

## PAPER

# The Analysis of Learning Management System towards Students' Cognitive Learning Outcome: A Systematic Literature Review

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## ABSTRACT

The purpose of this study was to determine the implementation of the moodle and edmodo learning management system (LMS) in education, to identify the specific features of the LMS that were utilized in the learning process, and to assess the impact of the LMS on student learning outcomes, drawing on cognitive learning theory. The research method is a systematic literature review (SLR) using the Scopus and Taylor & Francis databases, guided by the PRISMA (preferred reporting items for systematic review and meta-analyses) protocol, to analyze the data. The validity of the study was tested using the Gregory test with four expert examiners, namely an SLR expert, an LMS expert, and experts in cognitive learning outcomes. The results of the electronic database search focused on articles related to LMS implementation, LMS features, and student cognitive learning outcomes. This systematic literature review identified four key stages that serve as indicators of LMS implementation: 1) introduction, 2) registration, 3) learning materials, and 4) evaluation (assessment or feedback). The LMS features used in learning are grouped into four sections: communication features, course content features, course delivery features, and assignment features. The findings of the literature review indicate that the implementation of LMS and the features utilized in the learning process have an impact on various aspects of learning. These include learning satisfaction, engagement, learning experience, comfort, effectiveness, motivation, and the improvement of student learning outcomes.

## KEYWORDS

learning management system (LMS), moodle, edmodo, cognitive learning theory, learning outcomes

## 1 INTRODUCTION

Education in the 21st century emphasizes learning through the use of information and communication technology (ICT). Learning to use internet media requires consideration of risks, systems, structures, schedules, and costs. The solution that can

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be implemented to facilitate online education is to utilize a learning management system (LMS) [1], [2]. LMS is an information system or software used to manage online learning, encompassing various aspects such as class management, content, assessment, and placement [3]. LMS has been implemented to optimize and facilitate learning, bridging the gap between online and traditional learning. There are several LMSs available. Two popular platforms for educators are Moodle (moodle.org) and Edmodo (edmodo.com) [4]. Moodle, as an open source system, is popularly used in many universities around the world. It allows for the creation and management of virtual learning spaces, adapting them to the needs of students, teachers, and administrators. It is based on PHP and MySQL [5]. Edmodo facilitates collaborative learning, content exchange, and the use of communication tools and multimedia resources. It allows for content storage, which reduces the time spent handling physical documents [6]. LMS features, in general, help to support and optimize the learning process [7]. These features can be categorized into four groups: communication features, course delivery features, course content features, and assignment features. The learning modules, assignments, and quizzes provided can be viewed, downloaded, and completed by students through the LMS. In addition, online platforms allow students to access discussion schedules, assessments, and quizzes [8]. LMS can be accessed anywhere, anytime, and through any device [9], [10].

Learning outcomes are often used as a benchmark to assess the extent to which students have mastered the content that has been taught [11]. Changes in behavior, attitudes, knowledge, skills, and understanding of students, resulting in their improvement compared to before, are the impacts of learning [12]. Learning outcomes achieved by students are one indicator of whether or not a learning process has been successful. The theoretical basis for learning outcomes is cognitive learning theory, which focuses more on the learning process than the learning outcomes [13]. Piaget's theory of cognitive development [14] explains that cognitive ability or development is the result of the relationship between brain and nervous system development, as well as experiences that aid individuals in adapting to their environment. This is supported by the cognitive learning theory, as stated by Bruner [15], which posits that humans function as processors, thinkers, and creators of information. According to Bruner, three cognitive processes occur in learning, namely: the process of acquiring new information (information), the process of transforming the received information (transformation), and the process of testing the relevance and accuracy of knowledge (evaluation) [16].

E-learning systems, such as LMS, influence learning design and outcomes. Exemplarily, we refer to four studies that demonstrate the relationship between the e-learning system and learning outcomes. Several previous studies related to LMS have been conducted. One such study by Puspitasari focused on physical education learning through online media and its impact on students' cognitive learning outcomes. The study concluded that the use of online media has led to an increase in students' cognitive learning outcomes, thereby assisting them in their learning process [17]. Furthermore, research conducted in Thailand on e-learning to improve students' cognitive skills shows that the e-learning system can enhance students' creative thinking skills. This improvement is attributed to the presence of technology that supports learning, the active role of students, the guidance provided by teachers, self-direction, and self-evaluation [18]. Research was also conducted by Tong [19] on the analysis of the effectiveness of using the Moodle LMS in learning physics. The results showed a significant positive difference between the experimental class, which used the Moodle LMS, and the control class [19]. Research at the State University of Malang, particularly at the German Language Department, has also been conducted on e-learning. The focus of the research was on learning German vocabulary using *german-games.net*, which yielded positive results. The use of this

platform created a fun atmosphere, provided a new learning experience, and aided students in memorizing vocabulary [20].

However, these four exemplary studies only focused on e-learning without explaining which software or system was implemented. It is unclear whether a LMS was used and what specific features were utilized in the learning process. Additionally, the studies did not explore how the LMS influenced learning outcomes, particularly in relation to cognitive learning theory. To make a good choice for an LMS and its features, individual evaluations and reports may also be insufficient. Therefore, to establish a solid foundation for selecting an LMS for language learning, we aim to conduct a literature review that examines the relationships between LMSs, with a specific focus on Moodle and Edmodo. Being the two widely used LMSs by educators, we will analyze their features and their impact on cognitive learning outcomes. The aspects observed in the literature review include how the LMS is implemented, the features utilized in the LMS, and the impact of the LMS on cognitive learning outcomes. With this research, we can identify the criteria for implementing a good LMS to ensure continuous development of learning outcomes and enhance the quality of online learning.

## 2 METHODOLOGY

This research utilizes the systematic literature review (SLR) method. SLR is a literature review method that identifies, assesses, and interprets findings on a research topic to answer research questions that have been determined based on previously produced evidence [21], [22]. The facts presented in the research using the SLR method are comprehensive and balanced because it involves synthesizing relevant research findings through a systematic review. Researchers conduct reviews and identify journals in a structured manner, following a predetermined protocol in each process [23].

