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AI Transformation, Managerial Strategy, and Student Communication Behavior in Education

Nengah Sukendri[1*], I Komang Widya Purnama Yasa[1], I Wayan Astraguna[1], Ni Putu Ade Resmayani[1]
[1]Institut Agama Hindu Negeri Gde Pudja Mataram (IAHN Gde Pudja Mataram)
Jl. Pancaka No.7B, Mataram 83126, West Nusa Tenggara, Indonesia
*Corresponding Email: sukendri@iahn-gdepudja.ac.id

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ABSTRACT

The rapid adoption of Artificial Intelligence (AI) in education has transformed learning processes and raised concerns about its impact on students' communication behavior. This study aims to examine the effects of AI transformation and managerial strategy on students' communication behavior in non-formal English education institutions in Mataram City. A quantitative approach was employed using a questionnaire administered to 35 respondents, with data analyzed through multiple linear regression, classical assumption tests, and coefficient of determination (R^2) using SPSS 25. The results show that AI transformation has a significant positive effect on students' communication behavior ($t = 6.463$, $p < 0.001$), while managerial strategy has no significant effect ($t = -0.532$, $p = 0.598$). Simultaneously, both variables significantly influence communication behavior ($F = 24.026$, $p < 0.001$) with an adjusted R^2 of 0.575, indicating moderate explanatory power. These findings suggest that AI plays a more direct role in shaping communication behavior, while managerial strategy functions as a supporting factor. The study implies that educational institutions should prioritize effective AI integration while aligning managerial practices to support adaptive communication environments.

Keywords: Artificial Intelligence; Communication Behavior; Managerial Strategy; Sustainability; Technological Transformation

JEL Classification: M12; M14; M54

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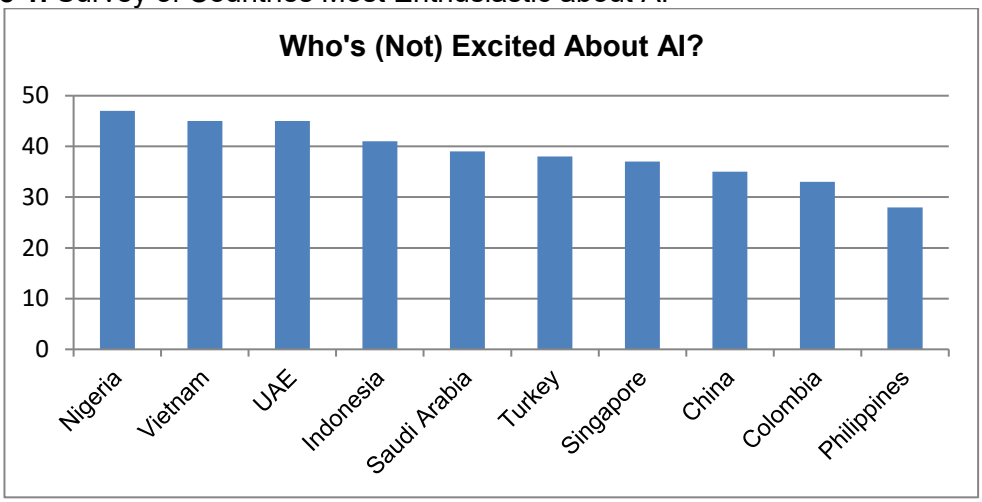
INTRODUCTION

Sustainability is one of the concepts that is referred to as the most slippery (Fauzi, 2019). Its essence is interpreted as continuous sustainability in the implementation of a harmonious relationship strategy between humans and nature. In the era of digital acceleration, the concept of sustainability or sustainable development requires a holistic approach, not only in maintaining harmony with nature but also in preparing superior human resources. The Indonesian government has declared sustainable development as a major agenda, with education playing a crucial role in preparing a generation that is adaptive to global developments. Amidst the wave of digital transformation (Andriyansah & Sukendri, 2025), Artificial Intelligence (AI) has emerged as a trending technology that is bringing revolutionary impacts to various sectors, including education. Technological transformation provides innovation in education management that can build a sustainable future (Akhmad et al., 2024; Sukendri, 2025). The latest Statista Consumer Insights survey (2024) even ranks Indonesia as the fourth most enthusiastic country in adopting AI in everyday life, with a percentage of 41%. These data were obtained from the Statista Consumer Insights survey conducted from April to June 2024.

