# The importance of a Learner Management System in implementing data-driven instruction in higher education institutions

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## Abstract

The Covid-19 pandemic has resulted in the worst downturn in the global economy since the Great Depression in the 1930s. To face the challenges of the global economy, a person needs to possess basic skills including educational skills. Education plays a vital role in building a competitive economy that will hardly be affected by crisis and will be able to ensure that there are high rates of social development. The student population has become very diverse over the decades, making it difficult to teach. Teaching has become very complex to handle because of the increase in a variety of teaching strategies and the diverse student population. There is therefore a need for inclusive and equity pedagogy where teaching considers the diversity of students and the need for teachers to develop teaching strategies that support all students, especially those from disadvantaged backgrounds. The most expensive education is the one that is not completed. This conceptual paper looks at the importance of the Learner Management System (LMS) in implementing data-driven instruction to achieve quality education for all types of students. The LMS is a software system that tracks students' participation and progress through data systems and assessments. It's a platform that stimulates an environment for learner achievement and engagement. 'Data-driven instruction' can be defined as using student data to enhance instructional practices in the classroom to address the needs and learning styles of individual students. Additionally, data-driven instruction will be explored to discover how it can be used as a systematic and purposeful work to maximise the students' performance. The study will provide recommendations on how LMS and data-driven instruction can be used to give direction to decisions to improve the students' outcomes.

Keywords: Data-driven instruction, instruction, learner management system

## 1    Introduction

The Covid-19 pandemic has resulted in the worst downturn in the global economy since the Great Depression in the 1930s (Kanu, 2020). According to Eriyanti *et al.* (2020), to face the challenges of the global economy a person needs to possess basic skills, including educational skills. Bolgova and Kurnikova (2019) allude to the fact that education plays a vital role in building a competitive economy that will barely be affected by crisis and will be able to ensure that there are high rates of social development.

The student population has become very diverse over the decades making it difficult to teach (Rotondi, 2017). Teaching has become very complex to handle because of the increase in a variety of teaching strategies (Conley & Cooper, 2013). This has led to the need for more research to be conducted on how the diverse student population can be accommodated with teaching and learning. According to Grunewald (2018), the most expensive education is the one that is not completed. Waldron (2021) added that there is a need to pay attention to the low completion rates and the importance of examining academic and institutional practices. Spratt and Florian (2015) highlighted that inclusive pedagogy is important and it involves the ability to maintain high levels of academic attainment by responding to differences between individual students and this way you ensure that you leave no student behind. In as much as inclusive pedagogy is important, equity pedagogy that is linked to inclusive pedagogy is just as important. According to Cleovoulou *et al.*, (2022), the equity pedagogy goal is to ensure that individuals from diverse backgrounds are recognised. Zygmunt *et al.*, (2020) added that to support student success, the pedagogy and the content should take into account the students' knowledge, backgrounds and experiences.

One of the effective ways that has been used for over a decade to account for student learning and overall performance has been associated with test scores. This has been effective in forming general programme improvement. However, the use of the test scores alone informs a narrow agenda and is insufficient in developing a responsive pedagogy (Pella, 2012). Schildkamp *et al.* (2012) highlighted the importance of using data to improve education. Data can be used to improve the quality of education. One of the ways to use data is through the implementation of data-driven teaching (Staijen, 2016).

Data-driven instruction is a growing trend used to improve the quality of education. Data-driven instruction can be defined as using student data to enhance instructional practices in the classroom to address the needs and learning styles of individual students (Terrill, 2018). Additionally, data-driven instruction is a systematic and purposeful methodology to maximise the students' performance. This type of instruction is used to give direction to decisions to improve the students' outcomes (Staijen, 2016). According to Stokke Larson (2018), one of the major concerns for secondary and tertiary education is student achievement. Data-driven instruction is therefore needed to enhance the improvement of students.

A learner management system (LMS) tracks students' participation and progress through data systems and assessments (Hodges and Grant, 2015). Bradley (2021) agrees as the author added that the LMS platform stimulates an environment for learner achievement and engagement. It allows the learners to be able to track their grades.

