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Conceptualizing and Measuring Student Utilization of Learning Management Systems in Undergraduate Health Professions Education: A Scoping Review

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Abstract

Background. Learning management systems (LMSs) are increasingly used in undergraduate health professions education to support and monitor learning activities. However, student LMS utilization is described using varying concepts and indicators, resulting in inconsistency in how utilization is interpreted and measured. This scoping review aimed to map how student LMS utilization is conceptualized and measured, focusing on utilization dimensions and indicators, data sources, measurement approaches, and remaining gaps.

Methods. This scoping review followed the Joanna Briggs Institute methodology and was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). The Population–Concept–Context framework guided eligibility criteria and the search strategy. PubMed, ScienceDirect, and SAGE Journals were searched for original empirical studies published in English between 2021 and 2026. Studies involving undergraduate health professions students were eligible if they reported at least one indicator or method for assessing LMS utilization. Study selection, data charting, and synthesis were conducted independently by two reviewers, with disagreements resolved by consensus or a third reviewer.

Results. The search identified 305 records, of which seven studies met the eligibility criteria. Studies involved medical, nursing, and pharmacy students. LMS utilization was conceptualized using terms including use, utilization, engagement, course activity, and learning behavior. Five recurring dimensions were identified: frequency, intensity, resource use, feature use, and participation in LMS-based learning activities. Measurement approaches included self-reported measures, LMS-generated behavioral data, and mixed or multisource approaches. No standardized conceptualization or measurement framework for student LMS utilization was identified.

Conclusions. Student LMS utilization is a multidimensional construct, but its conceptualization and measurement remain inconsistent. Future research should clearly define LMS utilization, specify relevant dimensions and indicators, and consider integrating self-reported and LMS-generated data. Greater conceptual and methodological consistency may support more meaningful comparisons across studies and future investigations of factors associated with LMS utilization.

Background

Digital technologies have become increasingly integrated into health professions education, transforming the ways in which educational content and learning activities are delivered across healthcare disciplines [1]. The growing adoption of digital education has introduced diverse learning modalities, including online learning, blended learning, virtual reality, mobile learning, digital games, and virtual patients [1]. The COVID-19 pandemic further accelerated the large-scale implementation of information technology in health professions education, with many technology-supported approaches expected to have lasting implications for educational practice [2]. Online learning has also provided greater flexibility for health sciences students, although challenges related to internet connectivity,

student–instructor interaction, and technology remain important considerations [3]. These developments demonstrate the increasingly established role of digital learning within contemporary health professions education.

Learning Management Systems (LMSs) are among the digital platforms increasingly used to organize and support teaching and learning activities in health professions education [4]. In undergraduate medical and nursing education, for example, LMSs such as Moodle, Canvas, and Blackboard are commonly used to deliver lecture materials, facilitate formative assessments and quizzes, support discussion forums, and track student progress through learning analytics dashboards [4, 5]. LMSs have been applied for multiple educational purposes, including content delivery, assessment and feedback, communication, and other learning activities [4]. The broader integration of digital platforms also allows learning activities and student progress to be recorded and evaluated through digital tracking mechanisms [6]. Therefore, an LMS function not only as a platform for delivering educational content but also as an environment in which students' learning activities can be observed and measured.

Student interaction with LMSs can generate behavioral data that provide information about how learners engage with digital learning environments [7]. Learning analytics commonly uses learner-generated data to examine learning behaviors, interactions, and educational processes [7]. LMS-based student engagement has been operationalized through indicators such as logins, access to course materials, assignments, assessments, messaging, and forum participation [8]. Furthermore, learning analytics research frequently uses observable behavioral indicators such as clicks and task duration to represent student engagement [9]. These different indicators suggest that student interaction with an LMS can be represented through multiple dimensions rather than a single measure of use.

, Concepts describing students' interaction with digital learning environments are not necessarily interchangeable. Student engagement is recognized as a multidimensional construct encompassing behavioral, cognitive, affective, independence, and sociocultural dimensions [10]. Learning analytics studies, however, predominantly operationalize engagement through observable behavioral measures, while cognitive, emotional, and other dimensions are less frequently captured through LMS-generated data [9]. Moreover, LMS-based engagement indicators vary substantially across studies, ranging from access and usage measures to assessment and communication activities [8]. Consequently, LMS utilization needs to be conceptually distinguished from broader constructs such as engagement, perception, acceptance, and satisfaction, while greater clarity is needed regarding which indicators represent LMS utilization.