Figure 1 shows that Indonesia is among the most enthusiastic countries in AI adoption, with 41% of respondents reporting active use. This highlights the growing integration of AI in educational contexts and its potential influence on student communication behavior.

Figure 1. Survey of Countries Most Enthusiastic about AI



Source: Buchholz (2025)

This high level of enthusiasm must be balanced with appropriate managerial strategies, especially in the context of education. The integration of AI in learning has changed learning methods to be more adaptive and personalized, but on the other hand, it has also triggered significant changes in the communication behavior of students. One study analyzed changes in the communication behavior of millennials and Generation Z (Zis et al., 2021). In the era of digitalization, there has been a noticeable change in the form of less interactive behavior in face-to-face communication. Technological transformation brings changes that can have a positive impact on improving efficiency and effectiveness in education, economics, health, and other fields (Sawitri, 2025), including analytical studies through effective management strategies needed to improve a company's performance in the era of digitalization (Jusdijachlan et al., 2024; Sukendri, 2024).

Along with these developments, communication skills are a must-have for leaders. Teachers and education managers must be able to convey ideas, influence, and motivate students through good communication skills with a persuasive approach. Of

course, through good communication skills, teachers and education managers are able to convey messages and ideas, and information is easily accepted even when there are differences of opinion, but with cooperation and communication skills, conflicts can be prevented (Sukendri et al., 2025).

This phenomenon confirms that even though they are supported by facilities and have advanced technological capabilities, communication skills and cooperation between the two parties are important things that a leader must have. Through the transformation of AI technology, this study analyzes the communication behavior of students. With this technological change, it is necessary to evaluate the importance of developing learning strategies that can balance the use of AI with interaction among students so that they continue to have good communication, critical thinking, and collaborative skills. The phenomenon of reduced direct social interaction, dependence on technology, and the potential for a digital divide are real challenges, especially in non-formal educational institutions.

The urgency in this study is that, according to the literature, AI technology is recognized as strategically driving educational transformation and administrative efficiency, but its impact on student communication behavior and the role of managerial governance still needs to be proven at the practical level. In non-formal education, communication patterns are shifting towards digital collaboration without eliminating face-to-face communication, which requires governed adoption, namely the integration of AI in line with management and ethics. This framework is important for sustainability.

The novelty of this research lies in the combination of variables and contexts, which consists of combining AI transformation (TAM: perceived usefulness, ease of use, attitude, intention, actual use) with management strategies, namely planning, organizing, directing, coordinating, and controlling, to explain communication behavior (mind, self, society) in non-formal English education in Mataram City. Many studies highlight AI in other sectors or in education in general, but none have linked TAM theory and management functions to communication outcomes in a specific non-formal context (Alamanda et al., 2021; Ricardianto et al., 2022; Sawitri, 2025; Ulpiana, 2025). Additionally, the novelty of this study lies in the explicit development of operational indicators across three theories (TAM, management functions, symbolic interaction), making the measurement more structured.

Therefore, this study aims to analyze the transformation of AI technology by developing managerial strategies for student communication behavior in achieving sustainability, with a focus on non-formal English language educational institutions in Mataram City. The objective is to describe the extent to which the application of AI and managerial strategies impact student communication patterns, as well as to formulate an ideal balance between technological innovation and the strengthening of social competencies for a sustainable future.

LITERATURE REVIEW

Artificial Intelligence Transformation (Technology Acceptance Model)

Artificial Intelligence (AI) has become a key driver of transformation in educational environments by enabling adaptive learning, personalized instruction, and efficient knowledge management. The adoption of AI is commonly explained through the Technology Acceptance Model (TAM), which posits that perceived usefulness and perceived ease of use shape users' attitudes, behavioral intentions, and actual system usage (Davis, 1989). In educational contexts, these constructs are essential for

understanding how students engage with AI-based systems and how such engagement influences learning-related behaviors.