## 1.1 Objective of the study

The main objective of the study is to understand how online learning, particularly the LMS, can improve the implementation of data-driven instruction.

## 2 Learner management system

The Learner Management System (LMS) has contributed significantly to distance learning and higher education institutions (Zheng *et al.*, 2018). The LMS is used to enhance teaching and learning through the use of web-based technology. It assists in facilitating teaching and learning without the constraints of time and place (Raza *et al.*, 2021). According to Oliveira (2016), the LMS was developed as a result of the increasing demand for information technology in education (eLearning). Jurado (2014) added that the LMS can be used in innovative ways in a variety of activities and is useful in the distribution and facilitation of open-access documents and freeware named Open Educational Resources in Education. Moodle, Blackboard, Disire@Learn and WebCT are a few examples of the LMS that are used by higher education institutions (Raza *et al.*, 2021). Al-Handhali *et al.,* (2020) highlighted some limitations of the LMS system as follows:

- There is limited student centricity
- High level of technical expertise which some instructors lack.
- The challenge of designing an appropriate mix of learning activities that meets the student's needs, instructor skills and institutional technical capacity.
- The challenge with user integration
- Course management and content

According to Lim (2021), there are several steps that can be taken to overcome these challenges and these include;

- Having the buy-in from the leadership of the institution when introducing the LMS.
- Finding the link between the institution's culture and the LMS will fit in the best.
- Integrating the LMS with the system that already exists within the institution.
- Having a strategy to train staff on the use of LMS in their daily tasks and providing the support structure for staff using the LMS
- Understand how the LMS is used including the limits of the LMS.

## 2.1 LMS features

The LMS integrates several media, resources and different languages together with alternative technologies that present information in an organised manner to construct learning through interaction (Oliveira, 2016). It has different

features including chats, emails, wikis, forums, assignments, quizzes and blogs. These features allow learners to be able to be active while achieving effective learning and engagement (Araka *et al.*, 2021). Furthermore, the LMS features assist in improving self-regulated learning. Jurado (2014) categorises the features into four categories including tools for administration, communication, distribution and interaction. According to Bradley (2021), for LMS features to be meaningful, teachers need to be trained on how to utilise these fully to motivate students to use more online resources.

## 3    Instruction

Instruction is when purposefully developed plans are created and implemented to guide the process of developing the skills, understanding and knowledge of learners (Kridel, 2010). Furthermore, instruction is linked to the term 'curriculum' as it refers to the methods used by instructors in carrying out the curriculum. However, the curriculum is the information that needs to be taught to the learners whereas instruction is how that information is taught and what methods are used (Nelson, 2023). According to Isman (2011), instruction is about the activities that should assist students in learning and moving the knowledge from the short-term to the long-term memory through learning how to rehearse, encode, process and feedback the new knowledge. Boleware (2013) indicates that there are five types of instruction used in the classroom:

- *Direct instruction:* The teacher gives the instruction and does not require input from the students. It is a teacher-centred approach.

- *Indirect instruction:* Student centred where teaching and learning are carried out using problem-solving techniques, scenarios and projects.

- *Interactive instruction:* Students interact with one another and with the teacher through brainstorming and tutoring.

- *Independent instruction:* Students teach themselves but under the supervision of

the teacher. Distance learning is one example of independent instruction.

- *Experimental instruction:* The main focus is not on the conclusion but rather the process followed to arrive at the conclusion. This gives students a chance to experiment and learn more about the problem and how it is solved.

The first instruction is teacher centred whereas the last four are student-centred instruction methods.

## 4    Data-driven instruction

Data-driven instruction is about putting together a database of information about the students in each classroom and using that information to improve the quality of teaching and learning (Neuman, 2016). Students have different needs, abilities and levels of understanding. Data-driven instruction seeks to take all this information into account when building curricula and teaching students (Neuman, 2016). According to Hilliger et al., (2019), data-driven instruction is useful in the continuous improvement of curriculum.

