

Exploring and Evaluating the impact of Blended Learning Outcomes through LMS in Rural Higher Education

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ABSTRACT

This study explores and evaluates the impact of blended learning through Learning Management Systems (LMS) on the educational outcomes of undergraduate students from rural backgrounds in higher education institutions, specifically in the context of Andhra Pradesh. By utilizing pre-test, post-test, mid-term, and end-semester grades, our study incorporates statistical analyses of data collected from 214 undergraduate students over two consecutive semesters. The investigation highlights the efficacy of eLearning via LMS, demonstrating significant improvements in teaching and learning performance compared to traditional instructional methods. The research underscores the relevance of these findings for higher education institutions, particularly in developing regions, as they consider adopting digital technologies to enhance educational delivery. The study also highlights the flexibility and independent learning opportunities provided by blended learning approaches, with over 85% of surveyed students expressing positive feedback. This approach, combining asynchronous and synchronous learning activities, has shown to effectively support students' academic progress and potential, particularly in challenging circumstances such as the COVID-19 pandemic. Results indicate that tailored teaching strategies using LMS platforms, such as classroom teaching, peer learning activities, group-wise experimental activities, and adoption of LMS, can significantly improve learning outcomes.

KEYWORDS: Blended Learning, Learning Management Systems (LMS), Rural Education, Higher Education, eLearning.

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INTRODUCTION

The non-cancerous enlargeme advent of technology has transformed the landscape of higher education, offering unprecedented opportunities for innovative teaching and learning approaches. Blended learning, which combines traditional face-to-face instruction with online learning, has gained popularity in recent years due to its potential to enhance student engagement, motivation, and ultimately, learning outcomes. The integration of Learning Management Systems (LMS) has further fueled the adoption of blended learning, enabling educators [16][18] to create, manage, and track student learning experiences more effectively. Rural higher education institutions, in particular, stand to benefit from the implementation of blended learning through LMS, as they often face unique challenges related to resource constraints, limited access to quality educational resources, and geographical remoteness. Despite its potential, there is a need for systematic exploration and evaluation of the impact of blended learning outcomes through LMS in rural higher education settings.

Undoubtedly, information technology like Artificial Intelligence (AI) is changing the world around us [1]. The outbreak and spread of the COVID-19 virus in 2020 acted as a catalyst for the widespread application of technology in the field of education. Academic institutions around the world, including universities and colleges, have already embraced virtual learning and online courses. Information and Communication Technology (ICT) is extensively [17] [19] employed across diverse domains, including organizational operations, development of educational resources, the holistic instructional process, facilitation of learning engagements. The educational sphere aligns itself closely with technological progress, recognizing that technology-supported learning is impactful and enhances the overall educational journey. This deeper integration fosters new teaching strategies and promotes systemic change in the educational ecosystem primarily driven by technology. These modifications have not only granted teachers increased independence, but they have also enabled researchers and educators to offer students more personalized and diverse learning opportunities. Institutions of higher education have commenced the integration of technology-enhanced approaches to teaching and learning, such as Blended Learning (BL), into their particular pedagogical methods.

Blended learning (BL) combines traditional face-to-face teaching [20] with online methods, offering flexibility, cost-effectiveness, and improved academic performance, making it a valuable tool in post-COVID-19 education [2]. Educational

technology, particularly BL, aids under graduate learners by enhancing learning strategies and motivation, though challenges like refining teaching methodologies and conducting quizzes, lesson activity and peer learning activities and discipline-oriented surveys [3]. Furthermore, in higher education, a theoretical model highlights the impact of blended learning on student engagement, emphasizing the role of teachers' attitudes, preparedness, and learning motivation in improving learning outcomes. The ongoing and extensive integration of technology and education has raised greater expectations and complexities regarding the flexibility, interactivity, and convenience of learning approaches. This trend has prompted the introduction of numerous Learning Management Systems (LMSs) as supplementary teaching aids by higher education institutions and educational technology organizations. Consequently, this has expanded the array of options accessible to both educators and learners, enhancing the diversity and depth of available resources.

