Evaluating the Impact of Information Communication Technology on Student Learning Outcome

[1]Archana Mourya, [2] Monali Kshirsagar, [3] Rupali Unhale, [4] Rohini Patil, [5] Dipak Kokande, [6] Mohini Aher,
[7]Manisha Khatri, [8] Neeta Khairnar, [9]Suman Kahandal, [10]Anuradha Bhalerao, [11]Keshav Nandurkar
[1,2,3,4,5,6,7,8,9,10,11]K.K. Wagh Institute of Engineering Education and Research, Nashik
[1]almourya@kkwagh.edu.in, [2]mjkshirsagar@kkwagh.edu.in, [3]rsunhale@kkwagh.edu.in,
[4]rspatil11@kkwah.edu.in, [5]dakokande@kkwagh.edu.in, [6]msaher@kkwagh.edu.in,
[7]mpkhatri@kkwagh.edu.in, [8]ngkhairnar@kkwagh.edu.in, [9]ss.kahandal@kkwagh.edu.in,
[10]acpawar@kkwagh.edu.in, [11]knnandurkar@kkwagh.edu.in

***Abstract*— This study assessed the performance and perceptions of students using Information Communication Technology (ICT) tools, specifically through the Learning Management System (LMS), and compared it with high-stakes theory examinations. The LMS, an ICT tool, is utilized to evaluate student learning throughout the daily teaching process. In contrast, high-stakes theory examinations are conducted at the end of the course to assess overall knowledge and understanding. The study involved a sample of 67 students and 25 faculty members. Data was collected through result evaluations and surveys, and the analysis revealed that assessments conducted via the LMS did not affect the outcomes of high-stakes theory examinations. Both students and faculty members agreed that the LMS is an effective tool for documentation, tracking, and delivering study materials.**

***Keywords*— Chi-square Test; High Stake Theory Examination; Information Communication Technology; Learning Management System; Paired t- Test.**

***ICTIEE* Track*:* Technology-assisted Collaborative Learning**

***ICTIEE Sub-Track:* Assessment for Learning: Empowering Students through Effective Assessment Practices**

I. INTRODUCTION

The use of Information and Communication Technology (ICT) in education has become not only commonplace but is increasingly recognized by researchers as a valuable tool for enhancing student understanding and encouraging active learning. ICT encompasses a wide range of tools for enhancing student understanding and encouraging active learning. ICT encompasses a wide range of tools and applications, including computers, the Internet, and other digital tools that facilitate the communication, storage, and processing of information. As education continues to evolve in the digital age, these technologies have proven essential in transforming traditional teaching methods, providing educators and students with innovative ways to interact, learn, and collaborate. However, despite the evident benefits of ICT, many college students do not fully utilize the Learning Management System(LMS), a critical component of ICT in education. LMS platforms are designed to streamline educational processes by enabling instructors to create, manage, and deliver content digitally. These systems provide a structured online environment where students can access course materials, participate in discussions, submit assignments, and receive feedback. According to recent studies, although many institutions have implemented LMS, the actual usage and engagement levels among students vary significantly. Some students may find the systems intimidating or challenging to navigate, while others may simply not be aware of the full range of functionalities that LMS platforms offer (Mantoro et al., 2017). In recent years, educational institutions have increasingly adopted the fourth generation of distance education, known as the flexible learning model. This model has evolved rapidly due to advancements in ICT tools, which have revolutionized the way education is delivered and received. The flexible learning model allows students to learn at their own pace and on their own schedule, making education more accessible and accommodating to diverse needs. The essential hardware required for this model includes computers and handheld devices such as smartphones, tablets, and e-readers. These devices provide the necessary platform for students to access learning materials, communicate with instructors, and participate in online classes. Additionally, a variety of software programs, including LMS and e-learning