School leadership must take the lead in building a culture of data-driven instruction. There are three main steps involved in data-driven instruction (Kampen, 2019):

- *Data collection:* The gathering of information from class assessments, tests and lecturer observations, and then creating a database of the information.

- *Data analysis:* Sorting out the data and only keeping the essential information. Check if there are any patterns and find out the reasons behind the results so you can draw conclusions and formulate teaching plans.

- *Action:* Congratulate your class and move to the next topic or prepare time to re-teach certain ideas to the class.

### 4.1    Data-driven instruction system model

The figure below represents the data-driven instruction system model.
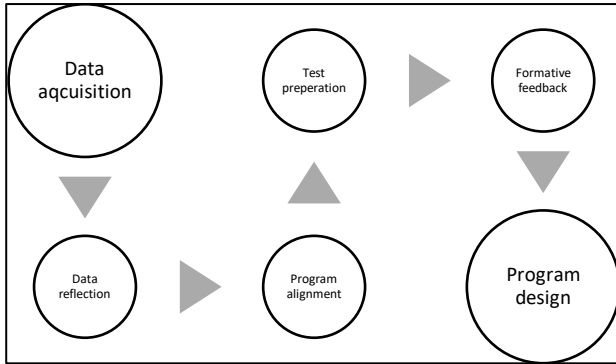
Source: Adapted from Halverson, Grigg, Prichett, and Thomas, 2015.

- *Data acquisition*: creating practices to collect, acquire and store data.

- *Data reflection and program alignment*: creating practices to reflect on data and set goals.

- *Program design*: the interventions that leaders develop and guide instruction.

- *Formative feedback*: the system that leaders establish to learn from programme design.

- *Test preparation*: links the instructional programme to explicitly summative testing practices.

## 5 Discussion

The LMS provides a range of features in support of the interactions between teachers, students and the content (Choi, Lee, Hong, Lee, Recker and Walker, 2016). According to Mangaroska, Vesin, Kostakos, Brusilovsky and Giannakos (2021), the LMS supports data-driven instruction by promising a wider application of learning through the data collected from several LMS systems and these can support the learning ecosystem of learners, teachers and content when these are merged. Furthermore, the LMS system allows teachers to have learning-related data that teachers can use to improve the overview of learners' progress and use this data to make pertinent decisions to re-design the learning context. This is the main focus of data-driven instruction where data is collected to inform programme alignment and design (Halverson *et al.*, 2015).

## 5.1 LMS Features for data-driven instruction

To provide a better learning experience for students, the LMS should possess certain features. These will aid in improving the data-driven instruction. The important LMS features as proposed by Baron (2020) are:

*LMS integration*

Having a LMS that integrates with other systems. The LMS has a well-developed virtual learning environment because it integrates pedagogical and technological features (Cavus, 2011). Green and Chewning (2020) add that the LMS is a higher education integrated piece of infrastructure. According to Ochoa-Orihuel *et al.*, (2020), studies show that most of the LMS systems have challenges in meeting the needs of students specifically when taking usability and learnability into account. This is one of the reasons why it is important that there is continuous research on how these systems can be integrated with others. One of the examples is the integration of the LMS with mobile devices. Hu *et al.* (2020) highlight that mobile access to the LMS is increasing owing to the increasing penetration rate of mobile devices. This device allows learners, who are at different locations, to be able to access the learning content at the same time or on their own time (Bradley, 2021). Another example is the integration of the LMS with artificial intelligence and data analysis to improve learning (Villegas *et al.*, 2020). Furthermore, the authors conducted a study at the University in Ecuador that was based on an online education model where they integrated machine learning into the model.

