Trends and the Future of Learning Management Systems (LMSs) in Higher Education

A Literature Review and Summary Report From the Center for Educational Innovation

Introduction

Today's higher education institutions are encountering many challenging and complicated issues, including increasing student enrollment in their education programs and expanding an infrastructure—such as a Learning Management System (LMS)—in order to accommodate increased enrollment and diversified classes, and to support student learning and faculty teaching (Dobre, 2015). To meet the need for a supportive learning environment in higher education institutions, various types of LMS vendors such as proprietary LMSs, open-source LMSs, and cloud-based LMSs have been introduced into higher education institutions (Dobre, 2015). The adoption of LMSs is a noteworthy phenomenon in higher education. Nearly 99% of higher education institutions currently adopt and run an LMS (Dahlstrom, Brooks, & Bichsel, 2014). According to an Educause Center for Analysis and Research (ECAR) survey, 85% of faculty use an LMS with 56% using it on a daily basis, and 83% of students use an LMS with 56% using it in most or all courses (Berking & Gallagher, 2016; Brown, Dehoney, & Millichap, 2015).

Higher education institutions benefit from using an LMS in the following ways: (a) instructor and student access to learning content anytime and anywhere, (b) a centralized source of learning, (c) tracking and reporting tools to enhance student learning and performance, (d) increased efficiency in student activities such as assignment submission, (e) increased communication, and (f) learning analytics.

Despite a successful adoption and use of an LMS in higher education, customers such as academic leaders, faculty, and students urge LMS vendors to improve LMS features and functions. 15% of higher education institutions have a plan to replace their current LMS within the next three years (Brown, Dehoney, & Millichap, 2015; Dahlstrom, Brooks, & Bichsel, 2014). As LMSs have evolved over time, the emergence of new types of LMSs—such as open-source LMSs and cloud-based LMSs—threatens the dominant position of the proprietary LMS market. Choosing the right LMS to support faculty teaching and student learning in a more efficient and effective way is of a great concern to academic leaders in higher education institutions (Berking & Gallagher, 2016). Thus, it is imperative to examine the current trends in and future of LMSs in higher education.

Purpose and scope of this paper

The purpose of this review is to provide a snapshot of higher education LMSs in order to help senior administrators make an informed decision on LMS adoption or replacement. In so doing, it reviews literature on various topics such as types of LMSs, features and functions of LMSs, popularity of LMSs, user satisfaction regarding LMSs, and the future of LMSs. This review answers following five research questions:

- What types of LMSs exist?

- What are features and functions of LMSs?

- What are the most popular LMSs in higher education?

- How satisfied are users with LMSs?

- What are the trends and next generation of LMSs?

What types of LMSs exist and what are the advantages and disadvantages?

LMSs are known by various names: course management system (CMS), learning content management system (LCMS), virtual learning environment (VLE), and virtual learning system (VLS) (Wright et al., 2014). An LMS is defined as the following:

> "software (web) application used to plan, implement, and assess learning processes. An LMS provides instructors with a way to create and deliver content, monitor learner participation, and assess performance. An LMS provides interactive features such as threaded discussions, video conferencing, and discussion forums, etc. Examples include Moodle, WebCT (Blackboard), and Sakai" (About Elearning, 2016).

There are three main types of LMSs: (a) proprietary LMSs, (b) open-source LMSs, and (c) cloud-based LMSs (Dobre, 2015). Proprietary LMSs have been licensed by developers so the goal of the proprietary LMS vendors is to produce profits. Examples of the proprietary LMS vendors are Blackboard, D2L, and eCollege. Open-source LMSs have been made publicly available to the source code and available free of charge to all users. Examples of the open-source LMS vendors are Canvas, Moodle, and Sakai. Cloud-based LMSs have been introduced as a convenient and low-cost way of using an array of cloud-based tools in higher education institutions (Dobre, 2015). For instance, Google Drive can be used for document sharing and collaboration, Dropbox for file storages, Skype for a communication tool, Flickr for photo sharing, and YouTube for useful video sharing. Examples of cloud-based LMSs are Amazon Web Services and Talent LMS. Table 1 shows the relative advantages and disadvantages of proprietary, open-source, and cloud-based LMSs.

