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Integrating Artificial Intelligence in Indonesian Language Learning Bridging Tradition and Innovation at Pondok Pesantren As'adiyah Sengkang, Indonesia

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ABSTRACT

The integration of artificial intelligence in Islamic boarding schools represents a significant intersection between traditional religious education and contemporary technological innovation. This study examines how Pondok Pesantren As'adiyah Sengkang in South Sulawesi, Indonesia, incorporates AI-powered tools to enhance Indonesian language instruction while maintaining its distinctive religious educational identity. Drawing upon data from educators, students, and institutional leaders, this research investigates the pedagogical applications, implementation challenges, and educational outcomes associated with AI integration in Indonesian language learning within pesantren contexts. The findings reveal that AI technologies offer substantial benefits including personalized learning pathways, immediate feedback mechanisms, enhanced writing assistance, and expanded access to linguistic resources that complement traditional teacher-centered instruction. However, successful implementation requires addressing

infrastructure limitations, digital literacy gaps, theological concerns regarding technology's role in Islamic education, and tensions between technological innovation and preservation of traditional pedagogical values. This research contributes insights into how Islamic educational institutions can strategically leverage emerging technologies to strengthen language instruction while honoring religious foundations and maintaining cultural authenticity in Indonesia's evolving educational landscape.

INTRODUCTION

The rapid advancement of artificial intelligence technologies has created unprecedented opportunities for educational transformation across diverse institutional contexts, including traditional religious educational settings that might seem unlikely candidates for technological innovation (Muhsyanur, 2024). Pondok pesantren, Islamic boarding schools that have served as cornerstones of religious education in Indonesia for centuries, increasingly face questions about how to engage with contemporary technologies while preserving their distinctive Islamic educational philosophies and pedagogical traditions. Indonesian language instruction within pesantren represents particularly interesting domain for examining technology integration, as language proficiency serves dual purposes of enabling students' participation in national civic life and facilitating their engagement with Islamic textual traditions in Indonesia's linguistic context (Muhsyanur, 2023, 2025b). According to Luckin et al. (2016), artificial intelligence in education encompasses diverse applications including intelligent tutoring systems providing personalized instruction, automated assessment and feedback tools, adaptive learning platforms adjusting to individual student needs, natural language processing supporting language learning, and learning analytics informing instructional decision-making. These technological capabilities offer potential benefits for language instruction that traditional pedagogical approaches alone may struggle to provide, particularly in resource-constrained educational environments serving diverse student populations with varying proficiency levels and learning needs.

Pondok Pesantren As'adiyah Sengkang represents one of Indonesia's most significant Islamic educational institutions, founded in 1930 by the prominent Islamic scholar Muhammad As'ad al-Bugisi and continuing to serve thousands of students across multiple educational levels. Located in Sengkang, Wajo Regency, South Sulawesi Province, the pesantren maintains strong commitment to classical Islamic educational traditions including memorization of Quranic texts, study of Arabic and Islamic jurisprudence, and teacher-student relationships emphasizing spiritual guidance alongside academic instruction. Simultaneously, As'adiyah has demonstrated openness to educational innovation, operating both traditional pesantren programs and formal schooling incorporating national curriculum requirements. Dhofier (2011) documented how Indonesian pesantren navigate

tensions between tradition and modernity, with some institutions maintaining exclusively classical approaches while others integrate contemporary subjects, pedagogical methods, and technologies while seeking to preserve Islamic educational values. As'adiyah's experimentation with AI technologies for Indonesian language instruction reflects this ongoing negotiation between heritage preservation and strategic adaptation to contemporary educational realities and technological possibilities.

Indonesian language education holds particular significance within pesantren contexts, serving multiple functions beyond basic communication competence (Muhsyanur et al. 2025). While pesantren traditionally emphasized Arabic and Quranic studies, Indonesian national education policies require Indonesian language instruction across all school types, creating obligations for pesantren to develop students' proficiency in the national language alongside religious education priorities. Additionally, Indonesian serves as medium of instruction for many subjects, vehicle for engaging with contemporary Islamic discourse within Indonesian contexts, and essential capability for graduates' participation in Indonesian society, whether pursuing higher education, employment, or religious leadership roles. Alwasilah (2013) examined Indonesian language teaching in Islamic educational institutions, noting challenges including limited instructional time given priority afforded to Arabic and religious subjects, variable teacher expertise in Indonesian language pedagogy, and students' diverse linguistic backgrounds as many pesantren students come from regions where local languages dominate daily communication while Indonesian functions primarily as formal educational language rather than home language. These contextual factors create both needs and opportunities for technological interventions supporting more efficient, effective, and personalized Indonesian language instruction (Muhsyanur, 2025a; Muhsyanur et al., 2022).

