 2023). This statement supports researchers' efforts by presenting appropriate learning media and approaches that encourage students to learn from existing case studies. These findings support Ulum (2022) and Akpen, Asaolu, Atobatele, Okagbue, & Sampson (2024), who utilized web-based e-learning media (websites) to improve student learning outcomes. Based on the pre-test and post-test results, it is concluded that web-based e-learning media can improve students' learning outcomes. These results are supported by student assessments with an average assessment score of 92.76% or categorized as very good. Hung et al. (2024) utilized LMS as a learning medium and found similar findings. The research focuses on identifying the effectiveness of the LMS in managing distance or asynchronous learning. The results state that LMS can be an effective online learning medium. The indicators for assessing the media are learning interest, learning outcomes, and practicality. Ahmed, El-Sabagh, & Elbourhamy (2025) stated that LMS learning media is effective in supporting the learning process. This is evidenced by the ease and flexibility of the LMS's learning media features, which require students to be more independent and encourage them to be more active learners.

The research results clearly show that an LMS-based Cloud Computing Web Media approach, grounded in scientific principles, is effective in improving students' accounting learning outcomes. The theoretical implications as a result of this study are: (1) LMS-based Cloud Computing Web Media becomes a stimulus (treatment) that can be used to improve students' learning outcomes through the features provided; (2) the scientific approach can provide an overview of the suitability of the learning process with a case study model based on real trading company activities adjusted to constructivism learning theory, especially on adjustment information or data; and (3) the use of LMS-based Cloud Computing Web Media increases students' responses in the learning process so that it can change students' learning interests and personalities in the learning process. The practical implications related to the findings of this study are: (1) the use of LMS-based Cloud Computing Web Media can improve students' learning outcomes so that the learning media should support and accommodate the learning process on the same material or subject; (2) the application of a scientific approach in the learning process is proven to be able to improve students' accounting skills, especially on adjustment journal material by presenting various relevant and real case studies by the business activities of trading companies. Implementing a science-based learning method effectively enhances students' accounting skills by incorporating the stages of observation, inquiry, information collection, reasoning, and result presentation. In this way, students will not just memorize the accounting points but also use them in life, leading to a deeper understanding. The implication is that educators should follow the steps of the scientific process by asking students to raise more questions, discuss their findings, and disseminate them. This has the umbrella benefit of enhancing type I and II knowledge, skills, attitudes for students: critical-thinking, problem-solving, analysis abilities; it also serves to acclimate students to journaling; and (3) the use of LMS-based Web Cloud Computing Media with a scientific approach has been proven to improve students' accounting learning outcomes, so that the combination of learning media and approaches can run simultaneously to optimize learning on the material on trading company adjustment journals.

■ CONCLUSION

The descriptive statistics show that more than 80% of respondents strongly agreed with all indicators of LMS-based Web Cloud Computing Media as fun media. Therefore, this

research confirms that LMS-based Web Cloud Computing Media is an interesting medium in accounting learning. The results also show that LMS-based Web Cloud Computing Media is effective in improving high school students' accounting learning outcomes in the moderate category. A low average N-Gain means their students' learning could even be enhanced, but not enough. The learning approach deployed was successful in promoting understanding of the conceptualization. However, it is unlikely to have fully accommodated all learning styles or integrated practice, deep discussion, and detailed feedback in an optimal way. External variables (time constraints, meeting intensity, and students' motivation to learn) may also affect academic success. A moderate N-Gain score indicates that the learning method has been somewhat effective. However, it needs strength strategies to differentiate instruction and enhance the quality of learning interactions to achieve higher student learning outcomes. It includes some interesting materials that students can repeat. Moreover, various practice questions that students can work on. The students' understanding of the material will improve, thereby positively impacting student learning outcomes.

The use of LMS-based Cloud Computing Web Media makes learning more interesting and challenging. It has practice and game features, as well as interactive and repeatable materials. Thus, it becomes one of the most fun and effective media for improving student learning outcomes, especially for materials that students find difficult, such as adjustment journal materials. However, the results cannot be generalized to all other subjects. It would be preferable for future studies to include corresponding media for the experimental and control groups, enabling comparisons of their effectiveness. Further studies are needed for LMS-based cloud computing web media in other domains. It could also serve as a substitute LMS for cloud-based accounting learning, particularly for web-based media.