Empirical studies indicate that technology adoption significantly influences user behavior, particularly in shaping interaction patterns and engagement in digital learning environments (Alamanda et al., 2021). In addition, AI plays an increasingly important role in student management and adaptive learning systems, where it supports more responsive, individualized, and data-driven learning processes (Nazla, 2025). This indicates that AI is not only a tool for information access but also a mechanism that restructures how students participate in learning activities. As AI becomes increasingly embedded in educational processes, it directly reshapes how students communicate, collaborate, and express ideas. Therefore, AI transformation can be understood as a behavioral driver that influences communication dynamics in technology-mediated learning environments.

Managerial Strategy and Management Functions

The integration of technology in education requires managerial strategies to ensure that implementation aligns with institutional objectives and learning processes. Managerial strategy is grounded in core management functions, including planning, organizing, directing, coordinating, and controlling, which provide a structured approach to managing resources and guiding technological adoption. These functions are essential in shaping how AI is implemented within educational settings.

Previous studies suggest that the integration of information technology and managerial capabilities contributes to improved organizational performance and system effectiveness (Ricardianto et al., 2022). In addition, IJABIM-based studies indicate that technology adoption is closely related to user engagement and system-related outcomes in organizational contexts (Alamanda et al., 2021). However, the influence of managerial strategy on individual behavioral outcomes, particularly communication behavior, is often indirect. Managerial functions primarily operate at the organizational level, supporting the learning environment and facilitating technology use rather than directly shaping how students communicate. This indicates that managerial strategy may function as an enabling factor rather than a primary determinant of communication behavior.

Student Communication Behavior (Symbolic Interaction Theory)

Communication behavior is a fundamental component of the learning process, as it determines how students exchange information, construct meaning, and engage in social interaction. From the perspective of symbolic interaction theory, communication behavior is shaped through the dimensions of mind, self, and society, which emphasize meaning-making, identity formation, and interaction within social contexts. These dimensions are critical in understanding how communication develops within learning environments.

In technology-mediated learning, communication behavior has undergone significant transformation. The increasing reliance on AI and digital tools has shifted interaction patterns from direct face-to-face communication to digitally mediated exchanges. While this transformation enhances flexibility and access to information, it may also alter the quality and form of interpersonal interaction. Studies show that students' perceptions of online learning are shaped by participation, accessibility, application use, and interactional challenges, including limited peer interaction in digital environments (Andries & Lengkoan, 2023). In addition, younger generations increasingly rely on digital communication, influencing their interaction styles and social engagement (Zis et al., 2021). As a result, communication behavior becomes a critical outcome in assessing the

impact of AI transformation, particularly in understanding how students adapt to and interact within technology-driven learning environments.

Hypotheses Development

Artificial Intelligence Transformation and Student Communication Behavior

Artificial Intelligence (AI) transformation plays a crucial role in shaping learning environments by enabling adaptive, interactive, and personalized educational experiences. Based on the Technology Acceptance Model (TAM), individuals who perceive AI as useful and easy to use are more likely to develop positive attitudes and behavioral intentions, which subsequently influence actual system usage (Davis, 1989). In educational contexts, this engagement extends beyond task completion and begins to affect how students communicate, collaborate, and express ideas.

Empirical studies indicate that the adoption of digital technology significantly influences user behavior and interaction patterns in learning environments (Alamanda et al., 2021). AI-supported learning tools facilitate idea generation, feedback exchange, and collaborative interaction, thereby enhancing communication processes among students. As AI becomes increasingly embedded in learning activities, it is expected to directly shape communication behavior in technology-mediated environments.

H1: AI transformation has a positive effect on student communication behavior.

Managerial Strategy and Student Communication Behavior

Managerial strategy is essential in guiding the implementation of technology within educational institutions. Grounded in management functions such as planning, organizing, directing, coordinating, and controlling, managerial strategy ensures that technological adoption aligns with institutional goals and learning processes. These functions contribute to the creation of structured and supportive learning environments in which technology can be effectively utilized.