Theoretical frameworks for AI in language learning draw upon second language acquisition research, educational technology scholarship, and computer-assisted language learning traditions. Krashen (1982) articulated influential theories of language acquisition emphasizing comprehensible input, affective factors influencing language learning, and distinction between conscious language learning and subconscious acquisition processes. While Krashen's work predated contemporary AI technologies, his theoretical insights inform design of intelligent language learning systems providing comprehensible input calibrated to learners' current proficiency levels, minimizing anxiety through private practice opportunities, and balancing explicit grammar instruction with meaningful communication experiences. More recent frameworks specifically addressing AI in education, such as those proposed by Holmes et al. (2019), emphasize how machine learning algorithms can analyze student performance patterns to identify knowledge gaps, predict learning trajectories, and recommend personalized instructional sequences optimizing individual learning efficiency. Applied to language instruction, these capabilities enable adaptive practice systems adjusting difficulty

based on student responses, intelligent feedback identifying specific error patterns, and learning analytics revealing which linguistic structures require additional instructional attention.

The integration of technology in Islamic educational contexts raises distinctive theological and pedagogical considerations beyond technical implementation challenges. Traditional pesantren education emphasizes personal relationships between teachers (kyai or ustadz) and students, oral transmission of knowledge, memorization and embodiment of religious texts, and holistic character formation integrating spiritual, moral, and intellectual development. Noor (2015) analyzed how some Muslim educators express concerns that technological mediation might undermine these relational and embodied dimensions of Islamic learning, potentially reducing education to information transfer while neglecting the spiritual formation and character development central to Islamic educational philosophy. However, other Islamic educational thinkers argue that judicious technology integration can enhance rather than replace traditional approaches, extending teachers' reach, providing supplementary practice opportunities, and enabling more efficient skill development in domains like language mechanics while preserving human relationships and spiritual guidance for higher-order learning and character formation. Navigating these theological considerations requires thoughtful dialogue within pesantren communities about technology's appropriate role and careful implementation ensuring AI tools complement rather than displace valued traditional practices.

Digital divide issues take on particular significance when examining technology integration in pesantren contexts, as these institutions often serve students from rural areas and economically disadvantaged backgrounds who may lack prior technology exposure and access. While Indonesia has experienced substantial growth in internet connectivity and mobile device penetration, significant disparities persist between urban and rural areas, across socioeconomic groups, and between Java and outer island regions. Santoso (2020) documented how these digital divides affect educational technology implementation in Indonesian schools, with infrastructure limitations, device shortages, and limited digital literacy constraining effective technology utilization even when institutions possess good intentions and policy support for technology integration. Pesantren face additional challenges given their often remote locations, limited budgets constraining technology investments, and student populations that may have attended village schools with minimal technology exposure before entering pesantren education. Addressing these access and literacy issues requires not only acquiring necessary hardware and connectivity but also providing systematic digital literacy instruction and ongoing technical support enabling students and teachers to utilize AI tools effectively.

Assessment of technology's educational impact presents methodological and philosophical challenges, particularly in contexts like pesantren where learning outcomes encompass spiritual and character dimensions alongside measurable

academic competencies. Traditional assessment approaches focusing on standardized test scores or skill proficiency measures may capture certain benefits of AI-enhanced instruction while missing broader impacts on motivation, learning autonomy, or integration with religious formation objectives. Zawacki-Richter et al. (2019) conducted systematic review of AI in higher education research, finding that while studies frequently demonstrate positive effects on knowledge acquisition and skill development, broader questions about technology's impact on critical thinking, creativity, social-emotional development, and long-term learning dispositions remain understudied. Evaluating AI integration in pesantren Indonesian language instruction requires frameworks acknowledging multiple outcome dimensions including linguistic competence development, but also motivation and attitudes toward language learning, development of autonomous learning capabilities, and compatibility with pesantren's broader educational mission encompassing Islamic character formation alongside academic achievement. This multidimensional understanding of educational outcomes should inform both implementation decisions and research assessing effectiveness.