### 2.1 Review protocol—PRISMA

This SLR study used the PRISMA (preferred reporting items for systematic review and meta-analyses) protocol for the review. PRISMA is one of the publication standards used for conducting an SLR. Publication standards are necessary to provide authors with guidelines for systematically evaluating and ensuring the quality and comprehensiveness of reviews [24]. In addition, PRISMA emphasizes writing peer-reviewed reports that evaluate randomized trials as the foundation for reporting systematic reviews of other types of research [25]. PRISMA is a popular methodology in medical research. This report-writing method is suitable for social science research because of its ability to accurately define, guide, and address the research problem formulation [26]. Similar to the research conducted by Bidin [27], who used this protocol in his study to identify the performance factors of the halal industry organization. PRISMA can establish inclusion and exclusion criteria for research to narrow down specific criteria relevant to the study. By utilizing the PRISMA method, SLR research can effectively analyze extensive databases of literature and identify relevant keywords pertaining to learning management systems and cognitive learning outcomes.

### 2.2 Data source

The SLR process is carried out using two main databases, namely Scopus and Taylor & Francis. These two main databases are accredited and reliable sources. The literature search is limited to articles published in the last 10 years, specifically from

2012 to 2022. The search for articles is conducted online in the Scopus and Taylor & Francis databases using the search keywords provided in the following search string:

Search string used for searching in scopus database:

1. TITLE-ABS-KEY (“learning management system”) AND (“cognitive learning outcome\*”)
2. TITLE-ABS-KEY (“learning management system”) AND (“moodle”) AND (“learning outcome\*”)
3. TITLE-ABS-KEY (“learning management system”) AND (“edmodo”) AND (“learning outcome\*”)
4. TITLE-ABS-KEY (“learning management system”) AND (“cognitive learning”) AND (“learning outcome\*”)

Search string used for searching the Taylor & Francis database:

1. “learning management system” AND “cognitive learning outcome\*”
2. “learning management system” AND “moodle” OR “edmodo” AND “learning outcome” AND “cognitive learning theory”

### 2.3 Article selection process

Based on the PRISMA flow diagram from The PRISMA 2020 statement [28], the process of selecting research materials for the SLR is described below.

**Identification.** The first stage is identification, which starts with determining keywords and then finding synonyms for these keywords. Thereafter, search strings were developed for systematic strategic searches across the displayed databases (Figure 1). Through the developed search string, 651 articles were identified. This number was further reduced to 645 articles through the remaining processes and during the removal of duplicate articles.

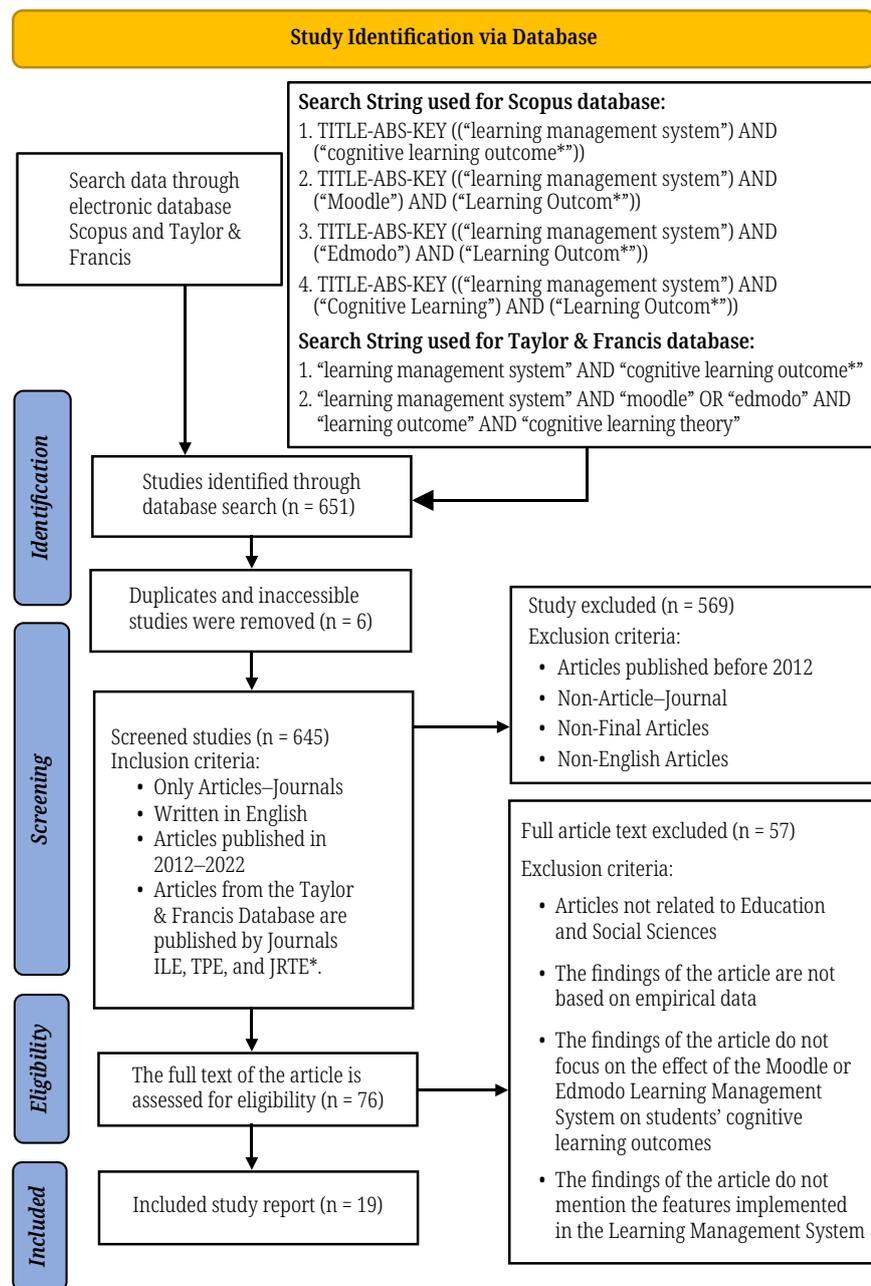
**Screening.** The second stage is filtering. All articles that have undergone the identification process are filtered using the “refine results” feature in the Scopus database and the “filter” feature in the Taylor & Francis database. The article search process at this stage is limited by the following criteria: year of publication (2012-2022), subject areas (education and social sciences), article document type, final publication stage, country of origin all over the world, journal source type, and articles written in English. Through a screening process, 10 articles were selected from the Scopus database, and 66 articles were selected from the Taylor & Francis database.

**Eligibility.** The selection of articles eligible for review is carried out in three stages. The first stage involves screening titles and abstracts. The second stage involves the analysis of articles by independent reviewers. The selection criteria were determined based on the formulation of the research problem (RQ). RQ1: How is the implementation of the LMS within a study program carried out? RQ2: What features of the LMS are used in learning? RQ3: How does the LMS affect students' cognitive learning outcomes?