REFERENCES

Afari, E., Aldridge, J. M., Fraser, B. J., & Khine, M. S. (2013). Students' perceptions of the learning environment and attitudes in game-based mathematics classrooms. *Learning Environments Research*, *16*(1), 131–150. https://doi.org/10.1007/s10984-012-9122-6

Ahmed, H. M. M., El-Sabagh, H. A., & Elbourhamy, D. M. (2025). Effect of gamified, mobile, cloud-based learning management system (GMCLMS) on student engagement and achievement. *International Journal of Educational Technology in Higher Education*, *22*(1), 49. https://doi.org/10.1186/s41239-025-00541-1

Akpen, C. N., Asaolu, S., Atobatele, S., Okagbue, H., & Sampson, S. (2024). Impact of online learning on students' performance and engagement: a systematic review. *Discover Education*, *3*(1), 205. https://doi.org/10.1007/s44217-024-00253-0

Al-Fraihat, D., Joy, M., & Sinclair, J. (2020). Evaluating E-learning systems' success: An empirical study. *Computers in Human Behavior*, *102*, 67–86.

Alhomdy, S., Thabit, F., Abdulrazzak, F. H., Haldorai, A., & Jagtap, S. (2021). The role of cloud computing technology: A savior to fight the lockdown in the COVID-19 crisis, the benefits, characteristics, and applications. *International Journal of Intelligent Networks*, *2*, 166–174.

Amadi, A. (2019). Assessment of instructional media use in enhancing teaching and learning of accounting by business education students in the niger delta, Nigeria. *International Multidisciplinary Academic Research Journal*, *3*(1), 24–39.

Arora, R., Arora, P. K., Kumar, H., & Pant, M. (2020). Additive manufacturing enabled

supply chain in combating COVID-19. *Journal of Industrial Integration and Management*, *5*(04), 495–505.

Artama, E. N. N., Amin, S. M., & Siswono, T. Y. E. (2020). *Pengaruh kecemasan matematika terhadap hasil belajar matematika siswa* [The influence of mathematics anxiety on students' mathematics learning outcomes]. *Jurnal Penelitian Pendidikan Matematika Dan Sains*, *4*(1), 34–40.

Belland, B. R., Kim, C., & Hannafin, M. J. (2013). A framework for designing scaffolds that improve motivation and cognition. *Educational Psychologist*, *48*(4), 243–270. https://doi.org/10.1080/00461520.2013.838920

Bosu, L. (2016). Accounting students learning difficulties and associated interventions: The views of accounting teachers. *Journal of Educational Management*, *7*, 45–65. Retrieved from https://journal.ucc.edu.gh/index.php/jem/article/view/1207

Chen, L., & Lertamornsak, G. (2023). Internet of things (IoT) based Investigation between Instructors' insight of constructivist learning theory and learners' performance analysis in higher vocational accounting training. *International Journal on Recent and Innovation Trends in Computing and Communication*, *11*(6 s), 217–227. https://doi.org/10.17762/ijritcc.v11i6s.6824

Désiron, J. C., Schmitz, M.-L., & Petko, D. (2025). Teachers as creators of digital multimedia learning materials: are they aligned with multimedia learning principles. *Technology, Knowledge and Learning*, *30*(2), 637–653. https://doi.org/10.1007/s10758-024-09770-1

Fatimah, S., Hasmidyani, D., Suranto, FH, Y., & Leisthari, A. (2025). Analysis of difficulties in learning accounting: perspective of teachers and students. *International Journal of Multicultural and Multireligious Understanding*, *12*(2), 136–147. https://doi.org/http://dx.doi.org/10.18415/ijmmu.v12i4.6642

Franco, A., & Roach, S. S. (2017). Factors that determine accounting anxiety among users of english as a second language within an international MBA program. *International Journal of Learning, Teaching and Educational Research*, *16*(1), 22–37. Retrieved from https://www.ijlter.org/index.php/ijlter/article/view/845

Harandi, S. R. (2015). Effects of e-learning on students' motivation. *Procedia-Social and Behavioral Sciences*, *181*, 423–430.

