

Enhancing Junior High School Teachers' English Vocabulary Competence through AI-Based Neo-Sorogan Learning Model Training

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Abstract

Background: Rapid advances in digital technology and artificial intelligence (AI) are transforming the educational landscape, particularly at the junior high school level. This stage is crucial for developing students' critical thinking skills, fostering independent learning, and shaping their character. During this transitional phase of cognitive and social development, students need intensive mentorship, meaningful interactions, and learning experiences that accommodate diverse abilities and learning styles.

Aims: This study aimed to better equip teachers to implement more personalized, effective, and meaningful English vocabulary learning experiences through the AI-based Neo-Sorogan model. Ultimately, it aimed to enhance the quality of human resources in education and prepare them to address 21st-century challenges.

Methods: A mixed-methods research design integrating quantitative and qualitative techniques was employed, using paired comparisons, a Likert scale, and descriptive statistics.

Results: The study's results demonstrated a significant improvement in vocabulary skills, with pre-test scores averaging ($M = 64.28$, $SD = 8.47$) and post-test scores averaging ($M = 78.63$, $SD = 7.21$). The analysis yielded a t -value of -11.98 with 42 degrees of freedom ($t(42) = -11.98$, $p < 0.001$), indicating strong statistical significance and a robust effect size ($d = 1.83$). Furthermore, participant satisfaction was categorized as high.

Conclusion: This study showed participants' enthusiasm improved understanding of the AI-based Neo-Sorogan model, focusing on individualized learning and interaction. They designed subject-specific activities and rated their satisfaction at an average of 4.59 out of 5, reflecting their increased willingness to implement AI strategies in the classroom.

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INTRODUCTION

Rapid advances in digital technology and artificial intelligence (AI) are transforming the educational landscape, especially at the junior high school level. This stage is crucial for developing students' critical thinking skills, fostering independent learning, and shaping their character. During this transitional phase of cognitive and social development, students require intensive mentorship, meaningful interactions, and learning experiences that cater to diverse abilities and learning styles (Rusdiana et al., 2025).

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Currently, a significant challenge in education is not only the mastery of academic content but also teachers' ability to leverage technology in pedagogically sound ways to facilitate deep, student-centered learning (Mujtahid et al., 2026). Unfortunately, in many schools, digital technologies are primarily utilized for administrative purposes or as tools for delivering content, rather than enhancing adaptive, reflective, and personalized learning experiences (Bentri et al., 2022). Nevertheless, AI can significantly support teachers in providing individualized feedback, facilitating differentiated instruction, and promoting student autonomy, provided it is integrated with appropriate pedagogical strategies (Hooda et al., 2022; Oktavianus et al., 2023; Sahnir et al., 2023).

Without a well-defined learning model, deploying AI in education risks diminishing human interaction in learning environments and alienating teachers from their fundamental roles as educators and guides (Rind, 2026; Turvey & Pachler, 2026). In light of this, the AI-based Neo-Sorogan learning model emerges as both a relevant and innovative approach for development and implementation. This model represents a modern adaptation of the traditional sorogan method, long used in the Nusantara educational context, particularly in Islamic boarding schools (pesantren). It emphasizes personalized mentorship, direct dialogue between teachers and students, and gradual, in-depth mastery of material. Integrating AI within the Neo-Sorogan framework enables a mentoring process that is dynamic and responsive to students' individual needs beyond conventional face-to-face interactions (Salam et al., 2025; Zahrani & Muthahari, 2024). This approach also supports the constructivist paradigm and the ethos of the '*Kurikulum Merdeka*', which positions students as active participants in their own learning journeys (Putri, 2023).

To achieve this, teachers must strengthen their ability to understand and apply innovative learning models that are not only technology-driven but also grounded in humanistic and contextual pedagogical values (Maass et al., 2019; Trihantoyo et al., 2023). Thus, the training on the AI-based Neo-Sorogan learning model is viewed as a strategic initiative to enhance the quality of the educational process, empower teachers, and foster a more meaningful learning experience for junior high school students.

