A SYSTEMATIC REVIEW OF THE TENDENCIES IN THE USE OF LEARNING MANAGEMENT SYSTEMS

Dr. Hakan ALTINPULLUK
ORCID: 0000-0003-4701-1949
Faculty of Open Education
Anadolu University
Eskisehir, TURKEY

Dr. Mehmet KESIM
ORCID: 0000-0002-8153-5159
Faculty of Open Education
Anadolu University
Eskisehir, TURKEY

ABSTRACT

In this study, 59 SSCI-indexed articles published between 2012 and 2017 in the Web of Science database were analyzed by systematic review, identified by the keywords "Learning Management Systems / LMS" in their titles. This study aims to determine the current situation and future trends in using LMSs as one of the tools that are getting increasingly popular both in blended and online environments. Accordingly, our study has revealed that the highest number of the articles were published in 2016, Moodle is the most popular LMS, the open-source LMSs are preferred over other types, LMSs are most often used to measure success, South Korea and the United States (US) are the pioneering countries in this field, the quantitative method and questionnaire tool are the preferred methodological approaches in the LMS scientific research, students are more likely to be selected as a sample group, with the 0-100 range as the most common sample size, and that the technology acceptance model (TAM) is the most frequently used model. The findings are visualized with tables, graphs and maps. The study is concluded with some suggestions for researchers and higher education institutions.

Keywords: Learning management systems, blended education, online education, open and distance learning, systematic review.

INTRODUCTION

In the twenty-first century, higher education institutions make an extensive use of the information and communication technologies (ICT) to carry out their basic tasks such as teaching and learning (Mkhize, Mtsweni, & Buthelezi, 2016). Given this ICT-based evolution of learning / teaching, new ways to improve learning based on the use of the Internet and computers have been discovered (Conde et al., 2014). In particular, online learning in relation to open and distance education has begun to become a form of traditional learning in higher education, which has not only increased the number of institutions providing online-only education, but also has led universities offering traditional face-to-face campus education to offer online courses to meet their student needs (You, 2016). In recent years, learning management systems (LMSs) have become increasingly popular in higher education, allowing easier course management, content management, assessment and reporting, and are therefore gaining rapid popularity as technological systems of choice in academic institutions (Draskovic, Misic, & Stanisavljevic, 2016). Many higher education institutions benefit from these LMSs, which support learning activities of students by providing a comprehensive and integrated set of services and tools for students (Zanjani, Edwards, Nykvist, & Geva, 2017). LMSs have shaped the landscape of higher education by transforming the traditional face-to-face education into blended and online learning environments (Beer, Clark, & Jones, 2010).

There are various definitions of LMSs, which have changed in parallel with the developments in ICT. According to Gasamyeh (2017), LMS refers to software applications and web-based technologies that help learning and teaching processes as an ICT playing an important role in higher education. According to De Moraes (2012), LMSs allow online content, learning activities and course management to be published in a variety of ways, addressing both pedagogical and technological needs. Islam (2015) defines the LMS as web-based software that is used for delivery, tracking, and management of online content.

LMSs have emerged as ICT tools that provide learning opportunities without time and space constraints that facilitate the open and distance learning process (Ain, Kaur, & Waheed, 2016). Pilli and Sozudogru (2012) point out that the use of LMSs to organize, manage, present and evaluate educational and training activities has become increasingly popular both for on-campus and off-campus education. Although LMSs are the most popular educational technology application used in remote online education (Almarashdeh, 2016), they have been frequently used in recent years not only in distance education-based education systems but also in traditional face-to-face university education systems and strengthened blended learning environments (Emelyanova & Voronina, 2014; Islam, 2015; Laflen & Smith, 2017; Torrisi-Steele & Drew, 2013). The use of LMS in learning environments offers several key advantages. As systems that support and manage learning content that allows a variety of file formats and environments (Son, Jeong-Dong, Hong-Seok, & Baik, 2016), and with their inbuilt online learning tools, LMSs support both critical thinking and also higher-level learning skills by providing opportunities for knowledge sharing and creating collaborative online communities (Zanjani, Edwards, Nykvist, & Geva, 2016). LMSs help regulate the management of students; facilitate access to resources and provide support for some remote collaboration activities through established means (Alario-Hoyos et al., 2015). In summary, the usage trends of LMSs, which have become indispensable to higher education institutions, need to be assessed. For this reason, the rationale behind carrying out this study, the problems it aims to solve, and its contribution to the relevant literature are explained under the problem statement and purpose sub-headings in the following section.

