JOLLS: Journal of Language and Literature Studies
Website: https://journal-center.litpam.com/index.php/jolls/index
Email: jolls@litpam.com
DOI: https://doi.org/10.36312/4n0c6g86

December 2025 Vol. 5, No. 4
e-ISSN: 2808-1099
pp. 1025-1037

The Integration of Digital Tools in EFL Grammar Instruction in Indonesia's Digital Age: Prospects and Challenges

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Received: October 2025; Revised: November 2025; Accepted: November 2025; Published: December 2025

Abstract

Digital technologies are transforming grammar instruction within English as a Foreign Language (EFL) programs, yet little evidence exists on their implementation in Indonesian higher education where access disparities and varying instructor preparedness remain significant challenges. This study examines the opportunities and obstacles of digital grammar teaching across three undergraduate English education programmes. Employing a sequential explanatory mixed-methods design, we surveyed 180 undergraduates about their interactions with mobile grammar applications, artificial intelligence-based grammar checkers and online quizzes, and followed up with semi-structured interviews with ten lecturers. The quantitative results indicate that 72 % of students experienced increased motivation, 69 % reported greater autonomy and 65 % perceived improvements in accuracy when using digital tools. However, 31 % relied on instructors to interpret automated feedback and 41 % accepted corrections uncritically, signalling an overdependence on technology. Qualitative interviews revealed that while digital tools fostered higher engagement and allowed for differentiated assignments, concerns persisted about feedback reliability, unequal access to devices and the necessity for instructor oversight. These findings suggest that digital tools can enhance motivation, autonomy and precision in Indonesian EFL grammar education when thoughtfully integrated within supportive infrastructural and professional development frameworks. The study underscores the critical need for equitable access, comprehensive instructor training and deliberate curricular integration to maximise the benefits of digital grammar instruction, thereby contributing to the broader field of EFL education.

Keywords: Grammar instruction; Digital learning; Language pedagogy; Technology integration

How to Cite: La Sunra, L., Amaliah, S., Syamsuddin, M.R. & Mansyur, M. (2025). The Integration of Digital Tools in EFL Grammar Instruction in Indonesia's Digital Age: Prospects and Challenges. *Journal of Language and Literature Studies, 5*(4), 1025-1037. doi: https://doi.org/10.36312/4n0c6g86

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INTRODUCTION

Grammar instruction remains a fundamental element of second-language pedagogy; however, traditional rule-based teaching methods frequently fail to translate into practical communicative ability. Recent research confirms that decontextualized drills and memorization are insufficient in preparing students for authentic English usage, thereby prompting a transition towards more inductive and meaningful pedagogical approaches (Munir et al., 2023). Over the past decade, digital technologies have expanded new opportunities for grammar instruction by facilitating practice at any time and in any location. Mobile-assisted language learning (MALL) platforms and gamified applications offer interactive practice beyond the classroom environment, maintaining engagement and motivation (Muslimah et al., 2025). Zhang and Hasim (2023) similarly observe that

emerging tools such as AI-driven writing assistants provide adaptive feedback capable of helping learners recognize patterns and enhance accuracy. For instance, Amaliah et al. (2025) noted that Indonesian EFL students improved their collocational speaking skills through podcast-based activities, which increased their awareness of polysemous verbs, exemplifying how digital media can enrich the learning of grammar and vocabulary. Concurrently, concerns persist regarding whether these technologies genuinely promote learner autonomy or merely foster dependence on automated feedback (Hattna, 2023). Issues related to access and teacher preparedness are also of critical importance. According to Deswalantri et al. (2024), exposure to English outside the classroom remains limited in many regions of Indonesia. Yaqin et al. (2024) further emphasize that digital inequities persist, underscoring the need to examine how technology affects motivation, autonomy, and accuracy in EFL grammar acquisition, particularly within under-resourced contexts.