However, many teachers lack the understanding and skills needed to design and implement learning models that pedagogically integrate AI technology. This is particularly evident in supporting individualized, reflective, and process-oriented learning (Kabudi et al., 2021). Currently, technology use remains largely confined to traditional digital media, with a notable scarcity of AI-based adaptive learning tool.

The prevailing pedagogical approach in junior high schools tends to be classical, affording minimal opportunities for individual mentoring and substantive dialogue between teachers and students. Consequently, this environment adversely affects students' learning independence, reflective abilities, and conceptual comprehension, issues that are especially pronounced among students with diverse learning capabilities (Ramadhan et al., 2025). At the junior high level, personalized guidance and a solid conceptual foundation is imperative to mitigate potential learning gaps (Dumont & Ready, 2023; Nitkin et al., 2022).

Yet, the ubiquity of digital technology and social media among students has significantly influenced their learning and interaction patterns. Students increasingly seek instant answers, making in-depth exploration less familiar and leading to heavy reliance on digital sources without substantial reflection. If this trend is not counterbalanced with appropriate educational approaches, it could significantly diminish the quality of students' critical thinking and their sense of responsibility toward their own learning (Indrašiene et al., 2023).

A needs analysis conducted through interviews and questionnaires with teachers further underscored that the integration of digital technology in learning is predominantly focused on material delivery and administrative tasks. Specifically, 65% of teachers lacked an understanding of strategies for incorporating AI into their teaching practices, while 35% had never received any AI

training. Additionally, several teachers reported challenges in providing individualized guidance and feedback to their students.

Furthermore, the discussions with school officials have highlighted the need for teachers to adopt a learning model that integrates AI seamlessly while preserving their role as facilitators. Educators clearly expect an approach that promotes personalized learning experiences, enhances student autonomy, and streamlines the feedback process (Mastrogiacomì, 2024; Tammets & Ley, 2023).

These observations reveal a significant gap between the demands of digital transformation in education and teachers' current competencies in effectively using AI in pedagogical contexts. Such challenges underscore the necessity for innovative learning solutions that can adapt to rapidly evolving technological landscapes while preserving the integral aspects of teacher mentoring and interpersonal interaction in the educational process (Moltudal et al., 2022). Consequently, this community service proposes training in the AI-based Neo-Sorogan learning model as a strategic intervention to equip teachers with the necessary pedagogical competencies and AI literacy. Through this training, teachers are expected to be better positioned to implement more personalized, effective, and meaningful learning experiences, thereby contributing to improved human resource quality in education and better preparing them to tackle 21st-century challenges.

METHOD

This study used a mixed-methods approach, combining quantitative and qualitative techniques, and employed a participatory and collaborative community service research design (Bieri et al., 2023). The design focused on teacher empowerment through training, workshops, mentoring, and practical implementation of AI-based Neo-Sorogan learning in the classroom.

The partners involved in this community service comprised 43 teachers of a junior high school in Surabaya. An initial analysis, along with discussions with these partners, revealed several critical challenges in teachers' implementation of effective learning practices.

To evaluate the impact of the training on teachers' English vocabulary competence, an objective test consisting of 10 multiple-choice items (each with four options) was administered both as a pre-test and a post-test. This assessment was developed based on a contextual vocabulary framework sourced from Neo-Sorogan.com, aligning with the English language pedagogical competencies required at the junior high school level.

The scoring system assigned 1 point for each correct answer and 0 points for incorrect answers, resulting in raw scores ranging from 0 to 10. For statistical analysis, these raw scores were converted to a scale of 0–100 by multiplying the number of correct answers by 10.

Prior to implementation, the quality of the measurement instrument underwent rigorous evaluation. Content validity was established through expert judgment from three specialists in English Language Teaching (ELT) and educational measurement, yielding Aiken's V indices between 0.85 and 0.92 for all items. These findings indicate high content relevance and clarity.