However, the influence of managerial strategy on individual behavioral outcomes, particularly communication behavior, is often indirect. Previous studies suggest that managerial capabilities primarily affect organizational performance and system effectiveness rather than directly shaping individual interaction patterns (Ricardianto et al., 2022). In educational settings, managerial strategy may facilitate the use of AI and provide a conducive learning environment, but it does not necessarily determine how students communicate. Therefore, its effect on communication behavior requires empirical examination.

H2: Managerial strategy has an effect on student communication behavior.

AI Transformation, Managerial Strategy, and Student Communication Behavior

The integration of AI transformation and managerial strategy reflects the combined influence of technological and organizational factors in shaping learning environments. While AI directly affects how students interact and communicate, managerial strategy supports the implementation and regulation of technology within educational settings. Together, these factors contribute to the overall structure and effectiveness of technology-mediated learning environments.

Previous research indicates that the combined presence of technological adoption and managerial processes can influence user behavior at the system level (Alamanda et al., 2021; Ricardianto et al., 2022). Although managerial strategy may not directly affect communication behavior, its role in facilitating AI implementation suggests that both variables jointly contribute to shaping communication dynamics. Therefore, examining

their simultaneous influence provides a more comprehensive understanding of student communication behavior.

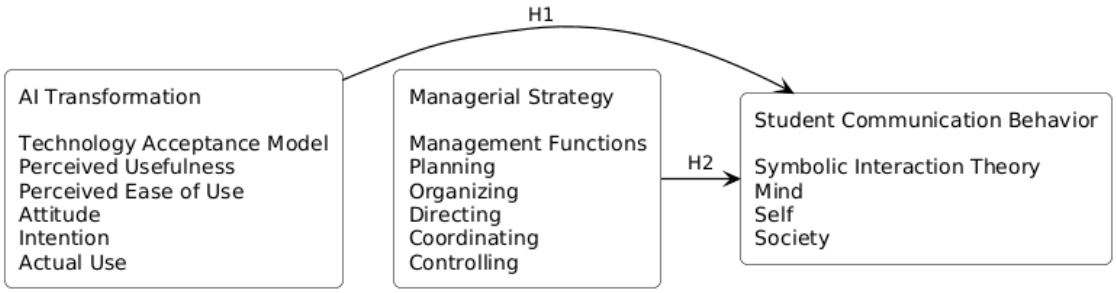
H3: AI transformation and managerial strategy jointly influence student communication behavior.

Conceptual Framework

This study proposes a conceptual framework that integrates technological, managerial, and behavioral perspectives to explain student communication behavior in non-formal educational settings. AI transformation is conceptualized through the Technology Acceptance Model (TAM), reflecting how perceived usefulness, perceived ease of use, attitude, intention, and actual use shape students' engagement with AI-based learning systems. As a technological dimension, AI transformation is expected to directly influence how students interact, communicate, and express ideas within learning environments. As illustrated in Figure 2, AI transformation is positioned as a primary driver influencing student communication behavior.

Managerial strategy represents the organizational dimension, grounded in management functions such as planning, organizing, directing, coordinating, and controlling, which shape the institutional environment in which AI is implemented. While managerial strategy supports the effective use of technology, its influence on communication behavior is assumed to be indirect. Student communication behavior, explained through symbolic interaction theory (mind, self, and society), serves as the dependent variable reflecting interaction and meaning-making processes. As shown in Figure 2, both AI transformation and managerial strategy are examined individually in influencing student communication behavior, without implying interaction or moderating relationships.

Figure 2. Research Framework



RESEARCH METHOD

Research Approach and Design

This study employs a quantitative approach using an explanatory research design to examine the influence of AI transformation and managerial strategy on student communication behavior. The explanatory design is appropriate as the study aims to test causal relationships between independent and dependent variables using multiple linear regression analysis. The focus is on identifying both partial and joint effects of the independent variables within non-formal educational settings.

Population and Sample

The population consists of non-formal English language education institutions in Mataram City that have implemented AI-supported learning. A non-probability sampling technique with purposive sampling was applied, selecting respondents based on their direct involvement in AI-based learning implementation.