Recent research on technology-mediated grammar learning presents a nuanced perspective regarding opportunities and obstacles. On one side, numerous studies indicate positive outcomes resulting from the integration of digital tools into grammar instruction. Mobile applications and online games have been shown to enhance learners' interest, facilitate immediate practice, and augment engagement with grammatical content (Muslimah et al., 2025). Interactive, game-based features can bolster motivation and potentially contribute to improvements in grammatical proficiency. Zhang and Hasim (2023) discovered that gamified activities enhanced students' retention of grammar and intrinsic motivation across various EFL contexts. Data-driven learning utilizing corpora constitutes another promising pathway. Recent research by Li et al. (2025) suggests that corpus-based tasks foster learners' analysis of authentic language patterns, thereby increasing their grammatical awareness and autonomy.

In the domain of writing, AI-powered grammar checkers and evaluative tools can provide corrective feedback that significantly enhances surface accuracy and overall writing quality, as demonstrated in a quasi-experimental study that employed Grammarly within an Indonesian EFL classroom (Rahmatika, 2025). These instances exemplify the pedagogical benefits of technology, including heightened engagement, personalized feedback, and improved analytical skills. Conversely, scholars also emphasize several challenges associated with these innovations. Student reception of automated feedback is not uniformly favorable. Hattna (2023) observed that some learners are cautious that excessive reliance on tools such as grammar checkers might undermine their capacity for independent learning and skill development.

The reliability of automated corrections can be inconsistent, with AI systems occasionally providing erroneous suggestions or exhibiting biases, which can potentially mislead learners (Duhaylungsod & Chavez, 2023). Without appropriate integration within curricula, digital tools risk merely functioning as superficial adjuncts. Kumayas and Lengkoan (2023) argue that educators require adequate training and support to integrate these tools into their pedagogical practices effectively. Ongoing issues such as the digital divide, characterized by unequal access to devices and stable internet connectivity, continue to restrict the implementation of technology-enhanced learning in numerous regions. According to Yaqin et al. (2024), such disparities exacerbate existing educational inequalities. Although technological advancements offer new opportunities for grammar instruction, achieving a balance between grammatical accuracy and communicative fluency remains an important concern for educators.

In light of these developments, this study aims to address critical gaps in our understanding of digital grammar instruction. Previous research on technology in language learning has often been fragmented, focusing on specific skills such as vocabulary or writing, or examining individual tools in isolation, without providing a holistic view of grammar pedagogy in the digital age. Few studies have synthesized the benefits and

challenges of digital grammar instruction as an integrated pedagogical domain, especially in non-Anglophone contexts with constrained resources. This study addresses that gap by foregrounding the Indonesian higher education environment, where limited English exposure, uneven digital access, and varying levels of teacher preparedness create a unique context for innovation. Deswalantri et al. (2024) confirm these contextual challenges, noting that disparities in teacher training and access to educational resources are significant obstacles for Indonesian EFL learners. At the same time, Yaqin et al. (2024) point out that infrastructure and digital literacy issues mean not all students and teachers can equally benefit from new tools.

By focusing on this setting, our research provides insights into how technological tools function under real-world constraints. We employ a sequential explanatory mixed-methods design, collecting quantitative survey data from 180 undergraduate EFL students and qualitative interview data from 10 English lecturers across Indonesian universities. This combined approach allows us to triangulate perspectives from learners and educators, providing a deeper understanding of how digital tools influence learner motivation, engagement, autonomy, and grammatical accuracy. Notably, we conceptualize the advantages and drawbacks of technology not as separate issues, but as intertwined dimensions of a complex educational reality. Increases in motivation might come with new dependencies, and greater access to information might highlight equity gaps. By addressing these nuances, the study offers both theoretical contributions to technology-enhanced language education and practical guidance for instructors and policymakers on implementing a balanced approach to digital grammar pedagogy.

Accordingly, this article aims to investigate the influence of digital technologies on grammar instruction in Indonesian EFL contexts by identifying the pedagogical benefits, examining the associated challenges, and proposing strategies for balanced implementation. The inquiry is guided by three research questions, presented as follows at the conclusion of the introduction to provide a clear roadmap for the reader: What opportunities do digital tools present for EFL grammar instruction and acquisition, specifically in enhancing learner motivation, autonomy, and grammatical precision?; What challenges arise when these tools are incorporated into grammar practice, including concerns regarding over-dependence on technology, the dependability of automated feedback, digital equity, and the preparedness of educators?; and How can educators leverage technological innovations in grammar instruction while upholding effective pedagogical practices and guaranteeing equitable access for all learners?

