



LEARNING MANAGEMENT SYSTEM ADOPTION, PRACTICES, AND BARRIERS IN EDUCATIONAL AND TRAINING INSTITUTIONS IN TEGAL INDONESIA

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Abstrak

Penelitian ini menganalisis penerapan Learning Management System (LMS) di lembaga pendidikan dan pelatihan di Kota Tegal melalui desain mixed-methods yang menggabungkan survei deskriptif kuantitatif dan wawancara kualitatif terhadap 10 lembaga yang dipilih secara purposif. Pengumpulan data dilakukan menggunakan kuesioner terstruktur dan wawancara mendalam dengan pimpinan lembaga, koordinator TI, serta tenaga pendidik. Hasil penelitian menunjukkan bahwa 80% lembaga (8 dari 10) telah menerapkan LMS; di antara kedelapan lembaga pengadopsi tersebut, Google Classroom (62,5%) dan Moodle (50%) menjadi platform yang paling banyak digunakan. Fitur yang paling sering dimanfaatkan oleh lembaga pengadopsi meliputi distribusi materi pembelajaran (100%), penugasan (87,5%), dan ujian daring (75%), sementara tantangan yang paling banyak dilaporkan mencakup infrastruktur internet yang belum memadai (87,5%), keterbatasan kompetensi digital sumber daya manusia (75%), dan biaya operasional (62,5%). Temuan kualitatif menunjukkan bahwa manfaat yang dirasakan – seperti fleksibilitas pembelajaran (100%) dan efisiensi administrasi (87,5%) – merupakan persepsi pengguna dan belum tentu mencerminkan hasil belajar yang terukur; wawancara juga mengungkap bahwa lembaga yang mengadopsi LMS secara terburu-buru pada masa pandemi cenderung hanya mencapai tingkat penggunaan moderat, berbeda dengan lembaga yang telah merintis transformasi digital sebelum pandemi. Penelitian ini merekomendasikan peningkatan infrastruktur, pelatihan berkelanjutan bagi tenaga pendidik, serta kolaborasi antarlembaga untuk mengoptimalkan penerapan LMS, dengan catatan bahwa temuan ini bersifat kontekstual untuk Kota Tegal dan generalisasinya ke wilayah lain masih terbatas.

Kata Kunci: learning management system, adopsi teknologi, kesenjangan digital, kompetensi digital guru, Indonesia, Kota Tegal

Abstract

Although Learning Management Systems (LMS) are increasingly central to digital education, empirical evidence on their implementation in medium-sized Indonesian cities remains limited. This study addresses that gap using a mixed-methods design combining a descriptive quantitative survey and qualitative interviews across 10 purposively sampled educational and training institutions in Tegal City. Data collection involved structured questionnaires and in-depth interviews with institutional heads, IT coordinators, and educators. Findings indicate that 80% of institutions (8 of 10) have adopted LMS; among

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these eight adopters, Google Classroom (62.5%) and Moodle (50%) are the predominant platforms, and the most frequently utilized features are learning material distribution (100%), assignments (87.5%), and online examinations (75%). Key challenges reported by adopters include inadequate internet infrastructure (87.5%), limited digital competence among human resources (75%), and operational costs (62.5%). Qualitative findings indicate that reported benefits—learning flexibility (100%) and administrative efficiency (87.5%) among them—reflect user perceptions rather than measured learning outcomes, and that institutions which adopted LMS hastily during the pandemic generally achieved only moderate use compared with those that began digital transformation earlier. The study recommends infrastructure enhancement, ongoing educator training, and inter-institutional collaboration to optimize LMS implementation, while noting that these findings are contextual to Tegal City and generalizable only with caution.

Kata Kunci: Learning Management Systems, Technology Adoption, Digital Divide, Teacher Digital Competence, Indonesia, Tegal City

INTRODUCTION

Digital transformation in the education sector is now unavoidable in the context of the Industrial Revolution 4.0 and Society 5.0. Schwab (2016) asserts that the digital revolution fundamentally alters how individuals live, work, and learn. The COVID-19 pandemic, which began in early 2020, further accelerated technology adoption in education, compelling institutions to transition to distance learning (Dhawan, 2020). Learning Management Systems (LMS) have consequently emerged as key technological solutions for the systematic and structured management of digital learning. LMS is a software application designed to plan, implement, and assess specific learning processes (Ellis, 2009). This system provides an integrated platform for educators to deliver learning content, monitor student participation, and assess their performance. For students, LMS offers flexible access to learning materials, enables interaction with educators and peers, and provides a more personalized learning experience (Watson & Watson, 2007).