Table 1. Advantages and Disadvantages of Proprietary, Open-Source and Cloud-Based LMSs

| LMS Type	Advantages	Disadvantages
Proprietary LMS	**Customer service**: Ongoing support of proprietary LMS developers for customers is one of the greatest advantages. **Secure and reliable**: While proprietary LMS vendors do not share the coding, they ensure the security and reliability of their LMS software. **Customized**: Proprietary LMSs are tailored to the specific needs of customers. In so doing, they continue to innovate their LMS software. **Centralized**: Proprietary LMSs can track all student activities and information in a centralized system. **High usability**: Customized proprietary LMSs have relatively high usability, with supportive services such as seminars and targeted training.	**Expensive**: As a profit-generating entity, proprietary LMS vendors charge a licensing fee which is fairly expensive. **Heavily dependent on the developer**: Only proprietary LMS vendors' own developers hold possession of the code. **Less adaptable and flexible:** Unopen coding source makes it difficult for proprietary LMS vendors adapt to constant changes. **Less centralized**: Unless open-source LMSs are integrated into existing administrative systems, tracking all student activities and information can be difficult. **Risk of discontinuous service:** If proprietary LMS vendors drop out of a race in the competition, an LMS service may be discontinuous.
Open-Source LMS	**Cost-effective**: In general, open-source LMSs, if not free, are cheaper than proprietary LMSs. **Innovation by users**: Unlike proprietary LMS vendors, open-source LMSs share the coding with their users so they have more freedom and flexibility in innovating LMSs. **Passionate and collaborative community**: Open-source LMSs are supported by a passionate and collaborative community open to new ideas. **Secure and reliable**: Like proprietary LMSs, open-source LMSs are also viewed as secured LMSs. Along with technology professionals, solutions to problems and its distributions are reliable compared to proprietary LMSs.	**Lack of support and service**: Service is a key issue of using open-source LMSs. Although open-source LMSs have a loyal and engaged online community network, open-source LMS vendors may not often receive right feedback on their questions. **Heavy dependency on the online community network**: It is still debatable whether changes in the original coding will be acceptable or limited in improving open-source LMSs. Also, it is not guaranteed that users are willing to share their innovation with all other users. **Less accountability**: No one is accountable when something is wrong with open-source LMSs.

| Cloud-Based LMS | **Cost-effective**: Using a variety of cloud-based tools is very cost-effective even though additional costs for advanced features might be generated.

Diverse personalized tools: Instructors and learners can select personalized tools based on their needs and preferences.

More familiar with tools: Many students are familiar with cloud-based tools such as YouTube, Skype, Facebook, and Google Drive.

Increased access: Students can retain access to all artifacts when they are no longer enrolled in higher education institutions. | **Authentication**: Unlike proprietary and open-source LMSs, authentication might be an issue unless enrollment, assessment, and grade information is integrated and managed in the institutional server.

Security and privacy: Cloud-based tools such as a blog might be vulnerable to security and privacy since the general public outside of courses can gain access to a blog as well. Students need to be aware of this problem.

Burden on learning multiple tools: Students might feel pressured to learn new tools or technology. |

Source: An excerpt and summary from Proprietary software versus open source software for education (Pankaja & Mukund Raj, 2013)

What are the most popular LMSs in the higher education?