The findings of the articles are presented in a table. The reviewer excludes full-text studies that are not accessible. In the third stage, the reviewer reads and integrates all the results into a single document. Articles in this stage were reviewed comprehensively to determine the inclusion criteria for the study. In order to address the research question, articles that did not meet the inclusion criteria were excluded for the following reasons: they were not related to education and social science, their findings were not based on empirical data, their findings did not focus on the application of moodle or edmodo LMS to enhance students' cognitive learning outcomes, and the articles did not mention the specific features used in the learning management system.

**Selection of articles.** The final stage involves selecting the articles to be reviewed. All selected articles were deemed to meet the criteria for addressing the RQ of this study. The criteria used to select articles at this stage were as follows: articles related to education and social science, articles based on empirical data, articles focused on the application of LMS to improve students' cognitive learning outcomes, and articles mentioning the features used in learning management system.

Then, we employed the validity test approach, as outlined by Gregory [29], with four expert examiners: a SLR expert, an LMS expert, and two cognitive learning outcomes experts. The test formula in the Gregory test is useful when there are many variables that need to be measured by the researcher [29].



**Fig. 1.** Review protocol used in the study (adapted from [28])

Notes: \*ILE: Interactive Learning Environment; TPE: Technology, Pedagogy and Education; JRTE: Journal of Research on Technology in Education.

### 3 RESULTS

#### 3.1 Characteristics of selected articles

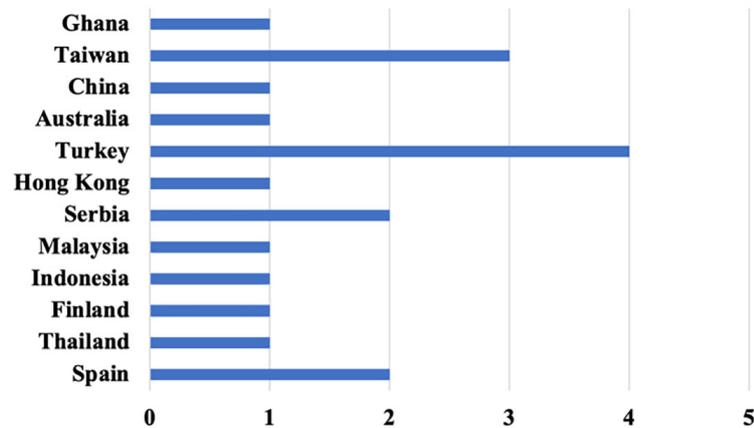


Fig. 2. Distribution of article publication countries

The selected articles are distributed across the geographic areas depicted in Figure 2. It has been identified that four previous studies were conducted in Turkey [30], [31], [32], [33]. Three research studies were conducted in Taiwan [34], [35], [36]. Two studies were conducted in Serbia [37], [38], and two studies were conducted in Spain [39], [40]. One study was conducted in Ghana [41], China [42], Australia [43], Hong Kong [44], Malaysia [45], Indonesia [46], Finland [47], and Thailand [48].

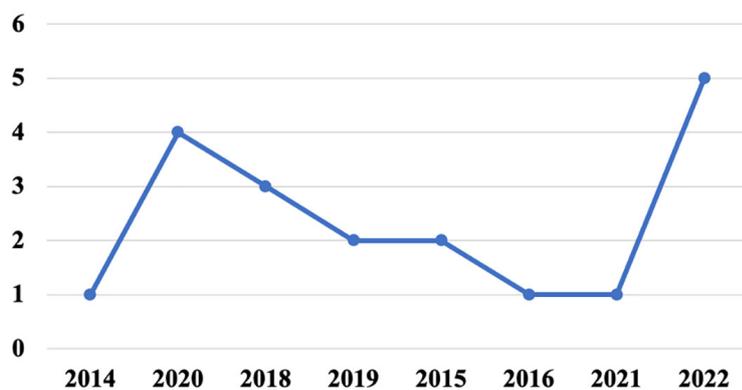


Fig. 3. Article publication year

As highlighted in Figure 3, the selected articles were spread out over a span of eight years of publication. One article was published in 2014 [37], two articles were published in 2015 [38], [45], one article was published in 2016 [42], three articles were published in 2018 [33], [34], [48], two articles were published in 2019 [40], [46], four articles were published in 2020 [35], [39], [43], [47], one article was published in 2021 [36], and five articles were published in 2022 [30], [31], [32], [41], [44].

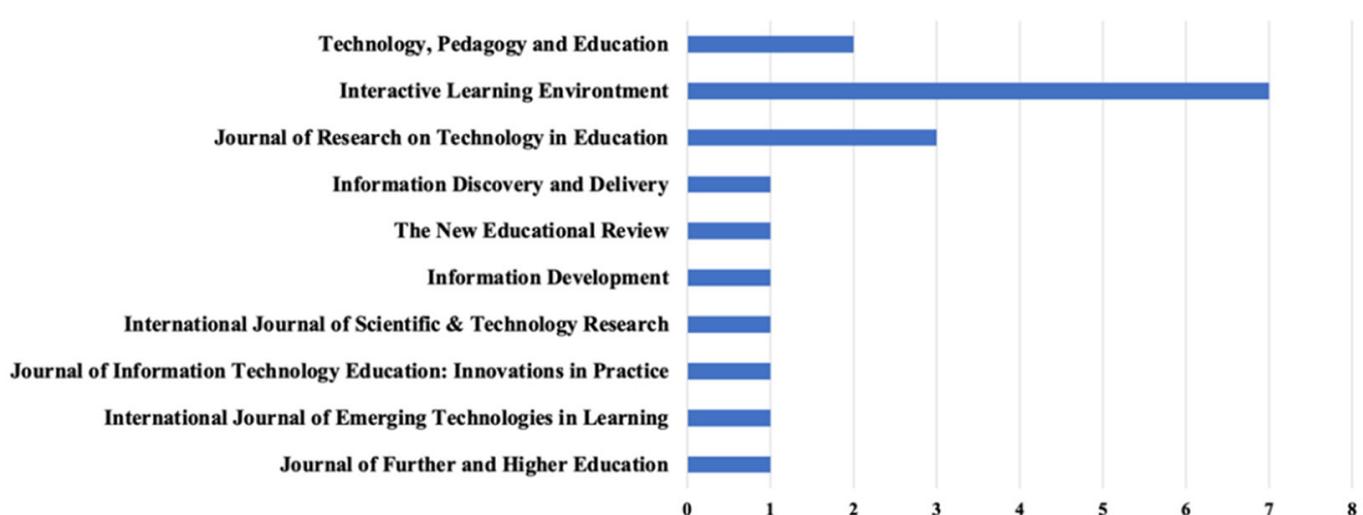


Fig. 4. Publication journal

Based on Figure 4, seven articles were sourced from the interactive learning environment journal [31], [33], [34], [35], [38], [42], [43], three articles were sourced from the *Journal of Research on Technology in Education* [32], [36], [44], two articles were sourced from the journal *Technology, Pedagogy and Education* [30], [41], and one article was sourced from the journal *Information Discovery and Delivery* [40]. A total of six articles were sourced from various journals. One article was sourced from the journal *The New Educational Review* [37], one article was sourced from the journal *Information Development* [45], one article was sourced from the *International Journal of Scientific & Technology Research* [46], one article from the *Journal of Information Technology Education: Innovations in Practice* [47], one article from the *International Journal of Emerging Technologies in Learning* [48], and one article from the *Journal of Further and Higher Education* [39].

