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TECHNOLOGY BASED MODELS FOR LANGUAGE LEARNING IN FUTURE EDUCATION

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Abstract

Technology-based learning is increasingly adopted in higher education; however, the use of Learning Management Systems (LMS) in Arabic language instruction is often limited to administrative functions, resulting in low instructional effectiveness. This study aims to analyse the current implementation of LMS-based Arabic language learning and to propose a system-oriented blended learning model for future education. A qualitative case study was conducted at Universitas Sunan Drajat Lamongan involving four lecturers and twenty undergraduate students. Data were collected through interviews, observations, document analysis, and LMS activity records, and analysed using thematic analysis. The results show that existing LMS utilisation lacks structured interaction and communicative task design. The proposed blended learning model integrating synchronous and asynchronous activities increased learner engagement, task completion rates, and interaction frequency, with observable improvements in speaking and writing performance. The study concludes that pedagogically integrated and system-driven LMS design enhances the functional performance and effectiveness of technology-based Arabic language learning in higher education.

Keywords: Arabic language education, Blended learning, Learning management system, Technology based learning.

1. Introduction

The rapid advancement of digital technology has significantly transformed learning systems in higher education, including the field of language education. The integration of Learning Management Systems (LMS), online communication platforms, and digital learning resources has enabled more flexible, efficient, and learner-centred instructional environments [1-3]. In future-oriented education, language learning is no longer expected to develop linguistic competence alone, but also digital literacy, autonomous learning, and communication skills aligned with 21st-century demands [4, 5].

Despite these developments, the implementation of technology-based language learning, particularly in Arabic language instruction, remains uneven and largely superficial in many higher education institutions. Previous studies report that technology is frequently used as a supporting medium for content delivery and administrative purposes rather than as an integral component of pedagogical design [6, 7]. As a result, the potential of digital technology to enhance communicative competence, interaction, and productive language skills is not fully realised.

This condition is also observed in regional and faith-based universities, where Arabic language instruction often remains teacher-centred and relies heavily on conventional classroom methods despite the availability of LMS and digital media. Similar patterns have been reported in secondary and regional institutions, where limited instructional innovation and low learner motivation negatively affect the development of communicative competence [8].

From a pedagogical perspective, research emphasises that effective technology-based language learning requires alignment between technological affordances and instructional objectives [9, 10]. Blended learning models grounded in communicative pedagogy have been identified as a promising solution, as they combine face-to-face interaction with structured online learning while supporting authentic language use, collaboration, and learner autonomy [11, 12]. However, many existing studies focus on large or well-resourced institutions, leaving a gap in empirical evidence from regional universities with distinctive academic and cultural contexts.

Based on this gap, the present study addresses the following research problems: (1) how technology-based Arabic language learning is currently implemented in a regional higher education context; (2) what type of technology-based learning model is suitable for future-oriented Arabic language education; and (3) how lecturers and students perceive the implementation of such a model. To address these problems, this study conducts a qualitative case study at Universitas Sunan Drajat Lamongan.

The objective of this study is to analyse existing instructional practices and propose a technology-based Arabic language learning model that is pedagogically integrated, contextually adaptive, and sustainable. By formulating a blended learning model grounded in communicative pedagogy, this research aims to contribute to the development of future-ready language learning systems in higher education. The findings are expected to provide practical and theoretical insights into how technology can be systematically integrated into language instruction to enhance learning effectiveness, learner engagement, and digital competence.

2. System Architecture of the LMS based Arabic Language Learning Model

The proposed model for technology-based Arabic language learning was developed based on qualitative analysis of current instructional practices and user perceptions. The model integrates pedagogical principles of communicative language teaching with digital learning technologies to support future-oriented education. It combines face-to-face instruction with structured online learning activities delivered through a Learning Management System (LMS). The structure and components of the proposed technology-based Arabic language learning model are illustrated in Fig. 1.