Problem

In recent years, no comprehensive content analysis or systematic review has been carried out on LMSs, which are one of the most important online learning tools that strengthen the blended learning processes in higher education institutions in particular. To date, there has been only one study (Soykan & Şimşek, 2017) reviewing LMSs in SSCI-indexed articles from various perspectives. Applying various criteria, their study presents an analysis of the articles focusing on LMSs between 2010 and 2014. The current study, however, has been carried out in a different context in terms of both the scope and the years studied. Our study is important because in addition to revealing the current status of LMSs, it describes the factors shaping higher education institutions' LMS preferences and their tendencies in using them as the online software tools that perform some basic tasks such as student follow up, course and content management, evaluation, and reporting. Also, the fact that there is only one study focusing on the use of LMS suggests that further research is needed on this specific subject.

Purpose

The purpose of this study is to examine, by applying the systematic review method, 59 SSCI-indexed articles published between 2012 and 2017 in the Web of Science database, which include the keywords "Learning Management Systems / LMS" in their titles. In order to achieve this purpose, the answers to the following research questions were sought:

1. How does the number of articles vary by year?
2. What are the types and names of LMSs used?
3. What is the purpose of using LMSs?
4. In which countries were the articles published?
5. Which research methods were used?
6. What data collection tools were used?

7. Who constitutes the sample group used in the articles?
8. What is the sample size used in the articles?
9. What are the theoretical frameworks and models used in the articles?

METHODOLOGY

Data Collection Tools and Inclusion/Exclusion Criteria

In this study, "Web of Science Core Collection" database was used as the data collection tool, which yielded a list of articles containing the keywords "Learning Management System" or the abbreviation "LMS" in their titles. These keywords were typed in quotation marks to ensure accurate results were obtained. In the timespan section, the period between 2012 and 2017 was selected and only the "Social Sciences Citation Index (SSCI)" was selected in the "Web of Science Core Collection: Citation Indexes" section. Then, on the opening webpage, the list was further filtered to include the articles only, which resulted in 61 articles. However, during the systematic review, it was determined that the words "LMS" in the titles of 2 articles had nothing to do with learning management systems. With the removal of these two articles, 59 articles were included the final list of articles selected for our systematic review. The journals publishing these articles are shown in Table 1.

Table 1. The journals where the articles were published

Journal	f	Impact Factor (2017)
Computers & Education	6	4.538
The International Review of Research in Open and Distributed Learning	6	1.826
Australasian Journal of Educational Technology	5	1.396
Journal of Educational Technology & Society	5	1.767
Computer Applications in Engineering Education	4	1.153
Computers in Human Behavior	4	3.536
Interactive Learning Environments	4	1.604
Eurasia Journal of Mathematics, Science and Technology Education	3	0.903
British Journal of Educational Technology	2	2.729
Expert Systems with Applications	2	3.768
Others	18	-
Total	59	

Note. One article was published in each journal in the "Others" column.

Data Analysis

In the current study, the systematic review method was used during the analysis. 59 articles were analyzed in various categories through a systematic review (Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004), which is defined as reviewing the literature according to a clear, rigorous, and transparent methodology. These articles were classified and analyzed according to nine research questions. During the analysis of the data, similar types of content were combined into the same category and the redundant data to be eliminated were removed from the related category. Using descriptive statistics, the findings were visualized with tables, graphics and maps.