Globally, the LMS market has experienced exponential growth. According to a MarketsandMarkets (2021) report, the global LMS market is projected to grow from USD 13.4 billion in 2021 to USD 25.7 billion in 2026, with an annual growth rate (CAGR) of 14.2%. In Indonesia, LMS adoption also shows a positive trend. Data from the Ministry of Education, Culture, Research, and Technology (2021) indicates that during the pandemic, more than 60% of schools in Indonesia used digital learning platforms. However, LMS implementation in Indonesia faces various challenges. Research by Adnan and Anwar (2020) reveals that limited internet infrastructure, technology access gaps, and unpreparedness of human resources are the main obstacles in online learning in developing countries. This aligns with findings by Mailizar et al. (2020) showing that



teachers in Indonesia face technical, pedagogical, and psychological constraints in implementing digital learning.

Tegal City, as one of the cities in Central Java Province, has various educational and training institutions serving formal and non-formal education needs. With a population of approximately 250,000 and a strategic position as a port and trading city, Tegal City has a fairly developed educational dynamic. Data from the Tegal City Education Office (2023) records 156 educational units consisting of elementary schools, junior high schools, senior high schools, vocational schools, and various course and training institutions. Although the Tegal City Government has launched a Smart City program that includes digital education aspects, empirical information regarding the extent to which educational and training institutions in Tegal City have adopted LMS technology is still very limited. There has been no comprehensive research mapping the actual conditions of LMS implementation at the local level. Existing studies of LMS adoption in Indonesia, reviewed in the following section, concentrate on large cities or single institutions and so cannot account for the resource constraints and heterogeneous institutional types characteristic of a medium-sized city such as Tegal; national- and provincial-level figures likewise obscure this local variation, and this data is very important for policy making and technology-based education development strategies.

LMS implementation in regions faces different challenges compared to large cities. Limitations in information technology infrastructure, human resource readiness, and budget constraints often become obstacles (Al-Fraihat et al., 2020). On the other hand, the need for flexible and quality learning remains a demand that must be met. Rogers (2003) in the diffusion of innovation theory explains that the adoption of new technology is influenced by various factors including the characteristics of the innovation itself, adopter characteristics, and socio-economic context. Therefore, this research becomes important and urgent to conduct. By understanding the actual conditions of LMS implementation at the local level, stakeholders can design strategies that are more contextual, realistic, and sustainable. This research can also provide insights for other cities with similar characteristics, as well as contribute to the body of knowledge about educational technology implementation in developing countries. The study deliberately examines a heterogeneous set of institutions—schools, vocational institutions, a higher education branch campus, and training providers—because Tegal City's digital education landscape spans exactly this range of institution types, and policy responses formulated from a single sector would not reflect that reality. The research is explicitly descriptive in intent: it aims to map current adoption, practices, and barriers rather than to test or extend theoretical models of technology adoption, although the discussion draws on existing theory to interpret the patterns observed.



Based on the background above, this research formulates several research questions as follows: (1) What is the level of LMS adoption in educational and training institutions in Tegal City? (2) What LMS platforms are used by educational and training institutions in Tegal City? (3) What LMS features are most utilized by institutions? (4) What are the challenges faced in LMS implementation? (5) What are the perceived benefits of LMS implementation?

LITERATURE REVIEW

Learning Management System (LMS) is defined as a software application or web-based technology used to plan, implement, and evaluate specific learning processes (Ellis, 2009). According to Watson and Watson (2007), LMS is an integrated system that manages all aspects of learning, including course catalogs, scheduling, registration, material delivery, assessment, and tracking student progress. LMS provides various important functions in digital learning. First, LMS functions as a learning content repository that allows educators to upload, organize, and distribute materials in various formats such as text, video, audio, and interactive multimedia. Second, LMS provides tools for communication and collaboration, such as discussion forums, chat, and video conferencing. Third, LMS has assessment features that allow the creation of quizzes, exams, and assignments with automatic or manual grading systems. Fourth, LMS provides tracking and reporting features that enable monitoring of learner activities and progress (Alias & Zainuddin, 2005).

In the pedagogical context, LMS supports various learning approaches. Garrison and Kanuka (2004) suggest that LMS facilitates blended learning that combines face-to-face learning with online learning. Moore (1989) in distance education theory emphasizes that LMS can reduce transactional distance through appropriate dialogue and structure, even though learners and teachers are physically separated. LMS platforms can be categorized into several types based on licensing models and deployment. Based on licensing models, LMS is divided into open-source and proprietary. Open-source LMS such as Moodle, Canvas, and Sakai provide freedom for institutions to download, modify, and distribute their source code without licensing fees (Cavus, 2010). Conversely, proprietary LMS such as Blackboard, Adobe Captivate, and Schoology require license payment but generally provide more comprehensive technical support (Lonn & Teasley, 2009).

Based on deployment, LMS can be cloud-based (SaaS - Software as a Service) or self-hosted. Cloud-based LMS such as Google Classroom, Schoology, and Canvas Cloud are managed by vendors and accessed through the internet, reducing the institution's burden in terms of server infrastructure and maintenance (Al-Busaidi & Al-Shihi, 2010).