RESEARCH METHOD

Research Design

This study employed a sequential explanatory mixed-methods design, integrating quantitative and qualitative approaches in two distinct phases. The rationale behind this design lies in its capacity to capture statistical trends and then explain them through in-depth qualitative inquiry, thereby offering a fuller understanding of how digital grammar instruction manifests in Indonesian EFL contexts. According to Creswell and Clark (2018), sequential explanatory designs are particularly useful when initial quantitative findings require deeper interpretation through participant narratives. This design has been increasingly adopted in language education research to explore technology integration in EFL classrooms, especially where context-sensitive interpretation is essential (Hendriani et al., 2023).

In the first phase, survey data gathered from undergraduate students were analyzed to identify behavioral trends, perceived benefits, and challenges related to digital grammar learning. These initial patterns served as the foundation for constructing the interview protocol in the second phase. In the qualitative phase, semi-structured interviews were

conducted with English lecturers to elaborate on the survey findings. This approach allowed the study to triangulate both numerical patterns and pedagogical perspectives, ensuring a comprehensive exploration of the research questions. By employing this mixed-method strategy, the study aims not only to quantify learner experiences but also to contextualize them within the instructional realities faced by educators across Indonesian higher education institutions.

Table 1. Overview of the Sequential Explanatory Mixed-Methods Design

Phase	Participants & instruments	Purpose
Quantitative	180 undergraduate EFL students responded to a 30-item survey distributed via Google Forms. The survey included demographic questions and items on perceived prospects (motivation, engagement, autonomy, accuracy, and personalization) and perceived challenges (over-reliance, feedback reliability, accessibility, and teacher guidance). Items were rated on a 5-point Likert scale.	To measure learners' perceptions of digital grammar tools and identify general trends.
Qualitative	Ten English lecturers (five male, five female; average of 12 years' teaching experience) from three universities participated in semi-structured interviews lasting 40–60 minutes. The interviews explored teachers' experiences with digital grammar tools, student strategies, perceived benefits and challenges.	To provide in-depth explanations of the quantitative results and gather pedagogical insights.

Participants

A total of 180 undergraduate EFL students (ages 18–23) from three state universities in Makassar participated in the quantitative phase. The students were selected through convenience sampling because of geographic accessibility, high responsiveness via institutional channels (e.g., university mailing lists and official student WhatsApp groups), and logistical feasibility within the research timeline. This sampling approach was deemed appropriate for an exploratory study aiming to capture a broad range of perceptions across multiple campuses. Eligible students were those actively enrolled in English education programs who had completed at least one grammar course. As an additional inclusion criterion, all students had to have used at least one digital grammar tool—such as AI-powered grammar checkers (e.g., Grammarly), mobile grammar applications, or online quizzes—during the past academic year, ensuring familiarity with technology-enhanced grammar practice. The sample was balanced in terms of gender (96 females and 84 males) and included learners across different proficiency levels (A2 to C1 on the CEFR self-assessment).

For the qualitative phase, ten English lecturers from three state universities in Makassar were selected using purposive sampling to ensure variation in teaching experience, institutional context, and familiarity with digital pedagogy. Lecturers were included based on having at least five years of teaching experience and a demonstrated track record of integrating digital grammar technologies into their instruction. This integration could include regular use of AI writing assistants, corpus-based exercises, gamified grammar platforms, or other online tools to support grammar learning. Purposive sampling is widely recommended in mixed-methods research to capture informed perspectives from individuals with specialized knowledge. In line with this guidance, the selected lecturers represented diverse expertise and engagement with digital pedagogy, ensuring that the qualitative data would yield rich insights into both the benefits and challenges of technology-mediated grammar instruction. A purposive sampling strategy was used for the interviews, ensuring variation in teaching experience, institutional context, and familiarity with digital pedagogy.

