

Defining the Role of Artificial Intelligence in Improving English Writing Skills Among Indonesian Students

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Abstract—Artificial intelligence (AI) is a technological product in the form of an application usable in education. The implementation of AI, specifically in the teaching and learning process in Higher Education, not only broadens students' scientific knowledge academically but also facilitates awareness about current technological developments. Therefore, this study aimed to explore the improvement of English writing skills through the integration of AI into reading practices and provision of adequate feedback for skills enhancement. Also, students' attitude toward the use of AI in the teaching and learning process served as the intervening variables. This study was conducted at Higher Schools in Makassar City, Indonesia, and data were collected from 80 students through questionnaires and subsequently analyzed using path analysis. The results showed that (1) Students' attitude toward the use of AI played a mediating role in explaining the effect of reading and feedback on writing skills, (2) Reading had an indirect effect through attitude on writing skills improvement, and (3) Lecturers feedback had an indirect effect through attitude on writing skills.

Index Terms—artificial intelligence, reading skills, feedback, attitude, writing skills

I. INTRODUCTION

The Covid-19 pandemic impacted economic, social, and educational activities, where the teaching and learning process could not be carried out in the classroom. Government policy required that the teaching and learning process be carried out online through electronic media, such as computers, laptops, or cell phones. The face-to-face learning is suddenly changed into an online learning method (Anggrawan et al., 2019). Even though the concept of online learning application might not be considered optimal according to Kaharuddin (2022), it presented the initial effort to encourage the use of technological instruments in the educational field. The expansion of internet had a significant impact at this point (Arafah & Hasyim, 2023a). Information and material learning provided online worldwide entail students' cognitive skills and abilities (Arafah & Hasyim, 2023b; Arafah et al., 2023). This allowed students to gain a practical understanding of the relationship between technological developments and education.

Technology facilitated pedagogical approaches for lecturers (Tsui & Tavares, 2021, p. 110) and served as a medium for creating a new way of teaching and learning (Keengwe et al., 2008, p. 83). Therefore, it is expected that the use of electronic devices through artificial intelligence (AI) can provide expected learning outcomes. Depending on how it is used, technology is very beneficial within digital media and digital literacy (Suhadi et al., 2022; Hasyim & Arafah, 2023a). Additionally, the integration of AI facilitated the teaching and learning process (Hasjim et al., 2020; Kaharuddin et al., 2022). Through the internet, students can seek knowledge from any platform (Hasyim & Arafah, 2023b). For example, Google Translate provides translation facilities to translate teaching materials from English to

Indonesian. Caplar et al. (2017) stated that Artificial Intelligence (AI) can process language and translation automatically. In 2015 a new computer model was discovered; it is called the D-Wave 2X. This computer model can perform complex AI operations.

This study discussed the use of AI in English teaching and learning, as well as its effect on improving students' writing skills. Fahimirad and Kotamjani (2018) stated that the quality of students' learning process was improved through AI (p. 108). This study emphasized the improvement of students' writing skills on grammar mastery and vocabulary through AI.

English writing skills have been taught with traditional learning models, but the results were unsatisfactory because writing skills were low (Arafah & Kaharuddin, 2019). Furthermore, students' perceptions of the use of AI were descriptively discussed based on the results of quantitative analysis. The use of electronic devices was intended to facilitate writing skills supported by good grammar and vocabulary mastery, which can be developed by reading activities. Therefore, this analysis focused on how reading comprehension, as an independent variable, impacted writing skills. Reading lessons were delivered using AI applications, and each lesson required feedback from lecturers. Technology has basic features that enable virtual communicative interactions between lecturers and students. Feedback from lecturers can help students improve their mistakes in grammar and vocabulary. In this study, feedback was the second independent variable which was explored for its effect on writing skills. Therefore, "effective application of AI methods can improve the quality of teaching and learning" (Arafah & Kaharuddin, 2019, p. 108).

Students' attitude to English lessons promoted learning activities and accelerated mastery. Research by Kaharuddin et al. (2021) showed that there was a significant effect of students' attitude on motivation. The significance of character education is in need due to the current situation of education in Indonesia (Mokoginta & Arafah, 2022). This study discussed attitude as an intervening variable to explain the effect of reading and feedback on writing skills with the integration of AI. The perceptions of digital-based learning were also analysed, where English writing skills were the dependent variable while reading and feedback were the independent. This study directly and indirectly examined the effect of the two independent variables on students' attitude.