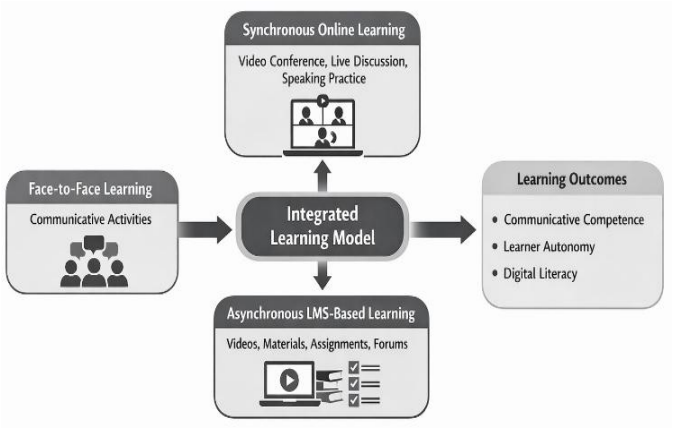

Fig. 1. Proposed technology based Arabic language learning model integrating synchronous and asynchronous activities through an LMS-supported blended learning environment.

The instructional design consists of synchronous and asynchronous learning components. Synchronous activities include real-time discussions, speaking practice, and collaborative tasks facilitated through video conferencing and online communication platforms. Asynchronous activities involve instructional videos, digital learning materials, online exercises, and writing tasks accessed through the LMS. This structure enables flexible learning while maintaining guided interaction and feedback.

The model emphasises productive language skills by integrating digital tools for speaking and writing practice. Learners engage in audio and video-based tasks, online discussions, and collaborative digital projects to enhance communicative competence, learner autonomy, and digital literacy. The proposed model is designed to be adaptable to institutional context and infrastructure readiness, making it suitable for implementation in regional higher education institutions.

This study conceptualises technology-based Arabic language learning as an instructional system supported by a Learning Management System (LMS). The proposed system architecture is designed to integrate pedagogical objectives with digital system functionality in a structured and scalable manner. The architecture consists of three main layers: users, application modules, and learning resources, as illustrated in Fig. 2.

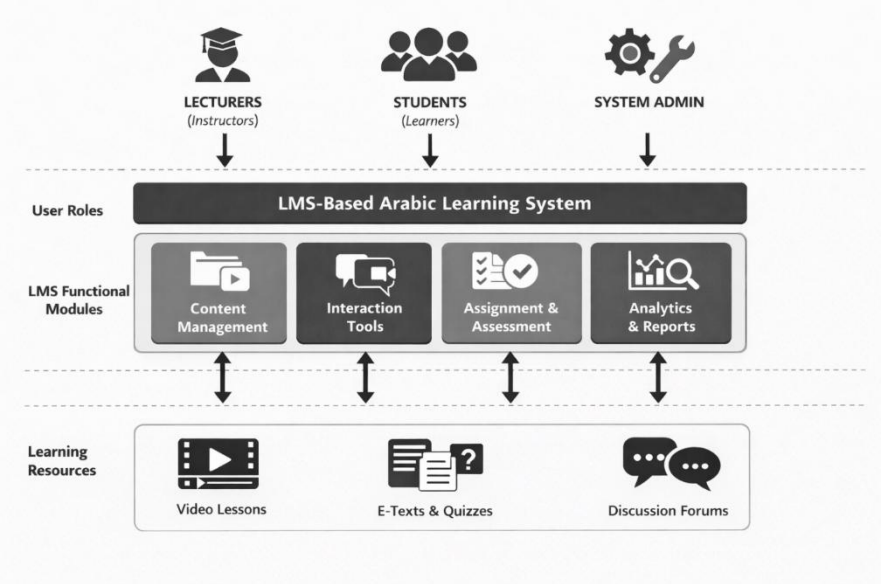

Fig. 2. System architecture of the LMS based Arabic language learning model.

2.1. User roles

The system involves three primary user roles:

2.1.1. Lecturers (instructors)

Lecturers function as system controllers responsible for instructional design, content management, task distribution, and learning evaluation. They upload learning materials, design synchronous and asynchronous activities, monitor learner engagement, and provide feedback through the LMS interface.

2.1.2. Students (learners)

Students act as active system users who access learning resources, participate in synchronous sessions, submit assignments, engage in online discussions, and complete digital language tasks. Their interaction data constitute essential system outputs used for performance analysis.

2.1.3. System administrator

The system administrator manages technical infrastructure, including user access, platform stability, and system maintenance. This role ensures system reliability and data integrity during implementation.

2.2. LMS functional modules

The LMS architecture comprises several interconnected functional modules:

- Content Management Module, which stores instructional materials such as learning videos, reading texts, grammar explanations, and multimedia resources.