FINDINGS

Change in the Number of Articles by Year

Figure 1 shows that there are nine SSCI-indexed articles published in 2012 including "LMS" or "Learning Management System" in their titles. However, the year 2013 (n=3) indicates a significant decline. Between 2014 and 2016, an increasing number of articles were published, which peaked in 2016 (n=19). However, 2017 witnessed a clear drop (n=9) in the published LMS articles again.
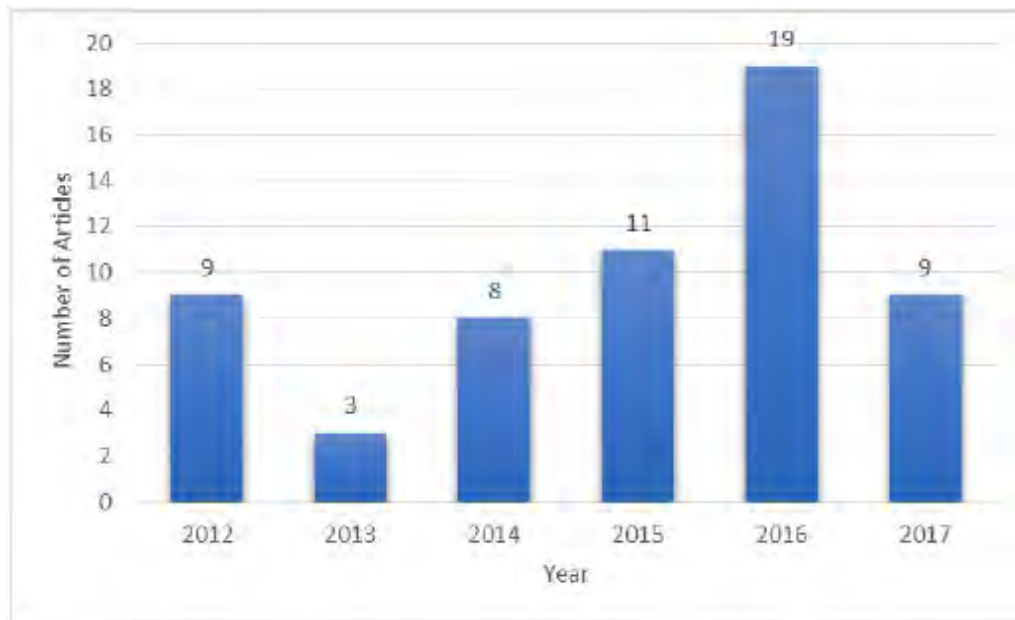

Figure 1. Change in the number of articles by year

Type and Name of LMS Used

Table 2 presents a classification of LMSs by their SCORM compliance, type, name, and quantity. Clearly, most of the LMSs used in the articles are of the open source type. Of these open source LMSs, the most commonly used LMS is Moodle (n=22). Besides Moodle, the other open source LMSs are Sakai, Ilias, Open eClass, eXe Learning and Glue LMS. The only commercial LMS encounteres in the reviewed articles is the Blackboard, which used to be known as WebCTs (n=5). In addition, some social network / Web 2.0 based LMSs have been used in recent years. Social networking sites such as Facebook (n=2), Twitter (n=2) and Google Plus (n=1) were found to be used as an LMS or integrated into an existing LMS. It also became clear that some universities or particular studies had specially developed their own LMSs for their specific purposes. Other than these, six of the articles gave no details about which particular LMS was used.

Table 2. SCORM compliance, type and name of LMS used

SCORM Compliance	Type	Name	f
SCORM Compliant	Open Source	Moodle	22
		Sakai	5
		Ilias	1
		Open eClass	1
		eXe Learning	1
		Glue LMS	1
	Commercial	Blackboard (WebCT)	5
	Social Network Based	Facebook	2
		Twitter	2
		Google Plus	1
SCORM Non-compliant	Self Developed		12
	Unspecified		6
Total			59

Purpose of Using LMSs for Students

A closer look at the purposes for using LMSs (Table 3) reveals that the most widely explored purpose was the effect of using LMSs on achievement. In addition, the articles investigated the effects and use of LMSs for collaboration, support, satisfaction, interaction/communication, evaluation, perception, attitude and engagement. In addition to all of these, it appears that in many articles the LMSs serve as multi-purpose tools, instead of serving just a single purpose.