Blended learning, facilitated by Learning Management Systems (LMSs), enables the collection and analysis of instructional data. This data can accurately pinpoint areas where learners struggle and identify gaps in their knowledge, allowing for adjustments in content and delivery methods. This capability enables the dynamic customization of learning paths, creating a new instructional ecosystem that can adapt intelligently and automatically. By harnessing LMSs and the data they provide, educators can deliver personalized learning experiences tailored to individual learner preferences and needs. This dynamic and adaptive approach enhances the efficiency, effectiveness, and engagement of the learning process.

Furthermore, blended learning through LMSs facilitates ongoing tracking of learners' academic progress. This tracking helps educators identify when and how to intervene in the learning process [20] to provide timely support. By employing machine learning algorithms and data analysis strategies, educators can explore the underlying characteristics of educational components within the LMS. By identifying patterns in the data, they can develop frameworks that explain relevant relationships. This data-driven approach empowers educators to make informed decisions and adapt their instructional strategies to meet the specific needs and learning progress of each student, thereby enhancing the overall effectiveness and personalization of the learning experience. Blended learning, supported by LMSs, bridges the gap between traditional instruction and online learning, capitalizing on the strengths of both modalities to create more comprehensive learning experiences [5][17]. Educational innovation is not just about introducing more technology into more classrooms, but about changing teaching methods to equip students with the skills necessary to thrive and flourish in the fiercely competitive global economy. By embracing this shift towards personalized and adaptive learning, education can better meet the diverse needs of individual learners, nurturing their growth and development more effectively.

Effective teaching is at the heart of higher education, playing a crucial role in shaping the minds and futures of students. As the landscape of higher education continues to evolve, instructors are faced with the challenge of adapting their teaching methods to meet the diverse needs of their students, foster critical thinking and problem-solving skills, and prepare them for an increasingly complex and interconnected world. This requires a deep understanding of the various teaching methods illustrated in Table 1. These methods can be employed to create an engaging, inclusive, and supportive learning environment. From traditional lectures and seminars to online and blended learning, problem-based learning, and flipped classrooms, the options are numerous, and each has its own strengths and limitations. In this context, it is essential for educators to be aware of the different teaching methods available, their underlying philosophies, and the circumstances in which they are most effective, in order to make informed decisions about their teaching practice and provide their students with the best possible learning experience.

Table 1. Teaching Methodologies

S.No	Type of Teaching Method	S.No	Type of Teaching Method
1	Chalk & Talk	11	Brain Storming Sheet
2	PPT	12	Buzz groups
3	Visualization	13	Animated lectures
4	Co-operative learning	14	Pictorial session
5	Enquiry based instruction	15	Debate session
6	Differentiation	16	Quiz
7	Technology	17	OHP
8	Virtual lab	18	Professional development
9	NPTEL Video	19	Behavior management
10	Seminar	20	Web reference

This research focuses on 180 plus undergraduate students specializing in Information Technology at Shri Vishnu Engineering College for Women(Autonomous), Bhimavaram, Andhra Pradesh, during the academic year 2023-24. The students are grouped into three sections and are using a widely adopted Learning Management System (LMS) for blended learning across three different courses. The study collects structured data from various learning evaluation methods facilitated through the LMS, including quizzes, course activities, case-study based activities, peer-mentor evaluations, and group activities. The primary objective is to investigate the impact of blended learning on students' learning skills. The study aims to identify factors within these dimensions that correlate with academic improvement, thereby enhancing understanding of the benefits and challenges associated with LMS utilization in higher education. Insights gained from data analysis enable educators to make informed

decisions in subsequent pedagogical activities, allowing for tailored teaching approaches that meet the individual needs of students. This personalized approach supports students in achieving educational objectives and maximizing their academic potential throughout their learning journey.

