

The Impact of Formative Assessment and Feedback on Student Engagement in an Economics Course

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ABSTRACT

Low student engagement, characterized by poor academic performance and widespread truancy, is a global challenge exacerbated by the dominance of conventional teaching methods. As an intervention, this study aims to analyze the effect of the quality of formative assessment and assessment feedback, both individually and simultaneously, on student engagement in economics classes. Using a quantitative associative-causal approach, data were collected via a questionnaire administered to a sample of 112 Phase E students at SMA Negeri 1 X Koto, selected through proportional stratified random sampling. The data were then analyzed using multiple linear regression. The results of the hypothesis testing confirmed that the quality of formative assessment and assessment feedback, when considered simultaneously, significantly enhanced student engagement ($R^2 = 0.664$, $F = 107.546$, $p < 0.001$). Partially, both variables also made positive and significant contributions, with formative assessment ($\beta = 0.237$, $t = 2.147$, $p = 0.034$, 95% CI [0.020, 0.505]) and assessment feedback ($\beta = 0.601$, $t = 5.457$, $p < 0.001$, 95% CI [0.261, 0.560]) each showing a significant effect, with assessment feedback emerging as the most dominant variable in enhancing student engagement in the classroom. This study concludes that the use of periodic evaluation instruments and the provision of constructive feedback can create an interactive classroom environment, thereby effectively transforming students from passive listeners into proactive and independent learners.

INTRODUCTION

Education is an effort to enrich the nation's life, with schools serving as formal institutions tasked with producing high-quality, successful individuals through the learning process. However, in reality, low academic achievement and widespread truancy reflect that these educational goals have not been fully realized, which also indicates weak student engagement at school (Fitriyah & Khotimah, 2025). This phenomenon of disengagement or a decline in student involvement has become a global challenge faced by adolescents in their learning (Thomas & Nair, 2023). In Indonesia, this situation is exacerbated by the dominance of conventional, teacher-centered learning; this one-sided teaching approach limits opportunities for interaction, causing students to tend to be passive, feel bored, rarely ask questions, hesitate to express their opinions, and fail to participate actively in learning activities (Suhartawan et al., 2018; Fitri et al., 2025; Iqrom et al., 2025).

Student engagement is a multidimensional aspect that is crucial for fostering students' academic success (Fredricks et al., 2011; Shernof et al., 2017). This engagement encompasses three main dimensions: behavioral, affective, and cognitive. The behavioral dimension (behavioral engagement) is characterized by adherence to rules, class attendance, concentration, and students' tangible efforts in completing academic tasks. The affective



dimension (affective engagement) reflects students' emotional reactions, such as curiosity, enjoyment, comfort, and positive attachment to the school or teachers. The cognitive dimension (cognitive engagement) involves internal psychological depth, self-regulation, the use of thinking strategies, and students' persistence in deeply understanding and mastering learning material (Shernof et al., 2017; Bond et al., 2020; Hart et al., 2011). When these three dimensions are not fully realized, disengagement behaviors emerge, such as indifference toward lessons, chatting with friends, a lack of enthusiasm, and even falling asleep during the learning process (Appleton et al., 2008).

As a corrective measure to address these issues, the quality of classroom assessments needs to be optimized, particularly through the implementation of formative assessments. Formative assessment is implemented continuously throughout the learning process to monitor students' competency development in real time, detect learning difficulties early on, and continuously improve the learning cycle (Black & Wiliam, 2009; Slamet et al., 2024; Marsandi et al., 2016). High-quality formative assessment is characterized by clear objectives and success criteria (clarifying expectations), the communicative presentation of assessment results (communication about results), and the teacher's ability to conduct an in-depth analysis of students' task responses (analyzing student responses) (Veugen et al., 2021). The results of this diagnostic and responsive evaluation are then used as the basis for taking follow-up actions to adjust instruction to align with students' needs (Veugen et al., 2021; Dylan Wiliam, 2011). Through this periodic process of eliciting student responses, this assessment encourages and motivates students to actively participate in classroom learning.