Table 3. Purpose of using LMSs

Purpose of Use	f
Achievement	13
Collaboration	12
Support	10
Satisfaction	9
Interaction/Communication	9
Evaluation	8
Perception	7
Attitude	7
Engagement	6

Note. Some studies involve multiple purposes.

Countries Publishing the Reviewed Articles

Focusing on the countries where the articles are published (Figure 2), it is evident that the highest number of articles were published in South Korea (n=8) and United States (US) (n=8). In the third place are the Spanish (n=7) researchers. Australia (n=5), Portugal (n=4), Serbia (n=4), South Africa (n=4), Turkey (n=4), and Greece (n=3) are the other countries shown on the map above. The remaining countries not shown on the map are England, Finland, Saudi Arabia and Taiwan, with two articles each. Apart from these, 12 countries published one article each. It was also found that in some articles researchers from more than one country (international co-authors) were included in a single article.
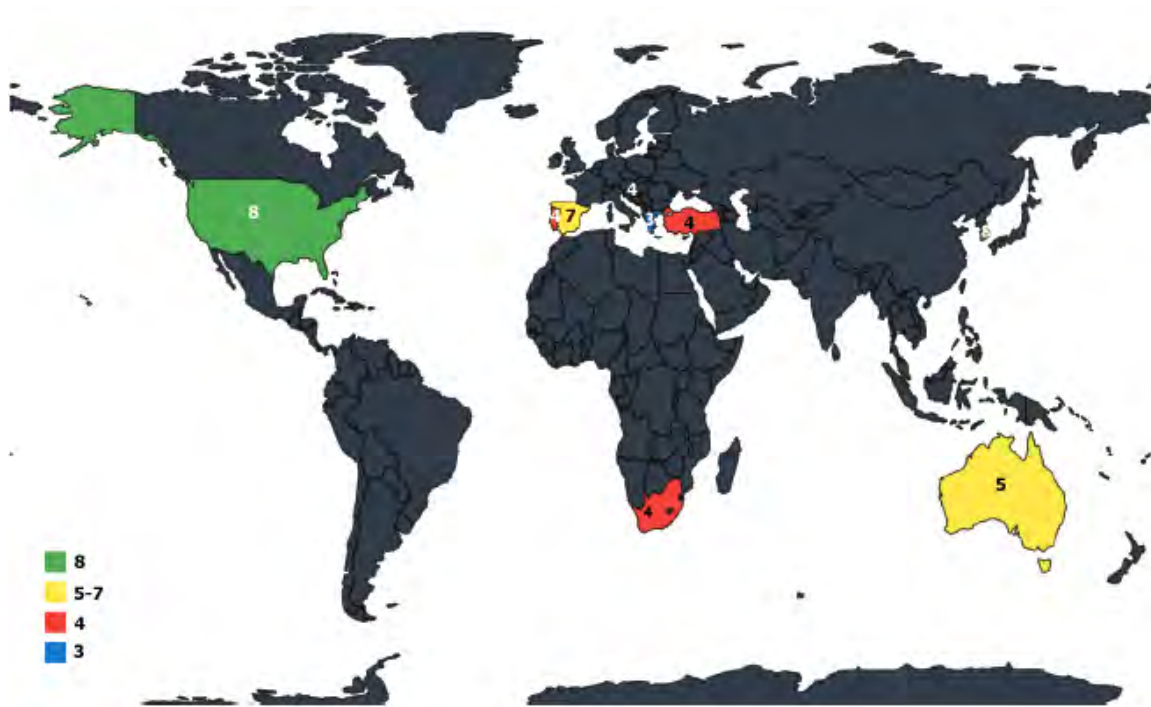
Figure 2. The countries where the reviewed articles were published

The Research Method

As can be seen in Table 4, in terms of the research method used, it is evident that quantitative (n=37) method is preferred the most, followed by the qualitative (n=10) method. While five articles employed the mixed method, one article applied the review method. In six articles, no method was used at all.