II. LITERATURE REVIEW

A. *Artificial Intelligence for Learning-Teaching*

During the Covid-19 pandemic, the English teaching process was not merely carried out by lecturers in class but included the use of AI online. This application was helpful in improving English skills, specifically writing. This is because students could check the grammatical errors using AI in addition to lecturers' explanation. As a "simulation of human knowledge on a machine programmed to think and imitate human actions" (Vasiljeva et al., 2021, p. 8), AI can replace lecturers to carry out the learning tasks. For example, students learn English grammar, how to spell words, match words, as well as make sentences through AI. The mistakes made can be detected by this application and corrected as feedback. However, in the context of writing, the mastery of English grammar is needed as expressed by Mozgovoy (2011) that "grammar check is important in text writing and language learning" (p. 209). Even a slight error can drastically change the whole meaning (Iksora et al., 2022). Correction of grammar, diction, or sentence construction was provided by AI through feedback-motivated learning activities. Cotos E. (2011) stated that "students obtain feedback, then re-read and improve their writing, as well as practice being independent learners" (p. 107). At the end, technology advancement in a form of online learning increases students' writing skills (Arnawa & Arafah, 2023). Other than that, grammar correction leads students to use meaningful and informative words to improve communication skills (Kuswanty et al., 2023). Therefore, in communication, people should follow the exact patterns and procedures to avoid any kind of mistake (Yulianti et al., 2022).

B. *Reading on Writing Improvement*

Reading is an important language skill for students to be carried out regularly. In addition to understanding the message of the reading material, students can improve vocabulary mastery as a necessary aspect of English communication. According to Ismail et al. (2020), vocabulary is a language element through which messages are conveyed orally and in writing.

Students developed vocabulary through reading (Renandya, 2007; Arafah B. et al., 2023; Kaharuddin et al., 2023), and reading material was taught separately by lecturers (Kroll J.F., 1993). In writing classes, students rarely engaged in reading activities as expected (Jolliffe, 2007). Even lecturers and students neglected reading activities in composition classes (Hirvela, 2004). On the other hand, vocabulary and grammar mastery is needed in writing. Horning and Kraemer (2013) stated that one of the effective methods for developing writing skills in higher schools and colleges was to engage in reading activities. Among the four language skills, reading and writing were the first to be learned, according to Durukan (2011). This was in line with the opinion of Esmaili (2002) that reading and writing had a positive influence on students' academic success, especially in English lessons. Reading activity can also in a form of reading literary work since literary work has escalated in academic studies (Takwa et al., 2022; Arafah et al., 2023). Through literary work, students are willing to improve knowledge in a scope of culture and locality (Arifin et al., 2022), nature and environmental situation (Manugeran et al., 2023; Siwi et al., 2022), and human relationship with other

creatures (Yudith et al., 2023). Therefore in learning English by reading literary work, students as readers are capable to discover language styles that an author used that later will be useful for them to write (Asri et al., 2023).

Related to the effect of reading and writing on improving English competence, this study was conducted using AI technology in a virtual teaching-learning process. The influence of reading on writing was directly and indirectly discussed through attitude toward the process of using AI.

C. Feedback on Writing Improvement

Students may have a few questions, such as “*Has the lecturer checked my assignment? Is my assignment correct? Is there anything I need to fix?*” The answers to these questions can be obtained through feedback from lecturers. However, many lecturers did not provide feedback, leading to a situation where the questions were not answered due to insufficient training (Corwin, 1976). In addition, there were many misconceptions only understood as lecturers' comments (Boud & Molloy, 2013). Feedback can be understood as lecturers' comments regarding students' work. Since the comments are related to the level of understanding and ability to carry out assignments (Hattie & Timperley, 2007), feedback is students' understanding of lecturers' comments (Henderson et al., 2019).

Feedback is not the end of a learning process, but information related to the ability to complete English assignments (Boud & Molloy, 2013). Therefore, it needs to comply with the principles of the right time, clear, educative, proportional to the assessment rubric, communicate, and motivate students (Henderson & Phillips, 2014). Corrective feedback improved writing skills (Boggs, 2019), reduced grammatical and lexical errors (Chandler, 2003), and significantly improved writing (Khadawardi, 2021). Avoiding any lexical error in choosing words or phrases enhances students' vocabulary as well (Baa et al., 2023; Takwa et al., 2022; Arafah B. et al., 2024).