Archana Mourya
K.K. Wagh Institute of Engineering Education & Research, Nashik,
almourya@kkwagh.edu.in

applications, support and enhance the learning process by providing a virtual classroom environment (Saikia, 2023). The integration of ICT tools into education has enabled remote learning via the Internet, necessitating significant changes in traditional teaching methods. Traditional education models, which rely heavily on face-to-face interaction and fixed schedules, are being challenged by the flexibility and accessibility that ICT provides. Remote learning tools allow educators to reach students who may not be able to attend classes in person, whether due to geographical, financial, or personal constraints. This shift towards remote and flexible learning models has compelled educators to adopt new pedagogical approaches, emphasizing student-centered learning and fostering greater autonomy and responsibility among learners. Moreover, ICT tools have been shown to effectively address common educational challenges, such as improving students' attention spans, enhancing class participation, and deepening conceptual understanding. In a traditional classroom setting, maintaining student engagement can be difficult, especially in large classes where individual attention is limited. However, ICT tools such as interactive multimedia, simulations, and digital games can capture students' interest and motivate them to participate more actively in their learning. These tools can present complex concepts in a more accessible and engaging way, making it easier for students to grasp and retain information (Bhamre & Jagtap, 2021). For example, a study on the use of systematic feedback interventions using ICT tools found that tailored feedback provided promptly can significantly impact students' learning outcomes. The feedback was customized to meet student's individual needs and was designed to correct incorrect or incomplete information, helping students improve their understanding of the subject matter. This approach was particularly beneficial for passive students who may be reluctant to participate in class discussions or activities due to fear of making mistakes. By receiving feedback in a safe and supportive online environment, these students were able to engage more fully in the learning process, enhancing their attention spans, increasing class participation, and improving conceptual understanding (Al-Qdah & Ababneh, 2017). Furthermore, LMS platforms enhance the learning process by providing a comprehensive online classroom environment that supports collaborative group work, professional training, discussions, and communication. Unlike traditional classroom settings, where interactions may be limited to scheduled class times, LMS platforms allow for continuous engagement and interaction among students and instructors. Instructors can use these platforms to facilitate discussions, plan activities, set expectations, and assist students in problem-solving, creating a more dynamic and interactive learning environment. This continuous engagement helps maintain students' motivation and interest in the subject matter, which is crucial for effective learning. Research indicates that the use of LMS platforms can help students become more independent learners. By providing access to a wide range of resources and tools, LMS platforms encourage students to take responsibility for their own learning and to engage more actively with the course content. Students can track their progress, identify areas where they need to improve, and access additional resources to help them succeed. This ability to self-monitor and regulate their learning activities is a key factor in sustaining engagement and improving learning outcomes over time. Since their conceptualization in the 1950s and significant advancements in the 1990s, LMS technologies have continued to evolve to support effective online learning. Initially, LMS platforms were relatively simple, providing basic functions such as content delivery and assessment. However, with technological advancements, modern LMS platforms now offer a wide range of features designed to enhance the learning experience. These features include interactive multimedia content, social learning tools, mobile accessibility, and advanced analytics that allow educators to monitor student performance and engagement closely (Bradley, 2020). One of the notable advantages of using LMS platforms for assessments is the ability to conduct online examinations. Online exams offer several benefits over traditional paper-based exams, including convenience, efficiency, and the ability to provide immediate feedback. Studies have found that features such as automatic grading and instant feedback are particularly favored by students, as they allow for quick review and reflection on their performance. This immediate feedback can be especially useful in practice exams, helping students to identify areas where they need to improve and adjust their study strategies accordingly. Interestingly, research suggests that the type of exam, whether paper-based or online, has little impact on student performance. Instead, the major factors influencing success are preparation and study habits. Students who are well-prepared and have good study habits tend to perform well regardless of the exam format, while those who are less prepared may struggle with both types of exams. This finding underscores the importance of effective study strategies and time management skills in achieving academic success, regardless of the assessment format (Bhamre et al., 2021).

The introduction of LMS as an ICT tool has led to significant changes in the assessment process. From the academic year 2022-23, the institute did not utilize LMS and conducted High Stake Theory Examinations (HSTE) at the end of the semester in a traditional format, consisting of a 60-mark exam over a duration of 2.5 hours. However, starting in the academic year 2023-24, the institute implemented LMS for course assessments, while continuing to conduct HSTE in the same format at the end of the semester. The integration of LMS into the assessment process has allowed for more frequent and formative assessments, providing students with regular feedback on their progress. Under the new system, faculty members use LMS to conduct assessments after each unit is completed. These assessments take the form of online tests administered through the LMS platform, and the average scores from these tests are integrated into the Continuous Comprehensive Evaluation (CCE) system. The CCE system is designed to evaluate students’ overall performance and progress throughout the entire course, rather than relying solely on periodic exams. By incorporating regular assessments into the CCE system, the institute aims to provide a more comprehensive evaluation of students’ learning and development, reflecting their continuous efforts and engagement with the course material. The use of LMS for assessments has several benefits. Firstly, it allows for more frequent and timely feedback, enabling students to identify and address gaps in their knowledge and understanding before they become significant issues. Secondly, it encourages continuous learning and engagement, as students are required to stay on top of their studies and prepare for regular assessments. Finally, it provides a more holistic view of students' performance, taking into account not just their performance on final exams, but also their progress and development throughout the course.