Additionally, the instrument was pilot tested with 30 English teachers who were not part of the final study sample. Item validity was verified using Pearson product-moment correlation, which produced item-total correlation coefficients (r) between 0.482 and 0.765 ($p < 0.05$), confirming the statistical validity of all 10 items. Finally, internal consistency reliability was assessed using the Kuder-Richardson 20 (KR-20) method, yielding a high reliability coefficient of 0.832, significantly exceeding the conventional threshold of 0.70. This result confirms the instrument's robustness and accuracy in measuring vocabulary competence.

Quantitative data, comprising pre-test and post-test scores related to teachers' English vocabulary competencies, were examined using descriptive statistical methods. Preliminary tests, specifically the Shapiro-Wilk normality test, were conducted to validate the assumptions necessary for subsequent analyses. A paired-samples t-test was employed to evaluate the significance of

differences observed between pre-intervention and post-intervention scores. Furthermore, qualitative data collected through classroom observations, participant satisfaction ratings utilizing a Likert scale, interviews, and open-ended responses from post-training questionnaires were subjected to descriptive analysis (Bieri et al., 2023). This qualitative analysis enriched and contextualized the quantitative findings.

This community service program was structured into three integral stages, including 1) Preparation, 2) Implementation, and 3) Evaluation. This program was implemented over three weeks, with each stage conducted within one week. These stages are explained in the following sections:

The preparation phase involves coordinating permits with the Foundation Chair and the School Principal, creating community service materials, and ensuring that all necessary facilities and infrastructure are in place, along with partner satisfaction survey tools. As part of the preparation phase, participants completed a pre-test on English vocabulary ability, while a post-test using the same instrument was administered following the Implementation phase to assess changes in vocabulary competence. During the implementation phase, the training sessions were conducted, and questionnaires were distributed to partners to gather feedback on the program. The evaluation phase focused on assessing the outcomes of teacher training through a product assessment rubric and evaluating the enhancement of the training delivery. This phase also includes administering partner satisfaction questionnaires, offering consulting services to teachers, monitoring the execution of online learning initiatives, and compiling comprehensive activity reports.

This study employed several practical approaches. The training began with an interactive discussion exploring teachers' experiences in addressing learning challenges at the junior high school level, particularly concerning differences in students' learning abilities, low levels of learning independence, and the use of digital technology in the learning process (Seo et al., 2025). During this stage, the implementation team provided conceptual insights into the AI-based Neo-Sorogan learning model. They covered the basic principles of Sorogan, its adaptation to modern learning, AI's role as a learning assistant, and the ethics and limitations of using AI in education (Sanusi et al., 2026). The discussion also emphasized personalized learning strategies, adaptive feedback, and utilizing AI to support reflection and understanding.

Next, in the demonstration phase, participants developed a lesson plan (RPP) using the AI-assisted Neo-Sorogan model, tailored to the subject matter and characteristics of junior high school students. Teachers practiced using AI to enhance learning by creating prompting questions, providing step-by-step feedback, and strengthening students' conceptual understanding. Participants then presented their learning plans and received constructive input and feedback from the implementation team and fellow participants to refine their designs. Participants were guided to verify information generated by AI, ensuring that the use of technology prioritized accuracy, ethics, and academic responsibility.

The evaluation phase involved implementing the training results in their respective classrooms. Teachers executed the AI-based Neo-Sorogan learning model according to the pre-designed plan. This implementation process was documented and shared with the implementation team through online meetings (video conferences) or lesson recordings. The implementation team then evaluated how the model was applied, teacher-student interactions, and the use of AI to support learning. They provided feedback and recommendations to improve the model's implementation.

After the study, the team worked with partner communities to assess the ongoing program. This will involve identifying its strengths and weaknesses and developing a sustainability plan. The program aims to help teachers improve their 21st-century teaching skills and better address the learning needs of 21st-century students.