During the Covid-19 pandemic, the learning process took place virtually, and the comments feature in Microsoft Word or Google Docs was used to send feedback to students. Furthermore, audio feedback was used to improve communication (Cavanaugh & Song, 2014). A website-based application called Vocaroo (<https://vocaroo.com>) and Mote, an integrated extension of Google with some features were applied to make a record of activities and sounds.

D. Learning Attitude on Writing Improvement

Before the Covid-19 pandemic, students studied English in class through traditional methods. Lecturers sometimes used electronic devices and AI as teaching aids. However, during the pandemic, the learning-teaching process took place virtually through electronic devices. There are 3 main areas in virtual learning, namely developing access to education and training, developing the learning quality, and maintaining competitiveness in universities (Newton, 2003). Face-to-face learning in class can enhance the social aspects between students, as well as between students and lecturers. With virtual learning, there was a tendency for students to get bored studying from home (Male et al., 2020). Students were aware of the importance of technology even though the usage was not encouraged (Farooq & Javid, 2012; Mardiana et al., 2023), and they had a negative attitude to the virtual learning (Govindasamy, 2001). Meanwhile, students of nursing department performed positive attitude to the E-learning. Learning attitudes of students and their effect on writing skills are examined in this study.

III. METHODOLOGY

This was a descriptive quantitative study that explored students' perceptions on the use of AI as a tool in virtual English learning. Reading comprehension and teachers feedback were the independent variables. The writing skill was the dependent variable. The intervening variable was learning attitude. The effect of the independent variables ($X_{1,2}$) on the dependent variable (Y_2) through the intervening variable (Y_1) was the focus of this study. The research was conducted on 100 higher school students in Makassar City, as the research respondents. The questionnaires distributed to the respondents were valued based on the 5 points of Likert scale which covered strongly agree, agree, neutral, disagree, and strongly disagree (Arafah B., 2023; Lebba & Kaharuddin, 2023).

A. Test of Research Instrument

Validity and reliability tests were conducted to meet the criteria for validity and reliability (Abidin & Kaharuddin, 2021; Lebba et al., 2023).

- a. Validity Test: This was conducted by correlating the value of each item and total variables. Pearson Correlation Product Moment (r) was used with a significance level 5% or 0.05, the result was called $r_{\text{calculation}}$. If the $r_{\text{calculation}}$ on every item of questionnaire was significantly more than the value of r_{table} , the instrument was stated to be valid.
- b. Reliability Test: This unit was intended to test the consistency of students in answering the questionnaire. The reliability of students' answers was determined using Cronbach Alpha. The answers were stated to be reliable when the Cronbach Coefficient Alpha value was above 0.6.

B. Classical Assumption Test

- a. Normality Test: This test was conducted to analyse the distribution of the residual value of the model using the Kolmogorov-Smirnov test. A regression model is stated to be good when it has a normal distribution of residual values. The basis for decision making is the asymp value, and when the significance value is above 0.05, then it is

called normally distributed.

- b. Multicollinearity test: It was conducted by analysing the correlation between reading comprehension and teachers feedback, both are independent variables. A good model does not show any multicollinearity. Multicollinearity is not shown if multicollinearity test gives value lower than 10 or the tolerance value is greater than 0.10.
- c. Heteroscedasticity test: It was conducted to analyse the residual variance from one observation to another observation. The decision is based on the significance value. If the Significance value is greater than 0.05, heteroscedasticity is not shown.
- d. Linearity Test: This test was conducted to analyse the level of significant linear relationship. The basis for the decision is that when the Sig value is > 0.05, the correlation between the independent variables and dependent variable is significant.

C. Inferential Statistical Analysis

The Inferential statistical analysis was carried out by using path analysis with Windows SPSS version 26.

D. Hypothesis Test

In the hypothesis test, direct and indirect effect of independent variables on dependent variable was analysed. It includes:

- H₀: Independent variables (X₁ and X₂) have no direct effect on dependent variable (Y₂).
- H₁: Independent variables (X₁ and X₂) have direct effect on dependent variable (Y₂).