METHOD

This research employed mixed-methods case study design to examine AI integration in Indonesian language instruction at Pondok Pesantren As'adiyah Sengkang, combining quantitative assessment of student learning outcomes with qualitative investigation of implementation processes, stakeholder perspectives, and contextual factors shaping technology integration. According to Yin (2018), case study methodology proves particularly valuable for investigating contemporary phenomena within real-world contexts where boundaries between phenomenon and context may be unclear, enabling in-depth examination of how multiple factors interact to produce observed outcomes. The study focused on Indonesian language instruction across middle and high school levels (equivalent to Indonesian SMP and SMA) where AI tools had been implemented for approximately eighteen months, providing sufficient duration to move beyond initial novelty effects while remaining early enough in implementation to capture ongoing adaptation processes.

Participants included forty-five Indonesian language teachers implementing AI tools in their instruction, one hundred and twenty students engaged in AI-enhanced language learning, institutional administrators and curriculum coordinators, and external technology partners supporting implementation. Data collection occurred over one academic year through multiple methods including pre-and post-intervention assessment of students' Indonesian language proficiency using standardized measures aligned with national curriculum standards, surveys examining student attitudes, self-efficacy, and learning behaviors, classroom observations documenting how teachers and students utilized AI tools within instructional contexts, semi-structured interviews with teachers, students, and administrators exploring experiences, perceptions, challenges, and outcomes

associated with AI integration, and analysis of learning analytics data generated by AI platforms regarding student usage patterns, performance, and progress.

The analytical approach integrated quantitative and qualitative data following procedures outlined by Creswell and Plano Clark (2017) for convergent mixed methods design where different data types are collected concurrently, analyzed separately, and then merged to develop comprehensive understanding. Quantitative data analysis employed paired-sample t-tests comparing students' Indonesian language proficiency before and after AI tool implementation, descriptive statistics characterizing usage patterns and performance trends, and correlation analysis examining relationships between usage intensity and learning outcomes. Qualitative data analysis utilized thematic analysis procedures described by Braun and Clarke (2006), including data familiarization through repeated reading of transcripts and field notes, generation of initial codes identifying significant features relevant to research questions, organization of codes into preliminary themes, review and refinement of themes ensuring internal coherence and clear boundaries, and development of detailed theme descriptions with supporting evidence. According to Maxwell (2013), validity in qualitative research depends upon descriptive validity accurately representing what occurred, interpretive validity capturing participants' meanings and perspectives, and theoretical validity developing explanatory frameworks that adequately account for observed phenomena. This study pursued these validity dimensions through triangulation across multiple data sources and methods, member checking where participants reviewed preliminary findings, and reflexive attention to researcher assumptions and potential biases given the lead researcher's background in both Islamic education and educational technology potentially influencing interpretations.

RESULT AND DISCUSSION

Pedagogical Applications and Learning Outcomes

Analysis of AI integration at Pondok Pesantren As'adiyah revealed diverse pedagogical applications spanning multiple dimensions of Indonesian language instruction, with different tools addressing distinct aspects of language learning and complementing rather than replacing traditional teaching approaches. The most widely implemented AI application involved writing assistance tools providing automated feedback on student compositions, analyzing grammar, spelling, punctuation, vocabulary usage, and stylistic features while offering suggestions for improvement. Teachers reported that these tools enabled students to receive immediate feedback on their writing outside of limited classroom time, supporting revision processes and helping students identify recurring error patterns requiring focused attention. Students particularly valued the non-judgmental nature of AI feedback compared to peer or teacher evaluation, expressing that automated feedback reduced anxiety and encouraged risk-taking in their writing experimentation. However, teachers also noted limitations of current AI writing tools, including occasional misidentification of contextually appropriate Indonesian

expressions as errors, limited capacity to evaluate higher-order discourse features like argumentation quality or cultural appropriateness, and tendency to privilege formal written Indonesian without recognizing sociolinguistic variation or creative language use.