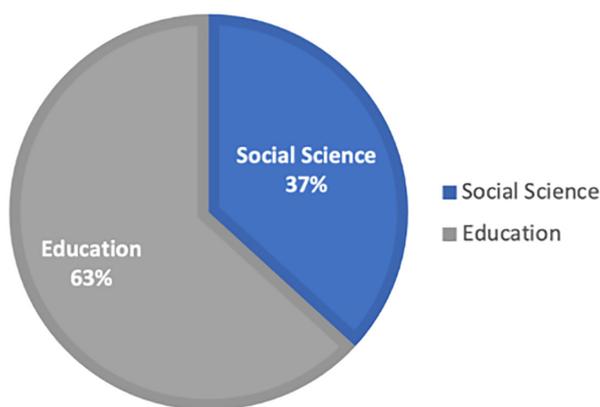


Fig. 5. The subject areas of the research articles

Based on Figure 5, a total of 12 selected articles focused on research in the field of education, accounting for 63% of the total. Additionally, seven articles focused on research in the field of social sciences, representing 37% of the total.

Based on the selected publications, previous studies related to this research have broadly explored three research themes. Most of the seven articles focus on the implementation of LMS in learning. Six articles focus on the features of LMS used in

learning, and another six articles examine the effect of applying LMS on students' cognitive learning outcomes. All publications selected as research materials focus on the implementation of the LMS and its impact on students' cognitive learning outcomes. Table 1 summarizes all articles based on the research themes covered.

**Table 1.** Research theme and country of origin

Author	Research Theme	Country
Pérez et al. (2020) Babo et al. (2020) Waheed et al. (2015) Sáiz-Manzanares, M. (2019) Ustun et al. (2022) Bansah & Agyei, (2022) Horvat et al. (2015)	Implementation of Learning Management System	Spain Finland Malaysia Spain Turkey Ghana Serbia
Chootongchai & Songkram (2018) Amril et al. (2019) Vitošević & Janković (2014) Jia et al. (2022) Yilmaz (2022) Burns et al. (2022)	Learning Management System Features	Thailand Indonesia Serbia Hong Kong Turkey Australia
Adeshola & Agoyi (2022) Tsai (2016) Tsai et al. (2018) Moradimokhles & Hwang (2020) Hsiao et al. (2021) Tezer & Çimşir (2018)	The Effect of Learning Management System on Cognitive Learning Outcomes	Turkey China Taiwan

### 3.2 Main findings

About 651 published studies were identified in a systematic search using the search string (Figure 1) in the Scopus and Taylor & Francis databases. These studies were then screened using inclusion criteria, resulting in the selection of 76 articles. After that, the feasibility of the article was reviewed based on the formulation of the research problem. It was found that 19 articles were selected for the analysis of research results. Based on the findings of the selected articles, three themes and 14 sub-themes have been identified in Table 2.

**Table 2.** Article finding based on themes and sub-themes

Themes	Sub-Themes	Author
Implementation of Learning Management System	Introduction of LMS, Registration (Enrollment) of LMS, Learning Materials, Evaluation (Feedback)	Pérez et al. (2020) Babo et al. (2020) Waheed et al. (2015) Sáiz-Manzanares, M. (2019) Ustun et al. (2022) Bansah & Agyei, (2022) Horvat et al. (2015) Amril et al. (2019) Vitošević & Janković (2014) Jia et al. (2022) Yilmaz (2022) Tsai et al. (2018) Moradimokhles & Hwang (2020) Hsiao et al. (2021)

(Continued)

**Table 2.** Article finding based on themes and sub-themes (Continued)

Themes	Sub-Themes	Author
Learning Management System Features	Communication Features Course Content Features Course Delivery Features Assignment Features	Pérez et al. (2020) Babo et al. (2020) Ustun et al. (2022) Chootongchai & Songkram (2018) Amril et al. (2019) Vitošević & Janković (2014) Jia et al. (2022) Yilmaz (2022) Burns et al. (2022) Tsai (2016) Tezer & Çimşir (2018)
The Effect of Learning Management System on Cognitive Learning Outcomes	Learning Satisfaction Learning Convenience & Effectiveness Motivation to learn Learning Engagement Learning Experience Improved Learning Outcomes	Pérez et al. (2020) Horvat et al. (2015) Vitošević & Janković (2014) Yilmaz (2022) Bansah & Agyei, (2022) Jia et al. (2022) Hsiao et al. (2021) Tezer & Çimşir (2018) Adeshola & Agoyi (2022) Waheed et al. (2015) Sáiz-Manzanares, M. (2019) Chootongchai & Songkram (2018) Amril et al. (2019) Burns et al. (2022) Tsai (2016) Moradimokhles & Hwang (2020)

Based on the summary table above, the selected articles have been classified into four main themes and their corresponding sub-themes. The themes and subthemes are then summarized and presented in Table 3 to enhance readers' comprehension.