RESULTS AND DISCUSSION

Results

Teachers' English Vocabulary Competence Analysis Results

The results indicate a notable improvement in participants' English vocabulary skills after engaging with the AI-based Neo-Sorogan Learning Model. A total of 43 participants underwent assessments of their English vocabulary skills through pre-tests and post-tests. The analysis was conducted systematically, beginning with descriptive statistics and prerequisite tests, followed by a paired t-test to evaluate significant differences in ability before and after the learning intervention.



Figure 1. Implementation of interventions

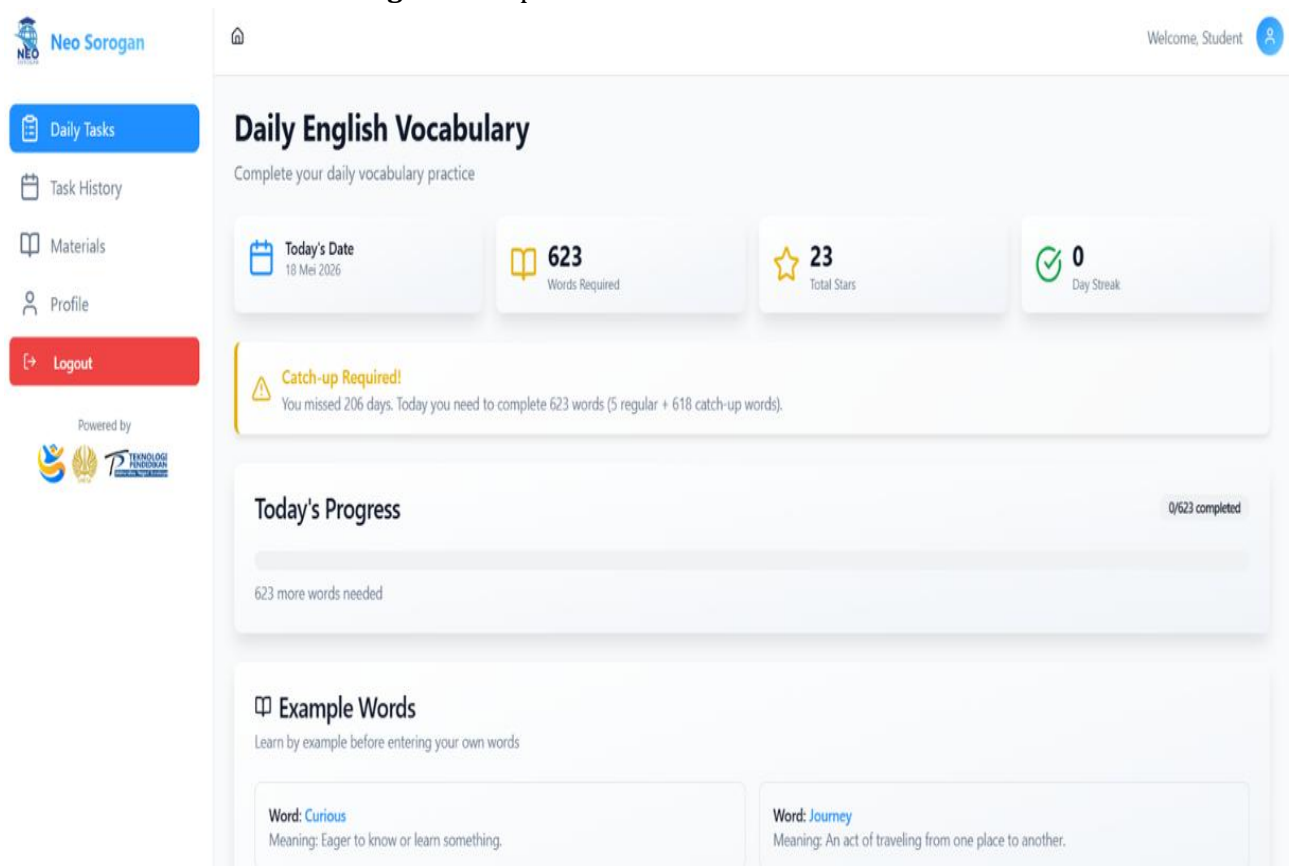


Figure 2. AI-Based Neo-Sorogan

Before conducting the descriptive statistics and paired-samples t-test, a prerequisite analysis was performed. The Shapiro-Wilk test was used to assess data normality, as the number of participants

was less than 50. This test was applied to the pre-test scores, post-test scores, and the difference scores between the pre-tests and post-tests. The results indicated that the significance value for the pre-test was 0.423, for the post-test was 0.278, and for the difference score was 0.587. All of these values were greater than 0.05 ($p > 0.05$), indicating no evidence of a departure from normal distribution. Therefore, the difference score met the normality assumption.

Table 1. Shapiro-Wilk Normality Test Results

Data	Statistic	df	Sig.
Pre-test	0.974	43	0.423
Post-test	0.968	43	0.278
Difference Score	0.979	43	0.587

Descriptively, the average pre-test score was 64.28, with a standard deviation of 8.47. In contrast, the average post-test score rose to 78.63, accompanied by a reduced standard deviation of 7.21. This represents an average increase of 14.35 points, or approximately 22.3% of the initial score. Furthermore, the decrease in standard deviation from 8.47 to 7.21 suggests that participants' scores after the learning experience were more consistently clustered around the mean value.

Table 3. Descriptive Statistics of English Vocabulary Ability

Measurement	N	Mean	Std. Deviation
Pre-test	43	64.28	8.47
Post-test	43	78.63	7.21