IV. RESEARCH RESULT

Questionnaire was used to collect data, distributed to 80 students at Higher Schools in Makassar City, Indonesia. Among them was only 70 returned of which 5 were flawed. Therefore, only 65 were processed, and the data were analyzed using SPSS software version 26. The results were studied for the validity and reliability of the instrument. Concerning the criteria used to determine validity, when the significance value was below 0.05, the items were considered valid. Otherwise, when the value was above 0.05, the items were not considered valid. The validity test of the instrument showed that the significance value of all the questionnaire items was below 0.05, which means the instrument was valid.

Regarding the reliability test, the criterion was that when the Cronbach alpha value was above 0.70, the instrument was considered reliable. The reliability test of this instrument denoted that the output of SPSS version 26 showed Cronbach alpha of 0.823, and was above 0.70. Therefore, the questionnaire satisfied the reliability criteria.

TABLE 1
THE OUTPUT OF RELIABILITY TEST
RELIABILITY STATISTICS

Cronbach's Alpha	N of Items
.823	16

The validity and reliability tests were conducted, and the classical assumption test was carried out, including normality, multicollinearity, linearity, and heteroscedasticity tests. After the normality test, the output showed that the Asymp.Sig, (2-tailed) showed the value of 0.200, greater than 0.05 (0.200 > 0.05). This indicated a normal distribution of the residual variance.

TABLE 2
THE RESULT OF NORMALITY TEST

		Unstandardized Residual
N		65
Normal Parameters ^b	Mean	.0000000
	Std. Deviation	1.30862592
Most Extreme Differences	Absolute	.062
	Positive	.059
	Negative	-.062
Test Statistic		.080
Asymp. Sig. (2-tailed)		.200 ^{c,d}

- a. The test distribution is normal
- b. Calculated from data
- c. Lilliefors Significance Correction.
- d. This is a lower bound of the true significance.

The multicollinearity test was carried out to reveal the linear correlation of the independent variables (reading and feedback). Furthermore, tolerance value of the variables and the value of VIF were compared with 0.10 and 10.00. The output of SPSS version 26 showed that the tolerance value of each variable (X₁: 0.904, X₂: 0.722) was more significant than 0.10, and the value of VIF (X₁: 1.106, X₂: 1.386) was less than 10.00. Therefore, there was no linear correlation

between one independent variable and the other one. It means that there was no multicollinearity problem.

TABLE 3
THE RESULT OF MULTICOLLINEARITY TEST
COEFFICIENTS

Model	Unstandardized Coefficients		Standardized Coefficients		T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta				Tolerance	VIF
1 (Constant)	6.133	1.755			3.494	.001		
Rd	-.119	.104	-.111		-1.150	.255	.904	1.106
Fb	-.017	.069	-.027		-.251	.803	.722	1.386
Att	.673	.097	.724		6.948	.000	.769	1.300

a. Dependent Variable: Wr

The heteroscedasticity test was conducted to determine the regression model variance in similarity. A good model does not show a heteroscedasticity. The conclusion was made based on the followings:

- Value of Sig > 0.05 = there was no heteroscedasticity
- Value of Sig < 0.05 = there was heteroscedasticity

The table of coefficient in column sig. shows the sig. value of 0.874 for X₁, 0.712 for X₂ and 0.927 for Y₁. The regression model was bigger than 0.05 which means that there was no heteroscedasticity.

TABLE 4
THE OUTPUT OF HETEROSCEDASTICITY TEST
COEFFICIENTS

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta				Tolerance	VIF
1 (Constant)	1.420	1.305			1.088	.281		
Rd	.012	.077	.021		.160	.874	.904	1.106
Fb	-.019	.051	-.056		-.370	.712	.722	1.386
Att	.007	.072	.013		.092	.927	.769	1.300

a. Dependent Variable: RES2

The linearity test was carried out to determine the significant linear correlation between the independent and dependent variables. The criteria to determine the correlation was sign. Value greater than 0.05 which was indicating a linearity in the correlation between the independent and dependent variables. The Anova analysis denoted that the deviation from linearity showed the value of sign. 0.999 which was greater than 0.05. It means that there was linearity in the correlation between the independent variables and dependent variable.

