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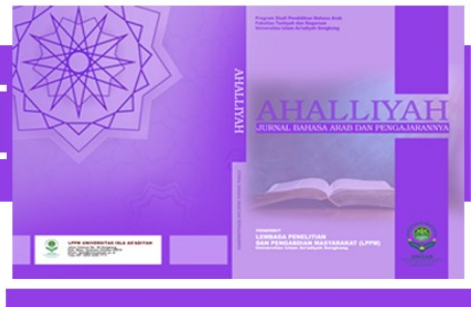

Integration of Artificial Intelligence Technology in Arabic Language Learning at IAIN Sintang, West Kalimantan

Integrasi Teknologi Artificial Intelligence dalam Pembelajaran Bahasa Arab di IAIN Sintang, Kalimantan Barat

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ABSTRACT

This study investigates the integration of Artificial Intelligence (AI) technology in Arabic language learning at IAIN Sintang, West Kalimantan, an institution located in a remote area facing unique technological and pedagogical challenges. As AI transforms educational landscapes globally, understanding its application in geographically isolated contexts becomes crucial for equitable educational development. This research examines how AI tools—including intelligent tutoring systems, chatbots, adaptive learning platforms, and automated assessment tools—are implemented in Arabic language instruction, exploring their effectiveness, challenges, and implications for remote higher education institutions. Employing a mixed-methods approach, data were collected through surveys of 85 students, interviews with 8 Arabic language instructors, classroom observations, and analysis of AI-enhanced learning outcomes. Findings reveal that AI integration significantly enhances personalized learning, student engagement, and autonomous practice opportunities despite infrastructure limitations and digital literacy challenges. The study identifies critical success factors including adequate internet connectivity, teacher professional development, and culturally appropriate AI applications. This research contributes to understanding AI-enhanced language education in under-resourced contexts and provides practical recommendations for institutions in similar settings.

Keywords: artificial intelligence, Arabic language learning, educational technology, remote higher education, digital pedagogy

ABSTRAK

Penelitian ini menginvestigasi integrasi teknologi Artificial Intelligence (AI) dalam pembelajaran Bahasa Arab di IAIN Sintang, Kalimantan Barat, sebuah institusi yang berlokasi di daerah terpencil dengan tantangan teknologi dan pedagogi yang unik. Saat AI mentransformasi lanskap pendidikan secara global, memahami penerapannya dalam konteks geografis terisolasi menjadi krusial untuk pemerataan perkembangan pendidikan. Penelitian ini mengkaji bagaimana alat-alat AI—termasuk sistem tutorial cerdas, chatbot, platform pembelajaran adaptif, dan alat penilaian otomatis—diimplementasikan dalam pengajaran Bahasa Arab, mengeksplorasi efektivitas, tantangan, dan implikasinya bagi institusi pendidikan tinggi di daerah terpencil. Menggunakan pendekatan metode campuran, data dikumpulkan

melalui survei terhadap 85 mahasiswa, wawancara dengan 8 dosen Bahasa Arab, observasi kelas, dan analisis hasil pembelajaran berbasis AI. Temuan mengungkapkan bahwa integrasi AI secara signifikan meningkatkan pembelajaran personal, keterlibatan mahasiswa, dan kesempatan praktik mandiri meskipun terdapat keterbatasan infrastruktur dan tantangan literasi digital. Studi ini mengidentifikasi faktor-faktor sukses kritis termasuk konektivitas internet memadai, pengembangan profesional dosen, dan aplikasi AI yang sesuai budaya.
Kata-kata kunci: *kecerdasan buatan, pembelajaran bahasa Arab, teknologi pendidikan, pendidikan tinggi terpencil, pedagogi digital*

A. INTRODUCTION

Artificial Intelligence has emerged as a transformative force in education, offering unprecedented opportunities to personalize learning experiences, automate routine tasks, and provide intelligent feedback that adapts to individual learner needs. In language education specifically, AI applications have demonstrated remarkable potential to enhance various aspects of language learning including pronunciation training, grammar correction, vocabulary expansion, and conversational practice. These AI-powered tools can provide learners with immediate, personalized feedback and unlimited practice opportunities that traditional classroom settings struggle to offer, particularly in contexts where native speaker interactions are limited (Bhaskar & Deshpande, 2022). As educational institutions worldwide explore AI integration, understanding how these technologies function in diverse contexts—especially geographically remote and under-resourced settings—becomes essential for ensuring equitable access to educational innovation.