Based on the number of institutions adopting LMS, Blackboard shows the highest market share (31.9%, 1,194 institutions). Moodle (19.1%, 713 institutions) and Canvas (15.3%, 573 institutions) took second and third place respectively, followed by D2L (317 institutions, 8.5%), eCollege (226 institutions, 6.0%), Sakai (141 institutions, 3.8%), and ANGEL (77 institutions, 2.1%). Figure 1 shows the higher education LMS market share by institutions.
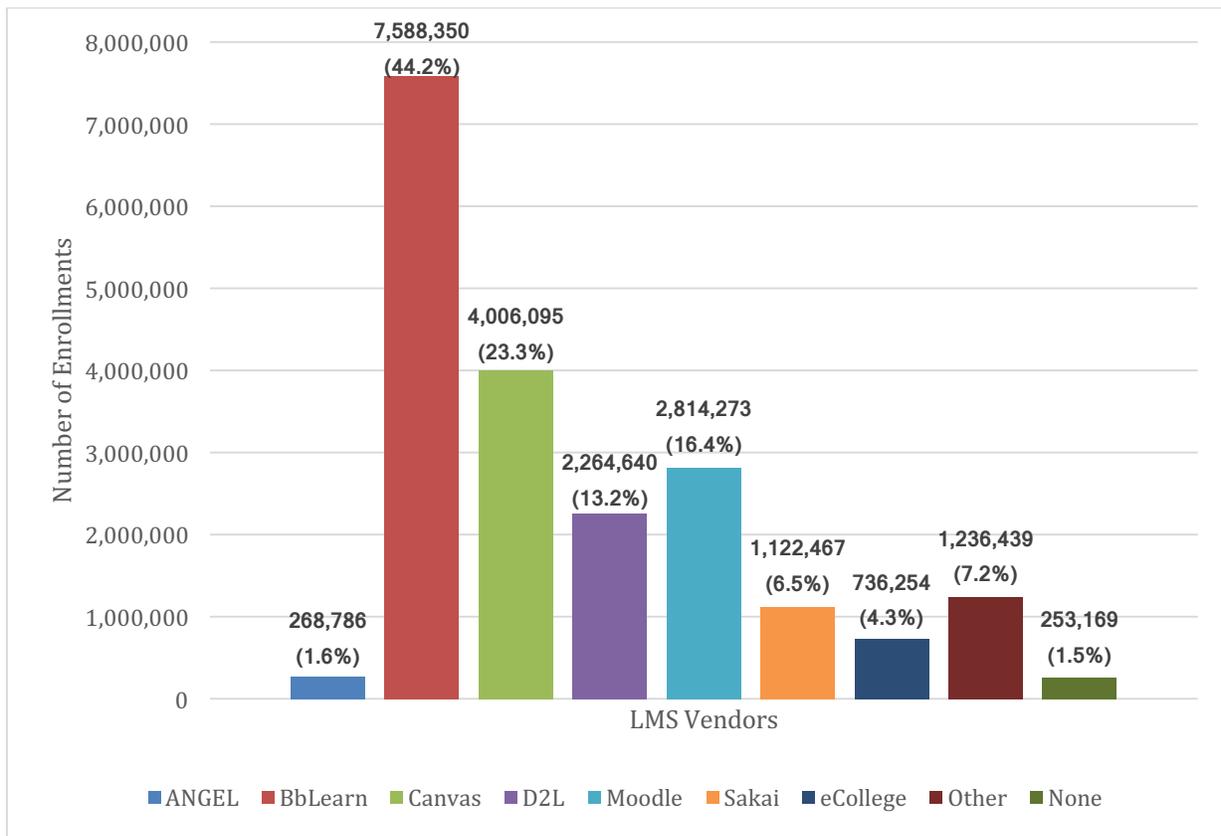
Figure 1. Higher Education LMS Market Share, Spring 2016 (By Institutions)
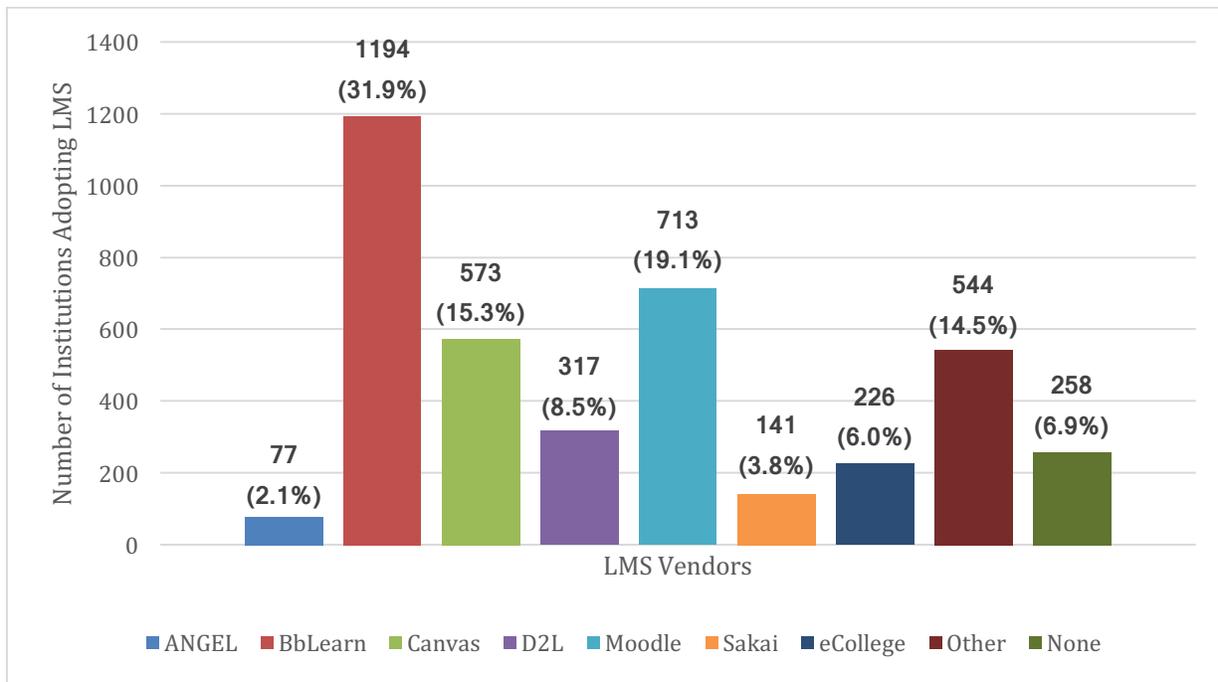
Source: LMS Data – Spring 2016 (Edutechnica. 2016)