This paper examines the performance and perceptions of students using ICT tools, specifically through LMS. It explores how the use of LMS for assessment in the classroom can improve students' results in Higher Semester Theory Examinations (HSTE) and determine the beneficial influence on their understanding and dynamic learning of concepts. By analyzing the impact of LMS on student learning outcomes and engagement, this study aims to provide valuable insights into the effectiveness of ICT tools in enhancing education and supporting student success.

II. METHODS

The random sample of 67 students was selected from all students of F.Y. B. Tech. of A.Y. 2023-24. Analysis was carried out on the sample in which correlation, regression analysis, and paired T-test were applied. The correlation is used to find a measure of the intensity of the degree of linear relationship between two variables. Here we are considering two parameters i.e. ICT test result and HSTE result. Regression analysis is a mathematical measure of the average relationship between two or more variables in terms of original units of data. Through the principle of least square, we obtain a line of regression which is best fit for bivariate distribution.R^2 is known as the coefficient of determination which tells how close the data is fitted to the regression line. A paired t-test is employed to compare the means of two populations when the samples are paired, meaning each observation in one sample corresponds to a specific observation in the other sample. Often referred to as the dependent sample t-test, this statistical method is designed to assess whether the average difference between two sets of paired observations is zero. In this test, each subject or entity is measured on two different occasions or under two different conditions, producing pairs of observations for analysis.

State the Hypotheses

Null Hypothesis (H): $H_0: \mu_1 = \mu_2,\ Where\ \mu_1, \mu_2$ are the population mean that is no significant difference between population means.

Alternative Hypothesis (H_A): $H_A: \mu_1 \neq \mu_2$ (two-tailed test) that is the significant difference between the ICT test and HSTE result.

Significance Level (α)

The significance level is the probability of rejecting the null hypothesis when it is actually true, here selected α is 0.05 with 66 degree of freedom. The procedure is given below:

1. Calculate the increment $d_i = x_i - y_i$
2. Calculate the mean difference $\bar{d} = \frac{1}{n}\sum_{i=1}^{n} d_i$ and

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(d_i - \bar{d}\right)^2$$

3. The t-statistic is given by $t = \frac{\bar{d}}{\frac{s}{\sqrt{n}}}$

P value for the pair t-test is calculated for courses Linear Algebra & Differential Calculus (LADC), Applied Physics (AP), Applied Chemistry (AC), and Fundamentals of Electrical Engineering(FEE) with a 5 % level of significance. The result is shown in Table I

TABLE I
P - VALUE FOR THE PAIR T-TEST

Courses	P- value	Accept/ Reject
LADC	0.000895	Reject H_0
AP	0.017397	Reject H_0
AC	0.218584	Accept H_0
FEE	2.07×10^{-9}	Reject H_0

The definition of R-squared is fairly straightforward; it is the percentage of the response variable variation that is explained by a linear model.

R-squared = Explained variation / Total variation

R-squared is always between 0 and 100%. 0% indicates that the model explains none of the variability of the response data around its mean. 100% indicates that the model explains all the variability of the response data around its mean. In general, the higher the R-squared, the better the model fits your data (Rana & Singhal, 2015).

TABLE II
CORRELATION AND R^2 VALUE FOR COURSES

Course	Correlation between LMS test Score and HSTE Score	R^2	R^2 in percentage
LADC	0.3737	0.1397	14%
PHY	0.2107	0.044	4 %
CHEM	0.3300	0.1089	11%
FEE	0.3784	0.1366	14%

From table no.2, it is observed that in the evaluation of the relationship between Learning Management System (LMS) test scores and High Stake Theory Examination (HSTE) scores, the degree of correlation varies across different courses. For the course, Linear Algebra and Differential Calculus (LADC), the correlation coefficient between LMS test scores and HSTE scores is calculated to be 0.3737. This results in an R-squared value of 0.1397, or approximately 14%. The correlation coefficient, which ranges from -1 to +1, measures the strength and direction of the linear relationship between two variables. A positive value, such as 0.3737, indicates a positive relationship, meaning that as LMS test scores increase, HSTE scores tend to increase as well. The R-squared value, in this context, represents the proportion of variance in the HSTE scores that can be explained by the LMS test scores. Thus, for LADC, about 14% of the variability in HSTE scores can be explained by LMS test scores, indicating a moderate positive relationship between these two assessment methods.

