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Effects of an Informal Arabic Fun Learning Ecosystem on Oral Arabic Proficiency among Malaysian Learners

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Abstract

This study examines the effect of the Informal Arabic Fun Learning Ecosystem on improving Arabic speaking proficiency among Malaysian learners. A quantitative quasi-experimental design using a non-equivalent control group pretest–posttest approach was conducted with 48 secondary school students divided into experimental and control groups. Data were collected through oral Arabic proficiency tests and analyzed using descriptive statistics, Shapiro–Wilk and Levene's tests, paired-sample t-tests, independent-sample t-tests, and Cohen's d effect size analysis. The findings indicated that the experimental group achieved significantly greater improvement in oral Arabic proficiency compared with the control group ($p < 0.05$), with a medium-to-large effect size ($d = 0.77$). These results demonstrate that integrating communicative activities, social interaction, collaborative learning, and informal language experiences effectively strengthens students' speaking ability. The study contributes to Communicative Language Teaching, Sociocultural Theory, and Informal Language Learning Ecosystem perspectives by providing empirical evidence for developing sustainable Arabic learning environments.

***Keywords**: Informal Arabic Fun Learning Ecosystem; Oral Arabic Proficiency; Sociocultural Theory*

Introduction

Oral proficiency is one of the key indicators of success in foreign language learning because it reflects learners' ability to use the language as a tool for communication in real-life situations. In Arabic language learning, speaking skills (mahārah al-kalām) hold

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a strategic position because they represent the ultimate goal of mastering linguistic elements such as vocabulary, grammar, and pronunciation. However, various reports indicate that many Arabic learners in Malaysia still struggle to communicate their ideas orally despite having studied Arabic for years. This situation is reflected in low speaking fluency, a limited productive vocabulary, a lack of confidence in communicating, and minimal opportunities to use Arabic outside the classroom. As a result, the learning process often produces students who have linguistic knowledge but cannot yet use it communicatively.

The evolution of 21st-century learning paradigms emphasizes that success in language learning is determined not only by the quality of formal instruction, but also by learning experiences gained through social interaction, the learning environment, and activities that take place outside the classroom. Various studies in the field of Second Language Acquisition show that informal learning provides students with broader opportunities to gain exposure to the language, practice authentic communication, and build self-confidence through meaningful experiences. Thus, a learning environment that encourages active participation, collaboration, and sustained language use is a key factor in improving speaking proficiency.

One approach that is beginning to gain traction is “Arabic Fun Learning,” a learning approach that integrates educational games, task-based communication, collaborative activities, simulations, group projects, and various learning experiences designed to create an enjoyable learning environment while encouraging active use of the Arabic language (Safitri et al., 2026) (Peterson & Swier, 2025). This approach is not only focused on delivering content but also on creating learning experiences that allow students to use Arabic naturally through interactions with peers, teachers, and the learning environment. In this study, Arabic Fun Learning is positioned as an Informal Arabic Fun Learning Ecosystem a learning ecosystem that extends language practice from the classroom to informal activities that remain goal-oriented and support the achievement of learning objectives (Majid et al., 2026, 2026) (Nachar, 2025).

Various previous studies have demonstrated that game-based learning, collaborative learning, task-based language teaching, and communicative activities can enhance motivation, participation, and foreign language learning outcomes(Al-Rashidi, 2025). Other studies also show that learning environments that provide opportunities for repeated speaking practice can improve learners’ fluency, accuracy, and confidence in using the target language (Darmawaty et al., 2026a) (Shadiev et al., 2026). Furthermore, research on informal language learning confirms that learning experiences gained through social interaction and out-of-class activities contribute to improved communicative competence because learners have the opportunity to use the language in more authentic contexts (Sunarko et al., 2026) (Lin, 2026).

Nevertheless, these research findings still have several limitations. First, most studies on Arabic language learning still focus on the effectiveness of specific methods, media, or technologies without considering the learning environment as an ecosystem that

connects formal and informal learning. Second, experimental research on the impact of the Informal Arabic Fun Learning Ecosystem on Arabic speaking proficiency in Malaysia remains very limited. Most studies merely evaluate improvements in learning outcomes following the implementation of a particular method, while learning mechanisms that integrate enjoyable activities, social interaction, and language practice outside the classroom have not been extensively tested empirically through experimental designs. This gap highlights the need for research capable of providing quantitative evidence regarding the effectiveness of informal learning ecosystems in enhancing Arabic speaking proficiency.