In terms of student enrollments, Blackboard also showed the highest market share (44.2%, 7,588,350 student users). Canvas (23.3%, 4,006,095 student users) and Moodle (16.4%, 2,814,273 student users) were the second and third place respectively, followed by D2L (2,264,640 student users, 13.2%), Sakai (1,122,467 student users, 6.5%), Pearson (736,254 student users, 4.3%), and ANGEL (268,786 student users, 1.6%).

Figure 2. Higher Education LMS Market Share, Spring 2016 (By Student Enrollments)

Source: LMS Data – Spring 2016 (Edutechnica. 2016)

As seen in Figures 1 and 2, Blackboard continues to have the top LMS market in higher education compared to other LMS vendors. Despite the dominance of Blackboard in the LMS market, several factors are shown to be contributing to the change in the LMS market share between the top LMS vendor (Blackboard) and other proprietary and open-source competitors (Dahlstrom, Brooks, & Bichsel, 2014). For instance, in spite of Blackboard's competitive advantage in the LMS market, their overall market share is decreasing, with the emergence of new strong competitors of open-source LMSs such as Moodle and Canvas. In particular, it is noteworthy that Canvas (open-source LMS) is rapidly growing in the LMS market, exceeding D2L (proprietary LMS) and quickly catching up with Moodle (open-source LMS). Moreover, by student enrollments in Figure 2, Canvas was in the second highest LMS market position. Other competitors such as Moodle (open-source LMS), D2L (proprietary LMS), and Saki (open-source LMS) show a steady increase in the market. ANGEL and eCollege seem to have their LMS market share (Dahlstrom, Brooks, & Bichsel, 2014).