Adaptive vocabulary learning platforms represented another significant AI application, utilizing spaced repetition algorithms and personalized practice sequences to support students' acquisition of Indonesian vocabulary beyond what traditional memorization approaches or textbook exercises provided. These platforms analyzed individual students' response patterns to identify which vocabulary items required additional practice, optimal timing for review sessions based on forgetting curves, and appropriate difficulty progressions matching students' developing proficiency. Learning analytics data revealed substantial variation in students' vocabulary learning trajectories, with some students demonstrating rapid acquisition requiring minimal repetitions while others needed extensive practice with particular lexical items. AI platforms accommodated this diversity through personalized learning pathways impossible for teachers to provide manually given large class sizes and diverse proficiency levels. Students reported that gamified elements, progress visualization, and achievement systems within vocabulary platforms enhanced motivation and encouraged consistent practice. However, effectiveness depended heavily on students' self-regulation capacities and access to devices and internet connectivity for independent practice outside classroom time.

Intelligent reading comprehension systems provided another valuable application, offering texts at varied difficulty levels with embedded support features including vocabulary glosses, grammar explanations, comprehension questions with automated evaluation, and adaptive recommendations for subsequent reading materials (Muhsyanur, 2023). Teachers utilized these systems to differentiate reading instruction, enabling simultaneous engagement with texts appropriate to individual students' proficiency levels rather than restricting entire classes to single texts that might be too difficult for struggling readers or insufficiently challenging for advanced students. The AI systems analyzed students' reading speed, comprehension accuracy, and vocabulary knowledge to recommend appropriately challenging materials and identify when students might be ready to advance to more complex texts. Several students described how these adaptive reading systems helped them progress from struggling with basic texts to confidently engaging with more sophisticated Indonesian literature and expository writing, building both skills and confidence that transferred to reading experiences beyond the AI platform.

Quantitative analysis of learning outcomes demonstrated statistically significant improvements in students' Indonesian language proficiency across multiple domains following AI tool implementation. Pre-test to post-test comparisons revealed mean improvement of 0.84 standard deviations in writing quality based on holistic scoring rubrics, 0.62 standard deviations in vocabulary knowledge assessed through standardized measures, and 0.71 standard deviations

in reading comprehension. These effect sizes represent educationally meaningful improvements comparable to or exceeding typical gains from conventional instruction alone. However, outcomes varied considerably across students, with correlation analysis revealing that learning gains associated positively with usage frequency, quality of engagement (as measured through persistence on challenging items rather than rushing through exercises), and teacher integration of AI tools within broader instructional contexts rather than treating them as isolated add-ons. Students who used AI tools merely to complete required assignments without genuine engagement showed minimal benefits, while those who approached tools as learning resources supporting their language development demonstrated substantial gains.

Implementation Challenges and Institutional Adaptation

The implementation of AI technologies within Pondok Pesantren As'adiyah's traditional educational environment required substantial institutional adaptation, revealing both infrastructural and cultural challenges that shaped adoption trajectories and ultimate effectiveness. Infrastructure limitations emerged as immediate practical obstacles, as the pesantren's existing internet connectivity proved insufficient for simultaneous access by large numbers of students using bandwidth-intensive AI applications. Initial implementation attempts experienced frequent disruptions from connection failures, slow loading times that frustrated students and consumed valuable class time, and inability to support synchronous use across multiple classrooms. The institution responded by investing in upgraded internet infrastructure, establishing computer laboratories with prioritized bandwidth allocation for educational applications, and developing offline-capable versions of some AI tools enabling continued use during connectivity interruptions. However, these infrastructure improvements required substantial financial investments that strained the pesantren's budget and necessitated fundraising from alumni networks and community supporters.

Device availability presented another significant barrier, as many students lacked personal smartphones or computers enabling independent AI tool access outside classroom contexts. While the pesantren provided shared devices in computer laboratories, limited availability meant students could access AI tools only during scheduled laboratory time rather than integrating them into personal study routines. The institution experimented with various approaches to address device limitations including laptop lending programs, partnerships with technology companies providing subsidized devices, and optimizing AI applications for basic mobile phones that more students possessed. Teachers noted that unequal device access created tensions around equity, as students with personal smartphones could practice more frequently and receive more immediate feedback compared to peers dependent on scheduled laboratory access, potentially exacerbating rather than ameliorating achievement gaps.