Self-hosted LMS requires institutions to install and manage the system on their own servers, providing full control but requiring technical expertise and infrastructure costs (Machado & Tao, 2007). Moodle is one of the most popular open-source LMS in the world. Developed by Martin Dougiamas in 2002, Moodle has been used by millions of users in more than 200 countries (Dougiamas & Taylor, 2003). Google Classroom, launched in 2014, became popular due to its integration with the Google Workspace ecosystem and ease of use (Iftakhar, 2016).

LMS implementation in educational institutions is a complex process involving various aspects. According to Rogers (2003) in Diffusion of Innovation Theory, adoption of new technology goes through several stages: knowledge, persuasion, decision, implementation, and confirmation. Each stage requires different strategies to ensure successful adoption. Davis (1989) through the Technology Acceptance Model (TAM) explains that user acceptance of technology is influenced by two main factors: perceived usefulness and perceived ease of use. In the context of LMS, if educators and students consider LMS beneficial and easy to use, they will be more likely to adopt it (Park, 2009).

DeLone and McLean (2003) in the Information Systems Success Model identified six dimensions of information system success: system quality, information quality, service quality, use, user satisfaction, and net benefits. This model has been adapted to measure LMS implementation success in various studies (Cidral et al., 2018). Various studies identify challenges in LMS implementation. Muilenburg and Berge (2005) categorize barriers in e-learning into eight categories: administrative issues, social interaction, academic skills, technical skills, learner motivation, time and support for studies, cost and access to internet, and technical problems.

In Indonesia, research by Rhahardjo and Petrus (2020) found that the main challenges of LMS implementation in higher education include limited technology infrastructure, lack of digital competence among lecturers and students, resistance to change, and lack of institutional support. Meanwhile, a study by Handayanto et al. (2021) on secondary schools found that limited internet access and teacher unpreparedness were the main obstacles. Al-Fraihat et al. (2020) in their systematic review identified factors affecting e-learning success in developing countries, including system quality, information quality, service quality, user competence, and organizational support. Contextual factors such as culture, infrastructure, and policy also play important roles.

Effective LMS implementation provides various benefits for educational institutions. Brown and Green (2020) identify the main benefits of LMS including: improved learning accessibility, flexibility of time and place, administrative efficiency, learning personalization, and increased student engagement. Research by Naveh et al. (2010) shows that LMS use increases interaction between teachers and students and



among students. LMS provides various communication channels that facilitate both asynchronous and synchronous discussions, allowing quieter students to participate actively in online discussions. From an administrative perspective, Lonn and Teasley (2009) found that LMS increases efficiency in managing course materials, grading, and tracking learning progress. Automation of administrative processes frees up teachers' time to focus on pedagogical aspects of learning.

In terms of learning outcomes, a meta-analysis by Means et al. (2013) shows that learning using technology, including LMS, can produce learning outcomes equal to or even better than conventional learning, especially when combined in a blended learning approach. Several studies have been conducted on LMS implementation in Indonesia. Aminoto and Pathoni (2014) studied the effect of Schoology-based e-learning media on student learning activity and outcomes and found a significant increase in both. Yazdi (2012) explored e-learning in the context of higher education in Indonesia and found that although LMS potential is very large, its implementation is still constrained by infrastructure and HR readiness. Research by Harsasi (2015) at Universitas Terbuka analyzed factors affecting student satisfaction with LMS and found that system quality, information quality, and service quality significantly affect user satisfaction. School leadership support and sustained teacher training are more broadly recognized as key factors for successful LMS implementation (Fullan, 2007), a pattern consistent with the local findings reported below. However, these studies were generally conducted in large cities or specific institutions. Research on LMS implementation in medium-sized cities like Tegal City is still limited, whereas the local context has unique characteristics and challenges that need to be understood for developing appropriate implementation strategies.

RESEARCH METHODS

This research employs a descriptive survey approach with mixed methods (quantitative and qualitative) to investigate LMS implementation in educational and training institutions in Tegal City. The study was conducted during September-October 2024, involving 10 institutions selected through purposive sampling based on the following criteria: actively operating in Tegal City, having a minimum of 50 active students, having operated for at least 2 years, and willing to participate. The sample consists of 3 senior high schools (public and private), 2 vocational high schools, 2 job training institutions, 1 higher education branch campus, and 2 professional course institutions, totaling 3,280 students and 270 educators (Creswell, 2014). Data Collection: Two main instruments were utilized in this research. First, a structured questionnaire adapted from Al-Busaidi and Al-Shihi (2010) and Cidral et al. (2018) covering six sections:

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respondent and institution profile, LMS adoption level, platforms and features used, infrastructure and technical support, implementation challenges, and perceived benefits. The questionnaire combined closed questions (Likert scale 1-5, multiple choice) and open questions, validated through expert judgment by two educational technology experts and piloted to 3 external institutions.