Based on this gap, this study aims to examine the effect of the Informal Arabic Fun Learning Ecosystem on Arabic speaking skills among learners in Malaysia. This study employs an experimental design so that it not only describes the characteristics of the learning process but also tests whether the intervention results in greater improvements in speaking ability compared to conventional learning. Thus, this study is expected to provide empirical evidence regarding the effectiveness of this approach in the context of Arabic language learning.

Specifically, this study aims to answer the following two research questions.

Is there a significant difference in Arabic speaking ability between learners who use the Informal Arabic Fun Learning Ecosystem and those who follow a conventional learning approach?

To what extent does the implementation of the Informal Arabic Fun Learning Ecosystem contribute to improving Arabic speaking skills among learners in Malaysia?

The scope of this study is limited to two aspects. First, the study examines only the effectiveness of the Informal Arabic Fun Learning Ecosystem as an instructional approach in Arabic language learning, without comparing it to other innovative learning models. Second, the dependent variable of the study is limited to oral Arabic proficiency; therefore, reading, writing, and listening skills are not analyzed in this study.

This study also has several limitations. The intervention was conducted with Arabic language learners in Malaysia over a specific period of instruction; therefore, the research results were influenced by the characteristics of the students, the school environment, and the timing of implementation. Consequently, the findings should be generalized with caution when applied to different educational contexts, grade levels, or countries.

This study has both theoretical and practical significance. From a theoretical perspective, the study enriches the field of Arabic language learning by providing empirical evidence regarding the effectiveness of the Informal Arabic Fun Learning Ecosystem in improving speaking skills, while also expanding the application of the language learning ecosystem perspective to the context of Arabic, where its use remains relatively limited. From a practical standpoint, the research findings are expected to serve as a foundation for teachers, curriculum developers, and educational institutions in designing learning environments that are more communicative, participatory, and oriented toward language practice through enjoyable activities.

The main contribution of this study lies in providing empirical evidence regarding the effectiveness of the Informal Arabic Fun Learning Ecosystem in improving Arabic speaking skills. Unlike previous studies, which have largely focused on evaluating learning methods or media in isolation, this study views learning as an ecosystem that integrates communicative activities, social interaction, and informal learning experiences into the formal learning process. The findings of this study are expected to enrich the literature on Arabic language learning and provide a scientific foundation for the development of learning models that are more adaptable to the needs of Arabic language learners in the 21st century.

Method

This study employed a quantitative approach with a quasi-experimental design using a non-equivalent control group pretest–posttest design (‘Nursing Students’ Anxiety about Distance Education during COVID19’, 2022). This design was chosen because the researcher could not randomly assign students to the experimental and control groups, given that class assignments had already been determined by the school(Aguhayon et al., 2023). Through this design, the study aims to examine the effect of implementing the Informal Arabic Fun Learning Ecosystem on improving Arabic speaking proficiency by comparing the pretest and posttest results between the experimental and control groups(Dehghan Nayeri et al., 2024).

This methodological design was selected to provide a more comprehensive analysis of the effectiveness of the Informal Arabic Fun Learning Ecosystem by integrating statistical measurement and comparative evaluation. Unlike previous studies that mainly focused on the effectiveness of specific teaching methods, instructional media, or classroom-based activities, this study examines the learning process as an integrated ecosystem involving formal instruction, informal learning experiences, social interaction, and communicative practice. The analytical procedures were designed to examine both statistical differences and the practical impact of the intervention. Descriptive statistics were used to identify changes in learners’ performance, while Shapiro–Wilk and Levene’s tests were applied to confirm the assumptions required for inferential analysis. Paired-sample t-tests, independent-sample t-tests, and Cohen’s d effect size analysis were further conducted to determine the significance and magnitude of the treatment effect. This approach strengthens the methodological depth of the study by providing empirical evidence on how an integrated learning ecosystem contributes to the development of Arabic speaking proficiency.

The study was conducted at a secondary school in Malaysia that offers Arabic as a foreign language. The location was selected through purposive sampling, considering that the school met the research objectives: it regularly offers Arabic language instruction, has an adequate number of students, and supports communicative-based learning. The study participants consisted of 48 students divided into two classes: 24 students in the experimental group and 24 students in the control group. Both groups had relatively

equivalent initial proficiency levels based on pretest results and shared the same background in Arabic language learning.