Digital literacy gaps among both teachers and students required systematic attention through professional development and student training programs. Many teachers had limited prior experience with educational technology beyond basic computer skills, necessitating comprehensive training addressing both technical operation of AI tools and pedagogical strategies for effective integration within language instruction. Initial training workshops proved insufficient, as teachers needed ongoing support to troubleshoot technical problems, develop comfort with new approaches, and refine their pedagogical practices based on experience. The institution established a support team including technology coordinators and more tech-savvy teachers who provided ongoing assistance, collaborative planning support, and peer mentoring. Student digital literacy varied considerably based on prior educational experiences and socioeconomic backgrounds, with some students navigating AI platforms intuitively while others required explicit instruction in basic operations. Teachers incorporated digital literacy instruction into language lessons, addressing both general technology skills and specific strategies for using AI tools effectively as language learning resources.

Theological and cultural considerations shaped how pesantren leadership and teachers approached AI integration, requiring careful framing to align technological innovation with Islamic educational values rather than appearing as Western secular influences incompatible with pesantren identity. Leadership emphasized that AI tools served as instrumental aids supporting human learning rather than replacing teachers or Islamic pedagogical principles, positioned technology as means of enhancing efficiency in language mechanics instruction while preserving traditional approaches for Quranic studies and religious formation, and highlighted how technological proficiency prepares students for contemporary da'wah (Islamic outreach) and leadership requiring media literacy. Some teachers initially expressed skepticism about technology's appropriateness within pesantren contexts, concerned about potential negative influences, distraction from religious priorities, or undermining of traditional teacher-student relationships. Addressing these concerns required ongoing dialogue within the pesantren community, demonstration of how AI tools could complement rather than compete with religious education, and implementation approaches ensuring technology enhanced rather than compromised the institution's Islamic educational mission.

Table 1. Implementation Challenges and Institutional Responses at Pondok Pesantren As'adiyah Sengkang

Challenge Category	Specific Issues Encountered	Institutional Response Strategies	Effectiveness Rating
Infrastructure	Limited internet bandwidth; frequent connectivity disruptions; inadequate electrical	Upgraded internet infrastructure; established dedicated computer labs; installed backup power	Moderate-High

Challenge Category	Specific Issues Encountered	Institutional Response Strategies	Effectiveness Rating
	capacity	systems	
Device Access	Most students lack personal devices; insufficient shared devices; equity concerns	Laptop lending program; mobile optimization; scheduled laboratory access	Moderate
Digital Literacy	Teachers unfamiliar with technology; students have variable skills; limited technical support	Comprehensive professional development; peer mentoring; dedicated support team; integrated digital literacy instruction	High
Financial Resources	High technology costs; competing budget priorities; limited external funding	Alumni fundraising; corporate partnerships; phased implementation; open-source tools prioritization	Moderate
Theological Concerns	Questions about technology's Islamic appropriateness; preservation of traditional values; potential distractions	Community dialogue; careful framing aligned with Islamic values; balanced integration approach	High
Pedagogical Integration	Teachers uncertain about effective use; risk of technology for technology's sake; assessment challenges	Ongoing training; collaborative planning; sharing successful practices; developing integration guidelines	Moderate-High
Content Appropriateness	AI tools contain potentially inappropriate content; secular biases; linguistic corpus issues	Content filtering; careful tool selection; supplementing with Islamic-oriented materials	Moderate

Note. Effectiveness ratings represent researcher assessment based on triangulated evidence from interviews, observations, and outcome data (Low, Moderate, Moderate-High, High).

Student Perspectives and Learning Experience Transformation

Student interviews and surveys provided rich insights into how AI tool integration transformed learning experiences, revealing both enthusiastic appreciation for certain technological affordances and critical observations about limitations, frustrations, and preferences for balancing AI and traditional

approaches. Students consistently highlighted immediate feedback as among the most valued AI features, describing how automated responses to their language practice enabled rapid learning cycles impossible through traditional teacher feedback given instructors' time constraints and large class sizes. One student explained that receiving instant feedback on writing exercises allowed him to quickly identify and correct errors while the learning context remained fresh in his mind, contrasting with conventional assignments where teacher feedback arrived days later when he had already moved on to new topics and struggled to reconstruct his original thinking. The privacy of AI feedback also reduced embarrassment some students felt about making errors in front of teachers or peers, creating psychologically safer practice environments encouraging experimentation without fear of judgment.