Questionnaires were distributed to 80 respondents across three categories: institutional heads (n=10), IT coordinators (n=10), and educators/instructors (n=60), achieving a 95% return rate (76 questionnaires returned, distributed across the 10 institutions in proportion to their staff size). Second, semi-structured interviews were conducted primarily with institutional heads or IT coordinators from each institution, supplemented at several institutions by interviews with educators directly involved in day-to-day LMS use, whose accounts are the source of the teacher quotations reported in the Results section, lasting 45-60 minutes and recorded with permission, covering topics such as LMS adoption process, implementation strategies, challenges and solutions, and future development plans. Additionally, documentation observation was performed on LMS platforms used and related documents including usage guides, statistical data, and digital learning policies.

Data Analysis: Quantitative data from questionnaires were analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation) with Microsoft Excel and SPSS. Qualitative data from interviews and open questions underwent content analysis involving transcription, data coding based on emerging themes, categorization and pattern identification, and interpretation triangulated with quantitative findings. To ensure research quality, several measures were implemented: content validity (instruments based on relevant theory and literature), face validity (expert review), data triangulation (multiple data sources), Cronbach's alpha reliability of 0.87 for Likert scales, and inter-rater reliability of 89% for qualitative coding by two independent coders, calculated as percentage agreement on theme assignment across a sample of transcripts, with disagreements resolved through discussion until consensus was reached. The research adhered to ethical principles including informed consent, confidentiality of institution and respondent identities, voluntary participation, and the right to withdraw at any time, and was conducted under institutional research ethics clearance obtained prior to data collection.

RESULTS AND DISCUSSION

1. Results

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Figures and tables must be introduced before they are presented. Generally, the discussion of the contents will follow the figure or table; however, the discussion may also precede the figure or table, depending on where best to position the figure or table.

Qualitative Findings

The qualitative data from in-depth interviews with institutional heads, IT coordinators, and educators provide rich contextual understanding of the quantitative patterns, organized around the five research questions that guide this study.

LMS Adoption Levels: Institutional Journeys and Motivations

Interview results reveal that the 80% adoption rate masks diverse implementation experiences and motivations, with institutions following distinct pathways based on timing and strategic vision. Two institutions had established digital learning visions before the pandemic, viewing LMS as strategic modernization rather than emergency response. A principal from a private senior high school explained: *"We started our digital transformation journey in 2018. When the pandemic hit, we were already familiar with the platform, so the transition was relatively smooth. Our teachers had basic training, and students were already comfortable with online submissions."* These early adopters achieved intensive use (>70% activities) and developed organizational capacity that proved invaluable during crisis. Four institutions implemented LMS in 2020 under crisis conditions, representing forced rather than planned adoption. A vocational school IT coordinator shared: *"The pandemic forced us to go online overnight. It was chaotic at first. Teachers were panicking, students were confused, and we didn't have a proper system. We chose Google Classroom because it was the quickest to deploy, but it took months before everyone was comfortable using it."* Despite earlier start dates than late adopters, these institutions often achieved only moderate integration (30-70% activities) due to traumatic emergency implementation creating inadequate foundations.

Two institutions adopted LMS post-2020, motivated by competitive pressure and observing peers' experiences. A training institution director explained: *"We waited to see how others managed. We learned from their mistakes and chose features that fit our needs rather than trying to implement everything."* These late adopters took cautious, selective approaches, and interview accounts suggest at least one remained at a minimal use level (<30% activities); because this qualitative sub-sample does not map one-to-one onto the quantitative intensity bands reported below (37.5% intensive, 50% moderate, 12.5% minimal, of the eight adopters), this account should be read as illustrative rather than as a direct breakdown of the survey figures, while avoiding some pitfalls of rushed adoption.

Platform Selection Rationales: Beyond Cost Considerations



While quantitative data shows Google Classroom (62.5%) and Moodle (50%) dominating, qualitative interviews reveal complex decision-making beyond simple cost calculations. Five institutions chose Google Classroom, but for varied reasons. A school IT coordinator explained the primary appeal: *"Google Classroom was the path of least resistance. Teachers and students already had Gmail accounts. No new logins, no new accounts to manage. It just worked immediately."* This "ecosystem advantage" proved decisive—integration with Google Docs, Drive, and Meet created seamless workflows. A teacher added: *"Students can collaborate on Google Docs directly from Classroom, submit work from Drive, join meetings with one click. It's all connected."* However, some Google Classroom users acknowledged limitations. A higher education lecturer noted: *"Google Classroom is great for basic course management but limited for assessment. No question banks, limited quiz types, weak analytics. For simple courses it's fine, but power users quickly hit ceiling."* This platform proved ideal for institutions prioritizing quick deployment and ease of use over advanced features.