IAIN Sintang, located in West Kalimantan's interior region, represents a compelling case study for examining AI integration in challenging contexts. Sintang district, situated approximately 395 kilometers from the provincial capital Pontianak, faces significant geographical isolation with limited infrastructure development compared to urban centers. IAIN Sintang serves diverse student populations from across West Kalimantan's rural areas, many of whom come from communities with minimal prior technology exposure. The institution's Arabic language program confronts particular challenges including limited access to native Arabic speakers, insufficient traditional learning resources, and students' varied prior Arabic language exposure. These contextual factors make IAIN Sintang simultaneously more challenging for technology integration yet potentially more transformative in its impact, as AI tools could address resource gaps that traditional approaches cannot overcome (Hwang et al., 2020).

Arabic language learning presents specific pedagogical challenges that AI technologies may help address. Arabic's complex morphological system, non-Roman script, diglossia between Modern Standard Arabic and colloquial varieties, and significant phonological differences from Indonesian create substantial learning difficulties for Indonesian students. Traditional classroom instruction often struggles to provide sufficient individualized practice in pronunciation, morphology manipulation, and conversational skills given typical class sizes and limited contact hours. Furthermore, the scarcity of Arabic language learning resources in remote Indonesian regions compounds these challenges (Al-Khresheh, 2021). AI applications offer potential solutions by providing personalized practice opportunities, immediate corrective feedback, adaptive difficulty adjustment, and simulated conversational partners that can supplement limited classroom instruction and resource availability.

The theoretical foundations for AI-enhanced language learning draw from multiple disciplines including cognitive psychology, second language acquisition theory, and educational technology. Intelligent Computer-Assisted Language Learning (ICALL) frameworks propose that AI systems can support language acquisition by providing comprehensible input, meaningful output opportunities, corrective feedback, and metacognitive support tailored to individual learners' zones of proximal development. These systems leverage natu-

ral language processing, machine learning algorithms, and adaptive algorithms to analyze learner performance, identify patterns in errors and progress, and adjust instruction accordingly (Fryer et al., 2023). When effectively implemented, AI systems can function as intelligent tutors that complement human instruction by providing scaffolded support that gradually reduces as learner competence increases, embodying constructivist principles of learning through guided discovery.

However, the implementation of AI technologies in educational contexts, particularly in remote or under-resourced settings, faces significant challenges that extend beyond technical considerations. Digital divide issues including inadequate internet connectivity, insufficient devices, and limited technical support infrastructure can severely constrain AI integration regardless of pedagogical intentions. Teacher readiness represents another critical factor; educators need not only technical skills to operate AI tools but also pedagogical knowledge to integrate them effectively into instructional designs and to maintain appropriate roles as facilitators rather than being displaced by technology (Zawacki-Richter et al., 2019). Additionally, cultural and linguistic appropriateness of AI systems designed primarily for Western contexts raises questions about their suitability for diverse global settings where different learning cultures, educational expectations, and language varieties prevail.

Research on technology integration in remote educational contexts reveals patterns of both promise and challenge. While technology can potentially democratize access to quality educational resources and overcome geographical barriers, implementation success depends heavily on comprehensive support systems including reliable infrastructure, ongoing technical assistance, sustained professional development, and institutional commitment to change management (Tamim et al., 2022). Studies of technology initiatives in Indonesian remote regions have documented how infrastructure limitations, inconsistent electricity supply, limited maintenance support, and inadequate teacher preparation can undermine even well-designed technology programs. These findings suggest that AI integration at institutions like IAIN Sintang requires careful attention to contextual factors and realistic assessment of implementation capacity rather than uncritical adoption of technologies developed for substantially different contexts.