Hartanto, W. (2017). *Cloud computing dalam pengembangan sistem pembelajaran* [Cloud computing in learning system development]. *Jurnal Pendidikan Ekonomi: Jurnal Ilmiah Ilmu Pendidikan, Ilmu Ekonomi Dan Ilmu Sosial*, *10*(2).

Haryani, E., Ahmad, S., & Aradea, R. (2021). *Analisis faktor-faktor penyebab rendahnya daya serap siswa pada pelajaran akuntansi* [Analysis of factors causing low student absorption in accounting lessons]. *Journal of Education Research*, *2*(2), 82–88.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. (2007). Scaffolding and achievement in problem-based and inquiry learning: a response to kirschner, sweller, and clark (2006). *Educational Psychologist*, *42*(2), 99–107. https://doi.org/10.1080/00461520701263368

Hosal Akman, N., & Simga Mugan, C. (2010). An assessment of the effects of teaching methods on academic performance of students in accounting courses. *Innovations in Education and Teaching International*, *47*(3), 251–260. https://doi.org/10.1080/14703297.2010.49817

Huda, M., Maseleno, A., Teh, K. S. M., Don,

A. G., Basiron, B., Jasmi, K. A., … Ahmad, R. (2018). Understanding modern learning environment (MLE) in big data era. *International Journal of Emerging Technologies in Learning (Online)*, *13*(5), 71.

Hung, C.-T., Wu, S.-E., Chen, Y.-H., Soong, C.-Y., Chiang, C., & Wang, W. (2024). The evaluation of synchronous and asynchronous online learning: student experience, learning outcomes, and cognitive load. *BMC Medical Education*, *24*(1), 326. https://doi.org/10.1186/s12909-024-05311-7

Jackson, L., & Otaki, F. (2023). Using team-based learning to optimize undergraduate family medicine clerkship training: mixed methods study. *BMC Medical Education*, *23*(1), 422.

Jung, S., & Huh, J.-H. (2019). An efficient LMS platform and its test bed. *Electronics*, *8*(2), 154.

Jung, Y., Hall, J., Hong, R., Goh, T., Ong, N., & Tan, N. (2014). Asian journal of social psychology payback/ : Effects of relationship and cultural norms on reciprocity. *Asian Journal of Social Psychology*, *17*, 160–172. https://doi.org/10.1111/ajsp.12057

Kehrwald, B., & Parker, B. (2019). Editorial 16.1: Implementing online learning, stories from the field. *Journal of University Teaching and Learning Practice*, *16*(1).

Khan, M. L. H., Setiawan, A., & Kustiawan, I. (2019). Design and development of a single page and web-based responsive e-learning system for higher education institutions. *INVOTEC*, *15*(2), 85–93.

Kraleva, R., Sabani, M., & Kralev, V. (2019). An analysis of some learning management systems. *International Journal on Advanced Science, Engineering and Information Technology*, *9*(4), 1190–119

Laugi, S. (2018). *Sistem Informasi berbasis Web dalam Penyelenggaran Lembaga Pendidikan* [Web-based Information Systems in the Implementation of Educational Institutions]. *Shautut Tarbiyah*, *24*(1), 109–126.

Le, T. Q., & Do, T. T. A. (2019). Active teaching techniques for engineering students to ensure the learning outcomes of training programs by CDIO Approach. *International Journal on Advanced Science, Engineering and Information Technology*, *9*(1), 266–273.