What are the strengths and weaknesses among LMSs?

As shown in Figure 2 above, the top four higher education LMS venders by student enrollments (e.g., Blackboard, Canvas, Moodle, and D2L) consist of 82.17% of the entire higher education LMS market. Interestingly, the top two open-source LMSs, Canvas and Moodle (48.63%), are quickly catching up with the top two proprietary LMSs, Blackboard and D2L (33.66%). Table 2 shows the strengths and weaknesses of the top four higher education LMS vendors.

Table 2. Strengths and Weaknesses of the Top Four Higher Education LMS Vendors

LMS Vendors	Strengths	Weaknesses
Blackboard	**Accessibility**: Gold certification from the National Federation for the Blind **Up-to-date user interface**: Modern user interface throughout the application **Compatible with other Blackboard products**: Extended with additional Blackboard products **File storage and management**: Secure and safe environment to store and manage all the data **Strong support for collaboration**: Supporting group works by providing collaborative workplace **Personalization**: Students can customize the Blackboard settings in their preferences **Specialized grading tools**: Various tools for supporting individual and group grading	**Steep learning curve**: With a wide range of tools, faculty and students feel pressured about learning something new **Overlap of multiple message tools**: Three different message tools overlap one another **Less student-centeredness**: Students themselves can't set up due date or submissions status **Restricted authority**: Instructors are not allowed to combine course sections without administrator's permission **Permission**: Permissions are set at the organization level and are not customized at the site level **Section management**: Instructors can't release announcements or activities to specific sections **No time-zone support**: Students can't set up their own time zone

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Canvas	**Accessibility**: Gold certification from the National Federation for the Blind **Up-to-date user interface**: Modern user interface throughout the application **Ease of administration**: Easy to learn and use the features and functions **Remarkable usability**: Faculty and students can immediately use application **Efficient workflow**: Easy to configure instructor tasks coupled with student activities **Plug-and-play LTI**: Simple Learning Tools Interoperability (LTI) can be added to the system **Strong support for collaboration**: Supports group work by providing a collaborative workplace **Rapid innovation**: New features and innovation are released every two weeks **Student centeredness**: Students are enabled to self-control their own learning	**Permission**: Permissions are set at the organization level and are not customized at the site level **Section management**: Instructors can't release announcements or activities to specific sections **Internal email system**: The internal email system does not support rich text messaging, searching, or sorting **Simplistic rubric tool**: Creating rubrics is cumbersome and the cell descriptor only has a few words **Simplistic rich text editor**: The advanced editing options are hidden in Canvas **No privacy preferences**: Students can't hide their names and profile
Moodle	**Cost-effective**: cost-effective even though additional costs might be generated **Ease of use**: Despite a variety of tool sets such as course management and communications, registration and enrollment tools, user management options, all features are simple and efficient **Customization**: Offers the ability to customize and control faculty and students' experiences **Rapid deployment**: Moodle offers the option of rapid deployment where LMSs need to deliver an online learning program on a project basis	**Accessibility**: Not certified from the National Federation for the Blind **Heavy dependency on third-party add-ons**: Heavily relying on third-party software increases time lag and workload to update the LMS **Insufficient maintenance investment**: It lacks the scale to make an investment in maintenance
D2L	**Accessibility**: Gold certification from the National Federation for the Blind **Assistance when designing course**: The Instructional Design Wizard helps instructors	**Steep learning curve**: With a wide range of tools, faculty and students feel pressured about learning something new **Restricted authority**: Instructors are not

	pedagogically build sound courses **Compatible with other D2L products**: Extended with additional D2L products **Mobility via response design**: The D2L interface is automatically adjusted to the device **Strong support for collaboration**: Supports random-, self-, manual-, and auto-assignment	allowed to combine course sections without administrator's permission **Instructor-centered orientation**: Students have little authority to manage LMSs even though instructors want to give more authority to students **Lack of student collaboration tools**: Collaborative workspace or tools are not currently offered **Lack of student-centeredness**: Students are not allowed to set due dates **No privacy preferences**: Students can't hide their names and profile

Source: An excerpt and summary from IU LMS pilots – A comparative functional review (University Information Technology Services (UITS), 2013) and Open-source learning management systems (Monarch Media, 2010).