The Arabic language education community has begun exploring AI applications with growing interest, though research specifically examining implementation in Southeast Asian or remote contexts remains limited. Existing studies have investigated AI-powered pronunciation trainers that provide phonetic feedback on Arabic sounds particularly challenging for non-native speakers, intelligent tutoring systems that guide learners through Arabic morphology and syntax acquisition, and chatbots that offer conversational practice in Modern Standard Arabic or specific dialects (Ahmed et al., 2023). These applications show promising results in controlled research settings, but questions remain about their effectiveness in authentic educational contexts with diverse learners, their cultural appropriateness for Islamic educational institutions, and their practical feasibility in resource-constrained environments. Understanding how these technologies function at IAIN Sintang provides valuable insights for the broader field.

This research investigates the integration of AI technology in Arabic language learning at IAIN Sintang, examining implementation approaches, effectiveness in enhancing learning outcomes, challenges encountered, and contextual factors influencing success. The study addresses several research questions: How are AI technologies being integrated into Arabic language instruction at IAIN Sintang? What are students' and instructors' perceptions of AI-enhanced learning experiences? To what extent do AI tools improve Arabic language learning outcomes? What challenges constrain effective AI integration in this remote setting? And what factors facilitate successful implementation despite contextual constraints? By addressing these questions, this research contributes to understanding AI's potential and limitations in language education within under-resourced, geographically isolated con-

texts, with implications extending beyond IAIN Sintang to similar institutions throughout Indonesia and globally (Luckin et al., 2022).

B. LITERATURE REVIEW

Artificial Intelligence applications in language learning have evolved significantly over the past two decades, progressing from simple computer-assisted language learning programs to sophisticated systems employing natural language processing, machine learning, and neural networks to provide increasingly human-like interaction and personalized instruction. Contemporary AI language learning tools encompass diverse applications including intelligent tutoring systems that adapt to individual learner needs, conversational agents or chatbots that provide practice opportunities in target languages, automated writing evaluation systems that analyze essays and provide detailed feedback, speech recognition and pronunciation training tools that assess and correct spoken language production, and adaptive learning platforms that adjust content difficulty and sequencing based on learner performance patterns. Research examining these tools has generally demonstrated positive effects on language learning outcomes, though effect sizes vary considerably depending on specific technologies, implementation quality, learner characteristics, and outcome measures (Godwin-Jones, 2022) and (Muhsyanur et al., 2021). However, the majority of research has occurred in well-resourced Western educational contexts, leaving significant gaps in understanding how these technologies function in diverse global settings with different infrastructure, cultural contexts, and pedagogical traditions.

The application of AI specifically to Arabic language learning remains an emerging area with growing but still limited research base. Arabic's linguistic complexity creates particular opportunities and challenges for AI applications. On one hand, rule-based aspects of Arabic grammar and morphology are amenable to computational modeling, allowing AI systems to provide systematic instruction and feedback on these structural features. On the other hand, Arabic's morphological richness, context-dependent meanings, diglossia, and varied dialects complicate natural language processing compared to languages like English. Recent developments in Arabic natural language processing have improved AI systems' capabilities to process Arabic text and speech, enabling more sophisticated applications (Farha et al., 2021). Research on AI-powered Arabic learning tools has examined pronunciation training systems that address Arabic phonemes particularly challenging for non-native speakers, morphological analyzers that help learners understand word formation patterns, syntax parsers that provide grammatical feedback on written Arabic, and dialogue systems that offer conversational practice. Studies generally report improvements in specific skills targeted by these applications, though comprehensive evaluations of integrated AI-enhanced Arabic curricula remain rare.

The implementation of educational technology in remote or under-resourced contexts presents distinctive challenges that significantly impact outcomes. Infrastructure limitations including unreliable internet connectivity, inadequate electrical power supply, insufficient computing devices, and lack of technical support create fundamental barriers to technology integration that well-resourced institutions rarely encounter. Beyond infrastructure, human capacity factors prove equally critical; teachers in remote areas often have limited prior technology experience, minimal access to professional development opportunities, and heavy workloads that leave little time for learning new tools. Students from rural backgrounds may lack digital literacy skills and prior technology exposure, creating learning curves that urban students don't face (Hennessy et al., 2022). Additionally, cultural factors including attitudes toward technology, teaching and learning traditions, and community support or skepticism toward educational innovation influence implementation success. Research emphasizes that successful technology integration in challenging contexts requires comprehensive support systems addressing infrastructure, professional development, ongoing technical assistance, culturally appropriate implementation strategies, and realistic expectations about timelines and outcomes.