Once the analysis assumptions were met, a paired-samples t-test was conducted to assess whether English vocabulary skills differed before and after the learning intervention. The results indicated a significant difference between the pre-test and post-test scores, with an average difference of -14.35, a t-value of -11.98, 42 degrees of freedom (df), and $p < 0.001$.

Table 4. Paired-Samples t-Test Result

Pair	Mean Difference	Std. Deviation	t	df	Sig. (2-tailed)
Pre-test – Post-test	-14.35	7.84	-11.98	42	< .001

A significance level of less than 0.05 provides evidence of a statistically significant difference in English vocabulary skills when comparing pre-test and post-test results. The observed post-test average score of 78.63 surpassed the pre-test average score of 64.28, suggesting a notable enhancement in English vocabulary proficiency following the implementation of the AI-based Neo-Sorogan Learning Model.

Moreover, the calculated effect size, represented by Cohen's d , was approximately 1.83, indicating a large effect. This finding demonstrates not only statistical significance but also substantial practical implications for improving English vocabulary skills. This improvement can be explained by the features of the Neo-Sorogan Learning Model, which offers participants a more personalized, interactive, and focused learning experience (Yavich, 2025). The integration of AI enables participants to better understand vocabulary meanings and usage, access contextual examples, engage in repeated exercises, and receive initial feedback on their learning outcomes. Meanwhile, the teacher continues to serve as a facilitator and guide, providing clarification, validating information, and reinforcing participants' understanding.

In summary, the analysis showed that participants significantly improved their English vocabulary skills after engaging with the AI-based Neo-Sorogan Learning Model. The pre-test average was 64.28, increasing to 78.63 in the post-test. The paired-samples t-test yielded results of $t(42) = -11.98$, $p < 0.001$, corroborating the substantial effect size ($d \approx 1.83$). These findings emphasize the enhancement of integrating AI in the Neo-Sorogan Learning Model, showcasing its potential to significantly augment English vocabulary acquisition.