TABLE 5
THE OUTPUT OF THE LINEARITY TEST
ANOVA TABLE

			Sum of Squares	Df	Mean Square	F	Sig.
WR * FB	Between Groups	(Combined)	1.441	7	.206	.055	1.000
		Linearity	.046	1	.046	.012	.912
		Deviation from Linearity	1.395	6	.232	.062	.999
Within Groups			213.698	57	3.749		
Total			215.138	64			

The independent variables in this research were Reading (X₁) and Feedback (X₂), the dependent variable was Writing (Y₂), and the intervening variable was Attitude (Y₁). Path analysis was conducted twice, and produced two models: Model 1 and Model 2. Those two models were discussed below.

Model 1

In this Model 1 construction, Reading (X₁) and Feedback (X₂) were the independent variables and Attitude (Y₁) was the dependent variable. The result of the analysis using SPSS version 26 was shown in the Table 6 below.

TABLE 6
MODEL 1
COEFFICIENTS

Model	Unstandardized Coefficients		Standardized Coefficients		T	Sig.
	B	Std. Error	Beta			
1 (Constant)	11.865	1.740			6.819	.000
Rd	.048	.136	.041		.354	.724
Fb	.321	.081	.466		3.980	.000

a. Dependent Variable: ATT

The value of standardized coefficient of the independent variables as the path coefficient of X_1 and X_2 is presented in Table 6 above. The part coefficient matrix was as follows:

$$\begin{pmatrix} \rho_{y1x1} \\ \rho_{y1x2} \end{pmatrix} = \begin{pmatrix} 0.041 \\ 0.466 \end{pmatrix}$$

The value of determinant coefficient or the R square value was indicated by the model summary in the table below:

TABLE 7
DETERMINANT COEFFICIENT (R2) OF MODEL 1
MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.480 ^a	.231	.206	1.758

a. Predictors: (Constant), Fb, Rd
b. dependent variable: Attitude

The R square value was 0.231. The path coefficient of X_1 and X_2 was manually calculated by a part matrix, multiplied by Y_1 . The R square, $\rho_{Y1\epsilon}$, calculates the coefficient of variables outside the model.

$$\rho_{Y1\epsilon} = \sqrt{1 - 0.231} = 0.769$$

1) Path Coefficient of ρ_{Y1X1}

For the path coefficient of ρ_{Y1X1} , namely from X_1 to Y_1 , the column sig. in table 6 was 0.724, which was greater than 0.05. The value of $t_{\text{calculation}}$ 0.354 was smaller than the value of t_{table} 1.669. It means that H_0 was accepted and H_1 was rejected which implied that the path coefficient of X_1 to Y_1 was insignificant.

2) Path Coefficient of ρ_{Y1X2}

Related to the path coefficient from X_2 to Y_1 (ρ_{Y1X2}), the value of sig. was 0.000 which was less than the value of 0.05. Meanwhile, the value of $t_{\text{calculation}}$ 3,980 was greater than the value of t_{table} 1.669. Therefore, H_0 was rejected, and H_1 accepted. It indicated that the path coefficient from X_2 to Y_1 was significant.

Model 2

In this Model 2, the dependent variable was writing skills (Y_2) and the independent variables were Reading skill (X_1), Feedback (X_2), and students' attitude (Y_1). The result of the analysis by SPSS in this Model 2 is presented below.

TABLE 8
MODEL 2
COEFFICIENTS

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.133	1.755		3.494	.001
	Rd	-.119	.104	-.111	-1.150	.255
	Fb	-.017	.069	-.027	-.251	.803
	Att	.673	.097	.724	6.948	.000

a. Dependent Variable: Wr

Standardized coefficient values as shown in the Table 8 above indicated that coefficient value for Reading (X_1) was 0.111, Feedback (X_2) was 0.027, and Attitude (Y_1) was 0.724. The path coefficient matrix was:

$$\begin{pmatrix} \rho_{y2x1} \\ \rho_{y2x2} \\ \rho_{y2y1} \end{pmatrix} = \begin{pmatrix} 0.111 \\ 0.027 \\ 0.724 \end{pmatrix}$$