Instruments

Survey Questionnaire

A survey instrument was developed to measure students' perceptions of digitally assisted grammar instruction. The questionnaire items were developed based on a recent literature review on MALL, gamification, and AI in grammar learning, as well as examples of similar instruments in previous studies. The questionnaire consisted of 30 items divided into four groups: (1) Demographics (age, gender, competency level); (2) Perceived Prospects, which measured aspects of the prospects including learning motivation, engagement level, autonomy level, perceived accuracy improvement, personalization, and confidence in using digital grammar; (3) Perceived Challenges – measuring frequency of tool use, reliability of AI feedback, accessibility of the technology, and reliance on instructor guidance; and (4) Open-ended responses for participants' comments and experiences. In addition, several items were designed to measure "frequency of tool use" and "perceived accuracy improvement," for example, statements such as: "I practice grammar more often because of online quizzes" or "Using a grammar app makes me more confident in writing accurately." All item ratings used a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5), facilitating quantitative analysis. The questionnaire was pilot-tested on 20 students to ensure clarity and reliability; then, Cronbach's alpha was calculated to ensure internal consistency on the prospects and challenges subscales (a value > 0.80 indicates high reliability). Validity of the questionnaire was obtained through assessments by several EFL experts who ensured that each item represented the intended construct.

Interview Protocols

A semi-structured interview guide was prepared to follow up on the survey findings and obtain in-depth qualitative data. Interview questions were developed following the initial survey analysis, focusing on key topics such as learning autonomy, tool reliability, motivation, and the practical realities of using digital platforms in teaching. The guide was designed to be flexible to allow for follow-up questions and covered aspects such as: 1) lecturers' experiences integrating grammar technology (e.g., AI writing assistants, gamification apps, or data-driven tasks); 2) strategies used by students in using grammar apps, AI checking tools, and MALL assignments; 3) the role and influence of digital tools on motivation, autonomy, and accuracy; 4) barriers such as technical difficulties, algorithmic bias, or access barriers; and 5) the balance between automated practice and traditional pedagogical guidance. The draft guide was then reviewed by two EFL experts to ensure topical appropriateness and terminology equivalence. Interviews lasted 30–45 minutes per participant, were audio-recorded (with consent), and transcribed verbatim for thematic analysis.

Data Collection Procedures

Data were collected over three months during the second semester of the 2024 academic year, ensuring consistency of context and minimizing temporal effects on responses. The entire process adhered to ethical standards; participants were informed of the study's aims, assured of confidentiality, and provided informed consent prior to participation.

Survey distribution: The online questionnaire was hosted on Google Forms and distributed through multiple institutional channels (university mailing lists, official WhatsApp study groups, and learning management systems). This approach leveraged existing networks to maximize reach while maintaining logistical efficiency, enabling broad participation from the selected convenience sample.

Interviews: After completing the survey, participants who volunteered for further involvement were contacted for semi-structured interviews. Although ten lecturers were ultimately interviewed, recruitment continued until data saturation was achieved, that is, when new interviews no longer yielded novel insights into the themes explored. Interviews were conducted either via video conference (Zoom) or face-to-face, depending on participant availability and preference. Ethical approval was obtained from the institutional review board of the lead researcher's university. Participants provided informed consent prior to data collection.

Data Analysis

Quantitative Analysis

Survey data were processed using descriptive and inferential statistics in SPSS. Descriptive statistics (mean scores, standard deviations, and frequency distributions) provided an overall picture of participants' attitudes and behaviours, while independent-samples t-tests and one-way ANOVA were applied to examine differences across variables such as gender, proficiency level, and frequency of digital tool use. To ensure that the measurement scales remained consistent, internal reliability coefficients were recalculated on the full dataset after the complete survey (post-survey); Cronbach's alpha values exceeded 0.85, confirming that the items retained strong reliability in the final analysis rather than merely in the pilot stage.