However, the effectiveness of formative assessments depends heavily on the quality of the feedback provided by teachers (Gunawan et al., 2022). Feedback serves as information for students about their learning outcomes, the mistakes they have made, and the corrective steps they need to take (Shute, 2008; Lipnevich & Panadero, 2021). Through the approaches of feeding up (clarifying learning objectives), feeding back (confirming current learning progress), and feeding forward (guiding future improvement strategies), constructive and timely feedback has been shown to improve understanding of the material, foster a sense of optimism, boost self-confidence, and stimulate students' intrinsic motivation to learn (Brooks et al., 2019; Nahadi et al., 2015).

Efforts to increase student engagement through assessment tools have become particularly urgent in economics classes. Economics requires students to actively engage in critical thinking, logically analyze concepts, and connect the course material to real-life situations. Previous research has also confirmed a real challenge: low student engagement among high school students, especially in economics classroom teaching (Rahmawati & Saepuloh, 2025). The level of student engagement in economics learning currently varies, as some students remain passive, are not sufficiently involved in group discussions, and do not optimally utilize feedback from teachers to improve their understanding of the subject.

There is a clear research gap in the existing literature, as many studies generally examine these variables separately. For example, the study by Veugen et al. (2021) focused on mapping teachers' and students' perceptions of the formative assessment cycle, while the study by Brooks et al. (2019) examined how high school students perceive the implementation of feedback, and Lipnevich & Panadero (2021) focused on a review of feedback models, while Hart et al. (2011) focused on the validation of student engagement instruments. However, to date, no study has simultaneously integrated the quality of formative assessment and assessment feedback into a single, comprehensive research framework to examine the combined effects of both on student engagement, particularly in economics education at the high school level.

Therefore, this study aims to analyze the impact of the quality of formative assessment and assessment feedback both partially and simultaneously on student engagement in the economics course for 10th-grade students in Phase E at SMA Negeri 1 X Koto. This study offers three significant contributions. First, theoretically, it explains how integrating formative assessment and teacher feedback can increase student engagement in the classroom. Second, empirically, this study provides concrete evidence of whether this integration of formative assessment and feedback is effective in enhancing student engagement. Third, from a methodological and contextual perspective, this study uses a validated measurement tool that can be directly applied to 10th-grade

students. This provides a new perspective on how the regular implementation of formative assessment and targeted feedback from teachers can transform passive students into more active learners.

METHODS

This study employed a quantitative approach using the associative-causal method and was conducted at SMA Negeri 1 X Koto during the 2025/2026 school year. The population in this study consisted of $N = 155$ students in 10th grade, Phase E, at the school. To ensure that the sample was representative and statistically adequate, a sample size of $n = 112$. The sampling technique used was proportional stratified random sampling to ensure that each group was represented proportionally according to its size (Sugiyono, 2023).

Primary data were collected through a questionnaire designed to measure respondents' perceptions of the research variables. To ensure theoretical credibility, the indicators used to measure the constructs were adopted and adapted from a validated measurement framework. The instrument for the formative assessment variable was adapted from Veugen et al. (2021) and consists of five indicators: clarifying expectations, eliciting student responses, analyzing student responses, communicating about results, and taking follow-up action. The variables for assessment feedback were adapted from Brooks et al. (2019), namely feeding up, feeding back, and feeding forward. The variables for student engagement were adapted from Hart et al. (2011) covering affective, behavioral, and cognitive engagement.

To ensure the credibility, reliability, and quality of the measurement tools, the instruments underwent testing to assess construct validity and internal consistency reliability. Construct validity was assessed using Pearson's Product Moment correlation analysis. Based on the testing, all retained items were deemed valid because the calculated r values were significantly higher than the table r values. Specifically, the calculated r values for the student engagement questionnaire ranged from 0.362 to 0.787; for the formative assessment quality questionnaire, they ranged from 0.471 to 0.813 (excluding one invalid item); and for the assessment feedback questionnaire, they ranged from 0.569 to 0.835. Reliability was determined using Cronbach's alpha to measure internal consistency. The instruments demonstrated excellent internal consistency, with Cronbach's alpha values of 0.921 for student engagement, 0.925 for formative assessment, and 0.967 for assessment feedback; all values exceeded the minimum acceptable threshold. Supporting secondary data were obtained from official school documents.

The final data analysis was conducted using multiple linear regression. This technique was applied to test and measure the effects of the formative assessment variable (X_1) and the assessment feedback variable (X_2) both jointly (simultaneously) and individually (partially) on the student engagement variable (Y).

