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An Experimental Study on Evaluating the Impact of A Learning Management System (LMS) on Student Engagement

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Abstract:

Student engagement is crucial as it drives motivation, enhances learning, and promotes overall academic success. The purpose of the study is to evaluate impact of Learning management system (LMS) on student engagement. An experimental Pre-Test Post-Test Design is used to evaluate impact of Learning management system (LMS) on student engagement. 72 students enrolled for data science certification course using python was selected and was bifurcated Randomly into Control and Experimental Group. Pre-Test student engagement score was measured of control and experimental group before implementing LMS and the Post-Test student engagement score was measured of control and experimental group after implementing LMS for the period of 60 Days in Treatment Group. The statistical technique used in the current study is independent t-test and statistical software is SPSS 29. Study revealed that the implementation of a Learning Management System (LMS) has a significant positive impact on post-Test student engagement score on Experimental Group students. Further studies can be conducted Building Regression model evaluating impact of Student engagement on students' performance.

Keywords: *Student Engagement, Experimental Study, Learning Management System.*

1. Introduction:

A lot has transpired in the field of technology in recent years. Because digital media is becoming more and more popular, teachers need to use modern strategies to keep students' interest and involvement maintaining students interested in the content they are studying, new ideas must be presented creatively. The significance of educational technology in the modern educational system has made technological instruments essential to students' learning processes. Life is made easier by technology. It impacts and simplifies the complex tasks. Better learning systems and appropriate communication between teachers and students can be ensured by technology. Educational technology gives students access to a variety of learning resources that meet their specific needs, improving their ability to acquire new skills and stay up to date on current information. In addition to improving communication skills which are critical for both academic and professional success, it makes the classroom more interesting, which keeps students focused despite possible distractions. Constant internet connectivity allows students to access information at any time, facilitating unbroken research and ongoing education. These resources also support students' physical, mental, and cognitive well-being while giving them the information and skills they need to succeed in the profession and prepare for the workforce (Jumman et al. 224)

1.1. LMS (Learning Management System) is a software platform designed to create, manage, and deliver educational content and track learner progress. It is widely used in educational institutions, corporate training environments, and by individual instructors to streamline and enhance the learning experience.

1.2. LMS Platforms

- **Moodle**: An open-source LMS popular in educational institutions.
- **Canvas**: Widely used in higher education for a robust and customizable experience.
- **Google Classroom**: Known for its simplicity and integration with Google apps, popular in K-12 education.

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- **Blackboard**: Often used in universities, with features for course content delivery, testing, and grading.

1.3. Experimental Research Design

An effective method for examining correlations between variables is experimental study design, which involves adjusting independent variables and monitoring how they affect dependent variables while regulating other variables. Typically, this design consists of important elements like controlling the independent variable, assigning participants at random, using control groups, and measuring the results. According to Campbell and Stanley (1966), random assignment reduces bias and improves internal validity by ensuring that any differences between groups are caused by the intervention itself and not by any unrelated factors. Pre- and post-intervention assessments are frequently included in experimental designs to guarantee reliable results and allow the researcher to assess the changes brought about by the experimental therapy (Shadish, Cook, & Campbell, 2002). To examine the data and check for significant changes across groups, statistical techniques including regression analysis, ANOVA, and t-tests are frequently employed (Field, 2013). Because of their controlled conditions and random assignment, experimental designs are strong at establishing cause-and-effect relationships with high confidence. This makes them perfect for studies such as evaluating the impact of learning management systems (LMS) on student engagement in higher education (Creswell, 2014).

1.4 Pre-Test-post Test Research Design

Table No: 1 Pre-Test-post Test Research Design

Experimental Group	**R**	**O1**	**X1**	**O2**
Control Group	R	O3		O4

Pre-test-post-test research involves assessing participants before and after an intervention to determine its effect. Both the experimental and control groups are pre-tested in this approach to determine the baseline amounts of the dependent variable. Once the experimental group (R) has received the intervention (X1), such as the use of a Learning Management System (LMS) in the study, the results are reevaluated (O2). Both the pre-test (O3) and post-test (O4) are administered to the control group (R), which does not receive the intervention. The researcher can compare the post-test results of the two groups to determine if the intervention (X1) had a substantial effect on the dependent variable (e.g., academic performance or student engagement). This approach accounts for any pre-existing differences measured in the pre-test (O1, O3) and makes it possible to compare the groups clearly while also separating the effects of the intervention. In educational studies where the goal is to examine improvements in student outcomes after an LMS intervention, this design's primary benefit is its ability to evaluate both the original status and the change brought about by the intervention.

1.5 Student engagement scale

- **Behavioural Engagement:** Students' active engagement, task completion, and participation in course-related activities (coding, assignments, and conversations) are the main focus of this.
- **Emotional (Affective) Engagement:** evaluates students' emotional attachment to the course, interest in the material, and intrinsic motivation.
- **Cognitive Engagement:** reflects the depth of learning, critical thinking, and intellectual work necessary to grasp challenging machine learning concepts.