This study aims to investigate the effectiveness of blended learning outcomes facilitated through LMS in rural higher education institutions, examining the impact on student learning outcomes, teacher professional development, and institutional capacity building. By exploring the complexities and nuances of blended learning in rural contexts, this research seeks to provide insights into the design and implementation of effective blended learning strategies that can improve the quality of education and strengthen the Overall development of rural communities. To ensure the effective implementation of blended learning outcomes through LMS in rural higher education, several best practices can be employed. These can include: (1) providing instructors with training and support, (2) ensuring timely technical support, (3) incorporating multimedia and interactive content, and (4) encouraging student participation and feedback [11]. Future research should focus on exploring the impact of blended learning on low-income and disadvantaged students, as well as investigating the role of mobile devices in facilitating blended learning in rural areas.

LITERATURE REVIEW

LMS have become an essential tool in facilitating blended learning, enabling instructors to design, deliver, and manage online courses. Research has shown that LMS can improve student outcomes, increase instructor efficiency, and enhance the learning experience [10]. In rural higher education, LMS can help bridge the gap between traditional classroom instruction and online learning, increasing access to quality education [11][17]. While blended learning has shown promise, several challenges and limitations exist. Rural areas often face infrastructure and resource constraints, including limited internet access, inadequate hardware, and insufficient technical support [12]. Additionally, instructors may require training to effectively design and deliver online courses using LMS [13]. Studies have shown that blended learning outcomes are generally positive, with students showing improved engagement, motivation, and academic achievement [15]. In rural higher education, blended learning has been found to increase student satisfaction, reduce dropout rates, and promote self-directed learning [11]. Another study found that blended learning environments facilitated through LMS improved student performance in mathematics and science courses[14].

Blended learning is an instructional approach widely used in many higher educational institutions and universities due to its demonstrated effectiveness in providing flexible, appropriate and continuous learning [6]. Blended learning is often understood as combining traditional classroom-based experiences with online learning opportunities. The adoption of blended learning environments in higher education has become a prominent feature of the 21st century [7] driven by rapid technological advances and the need to transform learning methods for modern students. Many studies in the literature have concluded that blended learning improves academic achievement. The combined use of blended learning and technology can accommodate multiple learning styles, increase student engagement [8], and support learning goals and values.

Today, more individualized and cooperative teaching and learning methods are being adopted alongside online learning and traditional face-to-face learning such as flex learning, self-blending learning, flipped classrooms and peer mentoring are widely followed methods. Some of these techniques are better than others in different aspects, and it is nearly impossible to produce one perfect, comprehensive best model [9].

METHODOLOGY

The primary purpose of this study is to investigate the impact of blended learning using LMS on the performance of teaching and learning in higher education. To adequately achieve the aim of this study, we have considered the undergraduate students who are in the third year of their Information Technology program. We have considered two semesters and the courses respectively: Machine Learning and Computer Networks, both theory and lab courses. The study is driven by the following research question: How effective is a Blended Learning through Learning Management System (LMS) in enhancing teaching and learning performance in higher education?

To thoroughly address this question, we have implemented blended learning through the LMS to assess students' understanding of the concepts. By designing courses within the LMS, we were able to compare the final outcomes, providing us with a clear insight into the overall effectiveness of eLearning through LMS in higher education. The study involves several specific steps, including creating courses in the LMS, defining course prerequisites, introducing the course, providing pre-class materials, conducting face-to-face lectures, and performing pre-test and post-test control experiments in the form of eLearning. It also includes quizzes, lesson activities, group activities, case-study-based activities, and traditional face-to-face group tutorials.

In our blended learning approach using the LMS (Moodle), the methodology involves several key phases illustrated in Figure 1 and Figure 2. Initially, the teacher creates a new course within the LMS, outlining the course objectives, prerequisites, and providing preview materials. To measure students' understanding, we employ quizzes or lesson activities within the LMS. Following this, we assess student preparedness for the course. Next, we prepare synchronous teaching and learning materials, including slides and handouts. Finally, the lecture session is conducted in class for the registered students, integrating both online and face-to-face elements to enhance the learning experience.