Table 3 compares a variety of features of the top four higher education LMSs such as Blackboard, Canvas, Moodle, and D2L.

Table 3. Comparing features of LMSs: Blackboard, Canvas, Moodle, and D2L

Features	Proprietary LMS	Open-source LMS	Open-source LMS	Proprietary LMS
	Blackboard	Canvas	Moodle	D2L
Standard LMS Functionality	√	√	√	√
Integrated Learning Outcomes	√ (Fee based)	√	√	√
Mobile Application	√ (Fee based)	√	√ (ver 2.1 only)	√ (Fee based)
Ease of Use	3.27/5	4.12/5	2.47/5	3.02/5
Accessibility	Gold-level	Gold-level	Not Certified	Gold-level
Native Cloud Service	—	√	—	—
Software Licensing	Closed source	Open source	Open source	Closed source
Open Application Programming Interface (API)	√ (Fee based)	√	√	√

Source: An excerpt and summary from Compare Canvas (Berkley ETS Confluence, 2016).

Note. "Standard LMS Functionality" stands for basic features every LMS offers; see "Integrated Learning Outcomes" for the features with which learning outcomes are aligned with learning objectives through specific course activities; see "Mobile Application" for freely available mobile applications included in LMS; see "Ease of Use" for the extent to which instructors and students are easy to use; see "Accessibility" for an LMS Gold-level certified by the National Federation of the Blind; see "Native Cloud Service" for whether or not an LMS provides cloud hosting; see "Software Licensing" for openness of the source coding; and see "Open Application Programming Interface (API)" for the ability for an LMS to integrate with third party web technologies.

How satisfied are users with LMSs?

Using data from the most recent report from the Educause ECAR survey, faculty and student perspectives and satisfaction on LMSs are examined in this section (Dahlstrom, Brooks, & Bichsel, 2014). From a faculty perspective, overall 92% of faculty were satisfied with the basic operational functions and features of an LMS. Faculty who seek to utilize more sophisticated activities in their courses had a tendency to show higher satisfaction than those who seek to use relatively less sophisticated ways. In terms of the perceived usefulness of an LMS, 74% of faculty thought of an LMS as a very useful tool to improve their teaching and 71% of faculty reported that an LMS is a very useful tool to enhance student learning as well. Among faculty who agreed an LMS is useful for their teaching, 60% said an LMS is an essential part of their teaching. However, many faculty members limit their usage to the basic functions rather than the more advanced features of an LMS. While 58% of faculty employed an LMS to disseminate information to students such as the course syllabus, contents, and additional resources, only 41% of faculty attempted to utilize more advanced features such as interaction and collaboration. Despite the prevalence of LMS use in higher education, the majority of faculty do not seem to benefit from advanced LMS features and capabilities. One of the root causes of this problem can be found in the lack of training about advanced LMS features. In reality, 25% of faculty were frustrated with the initial training of LMS as well as ongoing training support by institutions. 57% of faculty reported that they could be more effective in their teaching if they were well-prepared for integrating an LMS into their courses in an appropriate way.

In terms of students' perspectives regarding LMSs, students had a similar pattern of satisfaction as faculty. Overall, 85% of students used an LMS for their learning. Among those students, 56% said they used an LMS in most or all courses. In terms of utilization of an LMS, 93% of students were satisfied with the basic features and functions of an LMS such as accessing course contents, submitting assignments, and checking course progress. Compared to the basic features, students showed the lowest satisfaction with advanced features of an LMS such as collaboration tools/workspace and engagement in meaningful interactions. Likewise, one of the major reasons why students are frustrated with using the more advanced features of an LMS can be found in the lack of training supports. 51% of students indicated that they could do better in their learning if they were well-prepared for using LMS features. Even though 67% of student thought of themselves as being well-prepared to use technology such as an LMS, the perceptions of their preparedness for an LMS were not consistent with their actual ability to use an LMS in their learning. In addition to this, 56% of students wanted their faculty to actively use an LMS for their teaching.