*Data tracking*

Numerous sources of data are collected in the education field. This big data must be collected, organised and processed so that valuable and information can be extracted (Khan *et al.*, 2019). According to Yu and Couldry (2022), the collection and monitoring of data have contributed to the promotion of educational progress. Heng-yu *et al.* (2019) add that knowledge-tracking is important in following the student's progress during each stage of learning. Some institutions use Early Alert Systems (EASs)

that assists them in identifying the at-risk students who are more likely either to withdraw from the course or fail it (Kay and Bostock, 2023). The LMS systems are important because these are automated systems that assist with the administration, tracking and monitoring of the learning outcomes and educational activities (Aljaloud *et al.*, 2022). (Laflen and Smith (2017) highlight that data is collected automatically via the LMS. Furthermore, the data collected via LMS includes records of the text communication, LMS log files and server log files. The LMS log files contain very important large amounts of information including the patterns, frequency and sessions of actual learning (You, 2016).

*Personalised user experience*

Adaptive learning and assessments reflect the learners' performance. Personalised learning can be defined as a customised model approach with a focus on students' individual needs and it takes the educational services away from one-size-fits-all model (Morris, Davies and Smith, 2020). The reasoning behind personalised learning is that people learn differently. According to Kucirkova, Gerard and Linn, (2021), the word 'personalisation' is used interchangeably with 'adaptive learning', 'differentiated education' and 'customisation'. Personalised education is the best when one wants to support and develop students who are talented and gifted (Kucirkova and Karen Littleton, 2017). The authors add that the needs of individual learners and the nurturing of personal dispositions are addressed by personal instruction. Meacham *et al.* (2018) highlight the importance of incorporating technological enhancement in teaching as it assists with the personalisation of education where students can customise their learning activities taking into account personal diversity where they have different personal circumstances and learn in different ways of approaching the learning aspect. Kucirkova *et al.* (2017) support this notion and indicate that technology has increased the options for customization which is a great opportunity for personalisation. The LMS assists in extending the diversity of functionalities in a user-oriented context as it includes a combination of services from several sources to develop an individualised learning experience (Alserhan *et al.*, 2023). According to Samsara, Cahyarini and Kusuma (2022), the integrated LMS does come with a challenge. This includes the challenge of lack of resources the lack or limited resources such as infrastructure, human and financial resources. This, however, needs the invention of the government in ensuring that they set aside some funds for HEIs to implement such projects.

*Offline learning trackers*

The LMS should allow for the learning and assessments that involve manual activities to be captured. Alcock (2017) mentions that there are ways to track offline learning when using an LMS. This includes using Sharable Content Object Reference Model (SCORM)-compliant wrapper apps that are a set of files making it possible for the SCORM-compliant LMS to communicate back and forth. Secondly, by using an Experience Application Programming Interface (xAPI) compliance app that is an e-learning software specification that records and tracks various types of learning experiences for learning systems. According to Lim (2018), the xAPI is an offline system as it takes e-learning outside the browser and it focuses on tracking learning. This is however more recommended than the SCORM because of the type of learning that each one can track. The SCORM only stores information for online learning while the xAPI can track a wider variety of learner activities both on- and offline (Takev *et al.*, 2020). If the instructor can track offline learning, the data collected will be realistic and aid in a more accurate diagnosis of the problem to be solved with data-driven instruction.

*Automated alerts and notifications*

It is useful to send out auto-alert messages to teachers to track learners' engagement with the material and to learners to track deadlines. 'LMS automation' refers to automated invites, e-mails, notifications, grading, course release and timing as well as portal invites (Kassymtayeva, 2020). There are several benefits of automated alerts and notifications. The automated warnings are beneficial in that these alert the teachers to the potential errors in grading, equity issues (where it indicates the class performance), and any

opportunities for improvement that could assist in rethinking the pedagogy (Rynearson and Reazin, 2015). Sharma (2021) added that automated alerts and notifications benefits include bridging the communication gap, the luxury of using multiple channels to send notifications/alerts and being able to reach the masses. In as much as automated alerts and notifications come with many benefits, there are limitations associated with them. This includes but is not limited to the difficulty of authenticating the alert message and verifying if the alert message has been received by the recipient (Vdovin, 2017). After considering the benefits and limitations of automated alerts and notifications, institutions would be wise in investing in the LMS which can integrate email, text and other communication channels to deliver timely communication to all stakeholders.