Li, H., & Ni, A. (2024). What contributes to student language learning satisfaction and achievement with learning management systems? *Behavioral Sciences*, *14*(4), 271. https://doi.org/10.3390/bs14040271

Li, X., Bergin, C., & Olsen, A. A. (2022). Positive teacher-student relationships may lead to better teaching. *Learning and Instruction*, *80*, 101581. https://doi.org/10.1016/j.learninstruc.2022.101581

Mariati, & Saehu, U. A. (2018). Development of android application-based accounting learning media for basic competency of the accounting cycle in company services at the SMK-BM level. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *8*(5), 52–59. https://doi.org/https://doi.org/10.9790/7388-0805025259.

Mazzone, L., Ducci, F., Scoto, M. C., Passaniti, E., D'Arrigo, V. G., & Vitiello, B. (2007). The role of anxiety symptoms in school performance in a community sample of children and adolescents. *BMC Public Health*, *7*, 1–6.

McLure, F. I., Fraser, B. J., & Koul, R. B. (2022). Structural relationships between classroom emotional climate, teacher–student interpersonal relationships, and students' attitudes to STEM. *Social Psychology of Education*, *25*(2–3), 625–648. https://doi.org/10.1007/s11218-022-09694-7

Mötteli, C., Grob, U., Pauli, C., Reusser, K., & Stebler, R. (2023). The influence of

personalized learning on the development of learning enjoyment. *International Journal of Educational Research Open*, *5*, 100271. https://doi.org/10.1016/j.ijedro.2023.100271

Mustamila, N. (2021). *Analisis penggunaan teknologi informasi dalam proses pembelajaran fisika smk ma'arif di kecamatan sukoharjo saat pandemi covid-19* [Analysis of the Use of Information Technology in the Physics Learning Process at Ma'arif Vocational School in Sukoharjo District During the Covid-19 Pandemic]. *Physics and Science Education Journal (PSEJ)*, 126–132.

Nurkhin, A., Santoso, J. T. B., Baswara, S. Y., & Wolor, C. W. (2022). Applying peer tutor learning and interactive case methods in online learning: its effect on student activities and learning outcomes. *International Journal of Educational Methodology*, *8*(3), 551–565.

Olifant, T., Cekiso, M. P., Arendse, J., Mandende, P., Dieperink, M., & Jadezweni, J. (2024). Students' perceptions and attitudes toward factors contributing to the high failure rate of first-year Accounting students at a South African University. *South African Journal of Higher Education*, *38*(6). https://doi.org/10.20853/38-6-5495

Omerèeviæ, E., Lary, A. M., & O'Neill, K. (2025). Does adaptive learning improve student performance? Evidence from a Kuwaiti university. *Journal of Education for Business*, *100*(6), 257–264. https://doi.org/10.1080/08832323.2025.2518067

Prahani, B. K., Jatmiko, B., Saphira, H. V., & Amelia, T. (2022). Android and Web-Based Learning Research During the Last 10 Years: How Does It Impact Physics Learning? *International Journal of Interactive Mobile Technologies*, *16*(16).

Ramdhani, E. P., Khoirunnisa, F., & Siregar, N. A. N. (2020). *Efektivitas modul elektronik terintegrasi multiple representation pada materi ikatan kimia. Journal of Research and Technology*, *6*(1), 162–167. https://doi.org/10.55732/jrt.v6i1.152

Rezvani, A., Khosravi, P., & Dong, L. (2017). Motivating users toward continued usage of information systems: Self-determination theory perspective. *Computers in Human Behavior*, *76*, 263–275.

Robertson, C., & Doloc-Mihu, A. (2024). Effect of LMS course structure on student success in asynchronous online courses. *Proceedings of the 2024 ACM Southeast Conference on ZZZ*, 35–42. New York, NY, USA: ACM. https://doi.org/10.1145/3603287.3651204

Rodríguez-Muñoz, A., Antino, M., Ruiz-Zorrilla, P., & Ortega, E. (2021). Positive emotions, engagement, and objective academic performance: A weekly diary study. *Learning and Individual Differences*, *92*, 102087. https://doi.org/10.1016/j.lindif.2021.102087

Salshabella, D. C., Pujiati, P., & Rahmawati, F. (2022). *Analisis kebutuhan pengembang an media pembelajaran interaktif dalam upaya meningkatkan kompetensi akuntansi* [Analysis of the needs for developing interactive learning media in an effort to improve accounting competence]. *Economic Education and Entrepreneur ship Journal*, *5*(1), 35–43. https://doi.org/10.23960/e3j/v5i1.35-43

Samson, V. C., & Yango, A. R. (2023). Effectiveness of learning management system, teachers' techno-pedagogical skills, and students' learning engagement in Senior High School at the University of Perpetual Help System-Jonelta Campuses.