Previous reviews have addressed several related aspects of digital learning and LMS use. Bojic et al. (2023) mapped learning analytics across health professions education, focusing broadly on data sources, analytical approaches, and educational applications [7]. Alkhuzaimi et al. (2025) reviewed factors influencing undergraduate nursing students' perceptions of LMS use, emphasizing factors related to students, instructors, and LMS characteristics[11]. Kamath et al. (2025) examined LMS use in medical education with emphasis on educational applications, outcomes, feedback, and improvement

pathways [4]. Kassab et al. (2023) reviewed the conceptualization and measurement of student engagement across health professions education, rather than utilization of LMSs specifically [10]. Similarly, Bergdahl et al. (2024) examined how student engagement is conceptualized and captured through learning analytics across higher education, finding substantial variation in the interpretation of behavioral trace data[9]. More broadly, Stamer et al. (2026) mapped digital teaching methods used to support practical skills training across health professions, including e-learning platforms among numerous digital interventions [6]. Collectively, these reviews address LMS applications, perceptions, learning analytics, engagement, and digital teaching; however, they do not specifically map how student LMS utilization is conceptualized and operationalized across undergraduate health professions education or how its indicators and measurement approaches differ across studies.

A clear conceptualization and measurement of LMS utilization is important because inconsistent operational definitions may limit meaningful comparisons across educational studies. This concern is supported by evidence that identical or similar digital trace data may be interpreted differently across studies, thereby reducing comparability [9]. Similarly, the variety of LMS-based indicators reported in previous literature demonstrates the need for greater clarity regarding what specific digital behaviors represent [8]. Mapping these approaches is therefore necessary to establish a clearer conceptual and methodological foundation for future research on LMS utilization. Accordingly, this scoping review aims to map how student utilization of Learning Management Systems is conceptualized and measured in undergraduate health professions education, focusing on the dimensions and indicators used to operationalize utilization, the data sources and measurement approaches employed, and the remaining conceptual and methodological gaps.

Methods

Study design

This scoping review was conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [12, 13]. A scoping review approach was considered appropriate because the purpose of this review was to examine the range and characteristics of existing approaches to conceptualizing and measuring LMS utilization rather than to determine intervention effectiveness or estimate a pooled effect. This approach enabled the identification of different utilization dimensions, indicators, data sources, and measurement approaches reported across health professions education. The review was designed to map the existing evidence on how student utilization of Learning Management Systems (LMSs) has been conceptualized, operationalized, and measured in undergraduate health professions education. The Population–Concept–Context (PCC) framework was used to guide the formulation of the review question, eligibility criteria, and search strategy [12].

Eligibility criteria

Eligibility criteria were developed using the PCC framework. The Population comprised undergraduate students enrolled in health professions education programs, including medicine, nursing, midwifery, dentistry, pharmacy, physiotherapy or physical therapy, occupational therapy, and other relevant health sciences programs. Studies involving mixed populations were considered eligible when findings for undergraduate health professions students could be identified separately.

The Concept of interest was student utilization of an LMS. For this review, an LMS was considered an institutional or purpose-built digital platform used to organize, deliver, manage, or track teaching and learning activities, including access to learning materials, assignments, assessments, communication, feedback, and participation. Studies were eligible when they reported at least one indicator or method for assessing LMS utilization, such as frequency of access or login, duration or intensity of use, access to learning resources, participation in LMS-based learning activities, completion of activities, interaction with LMS features, or self-reported LMS use.

The Context was undergraduate health professions education delivered within higher education institutions. Studies published in English between January 2021 and the final search date in 2026 were considered for inclusion. Original empirical studies using quantitative, qualitative, or mixed-methods designs were eligible.

Studies were excluded if they focused exclusively on postgraduate education, continuing professional education, faculty members, or healthcare professionals without separately identifiable undergraduate student data. Studies examining only perceptions, acceptance, satisfaction, intention to use, or attitudes toward an LMS without reporting an indicator of actual or self-reported LMS utilization were excluded. Studies examining standalone digital technologies, such as videoconferencing, social media, messaging applications, or video platforms, were also excluded unless these technologies functioned as part of an LMS or an integrated learning environment. Reviews, editorials, commentaries, conference abstracts without sufficient empirical data, protocols, theses, and other non-primary research publications were excluded.

Information sources and search strategy

A structured literature search was conducted using PubMed, ScienceDirect, and SAGE Journals. The search strategy was developed according to the PCC framework and combined terms representing three main concepts: learning management systems, undergraduate health professions students, and LMS utilization. Keywords and synonyms included terms such as learning management system, LMS, virtual learning environment, Moodle, Blackboard, and Canvas, combined with terms representing health professions students and indicators of utilization, including use, utilization, usage, access, activity, interaction, participation, login, log data, and learning analytics. Boolean operators (AND and OR) were used to combine search terms, and the search syntax was adapted to the requirements of each source.