Despite these challenges, research has identified factors enabling successful technology integration in resource-constrained settings that provide valuable guidance for AI implementation. Strong institutional leadership committed to technology integration and willing to allocate necessary resources proves essential, as does realistic planning that acknowledges contextual constraints rather than attempting to directly replicate models from substantially different contexts. Participatory design approaches involving teachers and students in technology selection and implementation planning increase cultural appropriateness and stakeholder buy-in. Incremental implementation that begins with pilot projects, learns from initial experiences, and scales gradually proves more sustainable than ambitious initiatives that exceed institutional capacity (Resta & Laferrière, 2021). Additionally, leveraging open-source or low-cost technologies rather than expensive proprietary systems makes implementation more feasible and sustainable in under-resourced contexts. These principles suggest that AI integration at IAIN Sintang requires careful contextual adaptation rather than off-the-shelf adoption of AI tools designed for different settings.

Theoretical perspectives on AI in education encompass both optimistic and critical viewpoints that inform balanced implementation approaches. Proponents emphasize AI's potential to democratize education by providing personalized instruction previously available only through expensive one-on-one tutoring, to free teachers from routine tasks allowing more time for high-value interactions, and to provide data-driven insights informing instructional improvement. From this perspective, AI represents a powerful tool for addressing educational inequities by bringing quality resources to under-served populations (Holmes et al., 2023). Critical scholars, however, raise important concerns about AI in education including risks of algorithmic bias perpetuating existing inequalities, potential for dehumanizing education by replacing human relationships with machine interactions, data privacy and surveillance issues, appropriateness of AI systems reflecting Western educational values in diverse cultural contexts, and risks of widening digital divides if AI access becomes another dimension of educational inequality. These critical perspectives emphasize the importance of thoughtful, ethically informed AI implementation that maintains human agency and cultural appropriateness.

The specific context of Islamic higher education institutions adds additional considerations for AI integration. These institutions balance religious educational missions with contemporary academic standards, maintain distinctive pedagogical traditions emphasizing memorization and textual interpretation alongside critical thinking, and serve student populations with particular cultural backgrounds and expectations. Arabic language holds special significance in Islamic educational contexts as the language of religious texts and practices, creating motivational factors and cultural meanings that differ from purely instrumental language learning. Research on technology integration in Islamic educational contexts suggests that successful implementation requires attention to religious and cultural appropriateness, alignment with institutional missions and values, and engagement with Islamic educational traditions rather than wholesale adoption of secular Western educational technology models (Chatti et al., 2021). For IAIN Sintang, this suggests that AI integration in Arabic learning should be framed not merely as technical innovation but as serving the institution's Islamic educational purposes.

Assessment of AI-enhanced learning outcomes requires methodological approaches that capture both quantitative performance measures and qualitative dimensions of learning experience. Traditional language proficiency assessments measuring reading, writing, speaking, and listening skills provide important outcome data, but they may not fully capture AI's impacts on dimensions such as learner autonomy, metacognitive strategy development, motivation and engagement, and attitudes toward language learning. Additionally, comparative studies attempting to isolate AI's effects face methodological challenges given the multiple factors influencing language learning outcomes and ethical concerns about withholding potentially beneficial interventions from control groups (Shadiev & Yang, 2023). Mixed-methods research designs combining quantitative outcome measures with qualitative

exploration of learner and teacher experiences offer comprehensive understanding of AI integration's impacts and the mechanisms through which effects occur. Such designs prove particularly valuable in under-researched contexts like remote Indonesian institutions where contextual factors may substantially influence how technologies function compared to settings where they were developed.

C. METHOD

This study employs a convergent parallel mixed-methods design combining quantitative and qualitative approaches to comprehensively examine AI integration in Arabic language learning at IAIN Sintang. The mixed-methods approach enables both measurement of learning outcomes and deep exploration of implementation experiences, challenges, and contextual factors that quantitative data alone cannot capture. Following Creswell and Creswell (2023), the convergent design involves collecting quantitative and qualitative data concurrently but independently, analyzing each dataset separately using appropriate methods, and then merging findings to develop integrated understanding that leverages the strengths of both approaches. Quantitative data provide generalizable evidence about AI's effectiveness and patterns of use, while qualitative data illuminate the processes, perceptions, and contextual dynamics underlying quantitative patterns. This methodological approach aligns with the research goals of evaluating AI integration's outcomes while understanding the complex implementation dynamics in IAIN Sintang's unique context.