Feature Utilization Patterns: Understanding the Basic-to-Advanced Gap

The quantitative finding that basic features (87.5% average) vastly exceed advanced feature use (16.7% average) is illuminated by qualitative explanations of why institutions underutilize powerful capabilities. Every institution using LMS emphasized content delivery as primary function. A teacher explained: *"The first benefit we saw was organization. Instead of paper handouts that get lost, students access everything in one place. That alone justified the platform."* The universality reflects that content distribution requires minimal skill while providing immediate value—low barrier, high reward. Most institutions successfully adopted digital assignment submission. A mathematics teacher appreciated: *"No more collecting 150 papers, organizing by class, tracking who submitted late. Everything's timestamped, organized automatically, accessible anywhere. It transformed my workflow."* However, one institution's struggle revealed necessary prerequisites. A teacher at a peripheral school noted: *"We tried digital submissions but many students don't have computers at home, only phones. Typing long essays on phones is impractical. We reverted to paper for major assignments."* This illustrates that feature adoption depends on student device access.

Implementation Challenges: Lived Experiences Behind the Statistics

While quantitative data identifies challenge prevalence, qualitative accounts reveal how these obstacles manifest in daily practice and institutional strategies for coping. A school principal from peripheral Tegal vividly described bandwidth limitations: *"When all students access LMS simultaneously, the internet connection becomes very slow. Especially when some open learning videos, the system immediately overloads. We have*



upgraded the bandwidth but it's still not enough. During exams, we sometimes have to schedule students in shifts to avoid network congestion." This account reveals infrastructure not as minor inconvenience but fundamental constraint reshaping pedagogy—synchronous activities become impossible, multimedia content problematic, assessment logistics complex.

Institutions developed creative workarounds. Temporal strategies included staggering access times and prioritizing asynchronous activities. A teacher explained: *"I learned to schedule video lessons for evenings or weekends when fewer people are online. It's not ideal pedagogically, but it's the only way to ensure students can actually watch them."* Content adaptation involved creating lower-resolution media and text alternatives. An instructor noted: *"We create PDF versions of everything. Students with poor internet download them once and study offline. It's less engaging than interactive content, but at least it's accessible."* Partnership solutions proved most innovative. A vocational school *"partnered with a local internet cafe to provide access points for students without adequate home internet. We negotiated bulk rates for our students."* However, workarounds carry costs. A principal lamented: *"We're spending so much time working around infrastructure problems. This energy should go into improving teaching, not just making basic internet access possible."* Infrastructure emerges not merely as technical problem but systemic barrier consuming institutional energy and limiting pedagogical possibilities.

Perceived Benefits: Tangible Value Despite Persistent Challenges

Despite substantial obstacles, institutions reported significant benefits that justify continued investment, though with important caveats about equity and distribution. Every LMS-using institution emphasized flexibility as transformative. A higher education lecturer explained: *"LMS gives students the freedom to learn according to their time. Students who work or have other commitments are greatly helped. They can access materials at night or on weekends."* This flexibility proved valuable across contexts—accommodating working students, enabling makeup work for absences, supporting self-paced learning, and providing continuity during disruptions.

A teacher elaborated flexibility's pedagogical value: *"Some students need to review concepts multiple times. In traditional classroom, once lecture ends, it's gone. With recorded lessons and materials always available, students learn at their own pace. Fast learners move ahead, struggling students take extra time—both are served better."* However, flexibility's benefits distributed unevenly. An instructor noted: *"Flexibility is wonderful for students with devices, internet, and quiet study spaces at home. For students sharing one family smartphone, with unstable internet, in crowded homes without privacy—flexibility doesn't help much. They still*



need structured in-person time." This revealed that celebrated benefits may inadvertently favor privileged students.

Quantitative Findings

From the 10 institutions sampled in the research, the following profile was obtained. Three institutions are senior high schools with a total of 1,250 students, two vocational schools with 890 students, two job training institutions with 340 participants, one higher education campus with 520 students, and two professional course institutions with 280 participants. The total number of students from all institutions reaches 3,280 people.

Level of LMS Adoption

Survey results show that of the 10 institutions surveyed, 8 institutions (80%) have implemented LMS in their learning processes. Two institutions that have not implemented LMS are one job training institution still in the planning stage, and one course institution that states it still uses conventional methods considering participant characteristics more comfortable with face-to-face learning.

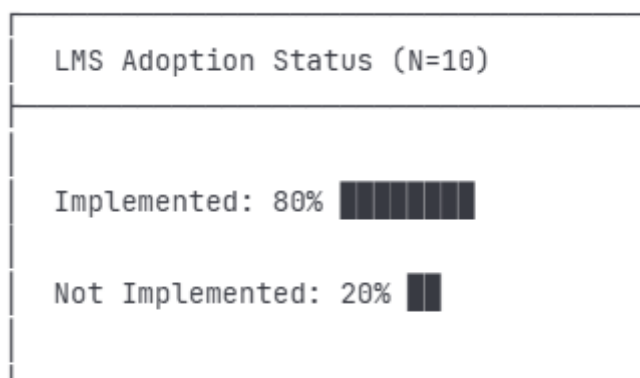


Figure 1. Level of LMS Adoption

Figure 1 shows a high adoption rate (80%) among surveyed institutions, suggesting strong awareness of digital learning importance in Tegal City. The 20% non-adoption represents institutions in planning stages or with specific contextual constraints rather than complete rejection of LMS.