Table 1. Characteristics of Research Participants

Characteristics	Characteristics Experimental Group	Control Group
Number	24	24
Educational	Educational level High school High school	High school
Average	16 years	16 years
Subject	Arabic	Arabic
Treatment	Informal Arabic Fun Learning Ecosystem Conventional learning	Informal Arabic Fun Learning Ecosystem Conventional learning

The treatment for the experimental group consisted of implementing the Informal Arabic Fun Learning Ecosystem for eight weeks, with two sessions held each week. This learning ecosystem was designed based on the principles of Communicative Language Teaching, Sociocultural Theory, and the concept of the Informal Language Learning Ecosystem, which emphasizes the importance of social interaction, collaboration, authentic learning experiences, and the use of Arabic in various communicative activities. During the intervention, students participated in various activities such as language games, pair dialogues, simulations, role-playing, group discussions, short presentations, and communication projects aimed at increasing the intensity of spoken Arabic use. Meanwhile, the control group participated in conventional learning in accordance with the standard teaching procedures typically implemented by teachers.

The research data consist of primary data obtained through Arabic speaking ability tests administered before and after the intervention. Speaking ability was assessed using an analytical rubric that covered the aspects of fluency, pronunciation, vocabulary mastery, grammatical accuracy, and interactive skills. To ensure the quality of the instruments, the assessment rubric was validated by three experts in Arabic language education, while its reliability was tested using Cronbach's alpha coefficient. In addition to the speaking tests, observation sheets were used to monitor the implementation of the instruction to ensure that all activities in the experimental group proceeded in accordance with the treatment design that had been established.

Table 2. Assessment Criteria for Speaking Skills

Aspect	Indicator
Fluency	Ability to speak fluently
Pronunciation	Accuracy in pronouncing Arabic sounds
Vocabulary	Accuracy and variety in vocabulary use
Grammar	Accuracy in using grammatical structures

Interaction	Ability to maintain communication and respond

The study began with a pretest administered to both groups to assess the students' initial proficiency. Next, the experimental group received instruction using the Informal Arabic Fun Learning Ecosystem, while the control group participated in conventional instruction for eight weeks. After the treatment period ended, both groups took a posttest using the same instrument so that changes in speaking proficiency could be objectively compared.

Table 3. Research Phases

Stage	Stage Experimental Group	Control Group
Pretest	Pretest	Speaking proficiency test
Treatment	Treatment Informal Arabic Fun Learning Ecosystem	Conventional learning
Posttest	Posttest Speaking proficiency test	Speaking proficiency test

The data obtained were analyzed using IBM SPSS Statistics version 29. The analysis began with descriptive statistics to characterize the data using the mean, standard deviation, minimum, and maximum values. Next, a normality test was conducted using the Shapiro–Wilk test and a homogeneity test using Levene's test as prerequisites for inferential analysis. The effectiveness of the treatment was analyzed using a paired-sample t-test to determine the improvement in speaking ability in each group, while an independent-samples t-test was used to compare the posttest results between the experimental and control groups. The magnitude of the treatment effect was calculated using Cohen's d to determine the strength of the effect of the Informal Arabic Fun Learning Ecosystem on Arabic speaking proficiency. All statistical tests were conducted at a 5% significance level ($\alpha = 0.05$).

Results And Discussion

A descriptive analysis was conducted to provide an overview of the students' Arabic speaking abilities before and after the intervention. The results of the analysis showed that the experimental group achieved a higher increase in scores compared to the control group. The experimental group's average pre-test score was 64.96 (SD = 7.68) and increased to 80.04 (SD = 5.25) on the post-test. Meanwhile, the control group's scores increased from an average of 68.67 (SD = 7.54) to 76.17 (SD = 4.85). The minimum and maximum scores in the experimental group ranged from 50 to 78 on the pre-test and from 70 to 90 on the post-test, while those in the control group ranged from 53 to 82 on the pre-test and from 67 to 89 on the post-test.

Table 1. Descriptive Statistics

Group	Stage	Mean	SD	Minimum	Maximum
Experimental	Pre-test	64,96	7,68	50	78
Experimental	Post-test	80,04	5,25	70	90
Control	Pre-test	68,67	7,54	53	82
Control	Post-test	76,17	4,85	67	89

Descriptively, it appears that the average increase in the experimental group (15.08 points) was greater than that in the control group (7.50 points), suggesting initially that learning using the Informal Arabic Fun Learning Ecosystem yields better results than conventional learning.