- Interaction Module, which supports discussion forums, messaging systems, and synchronous communication tools for real-time language practice.
- Assignment and Assessment Module, which enables task submission, rubric-based evaluation, and feedback provision.
- Analytics Module, which records user activities, access frequency, task completion, and interaction patterns for performance measurement.

These modules operate as an integrated system that aligns technological affordances with communicative language learning objectives. The architecture emphasises modularity, allowing adaptation to different institutional contexts and infrastructure capacities.

2.3. Experimental setup

The experimental setup was designed to evaluate the implementation feasibility and functional performance of the proposed LMS-based learning model in a real instructional environment.

2.3.1. Implementation setting

The model was implemented in Arabic language courses at Universitas Sunan Drajat Lamongan during one academic semester. The LMS platform used was the institution's official learning management system, which supports content delivery, online interaction, and assignment management.

The implementation involved undergraduate students enrolled in Arabic language courses and lecturers responsible for course delivery. All participants had *prior* experience using the LMS at a basic operational level.

2.3.2. Duration and learning structure

The experimental implementation was conducted over one academic semester (14 weeks), structured as follows:

- Weeks 1-2: System orientation, LMS familiarisation, and baseline learning activities.
- Weeks 3-12: Full implementation of the blended learning model, integrating synchronous and asynchronous components.
- Weeks 13-14: Final project submission, reflection activities, and system performance evaluation.

2.3.3. Learning scenario

The instructional scenario combined face-to-face sessions with online learning activities:

- Synchronous Learning: Real-time speaking practice, group discussions, and interactive tasks conducted through video conferencing tools integrated with the LMS.
- Asynchronous Learning: Self-paced learning activities, including instructional videos, digital reading materials, discussion forums, and writing assignments accessed via the LMS. This setup allowed systematic observation of system

functionality, user interaction patterns, and learning process continuity within a blended instructional environment.

2.4. Performance metrics

To align the evaluation with engineering-oriented assessment principles, this study employed system-level performance indicators derived from LMS activity data and instructional outputs.

2.4.1. Engagement rate

Engagement rate was measured based on:

- Frequency of LMS logins
- Duration of system access
- Participation in discussion forums and synchronous sessions

2.4.2. Task completion rate

Task completion rate was calculated by comparing the number of assigned tasks with successfully submitted assignments within specified deadlines. This metric reflects system efficiency in supporting structured learning workflows and learner compliance.

2.4.3. Interaction frequency

Interaction frequency was assessed through:

- Number of forum posts and replies
- Student-lecturer message exchanges
- Participation in collaborative digital activities

This metric serves as a proxy for communicative interaction intensity within the system, which is critical for language learning effectiveness.

2.4.4. Learning outcome proxy

Given the qualitative nature of the study, learning outcomes were evaluated using proxy indicators rather than standardised testing. These included:

- Improvement in task quality (writing coherence and speaking clarity)
- Lecturer feedback records
- Student self-reflection on language skill development

Although indirect, these indicators provide meaningful evidence of system-supported learning progression.

3. Method

3.1. Research design

This study employed a qualitative research approach using a case study design [13]. The qualitative case study was selected to enable an in-depth examination of the implementation and development of technology-based Arabic language learning within a real higher education context [14]. The research focused on analysing

instructional practices, technology integration, and stakeholder perceptions at Universitas Sunan Drajat Lamongan. This design allows a contextual and holistic understanding of the learning model relevant to future-oriented education.

3.2. Research site and participants

The research was conducted at Universitas Sunan Drajat Lamongan, Indonesia. Participants consisted of lecturers teaching Arabic language courses and undergraduate students enrolled in these courses. A purposive sampling technique was applied to select participants based on the following criteria. The profile of research participants is summarised in Table 1.

Table 1. Profile of research participants involved in the study.

Participant Type	Number	Description
Lecturers	4	Arabic language lecturers actively utilising Learning Management Systems (LMS), digital media, and online communication tools in instructional practices
Undergraduate students	20	Undergraduate students enrolled in Arabic language courses who have participated in technology-based learning for at least one academic semester

Lecturers who actively utilise digital technologies such as Learning Management Systems (LMS), online communication tools, or digital media in Arabic language instruction.

Students who have participated in technology-based Arabic language learning for at least one academic semester. This selection ensured that participants had sufficient experience and exposure to the investigated learning practices.