**Table 3.** Summary of the article's themes and subthemes

Author	LMS Implementation					LMS Features			LMS Effects on Cognitive Learning Outcomes					
	ILMS	RLMS	LM	E	CF	CCF	CDF	AF	LS	LCE	LM	LE	LEX	ILO
Pérez, et. al. (2020)	✓	✓	✓	✓	✓	✓	✓	✓	✓					
Babo, et. al. (2020)	✓	✓	✓	✓	✓	✓	✓	✓						
Waheed, et. al. (2015)	✓	✓	✓	✓										
Sáiz-Manzanares, M. (2019)	✓	✓	✓	✓									✓	
Ustun, et. al. (2022)	✓	✓	✓	✓	✓	✓	✓	✓						
Bansah & Agyei, (2022)	✓	✓	✓	✓										
Horvat, et. al. (2015)	✓	✓	✓	✓					✓					
Chootongchai & Songkram (2018)	✓	✓	✓	✓	✓	✓	✓	✓						✓
Amril, et. al. (2019)	✓	✓	✓	✓	✓	✓	✓	✓						✓
Vitošević & Janković (2014)	✓	✓	✓	✓	✓	✓	✓	✓	✓					
Jia, et. al. (2022)	✓	✓	✓	✓	✓	✓	✓	✓		✓				
Yilmaz (2022)	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			
Burns, et. al. (2022)					✓	✓	✓	✓						✓
Adeshola & Agoyi (2022)													✓	
Tsai (2016)					✓	✓	✓	✓						✓
Tsai, et. al. (2018)														
Moradimokhles & Hwang (2020)	✓	✓	✓	✓										✓
Hsiao, et. al. (2021)	✓	✓	✓	✓								✓		
Tezer & Çimşir (2018)						✓	✓	✓	✓			✓		

**LMS Implementation**

ILMS = Introduction of LMS  
RLMS = Registration of LMS  
LM = Learning Materials  
E = Evaluation (Feedback)

**LMS Features**

CF = Communication Features  
CCF = Course Content Features  
CDF = Course Delivery Features  
AF = Assignment Features

**LMS Effects on Student Cognitive Learning Outcomes**

LS = Learning Satisfaction  
LCE = Learning Convenience & Effectiveness  
LM = Learning Motivation  
LE = Learning Engagement  
LEX = Learning Experience  
ILO = Improving Learning Outcomes

Below, we have summarized the research results from selected articles based on the research problem formulation. Research that answers RQ1 regarding LMS implementation is described in fourteen articles [30], [32], [34], [35], [36], [37], [38], [39], [40], [41], [44], [45], [46], [47]. A summary of these findings is presented in Table 4.

**Table 4.** LMS Implementation in Learning

Author	Article Title	LMS Implementation
Pérez et al. (2020)	<i>An analysis of factors affecting students' perceptions of learning outcomes with Moodle</i>	Home OP Moodle is organized into 10 stages: provision of overall course information which includes syllabus, informational textbooks, and assessments.
Babo et al. (2020)	<i>E-assessment with multiple-choice questions: A 5-year study of students' opinions and experience</i>	The use of multiple-choice questions as a summative e-assessment quiz is delivered on the Moodle quiz to assess learning outcomes. During testing, students use a DBMS or spreadsheet tool.
Waheed et al. (2015)	<i>Perceived learning outcomes from Moodle: An empirical study of intrinsic and extrinsic motivating factors</i>	Students use the online education mode for their classes and utilize moodle as a learning technology.
Sáiz-Manzanares, (2019)	<i>Will personalized e-Learning increase deep learning in higher education?</i>	In the experimental and control groups, subjects were arranged into five thematic units with the following moodle-based designs: conceptual explanation; supplementary material; practice; and project-based learning. This project is carried out for one period (14 weeks).
Ustun et al. (2022)	<i>Learning analytics-based feedback and recommendations in flipped classrooms: an experimental study in higher education</i>	In the first week of the semester, all students are enrolled in the moodle LMS. Students attend course materials on the LMS before coming to class. They will participate in learning activities in class. They are also required to use the forums in the LMS for discussions and other learning activities.
Bansah & Agyei (2022)	<i>Perceived convenience, usefulness, effectiveness and user acceptance of information technology: evaluating students' experiences of a Learning Management System</i>	Moodle LMS features are introduced in class. Students are assisted to enter the LMS. Students can download study resources as well as upload documents back to the instructor as part of an assignment or project they have completed. They are involved in some discussion/interaction.
Horvat et al. (2015)	<i>Student perception of Moodle learning management system: a satisfaction and significance analysis</i>	The students were directed to use the Moodle LMS and measured student satisfaction with the characteristics of time, feedback, teaching materials, website users, diversity of cooperation, and communication.
Amril et al. (2019)	<i>LMS Edmodo to improve student understanding of the arithmetic concept in Microsoft Excel</i>	Product testing was conducted, namely LMS Edmodo for first semester students of AMIK Kosgoro. During the implementation, practical data and effectiveness of the Edmodo LMS were collected. The return of practicum data uses lecturer response questionnaires and student response questionnaires.
Vitošević & Janković (2014)	<i>Piloting of blended learning: Implementation and benefits</i>	First, students are introduced to the concept of learning with LMS, then teaching begins and students begin to carry out discussions, work on assignments, and provide feedback.
Jia et al. (2022)	<i>Adaptation of a conventional flipped course to an online flipped format during the COVID-19 pandemic: Student learning performance and engagement</i>	The students were asked to complete a pre-class activity that was in Moodle. They can also use the WeChat app to ask their peers or instructors questions.

(Continued)

**Table 4.** LMS Implementation in Learning (*Continued*)

Author	Article Title	LMS Implementation
Yilmaz (2022)	<i>An investigation into the role of course satisfaction on students' engagement and motivation in a mobile-assisted learning management system flipped classroom</i>	Mobile LMS moodle is used as a mobile learning platform during the course. Learning materials and discussion activities have been prepared. Instructors act as counselors and directors.
Tsai et al. (2018)	<i>Exploring the effects of web-mediated socially-shared regulation of learning and experience-based learning on improving students' learning</i>	Facebook and LINE are used as platforms for online interaction, discussion, and seeking academic help for students. Students can also use Moodle as a platform to share their perceptions and assignments if they don't have an account on Facebook or LINE.
Moradimokhles & Hwang, (2020)	<i>The effect of online vs. blended learning in developing English language skills by nursing student: an experimental study</i>	Instructors explain to students how to use the LMS, how to retrieve materials online, and how they can contact instructors online for specific training sessions. At the end of the training program, all students take a posttest of general English proficiency.
Hsiao et al. (2021)	<i>The flipped classroom approach in an English for specific purposes (ESP) course: A quasi-experimental study on learners' self-efficacy, study process, and learning performances</i>	Students from the experimental group were asked to actively participate in pre-class activities in Moodle. The course is conducted for 18 weeks. Moodle as an online learning platform allows students to learn anytime and anywhere as long as they have an electronic device with internet access.

Research that addresses RQ2 and focuses on the features of LMS used in learning, is described in eleven selected articles [30], [32], [33], [37], [39], [42], [43], [44], [46], [47], [48]. A summary of the findings is presented in Table 5.