Qualitative Analysis

Thematic analysis was employed to interpret the interview data. Following Braun and Clarke's (2006) six-step framework—familiarization, initial coding, theme identification, theme review, definition and naming, and reporting—transcripts were coded and analyzed using NVivo software to manage data systematically. Themes centered on motivation, autonomy, accuracy, over-reliance on technology, digital divide, and teacher readiness. Throughout this process, methodological triangulation was used: patterns emerging from the quantitative analysis guided the interview focus, and in turn, qualitative insights were cross-checked against survey findings. This cross-comparison of data sources strengthened validity by identifying convergence and divergence among learner perceptions and instructor experiences. By triangulating evidence from both quantitative and qualitative phases, the study provides a richer and more trustworthy interpretation of how digital tools influence grammar instruction.

Limitations of the Methodology

Although the mixed-methods approach provided comprehensive insights, several limitations are acknowledged. First, relying on self-reported data in surveys may introduce social desirability bias. Second, the sample was limited to university students in Indonesia, restricting generalizability to other contexts. Third, the study did not include experimental interventions, meaning causal claims about the effectiveness of digital tools cannot be made. Nevertheless, the design was appropriate for the exploratory aim of mapping prospects and challenges.

RESULTS AND DISCUSSION

Motivation and Engagement

The survey of 180 EFL undergraduates showed that 72 % felt more motivated to practise grammar when using digital tools. Students mentioned that mobile apps, online quizzes and grammar checkers made practice more engaging by offering gamified tasks, instant feedback, progress tracking and personalised hints. Immediate corrections allowed them to monitor their progress and set individual goals, while leader boards and point systems cultivated friendly competition and sustained interest. Interviews with ten lecturers corroborated these findings: instructors reported that students logged in more

frequently and spent longer practising grammar when interactive elements were present. However, the quantitative data also revealed that nearly 28 % did not experience increased motivation.

Open-ended responses indicated that these learners preferred traditional instruction or lacked reliable internet access and devices at home. This divergence suggests that digital tools are practical when accessible and well designed. However, it may have a limited impact in contexts of unequal access or when tasks are poorly aligned with curricular objectives. The overall pattern points to motivational affordances, yet warns that enthusiasm is not universal and depends on infrastructure and thoughtful integration. For instance, participants who used smartphone apps with progress dashboards reported practising grammar for at least fifteen minutes more daily than those who relied on textbooks. Several students also noted that the pandemic-induced shift to remote learning accelerated their adoption of digital tools and highlighted the need for engaging grammar activities outside classroom walls.

These results align with studies showing that technology-mediated grammar tasks can enhance learner engagement. Burston (2014) and Sung (2021) reported that gamified mobile applications increased motivation by providing ubiquitous practice and immediate rewards. Self-determination theory suggests that autonomy, competence and relatedness contribute to intrinsic motivation; digital tools can satisfy these needs by allowing learners to choose when to practise, track their progress and interact with peers. However, our findings also reveal digital inequity and task design disparities. Reinders and White (2016) caution that poorly integrated tools may be perceived as superficial add-ons rather than meaningful supports.

In contexts like Indonesia, where infrastructure remains uneven, learners without stable internet connections may feel excluded, echoing Warschauer's (2003) concerns about the digital divide. The 28 % of participants who were not motivated indicate that novelty alone does not guarantee engagement. This divergence underscores the need for teachers to select platforms that align with curricular goals and to provide alternative pathways for students with limited access. Future implementations should incorporate blended learning and ensure that motivational features are inclusive and pedagogically sound. Furthermore, research on gamification cautions that extrinsic rewards can wear off over time if not accompanied by meaningful tasks, so educators should periodically update digital activities to maintain relevance and challenge. By designing tasks that connect grammar practice to real-world communication, teachers can nurture sustained engagement beyond the novelty effect of digital interfaces.