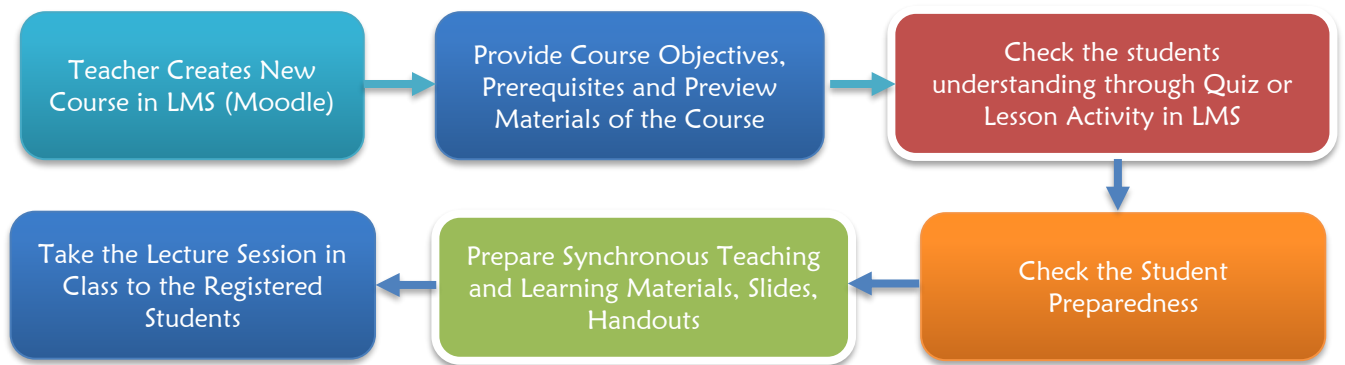


Figure 1. Blended Learning through Learning Management System – Course Instructor Perspective

From students' point of view, First, the students registered for the course on the LMS platform, where they accessed learning materials and course content. They then complete pre-class activities and tasks within the LMS. Should any doubts or clarifications arise, students were encouraged to contact the course instructor. Regular lecture hours were conducted, during which students attended classes and followed course instructions. Additionally, students actively participate in classroom discussions and responds to questionnaires, fostering engagement and interaction throughout the learning process.



Figure 2. Blended Learning through Learning Management System – Students Perspective

During the lecture hours, continuous assessments will be conducted for each unit. These assessments include submitting homework assignments, taking quizzes Figure 3 illustrated the quizzes, participating in case study-based peer evaluations, etc. Faculty will observe and evaluate students' understanding. Two mid-term tests will be conducted during the course, covering fifty percent of the syllabus. These tests will include both descriptive and objective-type questions. Based on the marks secured by the students, quick learners and those who need additional support will be identified.