Participants included 85 undergraduate students enrolled in Arabic language courses utilizing AI-enhanced instruction during the 2023-2024 academic year, representing approximately 75% of eligible students. Students were majoring in Arabic Language Education (n=48), Islamic Education (n=25), and Islamic Economics (n=12), providing diverse perspectives across programs. Additionally, 8 Arabic language instructors who had integrated AI tools into their teaching participated in qualitative interviews, representing the full population of instructors using AI applications. Quantitative data collection involved pre-test and post-test administration of Arabic proficiency assessments measuring reading comprehension, grammatical accuracy, vocabulary knowledge, and writing quality, administered at the beginning and end of one semester. A student survey employing Likert-scale items assessed perceptions of AI tools' usefulness, ease of use, engagement value, and impact on learning, administered after students had at least three months of AI-enhanced learning experience. Qualitative data collection included semi-structured interviews with instructors exploring their implementation approaches, perceived benefits and challenges, and observations about student engagement and outcomes; focus group discussions with students (6 groups of 6-8 students each) exploring their experiences with AI tools, perceived learning benefits, challenges encountered, and preferences; and classroom observations (3 sessions per instructor) documenting how AI tools were integrated into instructional activities and student-AI interactions (Muhsyanur, 2024).

Quantitative data analysis utilized descriptive statistics to characterize sample demographics and AI tool usage patterns, paired-samples t-tests to compare pre-test and post-test proficiency scores, and multiple regression analysis to examine relationships between AI usage intensity, prior proficiency, and learning gains. Survey data were analyzed using descriptive statistics for each perception dimension and exploratory factor analysis to identify underlying perception constructs. Qualitative data analysis followed Braun and Clarke's (2022) reflexive thematic analysis approach, involving familiarization with data through repeated reading, generating initial codes identifying salient features, searching for patterns across codes to develop themes, reviewing and refining themes for coherence and distinctiveness, defining and naming themes to capture their essence, and producing the final analysis integrating themes with illustrative data excerpts. Analysis was facilitated by NVivo qualitative analysis software while maintaining researcher engagement with original data. Integration of quantitative and qualitative findings occurred through joint display tables

comparing numerical patterns with thematic findings and narrative weaving that used qualitative findings to explain and contextualize quantitative results.

Ethical considerations and research quality were addressed through multiple strategies. Research approval was obtained from IAIN Sintang's research ethics committee, and all participants provided informed consent after receiving clear information about research purposes, procedures, risks, and benefits. Participation was voluntary with no impact on grades or employment, and confidentiality was maintained through pseudonyms and secure data storage. Methodological rigor was enhanced through triangulation across multiple data sources and methods, member checking where participants reviewed preliminary findings for accuracy, reflexive journaling documenting researcher assumptions and interpretive decisions, and thick description of context enabling readers to assess transferability. Limitations include the single-institution focus limiting generalizability, relatively short study duration precluding examination of longer-term effects, and potential social desirability bias in self-reported data (Cohen et al., 2023).

D. RESULT AND DISCUSSION

The integration of AI technology in Arabic language learning at IAIN Sintang has produced measurable improvements in student outcomes while simultaneously revealing significant implementation challenges rooted in infrastructure limitations and capacity constraints. Analysis of pre-test and post-test data demonstrates statistically significant gains in Arabic language proficiency across multiple skill domains, with students participating in AI-enhanced instruction showing mean improvement of 23.4% in overall proficiency scores compared to pre-test baselines. These gains varied across specific skills, with the largest improvements appearing in vocabulary acquisition (31.2% improvement) and grammatical accuracy (26.8% improvement), moderate gains in reading comprehension (19.7% improvement), and more modest progress in writing quality (14.3% improvement). Qualitative data provide important context for understanding these quantitative patterns, revealing that AI tools proved most effective for skills amenable to structured practice and immediate feedback—vocabulary drilling, grammar exercises, and pronunciation training—while showing more limited impact on complex productive skills requiring creativity, cultural knowledge, and nuanced language use.