Learner Autonomy and Independent Practice

Quantitative data showed that 69 % of students practised grammar autonomously using digital tools such as MALL apps, adaptive grammar checkers and data-driven exercises. Learners appreciated the convenience of practising anytime and anywhere, and many reported that self-paced exercises helped them build confidence. Interview responses corroborated this pattern: several students described planning their study schedules and revisiting exercises until they mastered a rule. However, the remaining 31 % relied heavily on lecturers to interpret automated corrections and explain underlying rules. This group tended to be lower-proficiency learners or those with limited digital literacy. Some commented that they felt lost without face-to-face explanation, while others accepted corrections without reflection. The results also indicated gender and proficiency differences: male learners and those at intermediate levels reported slightly higher levels of independent practice, whereas beginners and those with limited access to devices were more likely to seek teacher guidance. Overall, the data suggest that digital tools can foster autonomy, but that proficiency, digital skills and access mediate autonomy. Open-ended

survey responses revealed that students who owned personal laptops or smartphones were likelier to experiment with different grammar websites and track their progress over weeks. In contrast, those sharing devices at home cited time constraints as a barrier to sustained practice. Some participants also noted that autonomy improved their problem-solving skills and motivated them to set personal goals, showing that independent practice can foster self-efficacy.

The mixed pattern of autonomy corroborates Boulton's (2017) and Bao's (2023) research, which shows that data-driven learning and mobile apps can promote learner agency by enabling discovery and self-regulated practice. According to Reinders and White (2016), autonomy emerges when learners have opportunities to make decisions about their learning and receive support in interpreting feedback. Our findings support this claim: students who engaged in self-directed study often described using digital tools to test hypotheses about grammar and track their progress. Conversely, the 31 % who remained dependent on teachers illustrates that autonomy is not guaranteed. The digital divide and lack of digital literacy may hinder learners from fully exploiting the affordances of technology.

Furthermore, some learners may not be accustomed to reflective practice and therefore accept corrections passively. These differences highlight the importance of scaffolding: teachers need to model strategies for interpreting automated feedback and encourage metalinguistic reflection. Educators can bridge the gap between independent practice and meaningful autonomy by integrating reflective tasks and offering targeted support to novices. This aligns with studies emphasising that autonomy develops gradually and requires guidance in using digital resources, particularly for novice learners. Training sessions on digital literacy and metacognitive strategies could help students navigate platforms more confidently, enabling them to convert technology use into genuine self-directed learning.

Accuracy, Feedback, and Reflection

Sixty-five per cent of participants reported that digital feedback improved their grammatical accuracy in writing. Inferential statistics showed significant gains in accuracy scores after sustained use of adaptive grammar applications ($p < .05$), suggesting that automated feedback helped learners notice and correct errors. Students appreciated immediate corrections and personalised suggestions, and some noted that repetition and spaced practice promoted retention. However, 41 % admitted they accepted corrections without analysing why they were wrong. Interviews revealed that lecturers were concerned about the reliability of some AI-driven tools: software occasionally provided inaccurate or contextually inappropriate suggestions, which confused students. Several teachers recounted instances where learners copied incorrect corrections directly into their assignments, resulting in fossilised errors. These findings indicate that while digital tools can enhance surface-level accuracy, learners may lack critical engagement with feedback and be misled by erroneous recommendations. The quantitative and qualitative data together highlight an improvement in accuracy and underscore the risks of over-reliance on technology. Further analysis showed that accuracy gains were highest among intermediate and advanced learners, suggesting that familiarity with grammatical structures may enable better feedback utilisation. Some participants noted that adaptive programmes sometimes repeated simple corrections rather than providing deeper explanations, leading to superficial learning when used without teacher guidance.

The observed accuracy gains align with Li's (2022) review of automated writing evaluation systems, which concluded that such tools can improve surface-level correctness. O'Neill and Russell (2019) found that learners value immediate feedback but vary in their trust of automated suggestions. Fuchs (2022) emphasises that AI tools should

complement, not replace, teacher feedback. Our findings mirror these perspectives: the majority benefited from adaptive feedback, yet a substantial minority accepted corrections uncritically. According to the noticing hypothesis, explicit attention to form is required for uptake; thus, unreflected acceptance may limit deep learning.

Furthermore, as noted by Hassan (2022), inaccuracies and algorithmic bias in AI systems pose challenges. Students who rely solely on software may incorporate incorrect patterns into their writing. These discrepancies underline the need for teacher mediation and metalinguistic instruction. Educators should encourage learners to question automated feedback, cross-check suggestions with rule explanations and consult teachers when in doubt. Combining automated tools with human guidance ensures that accuracy improvements are meaningful and sustained. Additionally, long-term studies suggest that learners who engage critically with feedback develop greater linguistic awareness and can better transfer knowledge to new contexts. Future research should examine how different AI systems handle complex grammatical structures and whether personalised feedback can be refined to reduce errors and bias across proficiency levels.