Table 4. The research method

Research method	f
Quantitative	37
Qualitative	10
Mixed	5
Review	1
None	6
Total	59

The Data Collection Tool

According to the classification by the data collection tool used the research articles listed in Table 5, it is clear that the questionnaire (n=33) is the most frequently applied tool. Log data were also used in a high number of articles (n=11), as some LMSs retain log data and have advanced analytics features. The test was also preferred especially in quantitative studies (n=10). The interview was listed as a data collection tool used in qualitative research (n=10). 9 studies included the use of scale and scale development processes. In 7 studies, no data collection tool was reported.

Table 5. Data collection tool

Data collection tool	f
Questionnaire	33
Log data	11
Test	10
Interview	10
Scale	9
None	7

Note. Several studies used multiple data collection tools.

Sample Group

When examined according to the sample group (Table 6), it can be seen that 43 studies include students as their sample group. Undergraduate students were also analyzed in terms of the type of teaching they were taught by. In this respect, LMSs are used in the blended teaching type in 27 studies, while students in 13 studies took part in fully online teaching environments. Regarding the students, it was found that post-secondary vocational school students were selected as the sample in two studies and secondary school students were included in one study. Apart from students, university faculty members were also frequently selected as the study sample (n=13). Academic staff such as instructors, lecturers, professors are also included in the studies. Furthermore, sample groups from different fields and environments such as School Teachers (n=2), Experts / Professionals (n=1), LMS Stakeholders (n=1), and Full Time Employees (n=1) were also included in the analyzed studies. We also found that many studies use multiple sample groups rather than a single sample group.

Table 6. Sample group

Sample Group	Instruction Level	Instruction Type	f
Students	Secondary School	Blended	1
	Post-Secondary Vocational School	Blended	2
	Undergraduate	Blended	27
		Fully Online	13
Faculty Members			13
Teachers			2
Experts/Professionals			1
LMS Stakeholders			1
Full Time Employees			1
Unspecified			6

Note. Some studies have more than one sample group.

Sample Size

When examined in the context of the sample size, it can be seen that the 0-100 range sample was used 17 times. The range of 0-100 is the most preferred sample size in the articles, which is followed by the 301-400 sample size. There were 10 articles with the size of 101-200 participants.

One of the notable findings in Table 7 is that there are five studies with a sample involving 1001 or more participants. Examining studies of such large samples, it was determined that these samples were included especially in the studies conducted at universities offering fully online instruction. In eight of the studies, no sample was reported.

Table 7. Sample sizes

Size of the sample	f
0-100	17
101-200	10
201-300	4
301-400	11
401-500	2
501-1000	2
1001+	5
Unspecified	8
Total	59

Theoretical Frameworks and Models Used in the Articles

When Table 8 is examined, it can be seen that many theories or models are preferred in the articles. In particular, the technology acceptance model (TAM) is noteworthy as the most widely used model (n=6) in these studies. In addition to this model, the unified theory of acceptance and use of technology model (UTAUT), theory of planned behavior (TPB), theory of reasoned action (TRA), quality of interaction (QoI) model, and expectation-confirmation theory were used twice. Other theories and models used in the articles were used once as detailed in Table 8.

Table 8. Theoretical frameworks and models used in the articles

Theory/Model	f
Technology Acceptance Model (TAM)	6
The Unified Theory of Acceptance and Use of Technology Model (UTAUT)	2
Theory of Planned Behavior (TPB)	2
Theory of Reasoned Action (TRA)	2
Quality of Interaction (QoI) Model	2
Expectation–Confirmation Theory	2
Activity Theory	1
Cognitive Load Theory	1
Cognitive Theory of Multimedia Learning	1
Concerns-Based Adoption Model (CBAM)	1
Delone and McLean Model (D&M model)	1
Extended-Technology Acceptance Model (eTAM)	1
Felder and Silverman's Learning Style Model	1
Fuzzy QoI Model	1
Information System Success (ISS) Model	1
Kano's Satisfaction Model	1
Two-factor Theory	1
User Satisfaction Evaluation Model (USEM)	1

Note. Some studies used multiple theories or models.