**Table 5.** Learning management system features used in learning

Author	Article Title	LMS Features
Pérez et al. (2020)	<i>An analysis of factors affecting students' perceptions of learning outcomes with Moodle</i>	File Management (Learning Materials) Discussion Forums Multimedia Integration Quiz Assignment Feedback
Babo et al. (2020)	<i>E-assessment with multiple-choice questions: A 5 year study of students' opinions and experience</i>	Moodle Quiz DBMS or spreadsheet tools
Ustun et al. (2022)	<i>Learning analytics based feedback and recommendations in flipped classrooms: an experimental study in higher education</i>	Course Material Moodle Forum Assignments News / Notifications
Chootongchai & Songkram, (2018)	<i>Design and development of SECI and Moodle online learning systems to enhance thinking and innovation skills for higher education learners</i>	Course Dashboard Interactive Video Forum Chat Mindmap Online Meetings Stamp Collection Level Up Badge

(Continued)

**Table 5.** Learning management system features used in learning (*Continued*)

Author	Article Title	LMS Features
Amril et al. (2019)	<i>LMS Edmodo to improve student understanding of the arithmetic concept in Microsoft excel</i>	Login - Dashboard Notifications Assignments Test Online Activity
Vitošević & Janković (2014)	<i>Piloting of blended learning: Implementation and benefits</i>	Glossary Essay Quiz Forum News Chat Study materials Video animations
Jia et al. (2022)	<i>Adaptation of a conventional flipped course to an online flipped format during the Covid-19 pandemic: Student learning performance and engagement</i>	Course Material Moodle Forum Assignments Feedback News / Notifications
Yılmaz (2022)	<i>An investigation into the role of course satisfaction on students' engagement and motivation in a mobile-assisted learning management system flipped classroom</i>	Course Material Moodle Forum Assignments Feedback News / Notifications Group Quiz Library
Burns et al. (2022)	<i>Enhancing understanding of foundation concepts in first year university STEM: evaluation of an asynchronous online interactive lesson</i>	Library Assignments Grade
Tsai (2016)	<i>Exploring the effects of online team-based learning and co-regulated learning on students' development of computing skills</i>	Course Material Assignments News / Notifications Quiz Exams
Tezer & Çimşir (2018)	<i>The impact of using mobile-supported learning management systems in teaching web design on the academic success of students and their opinions on the course</i>	Notifications Messages Upload Calendar Events My Files My Courses

Research that addresses RQ3 and investigates the impact of LMS on students' cognitive learning outcomes is described in sixteen selected articles [30], [31], [33], [35], [36], [37], [38], [39], [40], [41], [42], [43], [44], [45], [46], [48]. A summary of the findings is presented in Table 6.

**Table 6.** Effect of learning management system on student cognitive learning outcomes

Author	Article Title	Students' Cognitive Learning Outcomes
Pérez et al. (2020)	<i>An analysis of factors affecting students' perceptions of learning outcomes with moodle</i>	This study explains that the quality of the learning system and the accuracy of information are fundamental in creating student satisfaction in the learning process. LMS moodle is an easy-to-use system that enhances student satisfaction. Studies reveal that when students find the information provided in the Moodle platform to be useful and up-to-date, they are more interested in using it and feel more satisfied.
Horvat et al. (2015)	<i>Student perception of Moodle learning management system: a satisfaction and significance analysis</i>	This study concluded that students who only used the Moodle LMS before the exam had significantly lower learning outcomes and satisfaction compared to students who used it on a daily basis.
Vitošević & Janković (2014)	<i>Piloting of blended learning: Implementation and benefits</i>	The study concluded that the implementation of blended learning has yielded positive and promising results, particularly in terms of student satisfaction and engagement. The students view the online component as an academic platform where they can not only acquire new knowledge, but also engage in discussions and delve into new subjects with their teachers and classmates. This allows them to address any uncertainties they may have regarding the subject matter. The Moodle platform did not pose any major difficulties for them, despite their lack of previous experience.
Yılmaz (2022)	<i>An investigation into the role of course satisfaction on students' engagement and motivation in a mobile-assisted learning management system flipped classroom</i>	This study aims to explore the effect of students' satisfaction with a flipped classroom supported by LMS on their engagement and motivation. The findings of the study showed that the satisfaction, involvement, and motivation of students in the LMS-based flipped class was high. In addition, student satisfaction and its sub-dimensions, including communication and usability, teaching process, instructional content, interaction and evaluation, were significant predictors of student engagement and motivation.
Bansah & Agyei (2022)	<i>Perceived convenience, usefulness, effectiveness and user acceptance of information technology: evaluating students' experiences of a learning management system</i>	This study found that three variables: perceived usefulness; perceived comfort; and perceived effectiveness contributed to predicting student user acceptance of the LMS, but the best predictor was perceived comfort. The use of LMS is encouraged to make it easier for students to carry out their assignments at any time, and the effectiveness and usability of the systems provided when using them.
Jia et al. (2022)	<i>Adaptation of a conventional flipped course to an online flipped format during the Covid-19 pandemic: Student learning performance and engagement</i>	The results showed that the online flipped classroom approach could be as effective as conventional flipped instruction and students remained interested during the online flipped class.
Hsiao et al. (2021)	<i>The flipped classroom approach in an English for specific purposes (ESP) course: A quasi-experimental study on learners' self-efficacy, study process, and learning performances</i>	The findings confirm that the flipped classroom approach with LMS positively affects students' self-efficacy towards learning English. Because the learning materials applied in this study are optional materials, students may have relatively higher motivation.
Tezer & Çimşir (2018)	<i>The impact of using mobile-supported learning management systems in teaching web design on the academic success of students and their opinions on the course</i>	This study concludes that there are significant differences between students who have used mobile LMS and students who have been taught by traditional methods. Most of the students stated that the learner using the LMS was useful and this system should be used in all lectures. In addition, because they have the opportunity to receive quick answers to their questions in the web design course using Mobile LMS, their motivation is increased.
Adeshola & Agoyi (2022)	<i>Examining factors influencing e-learning engagement among university students during covid-19 pandemic: a mediating role of "learning persistence"</i>	This study revealed that interactions with instruction, peer collaboration, and community support positively affect e-learning engagement and help students become more involved in their learning. This study reveals that there is a significant effect on e-learning involvement and teacher attendance. The findings of this study revealed that computer self-efficacy and students' academic self-efficacy contributed significantly to the usefulness of the e-learning platform (LMS).