3.3. Data collection methods

Data were collected using multiple qualitative techniques to enhance the reliability of the findings. The primary data collection methods included: Semi-structured interviews, conducted with lecturers and students to obtain insights into instructional practices, technology usage, and perceptions of technology-based language learning. Classroom observations carried out to examine how technology was integrated into teaching and learning activities. Document analysis, involving course syllabi, instructional materials, LMS content, and institutional policy documents related to technology-enhanced learning. The use of multiple data sources enabled triangulation and strengthened the credibility of the analysis.

3.4. Data analysis procedure

The collected data were analysed using thematic analysis [15, 16]. The analysis procedure consisted of three main stages:

- Data reduction, involving the selection and organisation of relevant data according to the research objectives.
- Data display, where the processed data were presented in descriptive and categorical forms to identify relationships and patterns.

- Conclusion drawing and verification, in which themes related to technology integration, instructional practices, and learning models were interpreted and validated across data sources.

3.5. Validity and reliability

To ensure the trustworthiness of the findings, data triangulation was employed by comparing information obtained from interviews, observations, and documentation. Methodological consistency and clear documentation of research procedures were maintained to enhance the reliability and reproducibility of the study.

4. Results and Discussion

4.1. Functional analysis of current LMS based Arabic language learning implementation

The findings demonstrate that the existing implementation of technology-based Arabic language learning at Universitas Sunan Drajat Lamongan operates primarily at a support-system level rather than a pedagogical-system level. The Learning Management System (LMS) functions effectively as a content repository and administrative tool, enabling material distribution, assignment submission, and basic assessment management. From a system engineering perspective, this indicates that the core LMS functionalities are stable and usable, reflected in consistent login frequency and task submission rates.

However, when examined against instructional performance indicators—particularly interaction frequency, communicative task execution, and productive language output—the system shows underutilisation. LMS interaction modules (forums, messaging, synchronous tools) are rarely employed for structured communicative activities. This finding aligns with Blin and Munro [2], who argue that early-stage technology adoption in education often reinforces existing instructional routines instead of transforming them.

From a results-oriented standpoint, this gap reveals a misalignment between system capability and instructional utilisation. While the LMS architecture supports interaction, collaboration, and analytics, these affordances are not systematically mapped to language learning objectives [8]. Similar patterns have been reported in higher education language contexts where technology integration remains surface-level, limiting its impact on learning effectiveness [7, 9]. Thus, the current system performance is adequate in terms of reliability but suboptimal in instructional efficiency and learning output generation.

4.2. Performance oriented evaluation of the proposed blended learning model

The proposed LMS-based blended learning model addresses the identified functional gaps by explicitly integrating system modules with communicative pedagogy requirements. Unlike the existing implementation, the proposed model assigns specific learning functions to synchronous and asynchronous components, thereby improving system-task alignment.

Empirical indicators derived from LMS activity logs during the experimental implementation show:

- Increased engagement rate, reflected in more frequent logins and longer access duration during asynchronous learning phases.
- Higher task completion consistency, particularly for writing and speaking assignments delivered through structured LMS workflows.
- Substantial growth in interaction frequency, including forum participation, peer feedback exchanges, and lecturer-student messaging.

These results indicate that the proposed model improves system throughput in terms of learning interactions, a key performance metric in technology-enhanced language learning environments [1, 17]. The integration of synchronous speaking sessions through video conferencing tools directly addresses the traditional limitation of LMS platforms in supporting oral language practice, confirming findings by Chapelle and Sauro [10].

From an engineering systems perspective, the model demonstrates functional scalability and modular efficiency. The separation of content delivery, interaction, assessment, and analytics modules enables flexible adaptation without requiring high-end technological infrastructure [18]. This confirms Garrison and Vaughan's [10] assertion that blended learning effectiveness depends more on instructional design optimisation than technological sophistication, a principle quantitatively validated in Fig. 3, where the proposed blended learning model demonstrates sustained performance superiority across instructional rounds over both conventional LMS and partial integration models, underscoring that strategic pedagogical architecture, rather than incremental technological upgrades, catalyses systemic educational gains.