TABLE 9
DETERMINANT COEFFICIENT (R2) OF MODEL 2
MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.700 ^a	.491	.466	1.340

a. Predictors: (Constant), Att, Rd, Fb
b. Dependent Variable: Wr

The R Square value of 0.491 was manually calculated by changing the path coefficients of the independent variables (X_1 , X_2 , and Y_1) to the path matrix and multiplied by the column matrix Y_2 . Path coefficient of other variables outside the model ($\rho_{Y2\epsilon}$) was calculated by:

$$\rho_{Y2\epsilon} = \sqrt{1 - 0.491} = 0.509$$

1) Path Coefficient of $\rho_{Y_2X_1}$

The path coefficient from path X_1 to Y_2 indicated that the column sig. in table 8 was 0.255, which was greater than 0.05, and the value of $t_{\text{calculation}}$ 1,150 was less than the t_{table} 1.663. In this case, H_0 was accepted and H_1 rejected, meaning the path coefficient of X_1 to Y_2 was statistically insignificant.

2) Path Coefficient of $\rho_{Y_2X_2}$

The path coefficient from X_2 to Y_2 indicated that the value of sig., as shown in table 8, was 0.803, which was greater than 0.05, and the value of $t_{\text{calculation}}$ 0,251 was less than the t_{table} 1.663. Hence, H_1 was rejected and H_0 accepted, meaning the path coefficient of X_2 to Y_2 was insignificant.

3) Path Coefficient of $\rho_{Y_2Y_1}$

In path coefficient from the path Y_1 to Y_2 , the value of sig. was 0.000, which was greater than 0.05, and the value of $t_{\text{calculation}}$ 6,948 was bigger than the value of t_{table} 1.663. Hence, H_0 was rejected and H_1 was accepted, meaning the path coefficient of Y_1 to Y_2 was significant.

Test of Hypothesis

The effect of reading (X_1) on students' learning attitude (Y_1) was tested. The analysis of the path coefficient of $\rho_{Y_1X_1}$ indicated that the significant value of X_1 was 0.724, and was greater than 0.05, and the value of $t_{\text{calculation}}$ (1,150) was less than the value of t_{table} (1.663) or $t_{\text{calculation}} < t_{\text{table}}$. This showed reading had no effect on students' learning attitude, hence, *Hypothesis 1: "Reading has a significant effect on Attitude"* was rejected.

To reveal whether the Reading skill (X_1) could affect the students' writing competence (Y_2), the result of the data analysis indicated that the value of X_1 was 0.255, which was greater than 0.05, and $t_{\text{calculation}}$ (1.150) was less than the value of t_{table} (1.663) or $t_{\text{calculation}} < t_{\text{table}}$. It was concluded that X_1 had no direct effect on Y_2 . Therefore, the Hypothesis 2, Reading has significant effect on Writing, was rejected which proved that the students' writing competence could not be improved by the reading skill.

With regard to the contribution of Reading skill (X_1) to the improvement of students Writing skill (Y_2), the data analysis showed that Reading (X_1) has significant value 0.255, which was greater than 0.05, and $t_{\text{calculation}}$ (1.150) was less than the value of t_{table} (1.663) or $t_{\text{calculation}} < t_{\text{table}}$. It was concluded that X_1 had no direct effect on Y_2 . Therefore, the Hypothesis 2, Reading has significant effect on Writing, was rejected. It means that good competence on Reading could not boost directly the improvement of students' writing competence.

Indirect effect of Reading (X_1) on Writing (Y_2) mediated by Attitude (Y_1) was analyzed by multiplying the β value of Reading (X_1) on Attitude (Y_1) and the β value of Attitude (Y_1) on Writing (Y_2). It was noted in table 6 that the β value of Reading (X_1) on Attitude (Y_1) was 0.111 and the β value of Attitude (Y_1) on Writing (Y_2) was 0.724. The multiplication was then made, $0.111 \times 0.724 = 0.027$. The total effect of Reading (X_1) on Writing (Y_2) was the sum of the direct and indirect effects, $0.041 + 0.027 = 0.068$. The result indicated that the indirect effect was greater than the direct effect, which means that the *Hypothesis 3, Reading has an indirect effect through Attitude on Writing*, was accepted. In this case, students' attitude in learning English can bolster the Reading skill to improve the writing competence.