DISCUSSION AND CONCLUSION

In this study, SSCI-indexed 59 articles were published in the period of 2012-2017 including the words "Learning Management Systems" or "LMS" in their title were examined by the systematic review method and the usage trends of LMSs, as the web systems used frequently in online / blended learning systems, were determined. The findings obtained by this systematic review are listed under 9 subheadings.

The analysis of the distribution of 59 articles by journal revealed that these articles were published in 28 journals. Computers & Education and The International Review of Research (IRRODL) journals, which are the leading publications in the field of distance learning and education technologies, draw attention as the two journals most frequently publishing on the subject of LMS. The finding by Soyuk and Şimşek (2017) indicating that the Computers & Education journal leads in the number of articles on LMS supports this conclusion as well. The analysis of the scope of the journals and the research focus of the articles reveals that the articles are published especially in the field of education, but also in various fields such as computer science, engineering, psychology, anthropology, which demonstrates the multidisciplinary nature of the LMS-related articles.

When the change in the quantity of article publication by year is examined, a great decrease is observed from 2012 to 2013. This could have been driven by the popularization of web 2.0-based learning, called staff learning environments, which is claimed to be superior to LMS by some researchers (Chatti, Agustiawan, Jarke, & Specht, 2010; Dabbagh & Kitsansas, 2012). The decline in this period, in which connectivism theory was also very popular in learning environments (Barnett, McPherson, & Sandieson, 2013; Duke, Harper, & Johnston, 2013; Tschofen & Mackness, 2012), can be interpreted as an expected development. From 2013 until 2016, there was a continuous rise in the number of articles, which proves that LMSs tend to regain popularity in educational institutions. This resurgence of LMSs can be explained by the fact that in this year, the connectivism theory and the popularity of PLEs began to decline (Clara & Barbera, 2014). In 2017, there was a fall again. A new approach is observed in the development of LMS after 2017. It is also predicted in the Horizon report (Adams Becker et al., 2017) that adaptive and flexible "next-generation LMS" systems using multiple environments rather than a single component based on universal design standards will become popular. In sum, it can be said that classical LMSs tend to be replaced by innovative systems called "next-generation LMS".

The analysis of the type and name of the LMSs used in the articles reveals that most of the LMSs are open source. The most widely used open source LMS is Moodle. Moodle had over 148 million registered users as of 2019 (Moodle, 2019) as a free, widely used, open source LMS (Seluakumaran, Jusof, Ismail, & Husain, 2011) that supports online learning based on the social constructionist framework. It can be said that Moodle is preferred because it is a free open source LMS, with an easy-to-install user-friendly structure. Blackboard is still used as a commercial LMS, and continues to be preferred in educational institutions (Atkinson & Lim, 2013) as a system facilitating the follow-up of students with advanced analytical tools, log data recordings, rubrics and rich evaluation tools. Soykan and Şimşek (2017), who reviewed the 2010-2014 articles on LMS, found that the most preferred open-source LMS is Moodle and the most common commercial LMS is Blackboard (formerly WebCT).

There are some studies in which some social networking / Web 2.0 based LMSs are either individually developed or embedded in an existing LMS. For instance, Facebook (Meishar-Tal, Kurtz, & Pieterse, 2012; Wang, Woo, Quek, Yang, & Liu, 2012), Twitter (Conde et al., 2014; Pettit, 2014), Google Plus (Pilli & Sozudogru, 2012) were reported to be either used as an LMS or integrated into an existing LMS. In Facebook-based research, especially Facebook groups seem to be used like an LMS. In Twitter-based studies, Twitter is not used as a standalone LMS; it seems to be integrated into an existing or newly developed LMS. Google Plus, however, has been largely used as a standalone LMS separate from any social networking websites. The fact that all of these studies, including social networking tools, were published in the 2012-2014 timeframe can be explained by the fact that this period was when social networks became popular.