Satisfaction Level of AI-Based Neo-Sorogan Training Participants

The evaluation results indicated that 43 participants responded very positively to the AI-based Neo-Sorogan Learning Model training. All five evaluated aspects received an average score above 4.50 on a scale of 5, demonstrating a very high level of participant satisfaction. The resource person aspect received the highest score, averaging 4.68, followed closely by the training's usefulness, which scored 4.67. These results suggest that participants perceived the resource person as effectively delivering the material and demonstrating mastery of the AI-based Neo-Sorogan Learning Model content. Moreover, participants viewed the training as highly beneficial for enhancing teacher competence, particularly in using AI to support the learning English vocabulary process.

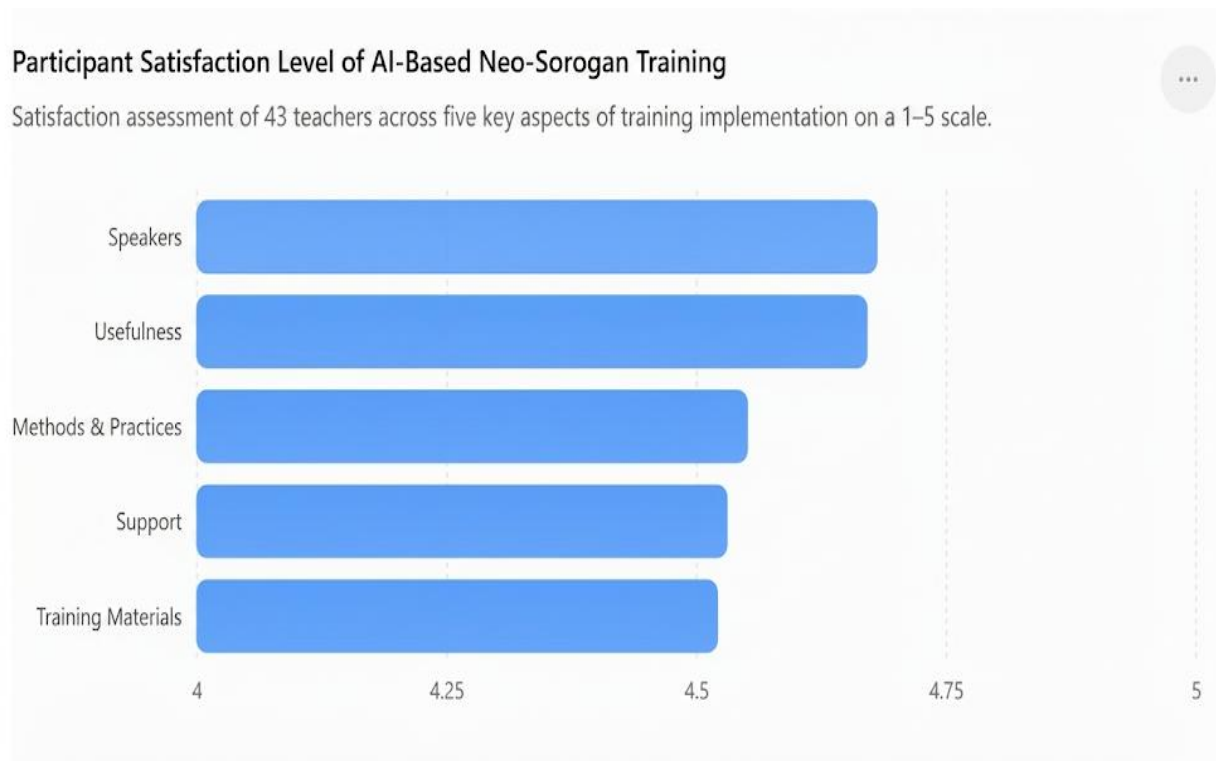


Figure 3. Level of participant satisfaction

The methods and practices aspect earned an average score of 4.55, while the mentoring aspect received a score of 4.53. This indicates that participants received the training activities well, which combined theoretical presentations with practical exercises, discussions, and mentoring. The training materials aspect scored slightly lower at 4.52, suggesting the content was relevant to participants' needs in developing technology-based learning.