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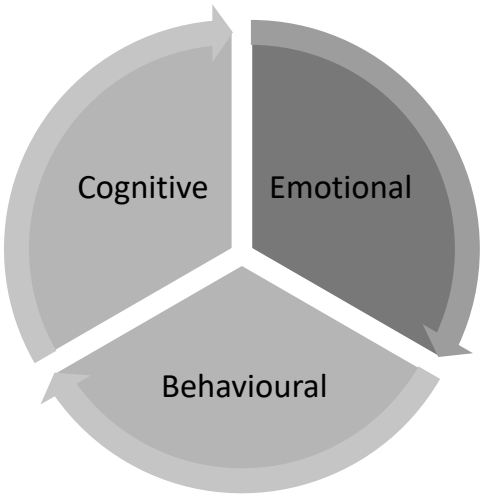
Figure No: 1 Student Engagement Scale



2. Significance of the Study

This research is vital for understanding how educational technologies can be optimized to improve learning outcomes and student-teacher interactions. By promoting self-directed learning, LMS fosters lifelong learning habits that extend beyond traditional classroom settings. The study is crucial as student engagement significantly influences students' academic performance. Furthermore, by assessing how LMS affects engagement, the study can offer important new perspectives on how technology can improve student motivation, retention, and academic achievement in general. To improve student results, educational institutions should use these data to improve their teaching practices and make better use of LMS platforms to create dynamic and engaging learning environments.

3. Literature Review

Learning Management Systems (LMS) have been repeatedly demonstrated to have a favourable impact on students' engagement and academic achievement in a variety of educational contexts. For example, Bushra et al. (2024) discovered that, in contrast to traditional learning settings, blended learning improved student achievement. Similar findings were made by Parlindungan et al. (2023), who found that using an LMS enhances academic achievement and cultivates favourable student perceptions. Although obstacles including poor ICT-based techniques and low professor commitment made it difficult to adopt LMS, Michael et al. (2024) found that university students utilising LMS outperformed those in traditional settings. To enhance engagement and performance evaluation, Sazzad Hussain et al. (2024) suggested a new LMS model that includes elements like automated attendance, personalised note-taking, and participation indicators. Additionally, it was shown by Rui Cruz et al. (2023) that LMS tools such as gamification and real-time at-risk identification could improve student performance and motivation. The beneficial effects of LMS on student performance, engagement, and success prediction were further substantiated by studies by Debarshi et al. (2024), Eluwumi et al. (2021), and Firman et al. (2021), particularly when paired with sophisticated data analysis techniques like machine learning and learner analytics.

The importance of instructional design and participation in optimising LMS efficacy was highlighted by several studies. According to Alia Lancaster et al. (2020), choices on course design have a significant impact on LMS usage trends, which in turn have an impact on student outcomes. Regular attendance at virtual synchronous sessions enhanced performance prediction, especially for students in moderate involvement groups, according to Kelsey et al. (2021). According to Khawlah &

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Mesonovich (2019), the McGraw Hill Education Connect system improved students' grades in a pre-calculus course. Urvashi Desai et al. (2021) demonstrated that active engagement in online discussion forums enhanced student performance, underscoring the significance of these platforms in enhancing academic attainment. Faisal et al. (2020) discovered that by addressing problems with conventional teaching methods, the University Putra Malaysia (UPM)'s LMS installation enhanced student engagement and learning outcomes. Last but not least, Ümmühan Avcı & Esin Ergün (2019) found that increased LMS participation had a beneficial impact on engagement and academic achievement, highlighting the necessity of routinely assessing student involvement to avoid learning challenges in online environments.

4. Research Gap

Learning Management Systems (LMS) are a component of blended learning and e-learning models, and their effects on student engagement and performance have been extensively studied. However, little focus has been placed on understanding the direct effects of particular LMS features and their implementation on student engagement in higher education environments. Although research such as those conducted by Bushra et al. (2024) and Michael Bamidele Ojo (2024) recognises that the use of learning management systems (LMS) improves student performance, few studies go into great detail about how LMS might either actively increase or decrease engagement levels. Furthermore, despite the increasing popularity of learning management system (LMS) platforms such as McGraw Hill Education's Connect (Khawlah & Mesonovich, 2019), there is a dearth of empirical data about the precise effects of LMS features on student engagement, motivation, and interaction for courses. The majority of research has not examined the different levels of student engagement in learning management systems (LMS) or determined the elements that influence engagement in addition to performance, such as the function of course design, opportunities for interaction, or personalised learning features (Rui Cruz et al., 2023; Sazzad Hussain et al., 2024). This research gap highlights the need for a thorough experimental study that assesses the LMS's overall efficacy in raising student performance as well as its effects on student engagement, offering insights into how various LMS components affect student engagement, retention, and satisfaction in higher education.