The final sample included 35 respondents, which meets the minimum requirement for multiple regression analysis with two predictors. According to Hair et al. (2019), a minimum of 15–20 observations per independent variable is acceptable. However, the relatively small sample size is acknowledged as a limitation, and results should be interpreted cautiously in terms of generalization.

Respondents' Profile

Respondents consist of teachers and managers who are directly involved in the implementation and supervision of AI-supported learning processes. These individuals are considered knowledgeable informants as they regularly observe student interactions, participation, and communication patterns during learning activities.

Data Collection

Data were collected using a structured questionnaire. The instrument consists of 63 items derived from three theoretical constructs: TAM, management functions, and symbolic interaction theory. The questionnaire was distributed both offline and online to ensure accessibility and response efficiency.

Measurement of Variables

All variables in this study were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). AI transformation (X1) was operationalized based on the Technology Acceptance Model (TAM), including perceived usefulness, perceived ease of use, attitude, intention, and actual use. Managerial strategy (X2) was measured using core management functions, namely planning, organizing, directing, coordinating, and controlling. Meanwhile, student communication behavior (Y) was measured using the dimensions of symbolic interaction theory, consisting of mind, self, and society.

The 63 items were distributed proportionally across these constructs to ensure adequate representation of each dimension, enabling a structured measurement of behavioral and managerial constructs.

Instrument Testing

Validity was assessed using Pearson correlation, where items exceeding the r-table value were considered valid. Reliability was tested using Cronbach's Alpha, with a threshold of ≥ 0.70 indicating acceptable internal consistency. Only valid and reliable items were retained for analysis.

Data Analysis

Data were analyzed using SPSS version 25. The analysis included descriptive statistics, classical assumption tests (normality, multicollinearity, heteroscedasticity), multiple linear regression, hypothesis testing (t-test for partial effects and F-test for joint effects), and coefficient of determination (R^2).

Unit of Analysis and Measurement Justification

The unit of analysis is student communication behavior; however, the data were collected through teacher/manager assessments. This proxy approach is justified because teachers and managers directly observe students' interaction patterns during the learning process. To minimize bias, respondents were selected based on active involvement in AI-based instruction, and standardized questionnaire items were used to reduce subjectivity and ensure consistency in evaluation.

Table of Research Institutions

As shown in Table 1, the study includes 12 non-formal English language education institutions in Mataram City that meet the sampling criteria. The inconsistency in the number of institutions has been reconciled, resulting in a final total of 12 institutions used in this study.

Table 1. Research Institutions

No	Institution Name
1	CEC Kampung Pare
2	UPT Pusat Bahasa Unram
3	Kumon
4	English First
5	Ganesha Operation
6	Kursus Bahasa Inggris Lombok
7	Mataram School of English
8	Straya Language Institute
9	Aisha Learning Center
10	Master's English
11	English Club
12	The Learning Zone

RESULTS

Respondents' Demographic Profile

The respondents in this study consist of 35 teachers and managers from 12 non-formal English language education institutions in Mataram City. These respondents were selected based on their direct involvement in AI-supported learning implementation, ensuring that they possess adequate knowledge of student interaction patterns and communication behavior in learning environments.

As shown in Table 2, the respondents are distributed across all institutions included in this study. The distribution reflects variations in institutional size and participation levels, indicating that the sample captures a diverse range of non-formal education providers implementing AI-based learning.

Table 2. Respondents Distribution by Institution

No	Institution	Number of Respondents
1	CEC Kampung Pare	3
2	UPT Pusat Bahasa Unram	4
3	Kumon	2
4	English First	4
5	Ganesha Operation	4
6	Kursus Bahasa Inggris Lombok	3
7	Mataram School of English	3
8	Straya Language Institute	2
9	Aisha Learning Center	2
10	Master's English	3
11	English Club	2
12	The Learning Zone	3
	Total	**35**

The distribution in Table 2 shows that respondents are not evenly allocated across institutions, which is consistent with the purposive sampling approach used in this study. Institutions with larger operational scales contributed more respondents compared to smaller institutions, supporting the representativeness of the sample.