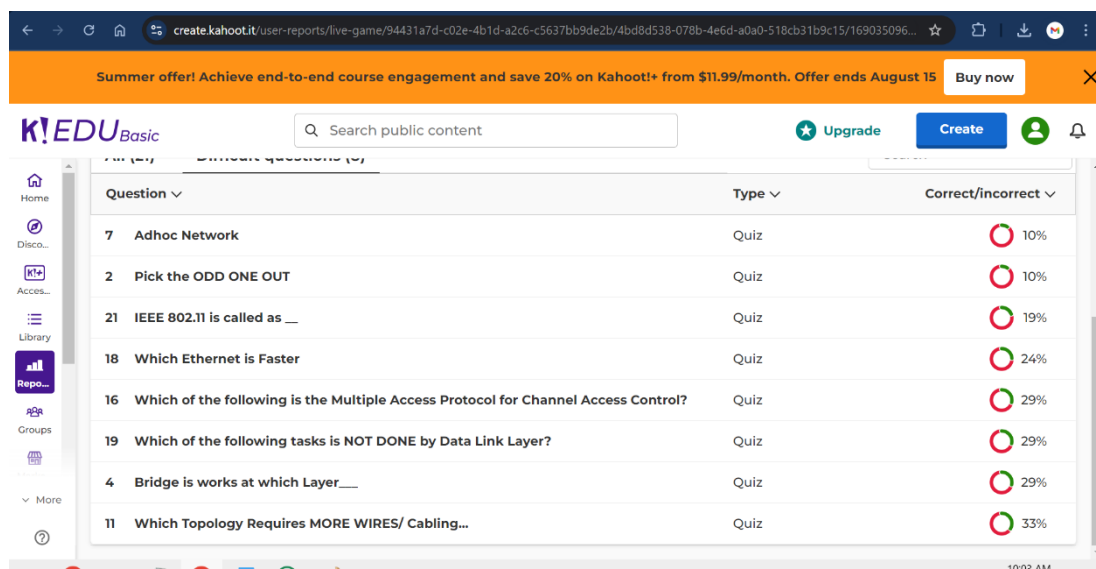


Figure 3. Continuous assessment Computer Networks quizzes on Kahoot platform

First name / Surname	State	Started on	Completed	Time taken	Grade/5.00	Q.1 /0.33	Q.2 /0.33	Q.3 /0.33	Q.4 /0.33
NAKKA PALLAVI Review attempt	Finished	21 September 2023 10:02 AM	21 September 2023 10:08 AM	6 mins 7 secs	4.67	✓ 0.33	✓ 0.33	✓ 0.33	✓ 0.33
NOUBATTULA BHAVYA SRI NAGA ANJANI DEVI Review attempt	Finished	21 September 2023 10:10 AM	21 September 2023 10:17 AM	6 mins 51 secs	5.00	✓ 0.33	✓ 0.33	✓ 0.33	✓ 0.33
KOPPARTHI BABY SRI PHANI ANISHA	Finished	21 September 2023 10:13	21 September 2023 10:17	4 mins 33	5.00	✓ 0.33	✓ 0.33	✓ 0.33	✓ 0.33

Figure 4. Continuous Assessment in Computer Networks course – Quizzes

Quick learners will be provided with advanced topics and content beyond the syllabus to further enhance their skills in the course. For students who are struggling, special attention will be given. This includes full-fledged discussions to understand the reasons behind their difficulties, conducting extra classes, and providing detailed course materials on important topics. The goal is to ensure that by the end of the course, these students are comfortable with the material, are prepared to advance to the next level, and are capable of achieving good marks in the upcoming examinations.