(Continued)

**Table 6.** Effect of learning management system on student cognitive learning outcomes (*Continued*)

Author	Article Title	Students' Cognitive Learning Outcomes
Waheed et al. (2015)	<i>Perceived learning outcomes from Moodle: An empirical study of intrinsic and extrinsic motivating factors</i>	The findings of this study conclude that the enhanced module of the moodle platform is certainly useful for students to improve learning experiences and outcomes.
Sáiz-Manzanas, (2019)	<i>Will personalized e-Learning increase deep learning in higher education?</i>	The use of personalized Moodle-based LMS has been found to improve student learning outcomes. The use of various sources of learning media, application of active methodologies such as PBL and feedback can facilitate the improvement of more effective learning outcomes.
Chootongchai & Songkram, (2018)	<i>Design and development of SECI and moodle online learning systems to enhance thinking and innovation skills for higher education learners</i>	Based on the research results, students who use LMS can significantly improve their skills in thinking and innovating. LMS with mobile technology support for student-centered learning, especially for higher education students who already use online learning and are familiar with mobile devices. The online learning system using SECI and Moodle processes is effective for enhancing thinking and innovation skills for higher education students.
Amril et al. (2019)	<i>Lms edmodo to improve student understanding of the arithmetic concept in microsoft excel</i>	The main finding of this study is that the Edmodo LMS has great potential for use in higher education learning environments. The knowledge of the lecturers will determine the success of learning with LMS Edmodo. LMS Edmodo can be used as a tool to address future-oriented student learning needs.
Burns et al. (2022)	<i>Enhancing understanding of foundation concepts in first year university STEM: evaluation of an asynchronous online interactive lesson</i>	The development and implementation of online lessons using an LMS has the potential to enhance students' transition to university teaching and learning where they are required to develop self-study skills and synthesize discipline-specific content.
Tsai (2016)	<i>Exploring the effects of online team-based learning and co-regulated learning on students' development of computing skills</i>	The results of this study indicate that students who received the online CRL intervention could have significantly better computational skills in using excel than those who did not use the intervention.
Moradimokhles & Hwang, (2020)	<i>The effect of online vs. blended learning in developing English language skills by nursing student: an experimental study</i>	The results showed that blended learning had a significant positive impact on improving the general English skills of nursing students. The results also revealed that blended learning improved the general English skills of nursing students more than online learning.

## 4 DISCUSSIONS

### 4.1 Implementation of learning management system

Implementation of the LMS is divided into four stages: introduction of the LMS, enrollment of students on the LMS platform, utilization of learning materials using the LMS platform, and the evaluation stage, which includes the submission of student assignments as well as exams and the delivery of feedback from teachers to students [49].

### 4.2 Moodle and Edmodo learning management system

**Introduction.** In the introduction stage, LMS Moodle and Edmodo are introduced to students by presenting the course information as a whole, including the syllabus, informational textbooks, and assessments. The introduction of the LMS is carried

out through five thematic units: conceptual explanation, supplementary material, practice, and project-based learning. In addition, the LMS instructor also mentioned the purpose and procedure for using it, as well as its functions, features, and uses, in order to enhance students' understanding of the learning media [32], [38], [39], [40], [41], [45], [46].

**Registration (Enrollment).** At the registration stage, all students are directed to register in the LMS and are guided to explore the LMS and become familiar with the online learning environment. They are also given access to course videos, e-books, and other course materials that have been uploaded to the system one week prior to the start of the course. This allows participants to preview the materials [30], [33], [37], [41].

**Learning materials.** At the stage of delivering learning materials, students engage in various learning activities and access learning materials through the Moodle LMS. They are also required to participate in discussions and other learning activities using the forums in the LMS for specified periods of time. Materials used in learning are added to the LMS. Students' applications allow them to download learning materials from the platform and upload documents back to the instructor as part of an assignment or project they have completed. The students need to be involved in discussions and interactions. Throughout the LMS implementation period, students are provided with ongoing support for the LMS. They can always email or ask questions on the platform [30], [32], [33], [41].

**Evaluation.** At the evaluation stage, the instructor will provide assessment, feedback, and further clarification on exercises, assignments, tests, projects, and discussions through the Moodle or Edmodo LMS platforms. To enhance interaction, motivation, and engagement with the proposed system, gamification techniques are implemented in the learning process. These techniques include features such as collecting stamps, leveling up, and earning badges, as seen in LMS [41], [46], [48].

### 4.3 Learning management system features

The LMS features used are grouped into four parts, namely communication features, course content features, course delivery features, and assignment features [31], [34], [35], [36], [38], [40], [41], [45]. In another study that utilized Moodle as a LMS, various features such as the course material, Moodle forum, assignments, news/notifications, groups, quizzes, exams, and library features were employed [30], [32], [42], [43], [44]. The course dashboard, interactive video, forum, chat, mind map, online meetings, stamp collection, level up, and badge [48]. Glossary, essay, quiz, forum, news, chat, study materials, video animations [37]. The learning process involving Moodle LMS was conducted by utilizing various features such as notifications, messages, uploads, calendar events, my files, and my courses. Nineteen selected articles were used, with one research article utilizing LMS Edmodo as a learning medium. The research utilized features such as login, dashboard, notifications, assignments, tests, and online activities.

The LMS feature used in all research based on selected articles is beneficial for optimizing the learning process and ensuring that learning objectives are achieved effectively. This is supported by the theory proposed by Harefa [49] in his book titled "LMS e-learning applications for online and blended learning." Harefa states that the features in the LMS can effectively assist and optimize the learning process.

#### 4.4 The effect of LMS on students' cognitive learning outcomes

According to Bruner [15], three cognitive processes occur in learning: the process of acquiring information, transformation, and evaluation. The process of acquiring new information can be observed through learning satisfaction, learning engagement, and learning experience. Learning comfort, learning effectiveness, and learning motivation can be observed during the process of transforming received information. Improving learning outcomes is a criterion that occurs in the evaluation process to assess the relevance and accuracy of knowledge.

Moodle, as a user-friendly and high-quality learning management system, mitigates the negative outcomes associated with its use. The quality of information is fundamental to creating student satisfaction. If the information provided through Moodle is useful and up-to-date, students will be more interested in using it and will feel more satisfied. Students who only used Moodle before exams had significantly lower satisfaction and significance compared to students who used it every day. Moodle did not present significant challenges for students, even for those without prior experience [30], [37], [38], [39].

Acceptance of LMS by students is determined by its benefits, comfort, and perceived effectiveness. The best predictor is perceived comfort. The advantage of perceived convenience is that students are relatively "technology literate" and are encouraged to adopt learning management systems, primarily because of how easily it allows them to work on their assignments anytime and anywhere. In addition, the acceptance of LMS by students can also be observed through the effectiveness and usefulness of the system when it is being used [41], [44].