Overall, the average score across all five aspects reached 4.59 on a 5-point scale, equating to approximately 91.8% of the maximum score. These results confirm that the AI-based Neo-Sorogan training achieved a very high level of satisfaction among participants. This strong positive response

indicates that the training activities met teachers' needs and have the potential for continuation through mentoring and the implementation of learning models in the classroom.

Discussion

Recent research indicates that the AI-based Neo-Sorogan Learning Model significantly enhances the English comprehension skills of junior high school teachers. Statistical evidence shows that the average post-test scores were notably higher than the average pre-test scores, demonstrating a large effect size. This suggests that the training not only evaluated but also substantially improved participants' comprehension performance.

Moreover, these findings align with previous studies in AI vocabulary literature, which report that AI-assisted vocabulary instruction improves learning outcomes, retention, and motivation when implemented within a structured pedagogical framework (Borshchovetska et al., 2026; Chen, 2026; Gao et al., 2026). Additionally, research conducted by (Imran et al., 2026; Kundu & Bej, 2025) shows that student performance improves when AI is integrated into structured learning tasks and objectives, especially when teachers act as mediators between students and the AI.

Participant satisfaction with the program further emphasizes the improvement from this community service initiative. Participants rated their satisfaction highly, particularly regarding the resource person, usability, and mentoring practice components, with an overall score of 4.59 out of 5. This indicates that the AI-based Neo-Sorogan Learning Model is not only effective in enhancing competencies but also user-friendly and satisfying for teachers. These findings support teacher development research suggesting that teachers generally have positive perceptions of artificial intelligence when professional development is well-structured, pedagogically relevant, and supportive of classroom practice (Baizhanov et al., 2026; Sayın & Coşkun, 2025). This aligns with broader evidence that AI-supported professional development enhances teaching effectiveness, self-confidence, and digital skills; however, these improvements depend on the quality of training and institutional support (Deng et al., 2026; Sayın & Coşkun, 2025).

One potential explanation for these results is that the Neo-Sorogan model integrates artificial intelligence (AI) with human guidance, interaction, and feedback. Within this framework, AI is not seen as a replacement for teachers; instead, it serves as a supportive tool that enhances individual learning, instructional design, feedback, and reflection. This approach is crucial because recent research consistently shows that AI is most effective in structured, teacher-led, and context-sensitive learning environments (Imran et al., 2026). Conversely, improvements in foreign language competence and high levels of satisfaction are observed in training models that combine technology, pedagogy, and mentoring, rather than relying solely on AI.

Teachers need to create more innovative, interactive, and student-centered learning experiences (Khalifeh & Santiago, 2026). However, they often struggle with personalizing learning and feedback for each student due to differences in abilities and learning speeds (Ellikkal & Rajamohan, 2026; Seo et al., 2025). The integration of technology, especially artificial intelligence (AI), poses another challenge. While some teachers use AI for materials and questions, they often lack the skills to effectively incorporate it into all aspects of learning (Martin et al., 2024; Tammets & Ley, 2023). An overreliance on AI may also hinder students' independent thinking (Hou et al., 2025; Zhai et al., 2024). A balanced model is needed, where AI enhances, rather than replaces, teacher-student interactions (Mulyani et al., 2025; Seo et al., 2025).

The AI-based Neo-Sorogan Learning Model provides a framework for personalized and interactive learning. Training for teachers will include ongoing mentorship to help them refine lesson plans that appropriately integrate AI (Berg & Plessis, 2023; Husna, 2023). Following this training, the implementation team will mentor teachers through consultations to adapt AI into classroom activities, emphasizing its role in enhancing learning and providing feedback (Wang et al., 2025). Monitoring and evaluation will allow teachers to discuss challenges and improve their approaches (al-Zyoud, 2020). Ultimately, this initiative aspires to evolve into a sustainable mentoring program, with lesson plans leading to best practices and ongoing development within the school environment (Ariyanto & Pantiwati, 2026; Hussain et al., 2025).