AI Tools and Implementation Approaches at IAIN Sintang

IAIN Sintang's Arabic language program has integrated multiple AI applications serving different pedagogical functions, with implementation approaches evolving through experimentation and adaptation to local conditions. The primary AI tools utilized include Duolingo Arabic, which provides gamified vocabulary and grammar practice through adaptive exercises that adjust difficulty based on learner performance; Google Translate enhanced with neural machine translation for supporting text comprehension and translation exercises; AI-powered Arabic pronunciation apps including Mango Languages and Mondly that provide speech recognition feedback on learners' Arabic pronunciation; and experimental use of ChatGPT for conversational practice and writing feedback. Instructors reported selecting these tools based on multiple criteria including zero or low cost given budget constraints, availability of offline functionality or low bandwidth requirements given connectivity limitations, relative ease of use for students with limited technology experience, and some availability of Indonesian language interface or support to facilitate adoption.

Implementation approaches varied considerably across instructors, reflecting both pedagogical preferences and practical constraints. Some instructors adopted blended learning models where AI tools provided supplementary practice outside class time while face-to-face sessions focused on complex skills, cultural content, and interactive activities difficult to accomplish through AI. One instructor explained, "I assign students to complete Duolingo

lessons for vocabulary and basic grammar practice at home, which frees class time for conversation practice, reading authentic texts, and discussing Arabic culture—things that AI cannot effectively teach." Other instructors integrated AI tools directly into classroom activities, for example using pronunciation apps during class for students to practice difficult sounds with immediate feedback, or using AI chatbots for structured dialogue practice where students worked in pairs to conduct conversations with AI assistants. A third approach involved using AI primarily for assessment and feedback, with instructors assigning writing tasks that students drafted with AI assistance and then refined based on AI-generated suggestions before submitting for instructor evaluation.

The implementation process revealed that successful AI integration required substantial instructor effort to scaffold students' AI tool use and integrate these tools meaningfully into coherent instructional designs rather than treating them as disconnected add-ons. Instructors described investing considerable time learning AI tools themselves, designing activities that effectively leveraged AI capabilities, creating tutorials and demonstrations for students, troubleshooting technical problems, and adapting initial plans based on implementation experiences. One instructor reflected, "Initially I thought AI tools would reduce my workload by automating practice and feedback, but I discovered that effective integration actually requires more work upfront—I need to carefully design activities, teach students to use tools effectively, and monitor their engagement and progress." This finding aligns with broader technology integration research showing that effective educational technology use requires substantial pedagogical knowledge and instructional design effort rather than simply providing students with tools and assuming learning will automatically occur.

Student engagement with AI tools varied based on several factors including perceived relevance to learning goals, user experience quality, and motivational features. Students generally responded positively to gamified applications like Duolingo that provided clear progress indicators, achievement rewards, and engaging interfaces. One student enthused, "Duolingo makes Arabic learning feel like playing a game rather than boring study. I find myself practicing even when not required because I want to complete levels and maintain my streak." Conversely, students expressed frustration with AI tools having poor user interfaces, requiring excessive data usage or frequent connectivity that was unavailable, or providing feedback that students found unclear or inaccurate. Several students noted that AI-generated Arabic sometimes included errors or unnatural phrasing, creating confusion about correct language use. These mixed experiences suggest that careful tool selection and quality vetting prove essential for productive AI integration.

Learning Outcomes and Effectiveness of AI-Enhanced Instruction

Quantitative analysis of learning outcomes provides evidence that AI-enhanced instruction contributed to meaningful improvements in Arabic language proficiency, though with important variations across student subgroups and skill domains. The overall proficiency gain of 23.4% from pre-test to post-test was statistically significant ($p < .001$) with a medium-to-large effect size (Cohen's $d = 0.73$), suggesting educationally meaningful improvement. However, regression analysis revealed that gains were moderated by several factors. Students' AI tool usage intensity, measured through self-reported weekly usage hours and application log data, showed positive correlation with learning gains ($r = 0.58$, $p < .001$), with students in the highest usage quartile (>5 hours weekly) demonstrating 34.7% proficiency improvement compared to 15.8% for the lowest usage quartile (<2 hours weekly). This relationship suggests a dose-response pattern where greater engagement with AI tools produces larger learning benefits, though causality remains unclear as more motivated students may both use AI tools more intensively and study more generally.