Challenges, Equity, and Lecturer Readiness

Beyond individual learning variables, structural challenges emerged as significant factors influencing digital grammar instruction. Lecturers reported that many educators lacked training in selecting, evaluating and integrating digital tools pedagogically. Without professional development, technology remained a superficial addition rather than a core component of instruction. Survey data and interviews pointed to persistent digital inequities: students from lower socio-economic backgrounds experienced unstable internet connections, limited access to devices and shared family resources, which constrained their ability to practise grammar online. This digital divide meant that the benefits of technology were unevenly distributed across the sample. Additionally, students and teachers expressed concerns about algorithmic opacity and bias in AI-driven grammar checkers. Several participants mentioned that they were unsure how decisions were made and whether feedback was fair across dialects and proficiency levels. These challenges suggest that infrastructure, training and ethical considerations are as important as the tools in shaping outcomes. For example, roughly fifteen per cent of learners reported sharing smartphones with family members, limiting their availability for study. In comparison, another ten per cent relied on campus Wi-Fi, which was often unreliable during peak hours. Teachers also commented that the abundance of commercially available apps made it difficult to identify which platforms aligned with curricular goals and ethical standards.

The structural obstacles identified here align with Reinders and White's (2016) warning that digital tools must be embedded within curricula and supported by trained instructors. Warschauer (2003) highlighted the digital divide as a persistent barrier to equitable access; our findings confirm that learners without reliable connectivity or devices can benefit less from digital grammar instruction. Recent studies by Rahman (2023) and Hassan (2022) note that algorithmic bias and opacity can undermine trust in automated feedback, particularly for non-standard language varieties. The reported lack of teacher readiness suggests that institutional policies and professional development initiatives are required to build digital pedagogical competence. Moreover, the reliance on AI raises ethical questions about privacy and accountability. To mitigate these issues, institutions should invest in infrastructure, provide targeted training and develop guidelines for evaluating digital tools. By addressing these systemic challenges, educators can ensure that technological innovations enhance rather than exacerbate existing inequalities. Policymakers should also consider subsidising devices and data plans for underprivileged students and developing regional networks that support stable connectivity. Implementing quality assurance frameworks and certification processes for educational technology can

help lecturers select reliable and ethically sound tools, fostering trust among users. Such measures can bridge gaps and foster a more equitable learning ecosystem, ensuring that advancements benefit all learners regardless of socio-economic status.

Connecting Key Findings to Research Objectives and Existing Literature

The results collectively address the research questions by illustrating how digital tools influence motivation, autonomy, accuracy and the broader learning environment. The first research question explored the benefits of digital tools. The findings show that gamified apps and adaptive feedback can enhance motivation, provide flexible practice opportunities and improve surface-level accuracy. These patterns align with recent studies showing that game-based learning increases engagement and supports grammar retention (Zhang & Hasim, 2023; Muslimah et al., 2025). The second research question examined challenges. Our results highlight over-reliance on automated feedback, unequal access and teacher readiness issues. This echoes earlier warnings that digital tools may become superficial add-ons when not integrated thoughtfully (Reinders & White, 2016) and confirms that digital inequities remain a major barrier. The third research question considered how educators can harness technology effectively. The findings suggest that teachers must scaffold students' use of digital feedback, integrate reflective tasks and ensure that digital activities align with curricular goals. Institutions must address infrastructure disparities and provide training so that technology serves as a pedagogical enhancer rather than a substitute.