What are the trends and next generation of LMSs?

Key trends and characteristics of the next generation of an LMS are as follows:

- **LMS upgrade and replacement**: As current higher education LMSs are eight years old on average and institutions have more options to select an LMS as a result the emergence of new competitive LMS vendors, higher education institutions are considering LMS upgrades and replacements. 15% of higher education institutions have a plan to replace their LMS within the next three years (Dahlstrom, Brooks, & Bichsel, 2014). The main reasons to update and replace the current LMS are to (a) upgrade functions, (b) replace legacy systems, and (c) reduce costs.

- **Interoperability and integration**: The interoperability of LMSs with other administrative systems is increasingly important. All elements in an LMS should be able to exchange contents. Users also

should be able to easily and quickly integrate and add tools to an LMS. Also, an interoperable LMS should be able to aggregate, integrate, and analyze student learning data (Brown, Dehoney, & Millichap, 2015).

- **Automated and advanced learning analytics**: One of the most obvious characteristics of the next generation of LMSs is a more advanced and integrated learning analytics feature. Compared with the current proprietary learning analytics which use data collected from an LMS, future learning analytics features may be outside an LMS and dashboards could be shown in an LMS. The scope of data for learning analytics will be expanded to dispositional data such as GPA and demographic data, student activities and engagement data, and learner artifacts such as essays and media products. These kinds of data will be integrated into data analytics (Brown, Dehoney, & Millichap, 2015). In addition to this, automated learning analytics features are another feature of the next generation of LMSs. Those features will include (a) adaptive learning functions where learning occurs depending on students' strengths and weaknesses, (b) real-time feedback on their learning progress using personalized dashboards, and (c) early alerts functions about course recommendations (Dahlstrom, Brooks, & Bichsel, 2014).

- **Personalization**: Many students want to have more personalized LMS experiences that the current LMSs have not provided. For instance, they want to set up their own pathways to reach their learning goals. This is closely related to adaptive learning features in which an automated system helps students complete their learning by monitoring and supporting specific to the needs of individual learners (Brown, Dehoney, & Millichap, 2015).

- **Collaboration**: The next generation LMS is expected to support student collaboration at multiple levels. It will not be necessary to restrict student collaboration within courses. Collaboration can be organized at the inter-class or institutional levels. For instance, social networking sites enable students or faculty to organize collaboration outside of a course.

Conclusions

As LMSs become increasingly essential for enhancing high quality teaching and learning in higher education, there is a strong need to choose an appropriate LMS in higher education institutions in order to enhance faculty teaching and student learning. As a result, many higher education institutions are actively seeking to implement or adjust their LMS subscriptions within the next several years. Blackboard (proprietary LMS) has been dominant in the LMS market compared to other LMS vendors. More recently, Canvas (open-source LMS) has shown rapid growth chasing Blackboard and Moodle (another open-source LMS). We need to pay attention to the rise of Canvas in the higher education LMS market. Comparisons of features between Canvas and other top LMSs show that Canvas includes all features going beyond other LMSs' features and is also cost-effective because it is a type of open-source LMS. In addition, both faculty and students are generally satisfied with basic features and functions of LMSs, but they still need stronger support for training about LMSs. Training should encourage faculty and students to actively use more advanced LMS features so they can feel more confident in using LMSs. Along with the current trends of LMSs, many users and stakeholders envision the next generation of LMSs in higher education. Looking at the big picture, features of the next generation of LMSs are likely to include (a) interoperability and integration with other systems, (b) automated and advanced learning analytics, (c) personalization of setting up their own learning paths, and (d) collaboration at the multiple levels.

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