RESULTS AND DISCUSSION

RESULTS

Descriptive Analysis of Variables

Research data were collected from 112 10th grade students in Phase E at SMA Negeri 1 X Koto to describe the actual conditions of the three research variables: formative assessment (X_1), assessment feedback (X_2), and student engagement (Y).

Student Engagement

The measurement of student engagement is based on 26 statements covering three main indicators.

Table 1. Mean Values of the Student Engagement Variable

Indicator	Average	TCR	Category
Affective engagement	3,825	76,500	Fair
Behavioral engagement	3,934	78,671	Fair
Cognitive engagement	3,980	79,598	Fair
Total	3,913	78,681	Fair

Sources: Authors' calculation (2026)

In Table 1, overall student engagement falls into the moderate category, indicating that engagement in economics learning has been established. Cognitive engagement achieved the highest score, demonstrating students' ability to direct mental effort toward understanding the material, applying learning strategies, and completing tasks independently, a process further supported by behavioral engagement. Conversely, affective engagement received the lowest score due to students' persistently high perception that economics classes are boring; this situation highlights the need to strengthen students' emotional connection to the learning process.

Formative Assessment

The measurement of formative assessment variables is based on 19 items, which measure the five stages of formative assessment implementation by teachers

Table 2. Mean Values of the Formative Assessment Variable

Indicator	Average	TCR	Category
Clarifying expectations	4,071	81,429	Good
Eliciting student responses	4,071	81,429	Good
Analyzing Student responses	4,210	84,196	Good
Communication about result	4,080	81,607	Good
Taking Follow up actions	4,046	80,929	Good
Total	4,096	81,635	Good

Sources: Authors' calculation (2026)

In Table 2, the analysis results show that all indicators fall into the good category; the analyzing student responses indicator recorded the highest score, demonstrating that teachers' competence in analyzing student work to identify learning difficulties is particularly strong. This success is supported by teachers' clarity in explaining learning objectives (clarifying expectations) and their active efforts to elicit student responses (eliciting student responses); however, the aspect of follow-up (taking follow-up action) received the lowest score due to the lack of student input or feedback used to evaluate and improve the quality of subsequent assessment activities.

Assessment Feedback

The measurement of the Assessment Feedback variable is based on 31 items, which are divided into three indicators

Table 3. Mean Values of the Assessment Feedback Variable

Indicator	Average	TCR	Category
Feeding Up	4,127	85,532	Good
Feeding Back	4,118	82,356	Good
Feeding Forward	4,146	82,911	Good
Total	4,130	82,598	Good

Sources: Authors' calculation (2026)

In general, teachers' implementation of feedback assessments has been effective. The feeding up indicator achieved the highest score, reflecting teachers' ability to transparently communicate learning directions and goals to students. Meanwhile, feeding back recorded the lowest score because feedback tends to focus on final outcomes, while reflection on the learning strategies used by individual students has not yet been fully optimized.

Inductive Analysis

Testing the Prerequisites for Analysis

Before conducting the hypothesis testing, several classical assumption tests were performed to ensure that the regression model met the prerequisites for multiple linear regression analysis. These tests included normality, linearity, multicollinearity, and heteroscedasticity tests. The normality test was designed to determine whether the population data were normally distributed, which is necessary to establish whether correlation analysis techniques are appropriate for analyzing the data. This test was conducted using the Kolmogorov-

Smirnov test. The One-Sample Kolmogorov-Smirnov Test produced an unstandardized residual with $N = 112$, a mean of .0000000, and a standard deviation of 6.49270488, yielding a test statistic of .066 and an Asymp. Sig. (2-tailed) value of 0.200 is greater than 0.05; it can be concluded that the data are normally distributed.

Next, the linearity test was conducted to determine whether the relationship between the independent variables (X_1 and X_2) and the dependent variable (Y) was linear, with the criterion that the relationship is considered linear if the significance level of the Deviation from Linearity test is greater than 0.05. The results show that the formative assessment variable (X_1) had a Deviation from Linearity significance value of 0.399, with an F statistic of 1.066, while the assessment feedback variable (X_2) had a significance value of 0.322, with an F statistic of 1.131. Since both significance values exceeded 0.05, and both F statistics were smaller than the F table value of 3.08, it can be concluded that both independent variables have a linear relationship with student engagement (Y).