For the course Applied Physics (AP), the correlation coefficient is much lower at 0.2107, which yields an R-squared value of 0.044, or 4%. This reflects a weak relationship, suggesting that only 4% of the variability in HSTE scores is explained by LMS test scores. A low R-squared value like this indicates that there is very little predictability between the LMS scores and the HSTE scores for this course. This means that factors other than LMS test scores are likely playing a much larger role in determining HSTE outcomes in AP.

The course Applied Chemistry (AC) shows a correlation coefficient of 0.3300, leading to an R-squared value of 0.1089, or approximately 11%. This signifies a moderate relationship, where 11% of the variability in HSTE scores can be attributed to LMS test scores. While this is slightly lower than LADC and FEE, it still suggests that LMS assessments have some predictive power in determining HSTE performance, though they do not account for the majority of the variance. For the course Fundamentals of Electrical Engineering (FEE), the correlation coefficient is 0.3784, which corresponds to an R-squared value of 0.1366, or 14%. This is similar to the relationship observed in LADC, suggesting that 14% of the variance in HSTE scores is explained by LMS test scores. This moderate positive relationship indicates that, like in LADC, students who perform well on LMS tests in FEE are likely to perform relatively well on the HSTE as well, though this is not always the case. When we consider the data across all these courses, it becomes evident that the strength of the relationship between LMS test scores and HSTE scores varies. LADC and FEE exhibit the strongest correlations, with both having 14% of the variance in HSTE scores explained by LMS test scores. This suggests that for these courses, LMS assessments might be a useful, though not perfect, predictor of HSTE performance. On the other hand, AP demonstrates the weakest correlation, with an R-squared value of just 4%. This low level of explained variance indicates that LMS test scores are not a reliable predictor of HSTE performance for AP, and other factors are likely more influential. Applied Chemistry (AC) falls in the middle, with an R-squared value of 11%, indicating a moderate correlation. The data suggest that while LMS test scores have some impact on HSTE performance, they do not explain the majority of the variance. The low to moderate R-squared values across all courses suggest that while there is some relationship between LMS test scores and HSTE scores, it is generally not strong enough to use LMS scores as a reliable predictor of HSTE outcomes. Figures 1 through 4 provide graphical representations of the relationship between LMS test scores and HSTE scores, including the R-squared values and regression lines for each course. These figures visually illustrate the degree of scatter in the data points and the slope of the regression lines, further emphasizing the relatively weak to moderate correlations observed. Given the generally low R-squared values, it is difficult to accurately predict HSTE results based solely on LMS test results. The weak correlation for AP, in particular, with an R-squared value of only 4%, highlights the challenges in using LMS assessments as a reliable indicator of HSTE performance for that course. This implies that LMS test scores might reflect different skills or knowledge areas than those tested by HSTE, or that students' performances vary significantly between these different types of assessments. Moreover, the overall low correlations across all courses suggest that while LMS tools offer valuable formative feedback and can help guide learning, they do not capture the full range of competencies or knowledge required to perform well on HSTE. Other factors, such as study habits, attendance, participation in class discussions, understanding of course materials, and perhaps even exam-taking strategies, might play more significant roles in influencing HSTE outcomes.