Prior proficiency level also influenced the magnitude of AI-enhanced learning gains, with intermediate-level students showing the largest improvements while beginners and

advanced students benefited less. Students assessed as intermediate proficiency at pre-test improved 29.3% on average, compared to 18.4% for beginners and 16.7% for advanced students. Qualitative data help explain this pattern: beginners reported feeling overwhelmed by AI tools designed for broader audiences rather than absolute beginners, struggling with vocabulary and grammar explanations that assumed more foundational knowledge than they possessed. One beginning student explained, "The AI app gives me Arabic sentences to translate, but I don't understand enough words to figure out the meaning. I need more basic instruction first." Conversely, advanced students found AI tools too simple and repetitive, offering insufficient challenge or authentic language exposure. An advanced student commented, "After practicing with these apps for a few weeks, I found them boring because I was just doing the same types of simple exercises. I need more complex, authentic materials." These findings suggest that AI tools' effectiveness depends on appropriate alignment with learner proficiency levels.

The following table presents detailed learning outcomes data disaggregated by skill domain and student proficiency level:

Skill Domain	Overall Gain	Beginning Level	Intermediate Level	Advanced Level
Vocabulary Knowledge	+31.2%	+42.1%	+35.6%	+18.9%
Grammatical Accuracy	+26.8%	+24.3%	+31.4%	+22.1%
Reading Comprehension	+19.7%	+15.2%	+26.8%	+14.3%
Writing Quality	+14.3%	+8.7%	+18.9%	+15.6%
Pronunciation (rubric)	+21.5%	+28.4%	+22.7%	+12.8%
Overall Proficiency	+23.4%	+18.4%	+29.3%	+16.7%

Note: Percentages represent mean improvement from pre-test to post-test. Beginning level: n=28; Intermediate level: n=39; Advanced level: n=18.

The pattern of differential gains across skill domains reflects both the strengths and limitations of current AI tools. Vocabulary and pronunciation showed the largest improvements, likely because AI applications provide extensive practice opportunities with immediate feedback on these relatively discrete skills. Students could practice vocabulary through spaced repetition algorithms optimized for retention and receive instant pronunciation feedback impossible in large classroom settings. Grammatical accuracy also improved substantially, supported by grammar-focused exercises with immediate error correction. Reading comprehension gains were more modest, perhaps because AI-recommended texts sometimes exceeded students' proficiency levels or lacked cultural contextualization that aided comprehension. Writing showed the smallest improvement, possibly because AI writing feedback, while useful for surface-level corrections, provided limited guidance on content organization, argumentation, and culturally appropriate rhetoric that effective Arabic writing requires.

Student survey data revealed generally positive perceptions of AI tools' contribution to learning, with 78% of students agreeing or strongly agreeing that AI tools helped them learn Arabic more effectively, 82% reporting that AI tools made learning more engaging and enjoyable, 71% indicating that AI feedback helped them understand and correct mistakes, and 68% stating that AI tools increased their confidence in using Arabic. However, students also identified limitations: 54% felt that AI tools could not replace human teachers, 49% reported technical difficulties interfering with learning, 43% found some AI-generated content confusing or incorrect, and 37% felt that AI tools did not adequately address cultural and contextual aspects of Arabic language use. These perceptions suggest that students view AI as a

valuable supplementary resource rather than a comprehensive solution, appreciating its benefits while recognizing its limitations and the continued importance of human instruction.

Challenges and Contextual Constraints

Implementation of AI technology at IAIN Sintang encountered substantial challenges rooted in the institution's remote location and limited infrastructure, requiring creative adaptations and realistic expectation-setting about what AI integration could accomplish given contextual constraints. Internet connectivity emerged as the most significant barrier, with unreliable and slow connections preventing consistent access to cloud-based AI applications. Instructors reported that many students lacked home internet access and relied on campus WiFi, which frequently experienced outages and became overloaded when many users accessed bandwidth-intensive applications simultaneously. One instructor described, "I planned activities using online AI tools, but frequently the internet was too slow or completely unavailable, forcing me to abandon those plans and improvise alternatives. Students became frustrated when they couldn't complete AI-based assignments due to connectivity problems beyond their control." These infrastructure limitations significantly constrained which AI tools could be used and how consistently students could engage with them.