*Centralised learning material*

Centralised learning material is about being able to store and control content from one location and it allows for ease of course creation as well as access to information (Anderson, 2019). Centralised learning material ensures that there is consistency and that all information is easily accessible in one central location. Bearman, Lambert, and O'Donnell (2021) add that a centralised approach gives the students consistent experience and provides them with a coherent teaching approach. According to Anderson (2019), the LMS provides a centralised way to manage learning materials. Furthermore, the LMS assists in centralising administration in education (Ninoriya, Chawan and Meshram, 2011 & Harahap *et al.*, 2023). The centralised learning material system will allow for ease of access of information by instructors for data-driven instruction and by students for learning.

*Flexible reporting and analytics*

The LMS should have a flexible reporting and analytics meaning that aligns to the e-learning objectives. The reporting and analytics should be done in such a way that patterns are easily and quickly identified. 'Analytics' refers to the applying business intelligence tools and strategies to guide the decision-making process within teaching and learning (Duin and Tham, 2020). Ingwersen

(2017) defines 'reporting and analytics' as a set of tools that assists in representing data using, tables, charts and other visualisations to make it easier for users to find useful information. Kassymtayeva (2020) added that the LMS assists with improved reporting and analytics as it is able to provide information on learners' progress, engagement in courses, results, completion rates and so forth. The LMS makes it possible for higher education institutions to collect, store and mine data for analytics (Duin and Tham, 2020). Gravity (2023), highlighted the shortcomings of analytics and these include firstly, data fatigue, where one has a lot of information and ways to process the information making it difficult to focus. Secondly, data accuracy and completeness as institutions need to ensure the accuracy of the data and that is free of errors and lastly considering the safety when using analytics through efficient encryption techniques. Furthermore, reporting has a shortfall of over-simplifying data. It is therefore important to ensure that the correct data is analysed and more than one report is considered when generalising the results.

*Compliance*

The LMS manages and stores a lot of sensitive personal data (Amo et *al.*, 2019). It is therefore important that the LMS is compliant with the rules and regulations of higher education institutions that include the protection of student and staff personal data. There is, however, a study that was conducted by Amo *et al.* (2019) that revealed the students' digital identity and personal data are not protected on the LMS. It should be able to assist the organisation in keeping track of the current compliance regulations (Anderson, 2019). Furthermore, organisations will meet compliance regulations if they have a proper software solution within their LMS. Aleksieva-Petrova, Chenchev, and Petrov (2019) highlight the need for more research to be done to explore LMS compliance with the general data protection regulations.

*Assessment tools*

Assessments are an important part of an education system and assist with assessing the knowledge that has been acquired. There is, however, an increase in the number of students

which makes assessments challenging (Gupta and Gupta, 2017). Febliza and Okatariani (2020) indicate that the Fourth Industrial Revolution has led to a need for higher education institutions to change their assessment strategies. Berzosa, Bernaldo, and Fernández-Sanchez (2017) emphasised the importance of having sustainable assessment tools. According to Aybek and Demirtasli (2017), adaptive assessments, which are tailored assessments based on students' capabilities, can be used. The LMS is a beneficial system because not only does it assist with adaptive learning it also provides for adaptive assessments (Morze, 2021). The assessment results are recorded on the LMS system making it easy to analyse the assessment data to see how students are performing. Furthermore, LMS assessments allow the instructors to see which questions are problematic and that will inform the new curriculum instruction.

## 6    Conclusion

Providing equity and inclusive pedagogy should be the main focus of higher education institutions. Data-driven instruction is one of the ways in which higher education institutions can ensure that they provide quality education to all students without leaving any student behind. This conceptual paper showed how the LMS, which is used by the majority of higher education institutions around the world, assists in the implementation of data-driven instruction. The LMS features are of utmost importance in the successful implementation of data-driven instruction.

Future research is recommended where an empirical study needs to be conducted to understand which data-driven instruction is implemented at higher education institutions.

## Acknowledgements

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