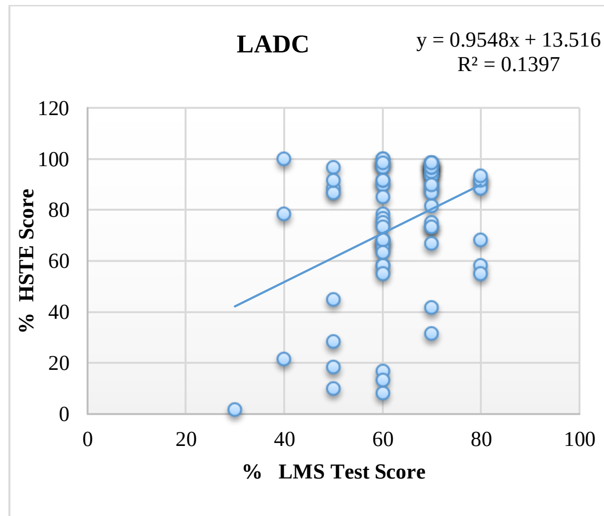

Fig.1. R^2value for the subject Linear Algebra and Differential Calculus

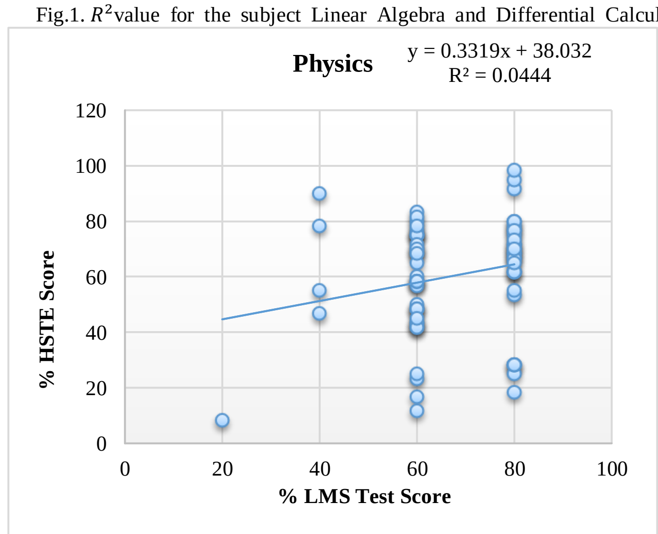

Fig.2. R^2value for the subject Applied Physics

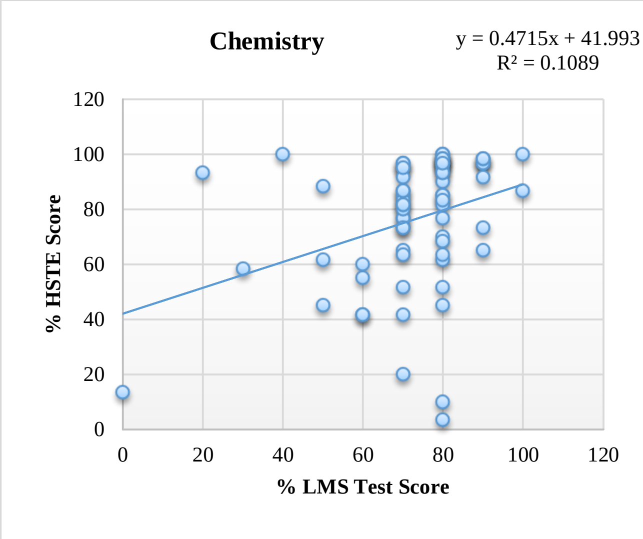

Fig.3. R^2value for the subject Applied Chemistry

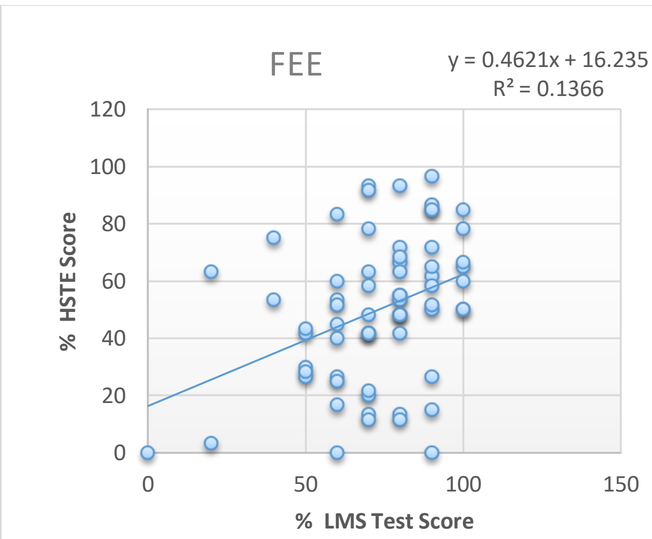

Fig.4. R^2value for the subject Fundamental of Electrical Engineering

A Chi-square test is an excellent choice to help us better understand and interpret the relationship between our two categorical variables. We start with the hypothesis that the features are independent. If we find that the value of χ^2 is less than the critical value from the table at a given significance level then we accept the hypothesis; otherwise, we reject it.