Implications

These community service activities have positive implications for improving middle school teachers' competencies in developing innovative, technology-based learning. Through the AI-based Neo-Sorogan Learning Model, teachers are encouraged to use AI appropriately, critically, ethically, and responsibly. This approach aims to support more personalized, interactive, and adaptive learning while preserving the teacher's essential role as an educator, facilitator, and feedback provider in the learning process.

Research Contributions

This community service aims to enhance the pedagogical competence and AI literacy of junior high school teachers at a middle school in Surabaya. It focuses on strengthening individualized student mentoring, improving overall learning quality, and supporting the implementation of the Independent Curriculum. Additionally, it seeks to reinforce the profile of Pancasila students.

Limitations

Several challenges remain in implementing AI-based Neo-Sorogan for teachers. This study used only 10 instrument items, especially in understanding how to integrate AI into learning activities, develop effective prompts, verify AI-generated information, and determine appropriate limits on AI use. Ensure that AI does not replace critical thinking or the role of teachers. Another concern is from the lack of a control group in this study. Therefore, ongoing support for teachers is essential.

Suggestions

Training and mentoring on the AI-based Neo-Sorogan Learning Model should be implemented on an ongoing basis. This approach ensures that teachers not only grasp the concept but also gain valuable experience in applying the model in real-world classrooms. Schools are encouraged to give teachers the opportunity to develop and implement Neo-Sorogan-based learning designs tailored to each subject's specific characteristics and their students' needs. Schools can document the results of these implementations as best practices and share them with other educators. Continued mentoring should focus on enhancing teachers' AI literacy, particularly in areas such as prompt development, information verification, data protection, ethical AI usage, and creating learning activities that promote critical and independent thinking among students.

CONCLUSION

This community service program significantly enhanced the competencies of junior high school teachers in AI-based English teaching through the Neo-Sorogan Learning Model. The training improved teachers' understanding of individual learning needs, fostered better interactions

between teachers and students, and facilitated the integration of AI into their teaching practices. With an overall satisfaction rating of 4.59 out of 5 and the observed post-test average score of 78.63 surpassing the pre-test average score of 64.28, participants particularly praised the quality of the presenters and the relevance of the training content. These results indicate that the program effectively addressed teachers' needs in developing technology-driven teaching skills.

A key contribution of the program was providing practical experience in designing AI-integrated learning activities tailored to specific subjects, successfully bridging the gap between theoretical knowledge of AI and its practical application in the classroom. The positive outcomes of this training suggest broader implications for teacher professional development, demonstrating that a structured AI-based training model can increase teachers' enthusiasm and readiness to implement AI strategies in their teaching practices. This approach offers a replicable framework for similar teacher training initiatives across various subject areas.

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AUTHOR CONTRIBUTION STATEMENT

UD, AK, and HM collaboratively designed the program and facilitated its materials while coordinating the training participants. Additionally, HM ensured the provision of essential facilities and infrastructure, collaborating with the student assistant. MA documented and published the community service documentation content on YouTube, including creating and editing videos for documentation purposes.

AI DISCLOSURE STATEMENT

The authors utilized Claude and Grammarly Gen-AI while preparing this manuscript to find suitable paraphrases and translations. After using these tools, the authors carefully reviewed and edited the content as necessary and takes full responsibility for the publication's content.

CONFLICTS OF INTEREST

The authors confirm that there are no conflicts of interest related to the publication of this community service activity titled "Enhancing Junior High School Teachers' English Vocabulary Competence through AI-Based Neo-Sorogan Learning Model Training." This program was carried out exclusively for academic and community development purposes, and no financial, commercial, or personal relationships could have affected the activity's results.

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