Instrument Testing

Instrument validity was assessed using Pearson correlation analysis. The results indicate that all questionnaire items have correlation coefficients greater than the critical r-table value, confirming that all items are valid.

Reliability testing was conducted using Cronbach's Alpha, and the results are summarized in Table 3.

Table 3. Reliability Test Results

Variable	Cronbach's Alpha
AI Transformation	0.89
Managerial Strategy	0.82
Communication Behavior	0.87

As shown in Table 3, all variables have Cronbach's Alpha values above 0.70, indicating that the instrument has satisfactory internal consistency and is reliable for further analysis.

Classical Assumption Tests

Before conducting regression analysis, classical assumption tests were performed.

The normality test results indicate that the data are normally distributed. The multicollinearity test shows that all independent variables have tolerance values greater than 0.10 and VIF values below 10, indicating no multicollinearity. The heteroscedasticity test results show no clear pattern, indicating that the model satisfies the homoscedasticity assumption.

These results confirm that the regression model meets the required assumptions.

Regression and Hypothesis Testing

Multiple linear regression analysis was conducted to examine the effect of AI transformation and managerial strategy on student communication behavior. The resulting regression equation is:

$$Y = 12.147 + 0.334X_1 - 0.033X_2 \ (1) \quad (1)$$

This equation indicates that AI transformation has a positive relationship with communication behavior, while managerial strategy shows a weak negative relationship.

As presented in Table 4, the regression results provide detailed statistical output.

Table 4. Regression Results

Variable	Coefficient (B)	t-value	Sig.
Constant	12.147		
AI Transformation	0.334	6.463	0.000
Managerial Strategy	-0.033	-0.532	0.598
F-value	24.026		
Sig. (F-test)	0.000		
Adjusted R^2	0.575		

As shown in Table 4, AI transformation has a statistically significant positive effect on student communication behavior ($t = 6.463$, $p < 0.001$), indicating that increased AI adoption is associated with improved communication behavior.

In contrast, managerial strategy does not have a statistically significant effect ($t = -0.532$, $p = 0.598$), suggesting that managerial functions do not directly influence communication behavior.

The F-test results ($F = 24.026$, $p < 0.001$) indicate that the model is statistically significant, meaning that both variables jointly influence communication behavior.

The adjusted R^2 value of 0.575 indicates that 57.5% of the variance in communication behavior is explained by the model.

DISCUSSION

AI Transformation and Student Communication Behavior

TThe findings indicate that AI transformation has a significant positive effect on student communication behavior, supporting H1. This result suggests that AI integration in learning environments is associated with changes in how students interact, express ideas, and participate in communication activities. Technology transformation refers to fundamental changes in how organizations utilize technology to improve processes and create value (Putra et al., 2025). In this study, AI is not merely positioned as a technical tool but as part of the learning environment that shapes communication practices.

This finding is consistent with the Technology Acceptance Model (TAM), which explains that perceived usefulness and perceived ease of use influence attitudes, behavioral intentions, and actual system usage (Davis, 1989; Zufiyardi et al., 2021). When AI is perceived as useful and accessible, it becomes more likely to be integrated into learning

activities and communication processes. Previous studies also show that AI and digital technologies contribute to adaptive learning, student management, evaluation, academic task completion, and communication-related learning activities (Agustina & Suharya, 2024; Amaliyah et al., 2025; Nazla, 2025; Nurmila et al., 2024; Oktavia & Suseno, 2024; Rhamadhani et al., 2024; Tristianto et al., 2025; Waita et al., 2025). This supports the interpretation that AI transformation can strengthen communication behavior by facilitating information access, feedback exchange, and participation in digitally mediated learning.

From the perspective of symbolic interaction theory, communication behavior develops through interaction, interpretation, and meaning-making. AI changes the context in which students access information and respond to learning situations, thereby influencing communication patterns. This is consistent with studies showing that digital learning environments affect participation, accessibility, interaction, and peer communication (Andries & Lengkoan, 2023; Zis et al., 2021). However, this study does not directly measure sustainability. Therefore, sustainability should be understood as a broader implication of adaptive and technology-supported learning rather than as a directly tested empirical outcome (Priandani et al., 2025; Ramdhan et al., 2022).