The general search string used in the databases combined the three PCC concepts using Boolean operators (AND/OR). The complete search strategies for each source are provided as Additional file 1 to ensure transparency and reproducibility of the review process. The search was limited to studies published from January 2021 to 26 September 2026.The complete search strategies for each source will be provided as a supplementary file to ensure transparency and reproducibility of the review process.

Study selection

All records identified through the searches were compiled and duplicates were removed by one reviewer (TP) using reference management software before screening. Study selection was conducted in two stages: (1) title and abstract screening and (2) full-text assessment. At both stages, two reviewers (TP and RW) independently assessed records against the predefined eligibility criteria. Any disagreements regarding eligibility were resolved through discussion until consensus was reached. When consensus could not be achieved, a third reviewer (S) was consulted. Reasons for exclusion at the full-text stage were documented. The study selection process was summarized using a PRISMA-ScR flow diagram

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Data charting

Data from the included studies were charted using a standardized data-charting form developed according to the objectives and research questions of the review. The form was piloted by two reviewers (TP and RW) on two included studies and refined by consensus to ensure that relevant information on LMS utilization was captured consistently.

The extracted information included author and year of publication, country, health profession and participant characteristics, study design, LMS or platform, concepts of LMS utilization, utilization dimensions or indicators, data source, measurement method, and key findings related to LMS utilization. Measurement approaches were additionally categorized as objective, when derived from LMS-generated behavioral or log data; subjective, when based on student self-report; or mixed, when both approaches were used.

Data charting was conducted independently by two reviewers. Discrepancies were resolved through discussion and consensus, with consultation of a third reviewer when agreement could not be reached.

Data synthesis

The extracted data were synthesized descriptively and narratively in accordance with the objectives of the scoping review. Descriptive characteristics of the included studies, including publication year, country, health profession, study design, and LMS platform, were summarized using frequencies and tabulation where appropriate.

A structured descriptive synthesis was then conducted to map how LMS utilization was conceptualized and operationalized across the included studies. Utilization indicators were grouped according to recurring dimensions identified from the evidence, such as frequency of use, intensity or duration of use, breadth of LMS feature or resource use, participation in learning activities, interaction, and completion of LMS-based activities. Measurement approaches and data sources were compared across studies, particularly with regard to the use of objective LMS-generated data, subjective self-reported measures, or a combination of both.

The synthesis also examined areas of conceptual and methodological variation across studies to identify gaps in the definition and measurement of student LMS utilization. Categorization was undertaken independently by two reviewers, and disagreements were resolved through discussion and consensus; a third reviewer was consulted when necessary. This descriptive approach is consistent with published BMC scoping reviews, which commonly use tabulation and descriptive or thematic synthesis to map heterogeneous evidence rather than perform statistical pooling.

Ethical considerations

As this scoping review involved the synthesis of data from previously published studies and did not involve human participants or identifiable personal data, ethical approval was not required.

Result

Study selection

The searches of PubMed, ScienceDirect, and SAGE Journals identified 305 records, comprising 101 records from PubMed, 94 from ScienceDirect, and 110 from SAGE Journals. After three duplicates were removed, 302 records underwent title and abstract screening, of which 292 were excluded. Ten reports were sought for retrieval; one could not be retrieved, leaving nine full-text reports assessed for eligibility. Two reports were excluded following full-text assessment, resulting in seven studies included in the final scoping review. The study selection process is presented in the PRISMA flow diagram (Fig. 1).

Characteristics of included studies

Seven empirical studies published between 2021 and 2026 were included, originating from Thailand, Austria, Saudi Arabia, the United Arab Emirates, the United States, and South Africa [5, 14–19]. The studies involved undergraduate medical, nursing, and pharmacy students and examined different LMS environments, including KKUMEDX, Moodle, Canvas, Blackboard, iKamva, and other online learning management systems. Study designs included cross-sectional and descriptive surveys, observational studies, pilot comparative approaches, and mixed methods, reflecting substantial methodological diversity in the investigation of student LMS utilization. The characteristics of the included studies are summarized in Table 1.