The multicollinearity test was then performed to determine whether a strong relationship (high correlation) existed among the independent variables, based on the Tolerance and VIF (Variance Inflation Factor) values obtained from the regression analysis. The results show that the formative assessment variable had a Tolerance value of .254 and a VIF value of 3.937, while the assessment feedback variable had the same Tolerance value of .254 and VIF value of 3.937. Since both independent variables had a VIF value below 10 and a Tolerance value above 0.1, it can be concluded that there is no multicollinearity between the two variables.

Finally, the heteroscedasticity test was conducted to determine whether the regression model exhibited unequal variances of the residuals across observations. As shown in the scatterplot, the data points were randomly scattered both above and below the zero point on the Y-axis and did not form a discernible pattern. Based on this result, there is no evidence of heteroscedasticity in the regression model. Overall, the results of these four classical assumption tests confirm that the regression model satisfies the prerequisites of normality, linearity, non-multicollinearity, and homoscedasticity, and is therefore appropriate for further hypothesis testing using multiple linear regression analysis.

Multiple Linear Regression Analysis

Based on the results of data analysis, the resulting multiple linear regression equation is

$$Y = 29,328 + 0,263 X_1 + 0,411 X_2 + e$$

This equation indicates that the direction of the relationship between all independent variables and the dependent variable is positive. The constant of 29.328 indicates the baseline value of student engagement when both independent variables are held constant. The regression coefficients for formative assessment ($b_1 = 0.263$) and assessment feedback ($b_2 = 0.411$) indicate that a one unit increase in either independent variable (holding the other variable constant) will be followed by an increase in student engagement proportional to the coefficient value.

Hypothesis Testing

Hypothesis testing in this study was conducted through two stages, namely the F-test to examine the simultaneous effect of the independent variables and the t-test to examine the partial effect of each independent variable on student engagement.

Table 4. Results of the F-Test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	9233.628	2	4616.814	107.546	.000
Residual	4679.229	109	42.929		
Total	13912.857	111			

Sources: SPSS 23.0 Output Results (2026)

The results of the F-test in Table 4. show that the calculated F statistic of 107.546 is greater than the F table value of 3.08, with a significance level of $0.000 < 0.05$. This proves that the regression model is valid and that formative assessment and assessment feedback simultaneously have a significant effect on student engagement.

Table 4. t-Test Results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	29.328	5.033	-	5.827	.000	19.353	39.302
Formative Assessment	.263	.122	.237	2.147	.034	.020	.505
Assessment Feedback	.411	.075	.601	5.457	.000	.261	.560

Sources: SPSS 23.0 Output Results (2026)

The results of the t-test in Table 8 show that the formative assessment variable has a significant partial effect on student engagement, as indicated by a calculated t statistic of 2.147, which is greater than the t table value of 1.982, with a significance level of $0.034 < 0.05$. The assessment feedback variable also has a significant partial effect on student engagement, as indicated by a calculated t statistic of 5.457, which is greater than the t table value of 1.982, with a significance level of $0.000 < 0.05$. Based on the standardized coefficient (Beta) values, assessment feedback (Beta = 0.601) contributes more dominantly to student engagement than formative assessment (Beta = 0.237).

Table 9. Test of the Coefficient of Determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.815 ^a	.664	.658	6.552

Sources: SPSS 23.0 Output Results (2026)

Based on the coefficient of determination test in Table 8, an R-squared value of 0.664 was obtained. These results indicate that the combined contribution of the variables formative assessment quality and assessment feedback explains 66.4% of student engagement, while the remaining 33.6% is influenced by other variables outside the scope of this research model.

DISCUSSION

The Effect of Formative Assessment and Feedback on Student Engagement

The results of the first hypothesis test show that the quality of formative assessment and assessment feedback together have a significant effect on student engagement. This simultaneous effect is empirically demonstrated by an F-value of 107.546 and a significance level of $p < 0.001$. The coefficient of determination of 0.664 indicates that the combined contribution of these two variables explains 66.4% of the variation in student engagement, while the remainder is influenced by other factors outside the scope of this study. This simultaneous effect yields an F^2 effect size of 1.98, which is categorized as a very substantial effect. Partially, the contribution of each variable is indicated by the standardized t-coefficient; specifically, assessment feedback has a far more dominant contribution ($\beta = 0.601$; $p < 0.001$; 95% CI (0.261, 0.560)) compared to the quality of formative assessment ($\beta = 0.237$; $p = 0.034$; 95% CI (0.020, 0.505)). These findings confirm that effective feedback acts as the primary driver within the provided assessment framework.