Managerial Strategy and Student Communication Behavior

The findings show that managerial strategy does not have a significant direct effect on student communication behavior, indicating that H2 is not supported. This result suggests that planning, organizing, directing, coordinating, and controlling do not automatically determine how students communicate in the observed learning environment.

This non-significant result can be explained by the different levels at which managerial strategy and communication behavior operate. Managerial strategy is grounded in classical management theory, particularly Henri Fayol's management functions, which emphasize organizational planning, coordination, direction, and control (Andriyani & Usiono, 2024). These functions are important for institutional effectiveness, technology implementation, and learning management. However, they primarily operate at the organizational level, whereas student communication behavior occurs at the interactional level.

Previous studies indicate that managerial capabilities and information technology contribute to organizational performance, service quality, user satisfaction, and system-related outcomes (Alamanda et al., 2021; Ricardianto et al., 2022). However, such contributions do not necessarily produce a direct effect on individual communication behavior. Therefore, the result of this study suggests that managerial strategy should be understood as an enabling condition that supports AI implementation rather than as a primary determinant of student communication behavior. Claims about self-confidence, motivation, teaching style, or sustainability awareness should not be presented as findings because those variables were not empirically measured in this study.

AI Transformation, Managerial Strategy, and Student Communication Behavior

The findings indicate that AI transformation and managerial strategy jointly influence student communication behavior at the model level, supporting H3. This means that both independent variables, when entered together in the regression model, explain variation in communication behavior. However, this result should not be interpreted as evidence of synergy, interaction, mediation, or moderation because the model does not test an interaction term.

The joint effect should be understood as a model-level explanation. AI transformation represents the technological dimension that has a direct relationship with communication behavior, while managerial strategy represents the institutional context in which AI-supported learning is implemented. This interpretation is consistent with studies showing that technology adoption and organizational processes contribute to system-level outcomes and user-related behavior (Alamanda et al., 2021; Ricardianto et al., 2022). Other studies also suggest that AI contributes to learning effectiveness, educational innovation, and communication-related skills, including speaking ability (Hartati et al., 2025; Kasman et al., 2025; Oktarian et al., 2025; Sihaloho & Napitupulu, 2024).

From the perspective of symbolic interaction theory, communication behavior is shaped through the interaction between mind, self, and society (Aditya & Sucipta, 2024; Sukendri & Andriyansah, 2025). AI influences this process by shaping how students access, interpret, and respond to information, while managerial strategy shapes the conditions under which these interactions occur. Thus, the contribution of this study lies in integrating technological engagement, institutional context, and interactional processes to explain student communication behavior in AI-supported non-formal education.

The broader sustainability implication should be stated carefully. AI-supported learning may contribute to digital collaboration and resource efficiency, but this study does not empirically test sustainability as a dependent variable (Hidayah et al., 2024). Therefore, sustainability is best positioned as a contextual implication rather than a direct finding.

CONCLUSION

This study examined the influence of AI transformation and managerial strategy on student communication behavior in non-formal English education institutions in Mataram City. The findings indicate that AI transformation has a significant positive effect on student communication behavior, whereas managerial strategy does not have a significant direct effect. At the same time, both variables jointly explain variation in communication behavior at the model level. These results suggest that changes in student communication behavior within AI-supported learning environments are more closely associated with direct technological engagement than with organizational management functions alone.

Theoretically, this study contributes by integrating the Technology Acceptance Model, management function theory, and symbolic interaction theory within a single analytical framework. The findings clarify that AI transformation operates as the primary explanatory factor influencing communication behavior, while managerial strategy functions as a contextual condition that supports, rather than directly determines, behavioral outcomes. This contributes to the literature by providing empirical evidence on how technological and organizational dimensions relate differently to communication behavior in non-formal educational settings.