5. Objectives

1. To measure student engagement of students attending machine learning using Python (Certification Course)
2. To examine impact of Learning management system (LMS) on students' engagement.

6. Hypotheses

Hypothesis-1

H_0**:** There is no significant difference in the mean pre-test scores of student engagement between the control and experimental groups.

H_a: There is a significant difference in the mean pre-test scores of student engagement between the control and experimental groups.

Hypothesis-2

H_0**:** There is no significant difference in the mean post-test scores of student engagement between the control and experimental groups.

H_a: There is a significant difference in the mean post-test scores of student engagement between the control and experimental groups.

7. Material and methods

Experimental pre-test and post-test research design is used in the current study. Data has been collected from 72 Data science students of MBA Institute. The students have been divided into Two groups randomly into control and Experimental group. Parametric independent t test is applied to examine impact of Learning management system (LMS) on students' engagement. SPSS 26 Statistical Software is used in the current study.

7.1 Measurement model:

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Table No: 2 Student Engagement Scale (SES)

Construct and Items	References
Cognitive Engagement **I make an effort to understand the theoretical concepts behind machine learning algorithms.** **I spend extra time reviewing difficult topics to ensure deep understanding.** **I apply course concepts to additional projects beyond assignments.**	**Fredricks et al. (2004)**
Emotional Engagement **I find the machine learning topics interesting and engaging.** **I feel excited to learn new concepts and techniques in Python and machine learning.** **I am motivated to apply course content to real-world problems.**	**Fredricks et al. (2004)**
Behavioural Engagement **I actively participate in coding exercises and programming tasks.** **I complete all assignments and hands-on projects on time.** **I attend or review all course sessions consistently.**	**Fredricks et al. (2004)**

8. Data analysis

Table No: 3 Reliability Statistics

Dimensions of Student Engagement **scale**	**Pre score reliability**	**Post score reliability**
Cognitive	0.732	0.862
Emotional	0.756	0.814
Behavioural	0.822	0.754

Pallant (2005) suggested above .70 as acceptable level of internal consistency as all the Cronbach's alpha values are above .70 indicating high level of internal consistency.

To analyse Difference in the mean pre-test scores of student engagement between the control and experimental groups.

Table No: 4 Group Statistics

	Group	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Pre-Test Score	Control Group	36	**27.94**	2.898	.483
	Experimental Group	36	**27.78**	2.542	.424

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Table No: 5 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Pre-Test Score	Equal variances assumed	1.291	.260	.259	70	.398	.796	.167	.642	-1.115	1.448
	Equal variances not assumed			.259	68.835	.398	.796	.167	.642	-1.115	1.448

Parametric Independent t test is applied as data is Normally distributed (P value of Kolmogrov-smirnov Test >0.05) and there is Homogeneity of variance as (P value of Levene's Test =.260 which is more than 0.05). There is no significant difference in the mean pre-test scores of student engagement between the control and experimental groups as p value of independent t test=0.796 which is more than 0.05 and t statistics=0. 259.Mean Pre-Test score of control score=27.94 and Mean pre score of Experimental score=27.78

To analyse Difference in the mean post-test scores of student engagement between the control and experimental groups.

Table No: 6 Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Post-Test Score	Control Group	36	**29.89**	4.315	.719
	Experimental Group	36	**38.11**	3.655	.609

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Table No: 7 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Post-Test Score	Equal variances assumed	2.715	.104	-8.724	70	<.001	<.001	-8.222	.942	-10.102	-6.343
	Equal variances not assumed			-8.724	68.158	<.001	<.001	-8.222	.942	-10.103	-6.342

Parametric Independent t test is applied as data is Normally distributed (P value of Kolmogrov-smirnov Test >0.05) and there is Homogeneity of variance as (P value of Levene's Test =.260 which is more than 0.05). There is a significant difference in the mean post-test scores of student engagement between the control and experimental groups as p value of independent t test=0.000 which is less than 0.05 and t statistics=-8.724. Mean Post-Test score of control score=29.89 and Mean post score of Experimental score=38.11

9. Conclusion

The findings from this experimental study reveal that implementing a Learning Management System (LMS) had a significant positive impact on student engagement, as evidenced by the difference in pre-test and post-test scores between the control and experimental groups. Students exposed to the LMS showed marked improvement in engagement, highlighting the system's potential to foster interactive and immersive learning experiences. This supports the integration of LMS platforms as a valuable tool in educational settings, providing structured resources and interactive opportunities that can elevate student involvement and participation.

10. Suggestions to the Faculty members

Faculty members should consistently utilize the LMS to organize course materials, assignments, and assessments, making it the central hub for student learning. By incorporating interactive tools such as discussion forums, polls, and quizzes, faculty can foster active learning and encourage greater student interaction. Additionally, faculty members need to remain available to assist students with any technical issues related to the LMS, ensuring that students can fully engage with the content without any barriers. This approach will enhance both the teaching experience and student engagement throughout the course.

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