2. Prerequisite Test

Normality Test

A normality test was conducted using the Shapiro–Wilk test to determine whether the data were normally distributed. The test results showed that all groups had significance values greater than 0.05, indicating that all the data met the assumption of normality.

Table 2. Results of the Shapiro–Wilk Normality Test

Data	Statistics	Sig.
Experimental Pre-test	0,968	0,614
Experimental Post-test	0,969	0,653
Control Pre-test	0,962	0,469
Control Post-test	0,931	0,101

Based on these results, all the data are normally distributed because the p-values for each group are greater than 0.05.

Homogeneity Test

The homogeneity of variances was tested using Levene's test. The results of the analysis showed a p-value of 0.306, which is greater than 0.05. Thus, the variances of the two groups were deemed homogeneous, making them suitable for a parametric test.

Table 3. Homogeneity Test Results

Levene Statistic	Sig.
1,073	0,306

3. Hypothesis Testing

Paired Sample *t*-Test

A paired-sample t-test was used to determine the improvement in speaking ability in each group following the learning process.

The results of the analysis showed that the experimental group experienced a significant improvement between the pre-test and post-test, with a t-value of 6.760 and $p < 0.001$. The control group also experienced a significant improvement ($t = 5.377$; $p < 0.001$), although the average improvement was lower than that of the experimental group.

Table 4. Results of the Paired-Sample t-Test

Group	T	Sig. (2-tailed)	Description
Experimental	6,760	<0,001	Significant
Control	5,377	<0,001	Significant

These results show that both groups experienced an improvement in their Arabic speaking skills after the instruction, but the improvement in the experimental group was greater.

Independent Sample *t*-Test

To determine whether there was a difference in learning outcomes between the two groups after the treatment, an independent samples t-test was conducted on the post-test scores.

The results of the analysis showed a t-value of 2.657 with a significance level of 0.011 ($p < 0.05$). Thus, there was a significant difference between the experimental group and the control group in the post-test scores.

Tabel 5. Hasil Independent Sample t-test

Variabel	T	Sig. (2-tailed)	Note
Post-test	2,657	0,011	Significantly different

These findings indicate that students who participated in learning using the Informal Arabic Fun Learning Ecosystem achieved better results in Arabic speaking skills compared to students who participated in conventional learning.

4. Effect Size

The effect size of the treatment was calculated using Cohen's d. The results of the analysis showed a Cohen's d value of 0.77. Based on Cohen's criteria, this value falls into the medium-to-large effect category.

Tabel 6. Effect Size

Effect Size	Nilai	Interpretation
Cohen's d	0,77	Moderate–High

These results indicate that the implementation of the Informal Arabic Fun Learning Ecosystem not only produced statistically significant differences but also had a practically meaningful impact on improving students' Arabic speaking skills.

The findings of this study are consistent with previous research demonstrating that communicative activities, collaborative learning, and authentic language experiences can improve learners' speaking proficiency. Previous studies have shown that opportunities for meaningful interaction and repeated language practice contribute to increased fluency, confidence, and communicative competence. However, unlike earlier studies that mainly examined the effectiveness of specific methods, learning media, or classroom techniques, this study provides a broader perspective by examining Arabic learning through an integrated ecosystem that connects formal instruction with informal learning experiences. The significant improvement in the experimental group and the medium-to-large effect size (d = 0.77) indicate that combining social interaction, enjoyable activities, and continuous language exposure can strengthen oral Arabic development. Therefore, this study extends previous findings by emphasizing that speaking proficiency is influenced not only by instructional strategies but also by the creation of a supportive learning environment that encourages sustained language use.

The research findings show that the implementation of the Informal Arabic Fun Learning Ecosystem contributed to an improvement in students' Arabic speaking skills. The higher average score in the experimental group compared to the control group indicates that learning that integrates communicative activities and informal learning

experiences provides students with broader opportunities to practice Arabic on an ongoing basis. This finding is consistent with the principles of Communicative Language Teaching, which emphasizes that speaking skills develop through the use of language in meaningful communication, not merely through mastery of grammatical rules.