It seems that some universities have also developed LMSs designed by their own team or some specially produced as part of a certain study. These types of LMSs are designed with various approaches for social networking (Son et al., 2016), are semantic / ontologic (Rani, Srivastava, & Vyas, 2016), or are developed completely for mobile use (Han & Shin, 2016; Shin & Kang, 2015). Mobile LMSs have been found to

be especially prevalent. It is also noteworthy that there is no information on SCORM compliance in the self-developed LMSs. Additionally, it was found to be a very common practice to give nicknames to SAKAI-based LMSs in the studies we analyzed.

When the LMSs are evaluated from the perspective of their use, it can be seen that the highest number of articles intend to measure achievement in terms of multiple variables. Studies have been conducted to answer questions such as how student achievement has changed with the use of LMS, and the degree of their academic effectiveness. Soykan and Şimşek (2017) found that the determination of student success has a lower priority regarding the intent for the use of LMS. LMSs are also highly preferred for collaborative work. The use of LMSs is a great convenience, not only for students but also for faculty members in the tasks that require team work. Through the LMSs, the collaborative learning approach can be used effectively not only in online distance learning but also in blended learning environments. In addition, since some LMSs (eg. Moodle) contain communication and collaboration tools, some interdisciplinary approaches such as human computer interaction have also been employed to determine the usability of LMSs (De Moraes, 2012).

It has also emerged that LMSs can be effectively used as support services. Particularly in terms of timely feedback, some studies report on both peer feedback mechanisms used by students and other support components that enable the instructor's feedback to be communicated quickly and smoothly. Furthermore, in the context of support services, some LMSs even have mechanisms that provide automated feedback through techniques such as artificial intelligence, learning analytics and data mining (Dias & Diniz, 2014; Mafuna & Wadesango, 2012; Park & Jo, 2017).

South Korea and the US are identified as the countries playing a leading role when the countries with the most studies on LMS are examined. This shows that there is a growing interest in LMSs in the Far East and North America. However, regarding research interest, it can be seen that research on LMS is not dominated by a single country, and researchers from various countries have published on the subject.

When the scientific research methods employed in the articles are examined, it is observed that the quantitative research method is used the most extensively, and this is followed by the qualitative research method. The availability of the records of large sample groups on LMSs and the detailed log records of these large masses of learners may be the reasons for the intensive use of the quantitative method. The frequent use of structural equality models is also noteworthy, especially in the quantitative research studies. In the quantitative research, while students were generally selected as the sample group, in the qualitative research, various groups such as faculty members and professionals were selected as the sample group as well as the students. Although scientific research methods such as mixed method and review are used, it is remarkable that no studies using the design-based research method could be identified.

It can be seen that the questionnaire tool is used as a data collection tool especially in the quantitative studies. Besides questionnaires, log data was also identified as a very popular data collection tool. In particular, keeping LMS log data in private databases has become an important data collection tool for highly valuable scientific studies. Studies using log data as their data collection tool was found to use innovative approaches such as learning analytics and data mining. However, few studies were found to use log data as a stand-alone data collection tool, and they are usually supported by tools such as tests or questionnaires. Apart from the tests used in experimental studies, the interview tool proved to be the most powerful data collection tool, especially for the qualitative research method. In seven studies, no research method was reported. These studies were concluded to be ones that should be evaluated within the scope of Engineering Sciences rather than Educational Sciences. Furthermore, when evaluated in terms of the data collection tools they used, the studies were found not to use a single data collection tool but instead to enrich their dataset with multiple data collection instruments.

In terms of the sample group, it was found that students were selected more often than other groups, with more tendency to include undergraduate students rather than the K-12 or post-graduate students. This finding is also confirmed by the study conducted by Soykan and Şimşek (2017).

Since the LMS is a tool that is used both in fully online and blended educational environments (Laflen & Smith, 2017), both were analyzed. LMSs are used more heavily in blended environments. It was also found that studies related to online environments are dominated by South Korean researchers and that it is mostly in South Korean universities that students are educated in fully online environments. LMSs are actively used

in these universities, which are called an "online" or "cyber" university. It is also remarkable that the studies carried out with students have a larger sample size. In addition to students, faculty members such as instructors, lecturers, and professors are also included in these studies. The studies involving these groups were found to have been conducted mostly by applying qualitative methodology and with smaller sample sizes.