Table 1
Characteristics of included studies

Author	Year	Country	Health profession / participants	Study design	LMS / platform
Thepwongsa et al. [5]	2021	Thailand	First-year medical students; questionnaire n = 157; LMS monitoring n = 283	Mixed-methods	KKUMEDX, customized web-based LMS
Pavo et al. [14]	2022	Austria	4th-year medical students; n = 1,315	Observational study	Moodle
Alhur et al. [15]	2023	Saudi Arabia	Pharmacy students; n = 508	Cross-sectional study	Online LMS; specific platform not stated
Benamer & Stanley [16]	2023	United Arab Emirates	Year-5 medical students; n = 34	Pilot observational study	Institutional LMS
Hinkle [17]	2023	United States	Undergraduate nursing students; intervention n = 59; comparison n = 57	Pilot comparative study	Canvas
Pangket et al., [18]	2025	Saudi Arabia	2nd–4th year nursing students; n = 264	Descriptive correlational study	Blackboard
Bimerew et al., [19]	2026	South Africa	Undergraduate nursing students; n = 253	Descriptive cross-sectional survey	iKamva LMS

Conceptualization and measurement of LMS utilization

Theme 1. Conceptualization of LMS utilization

Student LMS utilization was not consistently defined across the included studies and was represented using related concepts such as *use*, *utilization*, *engagement*, *course activity*, examination or learning behavior, and frequency of use [5, 14–19]. Some studies represented utilization broadly as students' frequency or patterns of LMS use [15, 18, 19] whereas others operationalized it through specific observable behaviors, such as login activity, assessment attempts, access to learning resources, page views, or participation in course activities [5, 14, 16, 17]. Overall, LMS utilization was conceptualized not as a single standardized construct but as different forms and levels of student interaction with an LMS.

Theme 2. Dimensions and indicators of LMS utilization

Five recurring dimensions of LMS utilization were identified: frequency, intensity, resource use, feature use, and participation in LMS-based learning activities. Frequency was reflected in indicators such as

LMS use or login frequency; intensity included learning time, duration, timing, and repeated attempts; resource use included completion of learning topics and access to prerecorded materials; feature use included assignments, course folders, discussions, announcements, and communication functions; and participation was represented by page views, assignment activity, assessments, and completion of learning tasks [5, 14, 16–19] additionally represented LMS utilization within students' broader use of educational technologies. These findings indicate that utilization encompasses not only how often or how long students use an LMS, but also what they access and what they do within the platform.

Theme 3. Data sources and measurement approaches

Three measurement approaches were identified: self-reported measures, LMS-generated behavioral measures, and mixed or multisource approaches. Self-reported questionnaires were used to capture students' frequency, patterns, and types of LMS use [15, 18, 19] whereas LMS-generated data provided objective records of behaviors such as login activity, time spent, assessment attempts, resource access, and other platform interactions [14, 16]. Thepwongsa et al. [5] and Hinkle [17] incorporated LMS-generated information alongside other student-related data. Although behavioral traces provide direct evidence of activity, they do not necessarily demonstrate meaningful engagement with learning content; for example, recorded access or downloading does not confirm that the material was subsequently viewed or meaningfully used [16]. Thus, self-reported and LMS-generated measures capture different but potentially complementary aspects of LMS utilization.

Theme 4. Conceptual and methodological gaps

The evidence revealed substantial conceptual and methodological heterogeneity, with no standardized definition, set of indicators, or measurement approach for student LMS utilization across the seven studies [5, 14–19]. Measures ranged from general self-reported frequency of use to detailed digital traces of login activity, duration, resource access, assessment behavior, page views, feature use, and task completion. Self-reported measures were unable to objectively verify actual LMS behavior, whereas LMS-generated data captured observable activity without necessarily indicating its purpose or depth of learning. Evidence was also concentrated in medicine and nursing, with limited representation from other undergraduate health professions. Overall, LMS utilization emerged as a multidimensional concept encompassing frequency, intensity, resource use, feature use, and participation, but no standardized conceptualization or measurement framework was identified.

The conceptualization, indicators, data sources, and measurement approaches of LMS utilization across the included studies are summarized in Table 2.