Device availability represented another substantial challenge, as not all students owned smartphones or computers capable of running AI applications effectively. While smartphone penetration has increased in Indonesia, many students from rural West Kalimantan backgrounds owned older, lower-capacity devices that struggled with memory-intensive AI apps or lacked sufficient data plans for regular use. IAIN Sintang provided limited computer lab access, but competition for these resources and restricted hours prevented students from accessing AI tools as frequently as pedagogically desirable. Several students reported sharing devices with family members, limiting their ability to practice consistently. One student explained, "I share a phone with my siblings, so I can only use it for studying a few hours each day. This makes it hard to practice Arabic with apps daily as my instructor recommends." These device limitations particularly disadvantaged students from lower socioeconomic backgrounds, raising equity concerns about AI integration potentially widening rather than narrowing achievement gaps.

Technical support and digital literacy challenges compounded infrastructure problems. IAIN Sintang's limited IT support staff were overwhelmed with basic technology maintenance, leaving minimal capacity to support AI implementation troubleshooting. Instructors often served as de facto technical support, helping students download apps, create accounts, troubleshoot errors, and navigate interfaces—roles they felt inadequately prepared for. Students' varied digital literacy created additional challenges, with some students adapting quickly to new applications while others struggled with basic operations like downloading apps, creating accounts, or navigating multi-step interfaces. Instructors spent substantial class time on technology orientation that they had not anticipated needing. One instructor reflected, "I assumed today's students were all 'digital natives' who could easily use any app, but I discovered many students had never downloaded and installed applications independently or had limited experience beyond social media. I had to teach basic digital skills before we could focus on Arabic learning."

Beyond technical challenges, pedagogical and cultural concerns emerged regarding AI tools' appropriateness for Islamic higher education contexts and Arabic language learning goals. Some instructors expressed concern that AI applications designed primarily for Western audiences reflected secular cultural assumptions and content that might conflict with Islamic values or perspectives. For example, conversational AI chatbots sometimes generated dialogue examples involving situations like dating or alcohol consumption that instructors felt inappropriate for IAIN students. Several instructors also worried that AI tools' focus on Modern Standard Arabic or Egyptian/Levantine dialects provided insufficient expo-

sure to Quranic Arabic and classical Islamic texts that IAIN's Arabic program emphasizes. One instructor articulated, "Our Arabic program serves religious purposes—helping students access Islamic scholarship and understand religious texts—not just general communication skills. Most AI tools focus on everyday conversation rather than classical or religious Arabic, creating misalignment with our goals." These concerns highlight the importance of culturally appropriate and purpose-aligned AI tools rather than one-size-fits-all applications.

E. CONCLUSION

This study demonstrates that AI technology integration in Arabic language learning at IAIN Sintang, while facing substantial infrastructure and capacity challenges, has produced meaningful improvements in student learning outcomes and offers promising opportunities for enhancing language education in remote higher education contexts. Students showed significant proficiency gains particularly in vocabulary, grammar, and pronunciation domains where AI tools provided extensive practice opportunities and immediate feedback that traditional instruction could not match. However, the research also reveals that AI's educational value depends critically on adequate infrastructure support, careful pedagogical integration, and realistic adaptation to contextual constraints rather than uncritical technology adoption. The findings indicate that successful AI implementation in resource-limited settings requires: investing in reliable internet infrastructure and device access to ensure equitable AI tool availability; providing comprehensive professional development helping instructors develop both technical competence and pedagogical knowledge for effective AI integration; selecting or developing AI applications culturally appropriate for Islamic educational contexts and aligned with Arabic learning goals emphasizing religious texts alongside communicative competence; implementing blended approaches where AI supplements rather than replaces human instruction, leveraging each approach's comparative advantages; and maintaining realistic expectations about what AI can accomplish while acknowledging its limitations in addressing complex linguistic, cultural, and religious dimensions of Arabic language education. Future research should examine longer-term learning trajectories and retention, investigate factors enabling some students to benefit more than others from AI-enhanced instruction, explore development of culturally appropriate AI tools specifically designed for Islamic educational contexts, and study scaling challenges as AI integration expands beyond pilot implementations to institution-wide adoption.

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