These findings indicate that student engagement cannot be optimized by relying on just one variable. Formative assessment serves as a structural instrument for learning, while feedback acts as a facilitator of interaction. The integration of consistent assessment with effective feedback has been shown to foster an effective learning environment. This two-way interaction encourages passive students to become more active, focused, and self-regulated because they feel supported during the learning process (Ole & Gallos, 2023). Theoretically, this relationship holds consistently because its effectiveness increases when teachers provide specific, appreciative feedback and create space for dialogue, allowing students to improve their learning outcomes. These conditions can trigger positive emotional responses that foster student engagement across behavioral, affective, and cognitive dimensions (Rabbani & Husain, 2024; Tay & Lam, 2022) Furthermore, from a methodological and contextual perspective, informative and timely feedback trains students to become

proactive learners capable of reflecting on their own achievements and providing meaningful input to their peers (Mohammadi Zenouzagh et al., 2025). This is particularly crucial in the context of economics education, which requires a bridge between theory and students' practical understanding. Overall, formative assessment and feedback are two complementary components. Formative assessment serves to track learning progress, while feedback guides students in understanding that information to make improvements; both help make economics learning more meaningful and strengthen student engagement in the classroom during the learning process (Ramdhani et al., 2024a).

The Effect of Formative Assessment on Student Engagement

The results of the second hypothesis test demonstrate that the quality of formative assessment has a positive and significant partial effect on student engagement. This partial effect is empirically supported by a t value of 2.147 and a significance level of $p = 0.034$ ($p < 0.05$). The contribution of this variable is indicated by a standardized beta coefficient (β) of 0.237 with a 95% confidence interval (95% CI (0.020, 0.505)). This positive relationship indicates that the more optimal and high quality the implementation of formative assessment by teachers is, the greater the students' engagement in the learning process will be. The positive confidence interval value, which does not cross zero, confirms the significance of the independent role of formative assessment quality in stimulating student engagement in the classroom.

In context, real-world observations show that formative assessment activities such as quizzes, group work, or critical thinking challenges serve as stimuli that trigger active student responses. Because they focus on improving the learning process rather than on final grades, formative assessments successfully reduce students' anxiety or fear of making mistakes, thereby making classes more effective and transforming students from passive listeners into focused, enthusiastic, and confident individuals. Formative assessment provides teachers with the opportunity to gauge students' level of engagement early on. Through periodic evaluations, teachers can identify students at risk of experiencing learning difficulties, so this tool serves not only as a measure of cognitive development but also as an indicator of student engagement (Veerasamy et al., 2022).

Methodologically and theoretically, activities in formative assessment compel students to direct their mental efforts toward understanding the material, thereby strengthening their motivation to learn and fostering student engagement (Ramdhani et al., 2024b). When the assessment process is interactive and mutually respectful, students' self-confidence and sense of ownership of the learning process will grow, encouraging them to be more active in improving their learning performance (Wilkie et al., 2023). The consistent implementation of formative assessment has been shown to have a tangible impact. Students accustomed to periodic formative assessments demonstrate higher levels of active participation, learning motivation, and initiative compared to those learning in conventional settings (Gulzhaina K. Kassymova1, 2025). Well-integrated assessment ultimately does more than just test memory; it fosters independence, stimulates critical thinking skills, and has a significant positive impact on enhancing all dimensions of student engagement (Alsalhi et al., 2026).

The Effect of Assessment Feedback on Student Engagement

The results of the third hypothesis test demonstrate that assessment feedback has a positive and statistically significant partial effect on student engagement. This partial effect is empirically supported by a t -value of 5.457 and a significance level of $p < 0.001$. The contribution of this variable is indicated by a standardized beta coefficient (β) of 0.601 with a 95% confidence interval (95% CI (0.261, 0.560)). This positive relationship indicates that the more optimal, constructive, and consistent the feedback provided by teachers is, the greater the students' engagement in the economics learning process will be. The positive confidence interval value, which crosses the zero line, confirms the significance of the role of feedback on its own in promoting student engagement in the classroom.