Table 2
Conceptualization and measurement of LMS utilization

Author	Year	LMS utilization concept	Utilization indicator(s)	Data source / measurement	Measurement approach
Thepwongsa et al., [5]	2021	Actual LMS learning behavior / usage	Topics completed; total learning time; frequency and timing of logins; course attendance	LMS monitoring system + questionnaire	Objective + self-report (mixed)
Pavo et al., [14]	2022	Examination behavior within LMS	Date of attempts; time to first attempt; number of attempts; duration of attempts; quiz completion/results	Moodle log data	Objective LMS-generated data
Alhur et al., [15]	2023	Self-reported use and preference for educational technologies including LMS	Regular use of LMS; preferred technology/platform	Validated questionnaire	Subjective self-report
Benamer & Stanley., [16]	2023	LMS engagement with learning resources	Number of mini-lectures watched/downloaded; engagement category/score	LMS-generated data	Objective LMS-generated data
Hinkle., [17]	2023	Online course activity / participation	Page views; assignment clicks/submissions; missing/late assignments; use of study materials	Canvas New Analytics + student responses	Objective + self-report (mixed)
Pangket et al., [18]	2025	Blackboard use/access and students' perceptions	Device used; facilities/access/time spent; use of announcements, assignments, course folders, discussion and mail	Adapted questionnaire	Subjective self-report
Bimerew et al., [19]	2026	Frequency of digital educational technology utilization, including LMS	Frequency of iKamva LMS use	Self-administered questionnaire	Subjective self-report

Key findings related to LMS utilization and the corresponding measurement limitations or gaps are presented in Table 3.

Table 3
Key findings and measurement gaps

Author	Year	Key findings related to LMS utilization	Measurement limitation / gap
Thepwongsa et al., [5]	2021	Mean 8.77/18 topics completed; mean LMS time 908.13 min. Login activity concentrated in morning and evening. LMS time/login frequency was not associated with good course scores.	Single institution; preclinical first-year students; observational design; possible questionnaire selection bias.
Pavo et al., [14]	2022	Earlier access and shorter first-attempt duration tended to correlate with better final examination performance; examination behavior differed partly by gender.	LMS utilization was restricted to behavior surrounding one compulsory Moodle quiz rather than overall LMS use.
Alhur et al., [15]	2023	LMS was among the most regularly used technologies and the most preferred platform category (25.7%). Students perceived technology as beneficial for learning.	LMS use was embedded within broader technology utilization; no objective LMS log metrics and no specific LMS platform reported.
Benamer & Stanley, [16]	2023	Mean engagement was 3.9/5; 58% accessed 41–48 mini-lectures. Engagement correlated significantly with internal medicine grade (r = 0.35, p=.044).	Small sample; LMS could not distinguish download from actual viewing, creating uncertainty in the utilization indicator.
Hinkle, [17]	2023	Canvas personalization improved mean course grades; LMS activity measures were examined in relation to learning outcomes.	Pilot/single-course setting; behavioral indicators primarily reflect course activity rather than a standardized multidimensional LMS-utilization construct.
Pangket et al., [18]	2025	Blackboard was perceived as accessible and useful; tablets/iPads were the most frequently reported access device. Students reported use of assignments, folders, discussions, announcements and mail.	Primarily perception/self-report based; utilization, acceptance, accessibility, and instructional experience overlap conceptually.
Bimerew et al.,	2026	iKamva was the most frequently used digital educational technology (94.5%; mean frequency 3.8/4).	LMS utilization was only one component of a broader digital-technology survey; no LMS log data or detailed LMS behavioral dimensions.

Discussion

This scoping review mapped how student utilization of Learning Management Systems (LMSs) has been conceptualized and measured in undergraduate health professions education. The principal finding was substantial conceptual and methodological heterogeneity across the seven included studies, with LMS utilization represented through terms such as use, utilization, engagement, course activity, and learning behavior [5, 14–19]. Despite this variation, five recurring dimensions could be identified: frequency, intensity, resource use, feature use, and participation in LMS-based learning activities. These findings suggest that LMS utilization is better understood as a multidimensional pattern of interaction with a digital learning environment than as a single measure of platform use.

The variation in terminology is particularly important because utilization and engagement are related but conceptually distinct. Student engagement in health professions education has been conceptualized as a multidimensional construct involving behavioral, cognitive, affective, independence, and sociocultural dimensions [10]. In contrast, the studies included in this review predominantly represented LMS utilization through observable or reported behaviors, such as logins, time spent, assessment attempts, resource access, and frequency of platform use [5, 14, 16, 19]. Therefore, behavioral LMS utilization should not automatically be interpreted as equivalent to the broader construct of student engagement.

The five dimensions identified in this review also demonstrate that frequency alone provides only a partial representation of LMS utilization. Frequency indicates how often students interact with a platform, whereas intensity reflects the amount or duration of interaction; resource and feature use describe what students access; and participation reflects the learning activities students perform within the LMS [5, 14, 16–18]. This multidimensional interpretation is consistent with the broader learning analytics literature, in which learner-generated data are collected and analyzed to understand learning behaviors and educational processes rather than relying on a single activity indicator [7]. Thus, studies assessing LMS utilization may benefit from specifying which dimension of utilization each indicator is intended to represent.