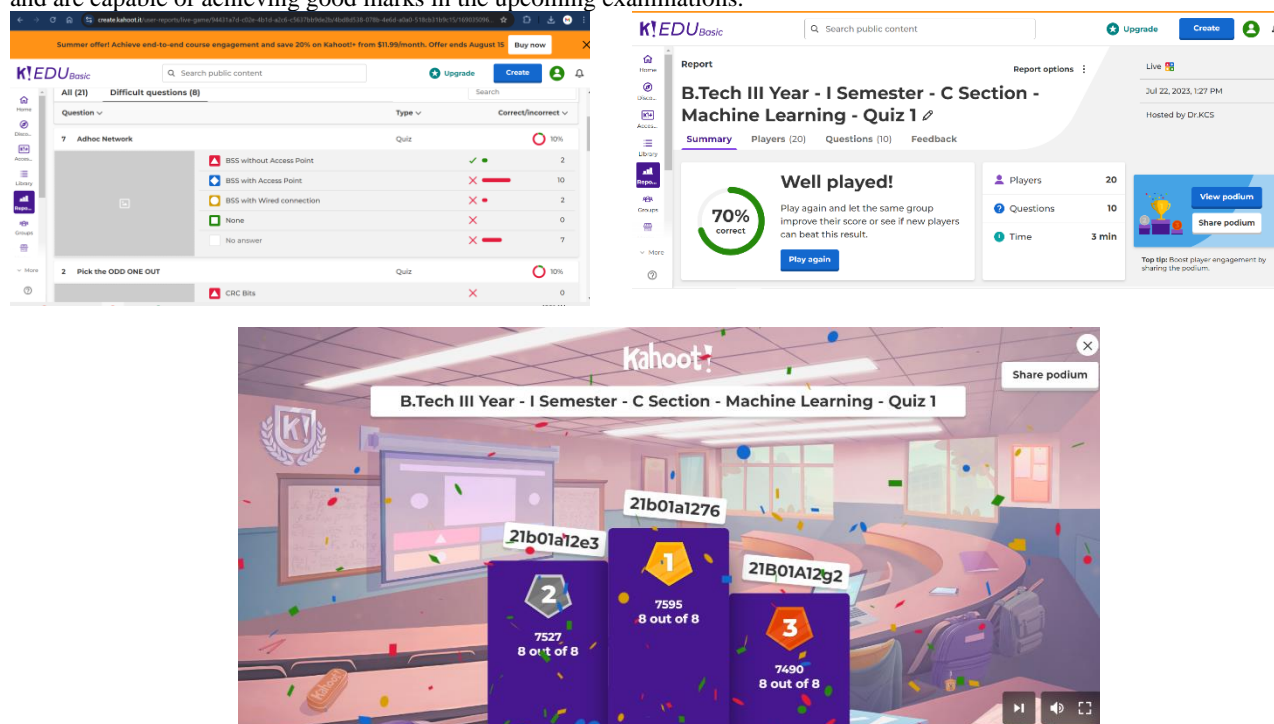


Figure 5. Quizzes on Computer Networks and Machine Learning courses – Kahoot platform

1. Analyzing the students' performance

Students will be evaluated through various continuous assessment methods such as case study-based activities, quizzes, peer-mentor evaluations, two mid-term tests, homework assignments, classroom seminar presentations, and a mini-project. These assessments are designed to help students enhance their skill sets, knowledge levels, and application-oriented thinking, particularly in relation to the mini-project and case study-based activities. The objective of these methods and strategies is to deepen students' understanding, improve their cognitive abilities, encourage innovative thinking, and help them achieve good overall grades in the End Semester examinations. For this research study, two undergraduate courses, "Computer Networks" and "Machine Learning," were considered. The continuous evaluation results were compared with the final grades. Our observations indicate that this approach leads to improved marks and satisfactory outcomes. Figure 7 illustrates the overall number of students achieving grades in quizzes

Case Study Based Activities, Quizzes,
Peer-Mentor Evaluations, Mid Term Tests

Analyse the students' Performance
Before and After the classes

Figure 6. Post Activities after taking the lecture hours

Overall number of students achieving grade ranges

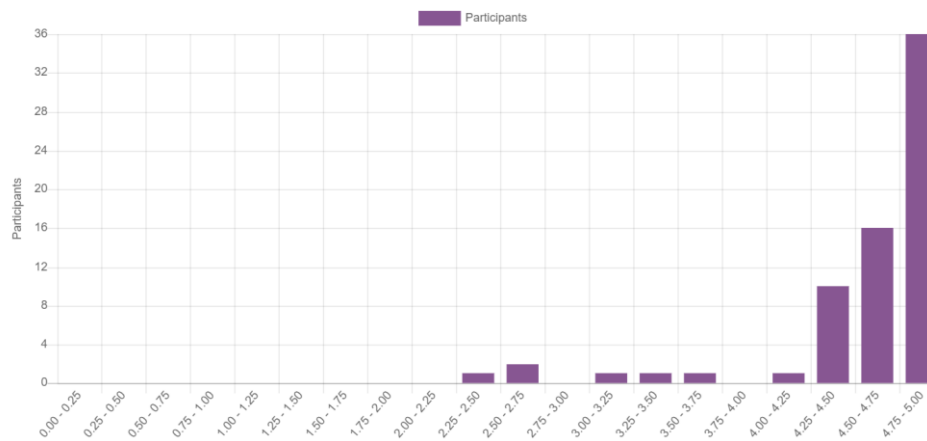


Figure 7. Overall number of students achieving grades in quizzes

Table 3. End Semester Results in Computer Networks and Machine Learning Course

Grade	Computer Networks Course	Machine Learning Course
A	59	50
A+	5	4
B	93	92
C	47	53
D	8	14
F	2	1
Total Students	214	214