$\chi^2 = \sum \frac{(Oj - Ej)^2}{E}$, where O_j= Observed frequencies, Ej= Expected frequencies[8]

From Table 11, In the first assertion (χ^2**=0.2695<3.841,** $\alpha = 0.05$), eleventh (χ^2**=0.3475<3.841,** $\alpha = 0.05$) and twelfth (χ^2**=0.8855<3.841,** $\alpha = 0.05$), Therefore, opinions are not influenced by category. The results of this study reveal varying opinions among students and faculty regarding the effectiveness and impact of different assessment methods, particularly High Stake Theory Examinations (HSTE) and Information and Communication Technology (ICT) based assessments. The analysis is structured around several assertions, each supported by statistical measures (Chi-square values) and percentages that indicate the level of agreement or disagreement among respondents.

In the first assertion, the chi-square value (χ^2 = 0.2695) is less than the critical value of 3.841, indicating that opinions are not significantly influenced by category (student or faculty). This assertion reveals that 72% of students and 76% of faculty believe that HSTE is more successful in fostering competition among students. This suggests a general consensus across both groups about the competitive nature of HSTE. Similarly, in the eleventh assertion, the chi-square value (χ^2 = 0.3475) is also below 3.841, reinforcing that opinions remain independent of the respondent category. Here, 63% of students and 56% of faculty agree that HSTE examinations help improve students' Semester Grade Point Average (SGPA). The twelfth assertion, with a chi-square value of 0.8855 (again less than 3.841), further supports this finding; 61% of students and 72% of faculty recognize the benefits of HSTE approaches in enhancing SGPA. These results indicate that a majority in both groups see a positive correlation between HSTE and improved academic performance. Additional assertions also show no significant difference in opinions between students and faculty. For instance, in the second assertion (χ^2 = 2.0931), 59% of students and 76% of faculty agree that HSTE offers higher reliability than ICT-based assessments. Similarly, the third assertion (χ^2 = 3.7982) shows that 44% of students and 68% of faculty believe that HSTE methods yield more precise results. In the fifth assertion (χ^2 = 2.083), it is evident that 94% of students and 84% of faculty find ICT examinations to be less stressful for students, indicating a strong agreement across categories regarding the reduced anxiety associated with ICT assessments. The eighth assertion (χ^2 = 3.232) reveals that 46% of students and 68% of faculty feel HSTE examinations allocate equal credit to different topics and their respective marks. Finally, in the fourteenth assertion (χ^2 = 3.5757), 63% of students and 84% of faculty believe HSTE examinations could be more beneficial for the overall development of students. All these chi-square values are below the critical threshold of 3.841, indicating that opinions are not significantly influenced by whether the respondent is a student or faculty member.

However, there are also assertions where opinions do vary significantly between students and faculty. For example, in the fourth assertion, the chi-square value (χ^2 = 4.5224) exceeds 3.841, indicating that the opinion is dependent on the category of the respondent. In this case, 76% of students but only 52% of faculty agree that HSTE might make students less confident. This suggests a divergence in how students and faculty perceive the impact of HSTE on student confidence. The sixth assertion (χ^2 = 4.9960) further illustrates this divergence, with 76% of students and only 28% of faculty agreeing that ICT testing approaches are better for developing creativity and thinking skills. Here, students seem more supportive of ICT methods for fostering innovative skills compared to faculty.

Further divergence is noted in the seventh assertion, where the chi-square value (χ^2 = 13.7395) is significantly greater than 3.841, showing a substantial difference in opinion. In this instance, 72% of students but only 28% of faculty agree that assessments using ICT are useful for every subject area. This suggests a marked difference in how students and faculty view the versatility of ICT in assessments. The tenth assertion (χ^2 = 12.0336) also reveals a significant difference in perspectives, with 57% of students and a much higher 96% of faculty agreeing that HSTE examination modes reduce malpractices. This indicates that faculty members have a stronger belief in the integrity of HSTE assessments. Lastly, in the thirteenth assertion (χ^2 = 7.593), 50% of students and 84% of faculty believe that HSTE examinations positively affect the overall educational system. This again highlights a considerable gap in how each group perceives the broader impacts of HSTE.