A second important finding concerns the distinction between self-reported and LMS-generated measurement. Self-reported measures captured students' reported frequency, patterns, and types of LMS use [15, 18, 19], whereas LMS-generated measures provided behavioral traces such as access patterns, time spent, assessment attempts, and resource use [14, 16]. Neither approach alone provides a complete representation of utilization. Self-report may capture activities or interpretations that cannot be inferred from digital traces, whereas behavioral data provide direct evidence that an interaction occurred but not necessarily why it occurred or whether it represented meaningful learning. This distinction is consistent with previous work emphasizing that the conceptual definition of an educational construct should guide the selection of appropriate measurement methods [10].

The included studies further indicate that greater LMS activity should not automatically be interpreted as better learning. Associations between utilization indicators and academic outcomes were inconsistent: some studies identified relationships between particular patterns of LMS activity and performance, whereas others found that indicators such as total learning time or login frequency were not significantly

associated with better course scores [5, 14, 16, 17]. Moreover, behavioral traces such as downloading a resource cannot confirm that students subsequently engaged meaningfully with its content [16]. These findings reinforce the importance of distinguishing the quantity of digital activity from its educational quality or purpose when interpreting LMS utilization.

The findings extend previous reviews of digital education and learning analytics by focusing specifically on the conceptualization and measurement of LMS utilization. Tudor Car et al. [1] demonstrated the breadth of digital education across health professions and proposed a framework incorporating context, infrastructure, education, learners, research, and quality improvement. Bojic et al. [7] subsequently showed how learning analytics can use data generated by digital educational platforms to understand and optimize learning processes in health professions education. Kassab et al. [10], meanwhile, highlighted substantial diversity in approaches to conceptualizing and measuring student engagement. The present review adds to this literature by demonstrating that similar conceptual and measurement inconsistencies exist specifically for student LMS utilization, particularly in distinguishing utilization from engagement and in selecting indicators that adequately represent different forms of platform interaction.

Several evidence gaps were also apparent. The included literature was concentrated in medicine and nursing, with only limited representation from pharmacy and no included studies from several other undergraduate health professions. Furthermore, many studies examined LMS activity within a particular course, assessment, or learning activity rather than students' broader utilization of the institutional LMS [14, 16, 17]. This pattern reflects a broader challenge in digital health professions education, where evidence has historically been unevenly distributed across professions, technologies, and educational contexts [1]. Future research should therefore examine LMS utilization across a wider range of health professions and educational contexts and determine whether common utilization dimensions remain applicable across different platforms and curricula.

Implications

The findings have implications for both educational research and LMS evaluation in health professions education. Researchers should explicitly define what they mean by LMS utilization and align each measurement indicator with the dimension it is intended to represent rather than relying on a single global measure of “use.” A multidimensional approach incorporating frequency, intensity, resource use, feature use, and participation may provide a more informative representation of students' LMS behavior, while combining self-reported information with LMS-generated data may help capture complementary aspects of utilization. This approach is consistent with calls for stronger conceptual frameworks and more meaningful use of digital educational data in health professions education [1, 7]. Such conceptual clarity may also support future studies examining how LMS utilization relates to learner characteristics or educational outcomes without assuming that greater platform activity necessarily represents better engagement or learning.

Strengths and weaknesses

A key strength of this review is its specific focus on the conceptualization and measurement of student LMS utilization rather than the broader effectiveness or acceptability of LMSs. This focus enabled comparison of terminology, dimensions, indicators, data sources, and measurement approaches across studies and allowed recurring utilization dimensions to be identified despite methodological heterogeneity. The inclusion of studies using both self-reported and LMS-generated data also provided insight into complementary approaches to measuring utilization. However, the evidence base itself was relatively small and heterogeneous, with only seven eligible studies across different professions, LMS platforms, educational activities, and research designs. Consequently, the dimensions identified in this review should be interpreted as a mapping of the available evidence rather than as a validated measurement framework.

Limitations

This review has several limitations. The search was restricted to studies published in English between 2021 and 2026 and to PubMed, ScienceDirect, and SAGE Journals; therefore, relevant studies indexed in other bibliographic databases or published before 2021 may not have been captured. The inclusion of ScienceDirect and SAGE Journals as publisher platforms may also provide less comprehensive bibliographic coverage than multidisciplinary indexing databases. In addition, the heterogeneity of terminology surrounding use, utilization, engagement, and learning behavior may have resulted in relevant studies using alternative terminology being missed. Finally, because the purpose of this scoping review was to map concepts and measurement approaches rather than evaluate intervention effectiveness, no formal risk-of-bias assessment was undertaken. These limitations should be considered when interpreting the identified dimensions and gaps and reinforce the need for further empirical work to refine and validate approaches to measuring LMS utilization.