LMS Platforms Used

The survey identified various LMS platforms used by institutions in Tegal City. Some institutions use more than one platform to meet different needs.



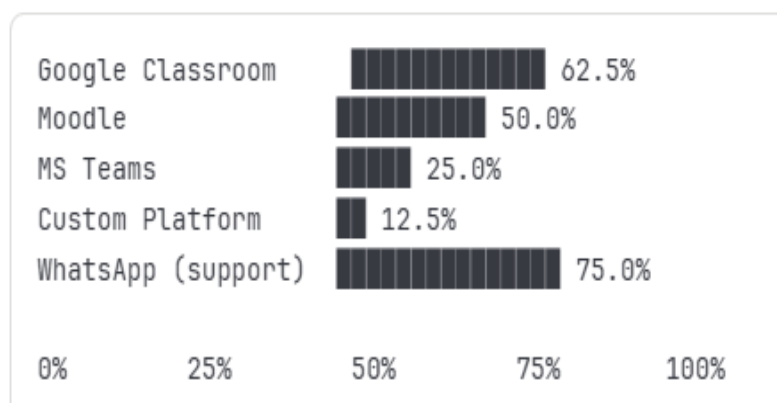


Figure 2. LMS Platforms Used

Figure 2 illustrates the clear preference for accessible, no-cost platforms (Google Classroom and Moodle), with WhatsApp serving as an unexpected but critical supplementary communication tool. The minimal use of custom platforms (12.5%) suggests limited technical capacity for bespoke development. Google Classroom became the most popular platform (5 of 8 adopters, 62.5%), chosen primarily for its ease of accessibility, user-friendly interface, zero cost for educational institutions, and seamless integration with Google Workspace. Moodle was preferred by institutions seeking more comprehensive features and customization capabilities (4 of 8 adopters, 50%). An interesting finding is the widespread use of WhatsApp (6 of 8 adopters, 75%) as a complement to formal LMS for quick communication and informal discussions.

LMS Feature Utilization

Analysis of LMS feature utilization shows a clear pattern where basic features are more widely utilized than advanced features.



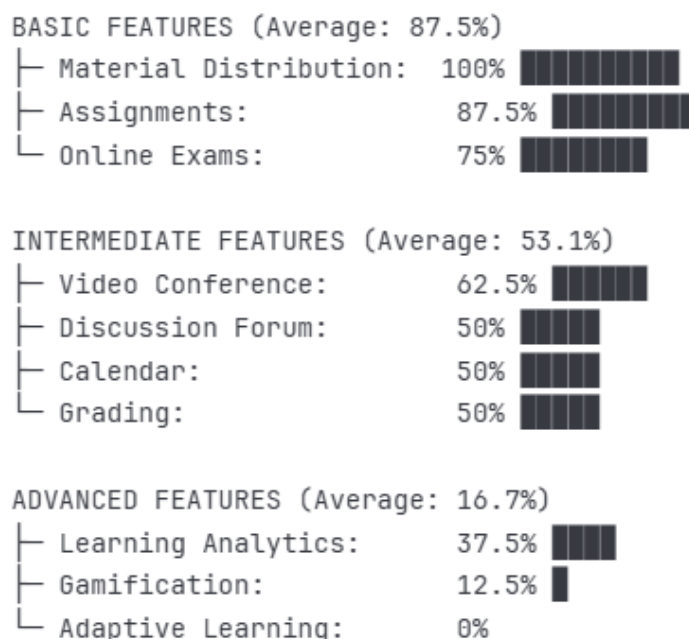


Figure 3. LMS Feature Utilization

Figure 3 visually demonstrates the adoption pyramid, where utilization decreases significantly as feature sophistication increases. This pattern suggests institutions are in early stages of LMS maturity, consistent with Puente's (2006) SAMR model's substitution and augmentation levels. This utilization pattern indicates that institutions are still focused on digitizing traditional learning processes rather than utilizing the transformative potential of LMS for learning personalization or data-driven instruction.

Infrastructure and Resource Support

LMS implementation is highly dependent on the availability of adequate infrastructure and resources.

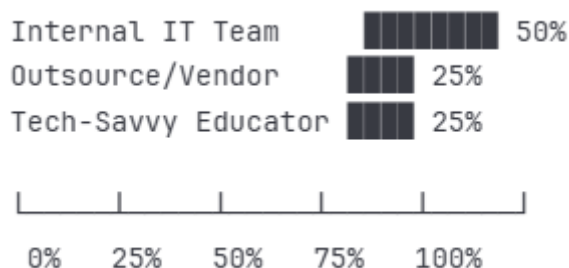


Figure 4. LMS Technical Support

Figure 4 shows half of institutions (50%) have dedicated IT support, a positive indicator. However, 25% relying on tech-savvy educators represents an unsustainable model that burdens individual staff members without formal support structures.