APPENDICES

List of statements included in the Questionnaire

Sr. No.	**Questions**	**ICT**	**HSE**
1	Which strategy is likely to be the more successful in generating competition among students?		
2	Which testing approach offers the higher reliability?		
3	Which examination method yields more precise results??		
4	Students might become less confident in...		
5	Which type of examination is less stressful for students?		
6	What testing approaches are better for developing creativity and thinking skills?		
7	Which mode of assessment is useful for every subject area?		
8	Which mode of examination gives equal credit to topics and their marks?		
9	In which mode of examination questions are frequently refreshed?		
10	Which modes of examination reduce cheating?		
11	Which modes of examination help to improve the SGPA of students?		
12	What testing approaches are beneficial for enhancing students' SGPA?		
13	Which mode of examination affects the entire educational system more positively?		
14	Which mode of examination could be more helpful for the overall development of students?		

TABLE III
RESPONSES OF STUDENTS AND FACULTY FOR ALL STATEMENTS AND CALCULATED VALUES OF χ^2

Sr.No.	**Student Response**				**Faculty Response**				χ^2 with df 1, $\alpha = 0.05$
	ICT	**ICT Response in %**	**HSE**	**HSE Response in %**	**ICT**	**ICT Response in %**	**HSE**	**HSE Response in %**	
1	16	30	38	72	6	24	19	76	0.2695
2	22	41	32	59	6	24	19	76	2.0931
3	30	56	24	44	8	32	17	68	3.7982
4	13	24	41	76	12	48	13	52	4.5224
5	51	94	3	6	21	84	4	16	2.3083
6	36	67	18	33	10	40	15	60	4.9960
7	39	72	15	28	7	28	18	72	13.7395
8	29	54	25	46	8	32	17	68	3.2328
9	46	87	8	15	15	60	10	40	6.1610
10	23	43	31	57	1	4	24	96	12.0336
11	20	37	34	63	11	44	14	56	0.3475
12	21	39	33	61	7	28	18	72	0.8855
13	27	50	27	50	4	16	21	84	8.2854
14	20	37	34	63	4	16	21	84	3.5757

CONCLUSION

Learning Management Systems (LMS) are beneficial across various subject areas due to their flexibility, accessibility, and support for diverse learning styles. LMS platforms enable students to access resources, engage in interactive learning, and receive immediate feedback, which enhances the overall learning experience. However, examinations conducted through LMS are more prone to malpractices compared to traditional methods like Higher Semester Theory Examinations (HSTE). The online nature of LMS assessments makes it difficult to enforce strict examination protocols, leading to concerns about cheating and fairness. Both faculty and students often believe that the HSTE system positively impacts the educational process more than LMS test assessments. This belief stems from the controlled environment and standardized conditions of HSTE exams, which are considered more reliable for evaluating a student's knowledge and skills. Moreover, predicting HSTE scores based on LMS test results is challenging, as the competencies assessed by these methods can differ significantly.

REFERENCES

Al-Qdah, M., & Ababneh, I. (2017). Comparing Online and Paper Exams: Performances and Perceptions of Saudi Students. International Journal of Information and Education Technology, 7(2), 106–109. https://doi.org/10.18178/ijiet.2017.7.2.850

Bhamre, P., & Jagtap, A. (2021). A Case Study of Use of MKCL SuperCampus in Teaching of Basics of Electronics Engineering to Enhance Classroom Interactions. Journal of Engineering Education Transformations, 34(3), 56. https://doi.org/10.16920/jeet/2021/v34i3/152234

Bhamre, P., Vaidya, A., & Nikam, J. (2021). Systematic and Rigorous Use of Feedback to Enhance Learning in Engineering Classes. Journal of Engineering Education Transformations, 34(0), 356. https://doi.org/10.16920/jeet/2021/v34i0/157179

Bradley, V. M. (2020). Learning Management System (LMS) Use with Online Instruction. International Journal of Technology in Education, 4(1), 68. https://doi.org/10.46328/ijte.36

Mantoro, T., Utami, P., Dewanti, R., Yudhi, W. S. A., & Ayu, M. A. (2017). The Use of Learning Management System (LMS) for College Students to Become an Active Learner: Constructivism View. Advanced Science Letters, 23(2), 796–800. https://doi.org/10.1166/asl.2017.7552

Rana, R., & Singhal, R. (2015). Chi-square test and its application in hypothesis testing. Journal of the Practice of Cardiovascular Sciences, 1(1), 69. https://doi.org/10.4103/2395-5414.157577

Saikia, R. (2023). Use of ICT Tools in Open and Distance Learning Systems. RESEARCH REVIEW International Journal of Multidisciplinary, 8(12), 83–87. https://doi.org/10.31305/rrijm.2023.v08.n12.012