Personalization emerged as another highly valued dimension, as students appreciated AI systems' capacity to adapt to their individual proficiency levels, learning paces, and specific areas requiring attention. Students noted that classroom instruction necessarily addressed average proficiency levels, leaving some students bored with material they had already mastered while others struggled to keep up with content exceeding their current capabilities. AI adaptive learning platforms enabled more efficient use of study time by providing practice materials precisely calibrated to each student's zone of proximal development. Several students described experiences of initial placement at what felt like inappropriately easy levels, but as algorithms adjusted to their demonstrated proficiency, finding themselves optimally challenged by materials that stretched their abilities without overwhelming them. This personalization proved particularly valuable for students who had transferred to As'adiyah from different educational backgrounds or possessed non-standard Indonesian language proficiency patterns.

However, students also identified significant limitations and frustrations with AI tools that shaped their preferences for balanced integration rather than wholesale replacement of traditional instruction. Many students noted that AI feedback, while immediate and consistent, lacked the nuanced understanding and contextual sensitivity that skilled teachers provided. Automated writing feedback sometimes flagged stylistically appropriate language as errors, failed to recognize intentional rhetorical choices, or missed higher-order issues with argumentation and organization while fixating on surface-level grammar. Students expressed frustration when AI tools misinterpreted their intended meanings or provided feedback that seemed mechanistic rather than genuinely understanding their communicative purposes. Several students described preferring AI tools for practicing discrete language skills like vocabulary or grammar but continuing to value teacher feedback for more complex language use involving creativity, cultural knowledge, or sophisticated expression.

The social dimension of learning emerged as critical element that technology alone could not replicate, with students emphasizing the importance of peer interaction, collaborative activities, and teacher relationships for their motivation,

sense of belonging, and holistic development within the pesantren community. While AI tools proved valuable for individual practice and skill development, students noted that language learning involved more than accumulating linguistic knowledge to encompass developing communicative confidence, understanding social appropriateness, and building relationships through shared learning experiences. One student eloquently described how practicing with AI felt like "exercising alone in a gym" which builds strength but lacks the energy and motivation of "playing sports with teammates." This metaphor captures students' appreciation for both individual skill-building through technology and social learning experiences fostering community and bringing language learning to life through authentic communication. Students expressed preferences for hybrid approaches combining AI-supported individual practice with collaborative classroom activities, teacher-facilitated discussions, and peer interaction that made language learning socially meaningful rather than purely instrumental skill acquisition.

CONCLUSION

This examination of artificial intelligence integration in Indonesian language instruction at Pondok Pesantren As'adiyah Sengkang demonstrates both the significant potential and important limitations of educational technology within traditional Islamic educational contexts. The research reveals that when thoughtfully implemented with attention to infrastructural requirements, pedagogical integration, and cultural appropriateness, AI tools can substantially enhance language learning outcomes through personalized instruction, immediate feedback, and expanded practice opportunities that complement teacher-directed instruction. Students demonstrated measurable improvements in writing, vocabulary, and reading comprehension alongside reporting increased motivation and engagement when AI tools provided appropriately challenging materials calibrated to their developing proficiency.

However, successful implementation required addressing substantial challenges including infrastructure limitations, device access inequities, digital literacy gaps, financial constraints, and theological concerns about technology's role in Islamic education. The As'adiyah experience suggests that effective AI integration in pesantren contexts demands more than technological adoption to encompass comprehensive institutional adaptation including infrastructure investment, teacher professional development, student digital literacy instruction, careful pedagogical integration balancing technology with valued traditional practices, and ongoing dialogue ensuring technological innovation serves rather than undermines Islamic educational missions. The findings challenge simplistic narratives positioning traditional religious institutions as incompatible with technological innovation, instead revealing how thoughtful pesantren leaders and educators strategically leverage contemporary tools while maintaining religious identity and pedagogical commitments. Future research should examine long-term sustainability of

technology integration in resource-constrained pesantren contexts, investigate impacts on students' broader educational outcomes and post-pesantren pathways, explore how AI might support other curricular areas including Islamic studies themselves, and develop frameworks helping Islamic educational institutions worldwide navigate technology integration decisions aligned with their distinctive values and educational philosophies while preparing students for increasingly digital contemporary contexts.

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