Technium Soc. Sci. J., *44*, 220.

Santoso, J. T. B., Prabawati, A., & Octavianto, S. N. (2023). *Efektivitas penggunaan media interaktif quizizz terhadap hasil belajar siswa SMK Negeri 2 Tebo* [The effectiveness of using quizizz interactive media on student learning outcomes at state vocational school 2 tebo]. *Business and Accounting Education Journal*, *4*(3), 329–336.

Santoso, J. T. B., & Widiyanti, A. (2022). *Kahoot! Sebagai inovasi evaluasi hasil belajar siswa yang efektif dan menyenangkan* [Kahoot!: An innovation for effective and fun student learning outcomes evaluation]. *Jurnal Inovasi Pembelajaran*, *8*(2), 171–184. https://doi.org/10.22219/jinop.v8i2.21384

Schunk, D. H. (2020). *Learning theories: An educational perspective* (8th ed.). New York: Pearson.

Sodik, F., & Wijaya, M. S. (2017). Implementing scientific approach of 2013 curriculum at KTSP-based school for teaching present continuous tense. *English Education: Jurnal Tadris Bahasa Inggris*, *10*(1), 16–28.

Syahputra, F., & Maksum, H. (2020). The development of interactive multimedia learning in information and communication technology subjects. *Journal of Education Research and Evaluation*, *4*(4), 428–434.

Taena, L., & Karno, E. (2023). *Analisis penyebab kesulitan belajar siswa kelas xi pelajaran ekonomi sma negeri 1 bungku selatan* [Analysis of the causes of learning difficulties of grade xi students in economics at SMA negeri 1 bungku selatan]. *Jurnal Online Program Studi Pendidikan Ekonomi*, *8*(1), 190–194.

Tailab, M. (2013). Difficulties of academic achievement in principles of accounting courses from the student perspective: Evidence from Libya. *Higher Education Studies*, *3*(5).

Ulum, H. (2022). The effects of online education on academic success: A meta-analysis study. *Education and Information Technologies*, *27*(1), 429–450. https://doi.org/10.1007/s10639-021-10740-8

Voshaar, J., Knipp, M., Loy, T., Zimmermann, J., & Johannsen, F. (2023). The impact of using a mobile app on learning success in accounting education. *Accounting Education*, *32*(2), 222–247. https://doi.org/10.1080/09639284.2022.20410

Waseso, H. P. (2018). *Kurikulum 2013 dalam prespektif teori pembelajaran konstruktivis*. [2013 Curriculum in the perspective of constructivist learning theory.] *TA'LIM/: Jurnal Studi Pendidikan Islam*, *1*(1), 59–72. https://doi.org/10.52166/talim.v1i1.632

Whitaker Sena, J. D., Lowe, P. A., & Lee, S. W. (2007). Significant predictors of test anxiety among students with and without learning disabilities. *Journal of Learning Disabilities*, *40*(4), 360–376.

Williams, B. K., & Brown, E. D. (2018). Double-loop learning in adaptive management: the need, the challenge, and the opportunity. *Environmental Management*, *62*, 995–1006.

Zaidi, S. F. H., Osmanaj, V., Ali, O., & Zaidi, S. A. H. (2021). Adoption of mobile technology for mobile learning by university students during COVID-19. *The International Journal of Information and Learning Technology*, *38*(4), 329–343.

Zainuddin, Z., Shujahat, M., Chu, S. K. W., Haruna, H., & Farida, R. (2019). The effects of gamified flipped instruction on learner performance and need satisfaction: A study in a low-tech setting. *Information and Learning Sciences*, *120*(11/12), 789–802.