The findings of this study also provide strong support for Vygotsky's Sociocultural Theory, which identifies social interaction as a key factor in cognitive development and language acquisition. From this perspective, language ability does not develop solely through individual effort but is constructed through processes of communication, collaboration, and the negotiation of meaning with others. Language is viewed as a mediating tool that enables students to construct new knowledge through meaningful social activities. During the implementation of Arabic Fun Learning, students not only receive material from the teacher but also actively interact with their classmates through group discussions, language games, dialogue simulations, role-playing, presentations, and various other collaborative activities. These interactions create a space for students to provide feedback to one another, correct pronunciation and grammatical errors, enrich their vocabulary, and naturally develop communication strategies.

In this context, the teacher acts as a facilitator who provides scaffolding in accordance with the concept of the Zone of Proximal Development (ZPD). The support provided by both the teacher and peers enables students to complete communication tasks that they were initially unable to perform independently. As the frequency of interactions increases, this assistance is gradually reduced until students are able to use Arabic more independently and confidently. Thus, the improvement in speaking skills observed in this study not only reflects the results of repeated practice but also demonstrates the success of the knowledge-construction process through social interaction, as explained in Sociocultural Theory.

In addition to reinforcing the sociocultural perspective, the findings of this study also support the concept of the Informal Language Learning Ecosystem—the view that language acquisition occurs continuously through various learning experiences that take place both inside and outside the formal classroom setting. This approach emphasizes that language learning is not limited to teacher-designed activities during class hours but is also influenced by the social and cultural environment, as well as students' opportunities to use the language in various everyday communication situations. In this study, a variety of enjoyable, communicative, and contextual activities encouraged students to continue using Arabic outside the classroom whether while discussing with friends, participating in extracurricular activities, practicing conversation on their own, or using digital media to improve their speaking skills.

These characteristics indicate that Arabic Fun Learning has successfully established continuity between formal instruction and informal learning experiences.

Learners no longer view Arabic as a subject studied solely to meet academic requirements, but rather as a communication tool that can be used in various social activities (Zuhriyah et al., 2026a). This situation increases both the frequency of language exposure and the intensity of language use, two factors widely recognized as contributing to the development of speaking proficiency in second-language and foreign-language learning. The more frequently students engage in meaningful communication, the greater their chances of internalizing vocabulary, sentence patterns, communicative expressions, and language strategies appropriate to the context (Darmawaty et al., 2026b).

The research findings also show that a pleasant learning environment has a positive psychological impact on students. Activities designed as games, simulations, light-hearted competitions, and group collaboration can reduce language anxiety, which has long been one of the main barriers to learning speaking skills. When students feel comfortable and are not afraid of making mistakes, they become more confident in expressing their opinions, trying out new vocabulary, and sustaining conversations in Arabic (Zuhriyah et al., 2026b). This emotionally safe learning environment fosters intrinsic motivation, boosts self-confidence, and strengthens the willingness to continue using Arabic in various situations. Thus, learning success is influenced not only by cognitive aspects but also by affective factors that support students' active participation.

The results of this study are also consistent with various previous studies reporting that learning based on communicative and collaborative activities, as well as authentic learning experiences, can improve speaking proficiency in a foreign language (Alzubi et al., 2024). Numerous studies indicate that students' active engagement in real-life communication provides opportunities to practice the language in context, receive immediate feedback, and develop both fluency and accuracy simultaneously(Sabat, 2024). Similarly, research on game-based learning, collaborative learning, and task-based language teaching consistently shows increased motivation, speaking confidence, and student participation throughout the learning process (Yu et al., 2024). The alignment of these research findings with various previous studies further strengthens the argument that language learning oriented toward real-world language use is more effective than learning that focuses solely on mastering grammar and memorizing vocabulary (Alisoy, 2023).

Nevertheless, this study offers a different scientific contribution compared to previous studies. Most prior research has focused on testing the effectiveness of a specific method, technique, or learning medium in improving speaking skills(Mahdi, 2022). In contrast, this study views "Arabic Fun Learning" not merely as a learning strategy, but as an informal learning ecosystem that continuously integrates formal and informal learning experiences (Alam, 2025). This ecosystem perspective emphasizes that the success of language learning is determined not only by the quality of in-class activities but also by the existence of a learning environment that enables students to continuously interact

using Arabic outside the classroom (Alam, 2025). In other words, effective learning occurs when there is continuity between academic activities, social interactions, school culture, and self-directed learning experiences that mutually reinforce one another (Maipath & Zulu, 2025).