The use of LMS in learning also has an impact on students' motivation to learn. The flipped classroom approach with LMS positively affects students' self-efficacy towards learning. There is a significant difference between students who have used the LMS and students who have been taught using traditional methods. In addition, most students stated that learning using LMS was useful, and they recommended that this system be used in all learning activities [30], [33], [36].

In another study, it was found that utilizing a LMS has a positive impact on e-learning engagement and promotes greater student involvement in the learning process. The presence of instructors to provide proper and extensive training before using e-learning platforms and other communication platforms for teaching is very important [31].

The enhanced modules of the Moodle LMS platform are useful for students to enhance their learning experiences and outcomes [45]. The use of personalized e-learning systems, such as Moodle and Edmodo, has been shown to improve student learning outcomes, facilitate safer and more effective learning environments, enhance thinking and innovation skills, and have great potential for use in higher education. These systems also have the potential to develop students' self-study skills, improve learning abilities, and significantly impact students' general abilities [35], [40], [42], [43], [46], [48].

Online platforms are effective tools for lecturers to assess students' abilities. In online assessment practice, cooperation between lecturers and students is needed to achieve the learning goals that have been set. This cooperation supports the delivery of certain announcements, the sharing of various ideas and learning sources, and online discussions [50]. This approach, which combines technology with the "human factor," has been proven to increase users' commitment to learning. Learning the German language using LMSs requires a well-established approach that combines

online and face-to-face learning for each specific learning group. As a general rule, learners who are more proficient in German and/or possess better digital skills are offered a higher proportion of online teaching [51].

#### 4.5 Validity test results

The validity test of the selected articles was carried out by four experts, namely the expert on SLR research methods, the learning management system expert, the assistant learning expert, and the cognitive learning outcomes expert. The purpose of this test is to assess the validity of the selected articles in addressing the research problem. This test uses the formula proposed by Gregory [29], which is useful when there are many variables that need to be measured by the researcher. The four validators used identical instruments, which consisted of: a) aspects of SLR; b) aspects of cognitive learning outcomes; and c) aspects of LMS. The validity of the selected articles is presented in the Table 7.

**Table 7.** Results of selected articles validity test

Systematic Literature Review Expert Assessment		Expert Assessment of Cognitive Learning Outcomes		Expert Assessment of Cognitive Learning Outcomes		Learning Management System Expert Assessment	
Relevant	Less Relevant	Relevant	Less Relevant	Relevant	Less Relevant	Relevant	Less Relevant
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	–	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	–	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	–	1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	3, 10, 22

Table 7 shows that experts in SLR and cognitive learning outcomes assess that all aspects in the selected articles are relevant. Meanwhile, according to experts in LMSs, there are certain aspects that are irrelevant to the SLR and LMS. These include the elimination of inaccessible articles, the inclusion criteria for English articles, and the specific name of the LMS used. The results of the validity test conducted by two experts were calculated using the content validity formula proposed by Gregory [29].

$$V_i = \frac{D}{A + B + C + D}$$

**Information:**

- A: both validators disagree
- B: validator I agree, validator II disagree
- C: validator I disagree, validator II agree
- D: both validators agree

**Validity score criteria:**

- 0.80–1.00: very high
- 0.60–0.79: high
- 0.40–0.59: medium
- 0.20–0.39: low
- 0.00–0.19: very low

**Table 8.** Classification of Gregory's cross validity test

Cross Tabulation 2 × 2		Rater I	
		Less Relevant Score 1 – 2	Very Relevant Score 3 – 4
Rater II	Less Relevant Score 1 – 2	<b>A</b>	<b>B</b>
	Very Relevant Score 3 – 4	<b>C</b>	<b>D</b>

By referring to Gregory's formula and Table 8, the results of the validity test are as follows:

$$V_i = \frac{354}{0 + 9 + 9 + 354} = \frac{354}{372} = 0.95 \text{ (very high validity)}$$

Based on the results of the validity test calculation, a value of 0.95 was obtained, which falls within the range of 0.8–1. In other words, it meets the criteria for "very high validity." This shows that the selected articles, which serve as sources in this study, are highly suitable for addressing the research problem formulation.

## 5 CONCLUSIONS

Learning management systems implementation is applied in learning through four stages: the introduction stage, which involves introducing the LMS to students by providing conceptual explanations, a syllabus, learning schemes, purposes and procedures for use, functions, features, and assessments. The registration stage involves the registration process and guidance to explore the LMS and get orientation in the learning environment to access course videos, e-books, and other course materials that have been uploaded to the system. The learning materials stage focuses on students undergoing learning within a certain time, accessing material resources, participating in discussions in forums, and engaging in other learning activities. Lastly, the evaluation stage includes the provision of assessment, feedback, and further clarification by the instructor.

Learning management system features used in learning are grouped into four parts: communication features (forum, chat, messages, groups), course content features (course materials, interactive video, library, my courses), course delivery features (news and notifications, calendar events, my files), and assignment features (quiz, essay, exams, upload, level up, badge). LMS features can help optimize the learning process to ensure that learning objectives are achieved.

Using a LMS as a medium for learning has an impact on students' cognitive learning outcomes. It affects their learning satisfaction, engagement, experience, comfort, effectiveness, and motivation, ultimately leading to improved student learning outcomes. Students who are accustomed to using the LMS experience significantly higher satisfaction and achieve better learning outcomes compared to students who do not use the LMS. The use of Moodle and Edmodo-based LMS has been proven to enhance students' cognitive learning outcomes and has significant potential for implementation in educational settings. Learning the German language using LMSs requires a well-established approach that combines online and face-to-face learning for each specific learning group. As a general rule, learners who are more proficient in German and/or possess better digital skills tend to have a higher proportion of online teaching offered to them.

This study has several weaknesses due to the limited data sources available in the selected database. In addition, the researcher only examined the Moodle and Edmodo LMS without integrating them with other LMS, particularly the Sipejar LMS, which is widely used in the learning environment at the State University of Malang.

Considering that this research yields positive results in enhancing the quality of learning, it is recommended that educational institutions, specifically the German language department, begin designing learning using LMS Moodle or Edmodo. These platforms offer features that can optimize the learning experiences, providing an alternative form of learning. This can support learning activities, allowing learning objectives to be achieved optimally. The suggestion for further research is to compare the effectiveness of the Moodle and Edmodo LMS with the Sipejar LMS. In addition, it is recommended for teachers to cultivate habits of using online learning media, as this can increase learning success. Teachers are also advised to have more patience in guiding and directing students so that they can become accustomed to an online learning environment that requires independent learning. This will help ensure that learning outcomes are achieved optimally.

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