The data reveals significant infrastructure disparities, with only 30% of institutions having dedicated fiber optic connections. The digital divide is evident in student device access, where approximately 25% of students lack adequate personal devices.

Implementation Challenges

Analysis of challenges reveals various obstacles faced by institutions in implementing LMS.

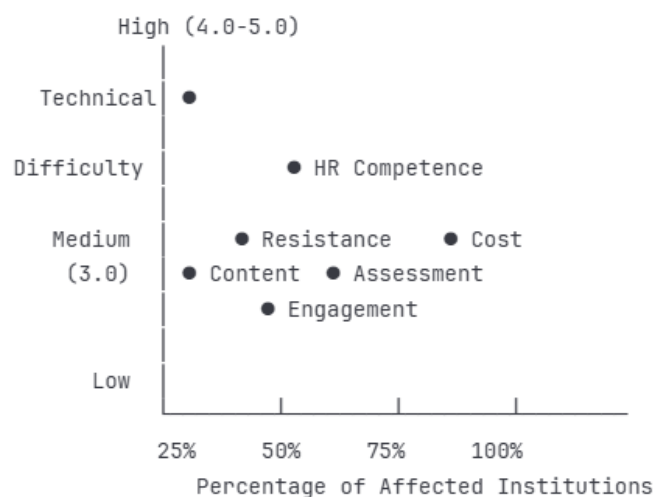


Figure 5. LMS Implementation Challenge Map

Figure 5 maps challenges by prevalence (x-axis) and difficulty (y-axis). The upper-right quadrant (high prevalence, high difficulty) contains infrastructure and HR competence—the most critical barriers. Challenges in the middle zone represent important but more manageable issues. Infrastructure and technical issues (87.5%) emerged as the most prevalent and difficult challenge, followed by digital competence gaps (75%) and operational costs (62.5%).

Perceived Benefits

Despite facing various challenges, institutions that have implemented LMS report significant benefits.



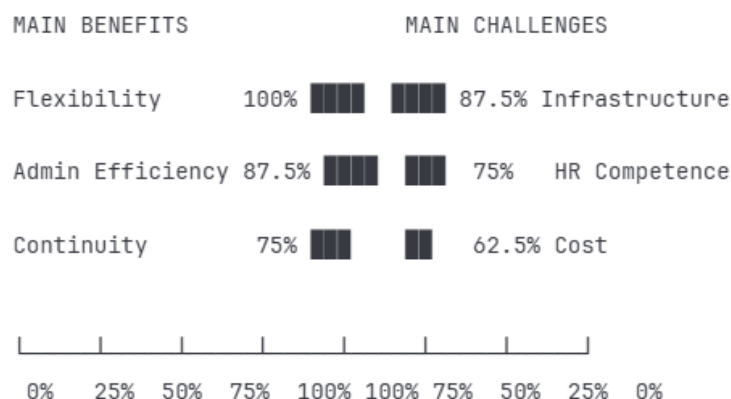


Figure 6. Comparison of Benefits vs. Challenges

Learning flexibility (100%) and administrative efficiency (87.5%) emerged as the most widely recognized and highly valued benefits of LMS implementation.

2. Discussion

The 80% adoption rate indicates substantial awareness and willingness to implement LMS in Tegal City. However, the depth of adoption varies considerably. Quantitative data reveal that only 37.5% of institutions use LMS intensively, while 50% demonstrate moderate use. Qualitative findings indicate that many institutions remain at the Substitution and Augmentation stages of Puentedura's (2006) SAMR model, rather than progressing to Modification or Redefinition. As one educator observed, institutions are "digitizing traditional teaching" rather than "transforming learning." This observation aligns with Rogers' (2003) diffusion of innovation theory, which conceptualizes adoption as a process involving implementation and confirmation stages. The qualitative data further illustrate that institutions are navigating this process with varying degrees of success, influenced by their specific contextual factors.

Both quantitative and qualitative data confirm that the digital divide remains a significant challenge. The statistical finding that only 30% of institutions have dedicated fiber optic connections and 20-25% of students lack adequate devices is given deeper meaning through qualitative accounts. Stories of scheduling students in shifts for exams, partnering with internet cafes for access, and creating offline content packages illustrate the creative but burdensome workarounds required to address infrastructure gaps. This divide manifests not only in infrastructure but also in digital competence. While quantitative data shows 75% of institutions face HR competence challenges, qualitative findings reveal the nuanced reality – the challenge is not simply about technical skills but about pedagogical transformation and mindset shifts. As Selwyn (2004) argues,



addressing the digital divide requires more than providing access; it demands addressing the complex socio-economic and educational factors that shape technology use.