Conclusion

This scoping review demonstrates that student utilization of Learning Management Systems in undergraduate health professions education is conceptualized and measured inconsistently across the existing literature. Across the seven included studies, LMS utilization was represented through related but distinct concepts, including use, utilization, engagement, course activity, and learning behavior. Despite this heterogeneity, five recurring dimensions were identified: frequency, intensity, resource use, feature use, and participation in LMS-based learning activities. Measurement approaches also varied, ranging from self-reported measures to LMS-generated behavioral data and mixed approaches, with each capturing different aspects of student utilization.

These findings highlight the need for greater conceptual and methodological consistency in future research on LMS utilization. Researchers should clearly define the construct being measured, specify the dimensions and indicators used to represent utilization, and consider integrating self-reported and LMS-generated data where appropriate. Further research across a broader range of health professions and educational contexts is needed to refine these dimensions and support the development of a more comprehensive and standardized approach to measuring student LMS utilization.

Abbreviations

JBI
Joanna Briggs Institute
LMS
Learning Management System
PCC
Population–Concept–Context
PRISMA
Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRISMA-ScR
Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analysed during this scoping review are included in this published article and its supplementary information files. The complete search strategies and data-charting materials are provided as supplementary files.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

TP conceptualized the study, developed the search strategy, conducted the literature search, and contributed to study selection, data charting, data synthesis, and interpretation as the first reviewer. RW contributed to the study design and methodology and independently participated in study selection, data charting, and data synthesis as the second reviewer. S provided methodological supervision, contributed

to the interpretation of findings, and served as the third reviewer when required to resolve disagreements. TP drafted the manuscript, and RW and S critically revised it for important intellectual content. All authors read and approved the final manuscript.

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References

1. Tudor Car L, et al. Digital education for health professionals: An evidence map, conceptual framework, and research agenda. J Med Internet Res. 2022;24(3):e31977.
2. Frenk J, et al. Challenges and opportunities for educating health professionals after the COVID-19 pandemic. Lancet. 2022;400(10362):1539–56.
3. Mutalib AAA, Akim AM, Jaafar MH. A systematic review of health sciences students' online learning during the COVID-19 pandemic. BMC Med Educ. 2022;22:524.
4. Kamath SG, et al. Leveraging learning management systems in medical education: A scoping review of use, outcomes, and improvement pathways. Med Educ Online. 2025;30(1):2603805.
5. Thepwongsa I, et al. The effects of a newly established online learning management system: The perspectives of Thai medical students in a public medical school. Heliyon. 2021;7(10):e08182.
6. Stamer T, et al. The role of digital teaching methods in supporting practical skills training in the academic training of health professions: A scoping review. BMC Med Educ. 2026;26:361.
7. Bojic I, et al. Empowering health care education through learning analytics: In-depth scoping review. J Med Internet Res. 2023;25:e41671.
8. Ahmadi G, et al. What are the indicators of student engagement in learning management systems? A systematized review of the literature. Int Rev Res Open Distrib Learn. 2023;24(1):117–36.
9. Bergdahl N, et al. Unpacking student engagement in higher education learning analytics: A systematic review. Int J Educational Technol High Educ. 2024;21:63.
10. Kassab SE, et al. Measurement of student engagement in health professions education: A review of literature. BMC Med Educ. 2023;23:354.
11. Alkhuzaimi F, Wilson CB, Wong WYA. Key factors influencing undergraduate nursing students' perceptions of the use of learning management systems: a systematic literature review. BMC Nurs. 2025;24(1):323.
12. Peters MDJ, et al. Updated methodological guidance for the conduct of scoping reviews. JBI Evid Synthesis. 2020;18(10):2119–26.
13. Tricco AC, et al. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. Ann Intern Med. 2018;169(7):467–73.
14. Pavo N, et al. Gender differences in examination behavior of 4th grade medical students: Results from an observational study on ECG e-learning. Wiener klinische Wochenschrift. 2022;134(5–

6):215–20.
15. Alhur AA, et al. Evaluating health information technology knowledge and skills among pharmacy students. Int J Biosci. 2023;23(4):55–64.
16. Benamer HTS, Stanley AG. The relationship of online pre-recorded neurology mini-lectures to medical student assessment: A pilot study. BMC Med Educ. 2023;23:225.
17. Hinkle JF. Personalization and learning outcome in a nursing pathophysiology and pharmacology course: Canvas Mastery adoption pilot study. SAGE Open Nursing; 2023. p. 9.
18. Pangket PP, et al. Bridging the gap between technology and nursing education: Assessing student perspectives on Blackboard integration. J Educ Health Promotion. 2025;14:173.
19. Bimerew M, Ticha V, Chipps J. *Utilisation of digital educational technology amongst undergraduate nursing students in the Western Cape.* 2026, 2026. 31.