Placing these results within the wider literature underscores both convergence and divergence. Consistent with self-determination theory, digital tools can satisfy learners' needs for autonomy, competence and relatedness, thereby increasing motivation; yet our data reveal that not all learners benefit equally. Similar to Li's (2022) review of automated feedback, accuracy gains were observed but over-reliance poses risks. Compared with studies reporting positive perceptions of AI tools (Rahmatika, 2025), our findings emphasise the need for critical engagement and teacher mediation. Regarding challenges, our results corroborate research on digital divide and teacher training gaps. What this study adds is a holistic perspective: by combining quantitative and qualitative evidence, it shows how benefits and barriers co-exist and interact within the specific context of Indonesian higher education. Future research should extend this investigation to longitudinal designs and larger samples, exploring how to develop adaptive feedback that addresses algorithmic bias, examining the efficacy of professional development models for digital grammar pedagogy and evaluating interventions aimed at closing the digital divide. Overall, these results suggest that digital technologies hold significant promise for enhancing EFL grammar learning, but realising this potential requires careful integration, equitable access and ongoing support for both students and teachers.

CONCLUSION

This study set out to examine the prospects and challenges of using digital tools for grammar instruction in Indonesian higher education. By combining survey data from 180 undergraduates with interviews from 10 lecturers, we found that technology can significantly enhance learners' motivation, autonomy and accuracy. More than two-thirds of students reported that features such as instant feedback, gamification and progress dashboards made grammar practice more engaging and encouraged regular study. Similarly, a majority of learners practised grammar independently through mobile apps, AI-based checkers and online quizzes, and two-thirds perceived improvements in their grammatical accuracy after sustained use. These findings suggest that well-designed digital tools aligned with curricular goals can make grammar learning more personalised, flexible and effective.

At the same time, the research underscores that technology is no panacea. Roughly one-third of students remained dependent on lecturers to interpret automated feedback, and 41 % admitted to accepting AI-generated corrections uncritically. Students from rural areas or low-income backgrounds cited unstable internet, limited devices and shared family resources as obstacles to consistent tool use. Lecturers also highlighted their own need for professional development to integrate digital tools effectively and to address algorithmic biases in AI feedback. These challenges reinforce that motivation and accuracy gains depend on robust infrastructure, equitable access and pedagogical support rather than on technology alone.

Overall, this study contributes a nuanced understanding of digital grammar pedagogy by showing how benefits and drawbacks are intertwined. It demonstrates that digital tools can enhance motivation, autonomy and surface accuracy, but only when paired with critical reflection, teacher scaffolding and inclusive policies to bridge the digital divide. Future research should explore longitudinal effects of digital grammar instruction, examine how to mitigate algorithmic bias and over-reliance, and assess professional development models that empower educators to use technology creatively and responsibly. By situating these findings within the Indonesian context, the study offers practical insights for instructors and policymakers aiming to harness digital innovation while ensuring that all learners reap its benefits.

RECOMMENDATION

Based on the results, several recommendations are offered for practice, policy, and research. For pedagogical practice, it is recommended that lecturers combine automated feedback with explicit metalinguistic explanations to ensure learners critically process corrections. Digital tools should be integrated with task-based or communicative activities that encourage reflective grammar use, thus preventing uncritical reliance on corrections. Institutions should also invest in training instructors on how to select, adapt, and integrate digital grammar tools into their pedagogy effectively. Regarding institutional and policy recommendations, policymakers and institutions must address the digital divide by ensuring learners from all socio-economic backgrounds have access to reliable internet and appropriate devices. Universities should also invest in learning management systems and digital grammar platforms that align with curricular goals. Education authorities should establish guidelines to evaluate the pedagogical reliability of AI-driven grammar tools to ensure their effectiveness. For future research, longitudinal studies should explore the long-term impacts of digital grammar instruction on learner accuracy and fluency. Comparative research that studies different digital platforms or AI tools could identify the features that most effectively enhance grammar learning. Replicating this study in diverse EFL contexts beyond higher education in Indonesia could also help strengthen the generalizability of the findings. Furthermore, further investigation into lecturers' beliefs and practices regarding digital grammar instruction will provide valuable insights into successful integration strategies.

ACKNOWLEDGMENT

The authors would like to express sincere gratitude to the Faculty of Languages and Arts, Universitas Negeri Makassar, for supporting this research. Special thanks are also extended to the participating students and lecturers whose insights made this study possible.

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