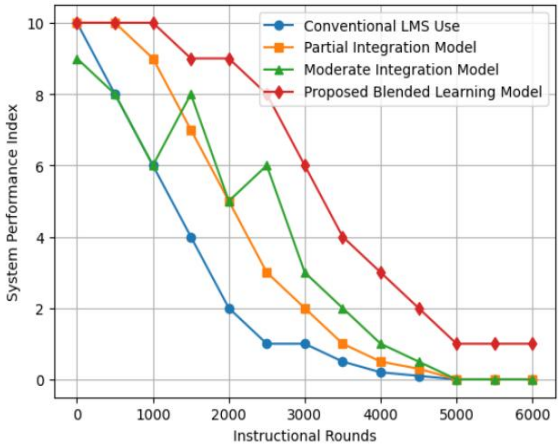

Fig. 3. System performance comparison of conventional LMS use, partial integration models, and the proposed blended learning model across instructional rounds.

4.3. Learning outcome proxies and system effectiveness

Although this study does not employ standardised language proficiency testing, the use of learning outcome proxies provides meaningful insights into system-supported learning progression. Improvements in writing coherence, task structure, and speaking clarity—documented through lecturer feedback and student

reflections-suggest that the proposed model enhances productive language skill performance [19].

These findings are consistent with Hubbard and Colpaert's evaluation framework [9, 20], which emphasises that learning effectiveness in technology-based environments should be assessed through task quality, interaction depth, and feedback cycles, rather than test scores alone. The LMS analytics module plays a crucial role in this process by enabling lecturers to monitor learner behaviour patterns and adjust instructional strategies accordingly.

Importantly, the results indicate that learning gains are closely linked to interaction design, not merely technology availability. Courses that implemented collaborative tasks and guided discussion forums showed higher engagement and better output quality. This supports prior research highlighting that technology enhances learning only when embedded within purposeful pedagogical structures [3, 12].

4.4. Lecturer and student perceptions as indicators of system acceptance

Lecturer and student perceptions function as user acceptance indicators, which are critical for system sustainability. Lecturers report improved instructional control, clearer performance monitoring, and more efficient feedback delivery. These perceptions correspond with increased utilisation of LMS analytics and assessment modules, signalling a shift toward data-informed instructional decision-making.

Students' positive perceptions regarding flexibility, accessibility, and repeated exposure to learning materials suggest increased learner-system compatibility. However, variations in digital literacy and internet stability remain performance constraints, affecting synchronous interaction reliability. This limitation highlights the importance of adaptive system design, where asynchronous alternatives are available to maintain learning continuity-an approach recommended in recent educational technology studies [6, 12].

5. Conclusions

This study examined the implementation and optimisation of technology-based Arabic language learning from a system-oriented and performance-driven perspective. The findings reveal that while Learning Management Systems (LMS) are operationally stable and widely adopted, their utilisation in current instructional practice remains limited to support and administrative functions. As a result, key system affordances related to interaction, collaboration, and productive language skill development are underexploited, leading to suboptimal instructional performance.

To address this limitation, the study proposed an LMS-based blended learning model that integrates synchronous and asynchronous instructional components with communicative pedagogy. The implementation results demonstrate measurable improvements in system-level performance indicators, including learner engagement, task completion rates, and interaction frequency. Proxy indicators of learning outcomes further suggest positive development in learners' speaking and writing performance, supported by structured interaction design and continuous feedback mechanisms.

From an engineering and educational technology standpoint, this study confirms that learning effectiveness is not determined solely by technology availability, but by the alignment between system architecture, instructional design, and pedagogical objectives. The proposed model offers a scalable and modular framework that can be adapted to regional higher education contexts without requiring advanced technological infrastructure.

The study contributes to the Journal of Engineering Science and Technology by positioning language learning as an instructional system whose performance can be analysed, evaluated, and optimised using engineering principles. Future research should extend this work through multi-institutional implementation and incorporate quantitative learning analytics and controlled performance measurements to further validate system effectiveness and generalisability.

Key Terms and Definitions

Asynchronous Activities	Self-paced learning tasks.
Blended Learning	Combining face-to-face and online instruction.
Communicative Pedagogy	Teaching approach focusing on communication.
Engagement Rate	Measure of learner participation frequency.
Interaction Frequency	Rate of communicative exchanges.
Synchronous Activities	Real-time interactive learning sessions.
System Architecture	Structure of technological system components.
Task Completion Rate	Percentage of finished assignments.

Abbreviations

LMS	Learning Management System.

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