Another conceptual contribution is that this study expands our understanding of the factors that influence the development of Arabic speaking skills(Alshehri & AlShabeb, 2023). The findings indicate that improvements in speaking ability result from the interaction of various components, such as teacher support, collaboration among students, opportunities for authentic communication, a positive learning environment, motivation to learn, and sustained language use outside the classroom(Jeong, 2022). Thus, improvements in speaking proficiency cannot be explained solely by the effectiveness of teaching methods; rather, they must be understood as the result of creating a learning environment rich in interaction, providing meaningful communication experiences, and encouraging repeated language practice in various contexts (Zega, 2025).

In the context of Arabic language education in Malaysia, these findings have important practical implications. Arabic teachers need to develop instruction that is not only focused on delivering content but also creates a communicative, collaborative, and enjoyable learning environment so that students have ample opportunities to actively use Arabic (Rekan et al., 2025). Schools can also support the development of an informal learning ecosystem by organizing Arabic language clubs, cultural activities, speech contests, discussions, educational games, and the use of digital media that allow students to continue practicing outside of class hours. Support from the school environment and peers will expand opportunities for language practice, allowing the language acquisition process to occur more naturally and continuously (Godwin-Jones, 2024).

Thus, the results of this study confirm that the development of Arabic speaking skills requires a holistic approach that integrates pedagogical, social, and learning environment dimensions (Hanafi et al., 2026) (Aini et al., 2025). Intensive social interaction, authentic communication, enjoyable learning experiences, and opportunities for repeated language use are key, complementary components in shaping students' speaking proficiency(Halim et al., 2023). Therefore, the implementation of the Informal Arabic Fun Learning Ecosystem can be viewed as an effective and sustainable alternative learning model for improving Arabic speaking proficiency among learners in Malaysia(Kamal, 2025). In addition to improving linguistic aspects, this model also contributes to strengthening motivation, self-confidence, independent learning, and the habit of using Arabic in daily life, thereby supporting the creation of a more meaningful language learning process oriented toward real-world language use(Erlina et al., 2025).

Conclusion

This study concludes that the Informal Arabic Fun Learning Ecosystem effectively improves Arabic speaking proficiency among Malaysian learners. In accordance with the research objective, the findings demonstrate that learners who participated in the ecosystem-based learning approach achieved significantly greater improvement compared with those receiving conventional instruction. The experimental group showed higher posttest performance with a medium-to-large effect size (Cohen's $d = 0.77$), indicating that the integration of communicative activities, social interaction, collaborative learning, and informal language experiences contributed meaningfully to speaking development. These findings extend previous perspectives on Arabic language learning by highlighting the importance of a learning ecosystem that connects classroom instruction with continuous language practice beyond formal settings. Practically, this study provides evidence that teachers and educational institutions can develop more interactive and sustainable Arabic learning environments to strengthen learners' confidence, participation, and communicative competence.

This study has limitations because it involved participants from a single school and had a relatively short intervention period; therefore, the results cannot yet be widely generalized. Consequently, future research should include a larger sample, multiple educational levels, and tests of this approach's effectiveness on other language skills. In practical terms, the findings imply that teachers, schools, and curriculum developers should foster a communicative, enjoyable learning environment that gives students opportunities to use Arabic actively inside and outside the classroom so their speaking proficiency can develop continuously.

Declaration of AI and AI-Assisted Technologies in the Writing Process

During the development of this manuscript, the authors utilized artificial intelligence-based tools, including ChatGPT, Grammarly, and Google Translate, to assist with language enhancement, grammar correction, translation support, and improvement of academic writing quality. All generated suggestions and translations provided by these tools were thoroughly reviewed, modified, and validated by the authors to ensure their appropriateness and accuracy. The authors remain fully responsible for the originality, integrity, accuracy, and final content of the manuscript.

Author Contribution Statement

Robith Juan Fahmi Fahmi contributed to the conceptualization, research design, methodology development, data analysis, interpretation of findings, and preparation of the manuscript. Fathurrohman contributed to data collection, research implementation, literature review, and manuscript revision. Ahmad Khoiri contributed to theoretical framework development, validation of research findings, and critical review of the manuscript. Dilrabokhon Madaminova contributed to manuscript review, academic editing, and refinement of the final version. All authors reviewed and approved the final manuscript.

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Data Availability Statement

The datasets and materials that support the results of this research can be obtained from the corresponding author upon a reasonable request.

Declaration of Interests

The authors confirm that there are no conflicts of interest, including financial, personal, or professional relationships, that may have affected the conduct of the research, data analysis, or interpretation of the findings.

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