From a practical perspective, the results suggest that non-formal education institutions should prioritize the effective and purposeful integration of AI into learning activities, particularly to support student interaction, participation, and communication processes. Managerial strategies should be oriented toward facilitating the implementation of technology and ensuring that learning environments remain structured and supportive, rather than being expected to directly shape communication behavior. While AI-supported learning may be associated with more adaptive and efficient educational practices, sustainability should be understood as a broader implication of technology integration rather than as a directly measured outcome in this study.

This study is subject to several limitations, including the relatively small sample size and the use of proxy assessments by teachers and managers to evaluate student communication behavior. Therefore, future research is recommended to involve larger samples, incorporate direct student-level data, and examine additional variables that may provide a more comprehensive explanation of communication behavior. Further studies may also explore how managerial strategies can be translated into interaction-level practices that more directly support communication outcomes in technology-mediated learning environments.

LIMITATION

This study has several limitations that should be acknowledged. First, the sample is limited to 35 respondents from non-formal English language education institutions in Mataram City, which may restrict the generalizability of the findings to broader educational contexts. The relatively small sample size also limits the statistical robustness of the results, particularly for regression-based analysis.

Second, the data were collected using a cross-sectional quantitative design, which does not capture changes in communication behavior over time. This is particularly relevant in the context of rapidly evolving technologies such as artificial intelligence (AI), where behavioral adaptation may develop dynamically.

Third, the study relies on proxy respondents, as teachers and managers were asked to assess student communication behavior. Although these respondents are directly involved in the learning process and have observational insights, this approach may introduce perceptual bias and limit the accuracy of representing students' actual communication experiences.

Fourth, the data were collected using self-reported questionnaires, which may be subject to response bias and social desirability bias. While standardized instruments were used to reduce subjectivity, the potential for bias remains.

Finally, although this study discusses sustainability in relation to AI-supported learning, sustainability was not directly measured as a variable in the research model. Therefore, it should be interpreted as a broader contextual implication rather than an empirical finding derived from the statistical analysis.

Future research is recommended to use larger and more diverse samples, incorporate direct student-level data, and apply longitudinal or mixed-method approaches to better capture behavioral dynamics over time. Further studies may also include additional variables, such as digital literacy, psychological readiness, and institutional culture, to provide a more comprehensive explanation of communication behavior in AI-supported educational environments.

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DECLARATION OF CONFLICTING INTERESTS

The authors declare that there are no conflicts of interest related to the research,

authorship, and publication of this article. This study was conducted independently without any financial, commercial, or personal relationships that could have influenced the research outcomes.

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ABOUT THE AUTHOR(S)

1st Author
Nengah Sukendri is a lecturer at Institut Agama Hindu Negeri Gde Pudja Mataram, Mataram, West Nusa Tenggara, Indonesia. His academic profile indicates research interests in financial management and economics, with a verified institutional affiliation at IAHN Gde Pudja Mataram.
Email: sukendri@iahn-gdepudja.ac.id
ORCID ID: https://orcid.org/0000-0002-2635-3109

2nd Author
I Komang Widya Purnama Yasa is a lecturer at Institut Agama Hindu Negeri Gde Pudja Mataram, Mataram, West Nusa Tenggara, Indonesia. He is affiliated with the field of communication studies and has been actively involved in academic and editorial activities, including serving as a journal editor. He is also listed as an academic staff member in the institution's lecturer formation records.
Email: komang.yasa1990@gmail.com

3rd Author
I Wayan Astraguna is a lecturer at Institut Agama Hindu Negeri Gde Pudja Mataram, Mataram, West Nusa Tenggara, Indonesia. His academic work is associated with communication and media studies, with publications indexed in Google Scholar. He is also recorded as part of the institution's academic staff cohort.
Email: i.w.astraguna89@gmail.com

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4th Author
Ni Putu Ade Resmayani is a lecturer at Institut Agama Hindu Negeri Gde Pudja Mataram, Mataram, West Nusa Tenggara, Indonesia. Her academic background is in education, and she is actively engaged in teaching and academic activities within the institution. Institutional records confirm her role as academic staff.
Email: aderesmayani@gmail.com