Focusing on the theoretical models and frameworks used in LMS studies, it was found that TAM and UTAUT are often used. It is only to be expected that these models (De Smet, Bourgonjon, De Wever, Schellens, & Valcke, 2012; Venkatesh, Morris, Davis, & Davis, 2003) which intend to determine the technology use priorities and the adoption level of technology are frequently used in LMS studies. However, TRA and TPB, from which TAM was derived, are also frequently used especially in the mobile LMS studies (Shin & Kang, 2015). Expectation-confirmation theory (Bhattacherjee, 2001; Davis, 1989), which describes measuring the degree of alignment between the perceptions of users' technology use expectations and their real performance, and QoI (Dias & Diniz, 2013) which intends to determine the quality and efficiency of user interactions in online teaching-learning environments, are two other notable theories and models that are frequently used.

In the light of the findings obtained by this study, the following suggestions can be made to researchers and institutions: The research questions examined through this systematic review can be expanded to include some other methods of analysis such as social network analysis, content analysis, or bibliometric analysis. In addition, different databases and digital libraries can be used instead of the Web of Science database used in the present study. Instead of SSCI, articles in other prestigious indices such as SCI-Expanded or ESCI can also be analyzed by other researchers.

Regarding methodology, it can be seen that the number of design-based studies in LMS articles is inadequate. Conducting further research in this regard is strongly recommended. Our review has also revealed that log data has been increasingly used in the studies conducted in recent years. It can be safely predicted that it will be used as a means of collecting data in a higher number of future studies. It may be suggested that researchers pay further attention to such log data. Keyword analyses of the articles can be conducted by different researchers and further lexical analyses can also be performed. In addition, although TAM and its derivatives are used extensively as a model, the connectivism theory, which was not detected in any of the LMS studies analyzed here, can be applied in new studies.

As for institutions, the increasing popularization of using free open source, LMSs with advanced support services such as Moodle may offer an idea to the higher education institutions that are in their LMS establishment/development stage. In addition, organizations would be well advised to take notice of the growing popularity of mobile devices and consider mobile LMSs as another alternative to achieve their educational objectives.

BIODATA AND CONTACT ADDRESSES OF AUTHORS

Dr. Hakan ALTINPULLUK is an Assistant Professor of Open and Distance Education at Open Education Faculty, Anadolu University. He undertook undergraduate studies in the field of Computer Education and Instructional Technologies (CEIT) between the years of 2005 and 2009 at Anadolu University. He received his Ph.D. Degree in the field of Distance Education in 2018. Hakan Altınpulluk continues to work in the field of Open and Distance Education, Augmented Reality, Virtual Reality, Mobile Learning, Mobile Health, Massive Open Online Courses, Learning Management Systems, Open Educational Resources, Personal Learning Environments, and E-Learning Systems.

Hakan ALTINPULLUK
Department of Distance Education, Open Education Faculty
Address: Anadolu University, Open Education Faculty, Eskisehir, Turkey
Phone: +90 2223350580/5839
E-mail: hakanaltinpulluk@anadolu.edu.tr

Dr. Mehmet KESIM is Professor at Open Education Faculty, Anadolu University. In 1982 he took active part in the establishment of the Anadolu University Open Education Faculty. He carried out various projects on the use of new communication technologies in education. In 1985 he completed his PhD with his thesis titled "The Use of Teletext and Viewdata in Distance Education". In 1988 he was become Associate Professor in the field of Communication Systems. In 1993 he received the title of Professorship in Distance Education. He is member of EDEN (European Distance and E-Learning Network) and received "Fellowship" from EDEN in 2009. He has published various articles and book chapters. He teaches undergraduate and graduate courses. Also, he continues his duties as an MA and PhD advisor.

Mehmet KESIM
Department of Distance Education, Open Education Faculty
Address: Anadolu University, Yunusemre Campus, 26470, Eskisehir, Turkey
Phone: +90 222 3350580/2468
E-mail: mkesim@anadolu.edu.tr

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