In context, the reality in the classroom demonstrates the impact of teachers shifting from simply assigning numerical grades to providing meaningful feedback, such as explaining where mistakes were made, offering suggestions for improvement, and acknowledging students' efforts, which makes students feel that their academic performance is valued and taken seriously. Tangible evidence in the classroom is evident in the

disappearance of students' indifference after receiving their assessment sheets; they become more focused on correcting errors, enthusiastic about following correction instructions, and more willing to communicate to confirm their understanding. These results demonstrate that feedback acts as an effective bridge of communication in maintaining student engagement throughout the learning process. This aligns with the fulfillment of students' psychological needs in the classroom. When students feel that their learning efforts are appreciated through positive feedback, their emotional needs are met, thereby triggering intrinsic motivation to actively engage (Yulhendri et al., 2025).

Theoretically and methodologically, structured feedback can enhance student engagement whether in terms of behavioral aspects, as evidenced by increased time spent studying, affective aspects, marked by growing self-confidence, or cognitive aspects, reflected in students' metacognitive abilities to independently evaluate their assignment results (Zhang & Hyland, 2022). These findings are consistent because feedback is not merely a one-way transmission of information, but a dialogic tool that opens up space for discussion and consultation after assignments are completed. The clarity of feedback prompts students to engage in a self-evaluation process to identify gaps between their achievements and the learning targets they must meet (Ryan et al., 2020; Tay & Lam, 2022). As an effective catalyst, the quality of and students' understanding of the feedback they receive will guide them in actively determining steps for improvement when students are motivated to use this information to guide their learning; their engagement in all learning activities will reach an optimal level (Meyer et al., 2025).

CONCLUSION

The results of this study conclude that the quality of formative assessment and assessment feedback both simultaneously (together) and partially (separately) has a positive and significant effect on student engagement among 10th-grade students in Phase E at SMA Negeri 1 X Koto in the economics course. Together, these two instruments are capable of transforming the classroom environment so that students are actively, focused, and meaningfully engaged in improving their learning process. Individually, the optimal implementation of formative assessment helps teachers identify students' competencies and learning difficulties early on to foster classroom enthusiasm. Meanwhile, providing clear and constructive feedback serves as a communication bridge that helps students understand learning objectives and success criteria, thereby strengthening their intrinsic motivation and engagement in learning. However, this study has limitations because its scope is restricted to a single school and a single subject. It is recommended that economics teachers continue to consistently provide solution-oriented feedback, that schools facilitate ongoing assessment training, and that future researchers expand the focus of their studies.

AUTHOR CONTRIBUTION

Wiwi Fitria Anjani was responsible for planning, methodology, data collection, statistical analysis, visualization, and report writing. Priyatmi was involved in manuscript writing, manuscript editing, and project supervision and management. All authors have read and approved the published version.

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DATA AVAILABILITY

The data that support the results of this research are available from the corresponding author upon request. The data are not publicly available for confidentiality and ethical reasons.

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COMPETING INTEREST

The authors declare that there are no conflicts of interest related to the publication of this article.

ETHICAL CLEREANCE

This study has received official approval and authorization from the Dean of the Faculty of Economics and Business at Padang State University (No. 3915/UN35. 7/TU/2026) and the West Sumatra Provincial Education Office (No.:000.9.2/6615/PSMASLB/DISDIK-2026), dated June 18, 2026. All research procedures involving students were carried out in accordance with the ethical standar of the 1964 Helsinki Declaration and its amendments. Prior to administering the Likert-scale questionnaire, informed consent was voluntarily obtained from each student, accompanied by full guarantees of data confidentiality and privacy.

AI STATEMENT

The authors state that during the preparation of this manuscript, artificial intelligence (AI)-based tools were used only for grammar checking, language editing, and final proofreading. All suggestions made by the AI were thoroughly reviewed, edited, and approved by the authors. These AI tools were not used for data collection, data analysis, interpretation of results, or drawing scientific conclusions. The authors are fully responsible for the integrity, originality, and accuracy of the published work. The use of AI tools does not alter the authors' compliance with the journal's policies regarding the sharing of data and materials.

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