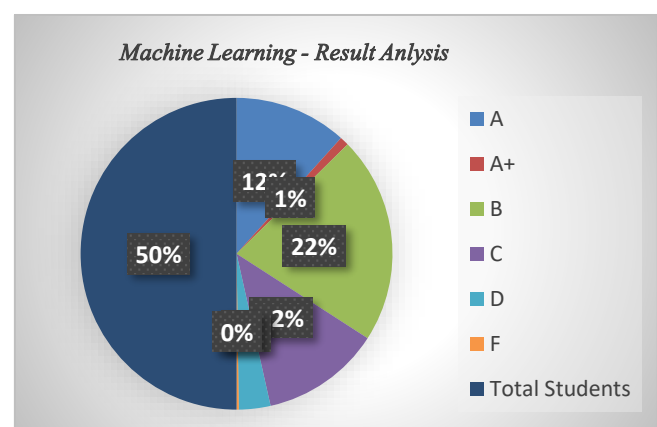
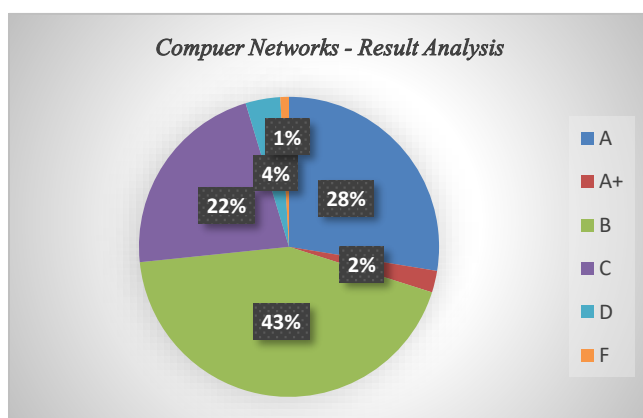


Figure 8. End Semester Grades in Computer Networks and Machine Learning courses

The analysis of the grade distribution for the "Computer Networks" and "Machine Learning" courses illustrated in Figure 8, it reveals several key insights. In both courses, the majority of students achieved a grade of B, with 93 students in "Computer Networks" and 92 in "Machine Learning," indicating a generally strong but not exceptional performance across the cohort. A significant number of students received a C grade—47 in "Computer Networks" and 53 in "Machine Learning"—suggesting some challenges in fully grasping the material. Grades of A were earned by 59 students in "Computer Networks" and 50 in "Machine Learning," with only a small percentage reaching the highest grade of A+ (5 and 4 students, respectively). A smaller portion of

students received lower grades, with D grades being more common in "Machine Learning" (14 students) compared to "Computer Networks" (8 students), and very few students failed the courses (2 in "Computer Networks" and 1 in "Machine Learning"). Overall, the grade distributions suggest that while most students performed adequately

CONCLUSION

The study explores the impact of Blended Learning through a Learning Management System on teaching and learning performance in higher education. Our findings indicate that both traditional face-to-face instruction and Blended Learning via LMS contribute positively to educational outcomes. However, the adoption of blended learning using LMS demonstrates a more significant improvement in teaching and learning performance compared to traditional face-to-face methods. These results offer valuable insights for higher education educators, highlighting the transformative potential of eLearning through LMS in enhancing educational practices. Despite these positive outcomes, the study is limited by its scope, as it only examines two courses within a single program Information Technology. For more comprehensive insights, future research should involve a larger sample size across multiple programs and diverse groups. Expanding the sample will allow for a broader analysis and facilitate the generalization of findings to a wider educational context. This approach will provide a more robust understanding of the efficacy of blended learning using LMS in various educational settings.

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