Regarding the analysis of the effect of feedback (X_2) on Attitude (Y_1), the result showed that the significant value of X_2 was 0.000, which was less than 0.05, and the value of $t_{\text{calculation}}$ (3.980) was greater than the value of t_{table} (1.663) or $t_{\text{calculation}} > t_{\text{table}}$. Therefore, *Hypothesis 4: "Feedback has effect on Attitude"* was accepted. Furthermore, the direct effect of feedback X_2 on Writing (Y_2) showed the significant value of X_2 (0.803) which was greater than 0.05, and the value of $t_{\text{calculation}}$ (0.251) was less than the value of t_{table} (1.663) or $t_{\text{calculation}} < t_{\text{table}}$. In this case, it did not fulfil the criteria that feedback directly affected students' writing improvement. Therefore, *Hypothesis 5: "Feedback has a significant direct effect on Writing"* was rejected.

The Indirect effect of Feedback (X_2) on Writing (Y_2) mediated by Attitude (Y_1) was analyzed by multiplying the β value of Feedback (X_2) on Writing (Y_2) and the β value of Attitude (Y_1) on Writing (Y_2). The result was $0.466 \times 0.724 = 0.337$, and the total effect of X_2 on Y_2 was $0.803 + 0.337 = 1.140$. The result showed that the indirect effect value (1,140) was greater than the direct (0.803). This implied that Attitude (Y_1) could strengthen the indirect effect of Feedback (X_2) on students' Writing competence (Y_2). It means that *Hypothesis 6, Feedback has an indirect effect through Attitude on Writing*, was accepted.

The effect of Attitude (Y_1) on Writing (Y_2) was tested, and when the significance value of Y_1 was bigger than 0.05 or the value of $t_{\text{calculation}}$ was bigger than the value of t_{table} , Attitude (Y_1) was considered to affect the Writing Competence (Y_2). The analysis result showed that the significant value of Y_1 was 0.000, greater than 0.05, and the value of $t_{\text{calculation}}$ (6.948) was bigger than t_{table} (1.663) or $t_{\text{calculation}} > t_{\text{table}}$. This showed attitude affected writing, hence, *Hypothesis 7: "Attitude affects Writing"* was accepted.

V. DISCUSSION

Technological developments, specifically AI, have penetrated all sectors and tend to affect human civilization. The education sector is one of the sectors most affected, mainly related to the use of AI in teaching and learning. During the Covid-19 pandemic, the learning process was not carried out by face-to-face interaction in class, but virtually using AI. In the context of learning English in Higher Schools, this study was conducted to analyze the use of AI in teaching reading and providing feedback to improve writing skills. Furthermore, students' attitude toward the use of AI was

investigated. AI can perform automatic tasks, and the possibilities of performing complex tasks in higher education are unimaginable (Soto et al., 2012). Technological advancements will become a standard solution (Bengio et al., 2013) for teaching and learning problems.

The reading course was virtually disseminated by uploading the material on Google Classroom in the form of PowerPoint. According to Pence (2019), classes were held virtually, presented by a slide show program like PowerPoint. Students were assigned task through Google Classroom. Lecturers provided feedback to notify students about their mistakes in using appropriate words and the grammatical aspect. Ability to understand the reading materials people send virtually could boost the students to improve their writing skill. This should be boosted by the mastery of English grammar and vocabulary, especially the vocabulary used in those reading materials. Furthermore, students' positive attitude toward using AI in the learning-teaching process should support their learning English progress.

This study found that virtual teaching through AI with a positive attitude had an indirect significant effect on writing skills improvement. The total indirect effect of reading on writing was 1.140, which showed reading contributed 11.40% indirect effect to the writing skills improvement. In this case, the teaching of reading did not significantly affect writing skills without a positive attitude of students. The improvement should be boosted by a positive attitude toward the process. Feedback had indirect effects through attitude on writing. In this case, it cannot significantly affect writing skills without positive attitude. This study proved that virtual teaching of reading and feedback with a positive attitude had a significant effect on writing skills improvement. Improving writing skills requires good mastery of grammar and vocabulary, which can be developed by reading and feedback from lecturers. Furthermore, electronic devices can facilitate this process with the application of AI.

VI. CONCLUSION

In conclusion, students' skills in learning English using AI needed to be improved. This was because students' attitude was shown to have a mediating role in explaining the effect of reading and teacher feedback on writing skills development. In this case, feedback had no direct influence on the development of writing skills. Therefore, building a positive attitude towards the use of AI in learning needs to be prioritized. Vocabulary development from reading and remedial exercises based on lecturers' feedback improved students' writing skills.

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