The preference for free or low-cost solutions (Google Classroom at 62.5%, open-source Moodle at 50%) reflects rational decision-making under budget constraints. However, qualitative data reveals a deeper tension between cost concerns and quality aspirations. Institutions recognize that free platforms may limit advanced features, yet the alternatives are often financially prohibitive. The cost figures reported by institutions, combined with qualitative accounts of financial struggles, illustrate what Al-Fraihat et al. (2020) identify as a critical barrier in developing country contexts – sustainable funding for educational technology. The concern expressed by several respondents about long-term sustainability highlights that initial adoption is only the first step; maintaining quality implementation requires ongoing investment.

While quantitative data shows what challenges exist and their prevalence, qualitative findings reveal how these challenges are experienced and navigated. The gap between having technology and using it effectively is fundamentally a human challenge. Stories of resistant teachers who gradually became advocates, of peer mentoring systems, of leadership commitment making the difference – these narratives underscore Davis's (1989) Technology Acceptance Model insight that perceived usefulness and ease of use are subjectively experienced and socially constructed.

The quantitative finding that 50% of institutions adopted LMS in 2020 statistically confirms the pandemic's role as a catalyst. Qualitative accounts add texture to this finding, distinguishing between institutions that were prepared (having started before 2020) and those thrust into "overnight" adoption. The contrast in experiences – "relatively smooth transition" versus "chaotic...teachers were panicking" – illustrates Hodges et al.'s (2020) important distinction between planned online learning and emergency remote teaching. The pandemic served not only as a catalyst but also as a harsh teacher. Institutions learned through trial, error, and crisis adaptation. The question raised by several respondents – whether post-pandemic momentum can be sustained – reflects broader concerns about whether LMS will be integrated as a permanent pedagogical tool or reverted to an emergency measure.

The research reinforces that effective LMS implementation cannot be one-size-fits-all. The variation in adoption intensity, platform choice, feature utilization, and implementation strategies across the 10 institutions reflects different contexts, needs, and capacities. Qualitative findings reveal how institutions adapted general LMS capabilities to their specific circumstances – from scheduling shifts to avoid bandwidth congestion to forming content creation teams leveraging diverse teacher skills. This supports Fullan's (2007) argument about the importance of context in educational change. Successful



implementation requires understanding and responding to local realities rather than importing external models wholesale.

An interesting finding is that despite substantial challenges (87.5% facing infrastructure issues, 75% facing competence gaps), institutions report high satisfaction with LMS benefits (100% appreciating flexibility, 87.5% valuing administrative efficiency). This paradox is explained by qualitative accounts showing that benefits are immediately tangible—time saved, flexibility gained—while challenges, though frustrating, are seen as surmountable with effort and resources. However, this positive perception is tempered by concerns about sustainability and equity. The benefits accrue most to those with adequate resources, potentially widening rather than narrowing educational inequalities—a concern explicitly raised by several respondents.

CONCLUSION

This research investigated LMS implementation in educational and training institutions in Tegal City through a mixed-methods survey of 10 institutions. Eighty percent of institutions (8 of 10) had implemented LMS, with Google Classroom and Moodle as dominant platforms chosen primarily for accessibility and low cost, though adoption depth varied: only 37.5% of adopters used LMS intensively, while 50% showed moderate use. Basic features such as material distribution (100%) were adopted by all users, while assignments (87.5%) and advanced capabilities such as learning analytics and gamification were adopted less consistently and were not universal. This gradient indicates institutions are predominantly digitizing traditional practices rather than transforming pedagogy, consistent with the substitution and augmentation stages of Puentedura's SAMR model.

The three principal implementation barriers were infrastructure limitations (87.5% of institutions, with only 30% having adequate fiber-optic connectivity), digital competence gaps among educators (75%, linked to inconsistent training investment), and operational costs (62.5%, with internet costs alone consuming a substantial share of reported annual expenses). Qualitative findings suggest these challenges are interconnected—poor infrastructure exacerbates competence gaps as educators struggle with unreliable systems, while cost constraints limit both infrastructure upgrades and training programs—though this interconnection is inferred from interview accounts rather than statistically tested. Institutions also reported substantial perceived benefits, particularly learning flexibility and administrative efficiency; however, these reflect user satisfaction and self-reported experience rather than independently measured learning outcomes, which this study did not assess, and qualitative accounts indicate the benefits are not evenly distributed, tending to favor better-resourced institutions and students.



These conclusions should be read in light of the study's limitations: the ten institutions were purposively rather than randomly selected, the sample is small and specific to one medium-sized city, and most measures rely on institutional self-report rather than independent verification or learning-outcome data, so findings should not be generalized beyond broadly similar contexts without further testing. With these caveats, this research recommends: (1) continued investment in broadband infrastructure and device access to narrow the digital divide; (2) sustained, ongoing professional development for educators rather than one-time training, with an emphasis on pedagogical rather than purely technical skills; (3) cost-sharing arrangements or regional LMS platforms to improve sustainability for resource-constrained institutions; and (4) progression from basic feature adoption toward strategic use of analytics and personalization capabilities. Future research should track implementation over time, compare across cities of similar size, and examine LMS use in relation to independently measured learning outcomes rather than self-reported perceptions alone.

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