Figures

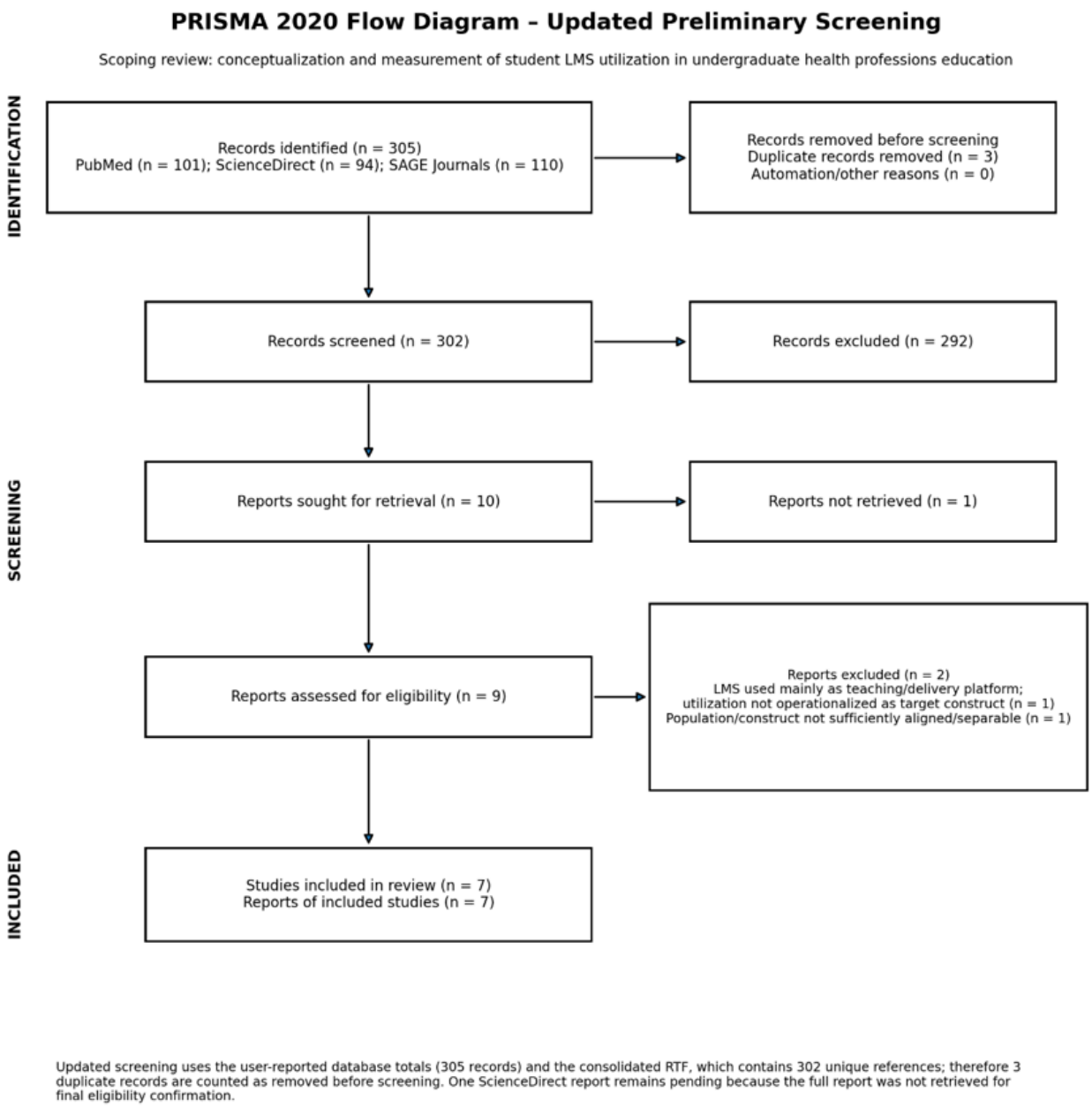


Figure 1

PRISMA-ScR flow diagram of the study selection process

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