



Journal of Advanced Research in Social and Behavioural Sciences

Journal homepage:
<https://karyailham.com.my/index.php/jarsbs/index>
ISSN: 2462-1951



Students' Perceptions of AI-Mediated Formative Feedback in Academic Writing: Evidence from Malaysian Higher Education

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ARTICLE INFO

Article history:

Received 14 January 2026

Received in revised form 2 April 2026

Accepted 6 April 2026

Available online 22 April 2026

ABSTRACT

The increasing use of artificial intelligence (AI) writing tools in higher education has raised important questions about their role in supporting formative assessment in academic writing. While AI-generated feedback is widely available, empirical evidence on how students perceive such feedback as part of their learning process remains limited in the Malaysian higher education context. This study addresses this gap by examining tertiary-level ESL students' perceptions of AI-mediated formative feedback in academic writing courses. The purpose of this study is to investigate students' perceptions of (i) the effectiveness of AI writing tools as formative feedback, (ii) the extent to which AI feedback supports learner autonomy and affective aspects of learning, and (iii) students' confidence in evaluating and exercising judgment over AI-generated feedback. A quantitative survey design was employed, involving 210 undergraduate students enrolled in English academic writing courses at a Malaysian public university. Data were analysed using SPSS, applying descriptive statistics, reliability analysis, and Pearson correlation analysis. The findings indicate generally positive student perceptions of AI-mediated formative feedback, particularly in relation to identifying language issues, supporting revision, and promoting independent learning. Pearson correlation analysis revealed moderate positive associations between perceived effectiveness of AI feedback and learner autonomy, as well as between perceived effectiveness and AI feedback literacy. Learner autonomy was also positively associated with students' confidence in evaluating AI-generated suggestions, suggesting that students who perceived greater learning support were more likely to engage critically with AI feedback. Overall, the study demonstrates that AI writing tools can function as supportive formative feedback resources when integrated responsibly into academic writing instruction. The findings highlight the importance of guided implementation that encourages students to develop feedback literacy rather than rely uncritically on AI-generated suggestions.

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<https://doi.org/10.37934/arsbs.43.1.91100>

Keywords:

Artificial intelligence; formative feedback;
academic writing; learner autonomy; higher
education

Implications are discussed for learning-oriented assessment practices and ethical AI integration in Malaysian higher education.

1. Introduction

The use of artificial intelligence (AI) writing tools in higher education has increased in recent years, especially in academic writing contexts. These tools generate automated feedback on grammar, vocabulary, and clarity and are widely available to university students, many of whom use them during drafting and revision stages of writing tasks. Recent research has shown that generative AI tools are increasingly shaping students' academic reading and writing practices in higher education across disciplines and contexts [1] [2]. As the use of AI writing tools becomes more common, it is important to understand how students perceive and use AI-generated feedback as part of formative assessment rather than viewing it only as a technological tool.

Formative feedback plays an important role in learning-oriented assessment, particularly in academic writing, where improvement depends on repeated drafting and revision. Such feedback helps learners identify gaps between their current work and expected standards and supports improvement over time [3][4]. In second language (L2) writing contexts, formative feedback is also linked to affective aspects of learning, such as confidence and anxiety. However, in many tertiary settings, large class sizes and limited instructional time reduce opportunities for frequent and individualised feedback from instructors. In this context, AI-mediated feedback has been introduced as a supplementary resource that can provide immediate and consistent feedback during the writing process. Previous studies and reviews have reported that AI-generated feedback can support revision and language accuracy, although its effectiveness varies depending on task design and learner engagement [5][6]. Research has also shown that students often perceive AI feedback as useful, particularly for identifying language-related issues, while still preferring human feedback for higher-order concerns [7][8]. Despite the growing body of work, empirical evidence remains limited on how students perceive AI-generated feedback specifically as formative feedback, particularly in relation to learner autonomy, affective support, and students' confidence in evaluating AI-generated suggestions. Other studies provide evidence on how AI assists students in improving their writing accuracy, even though the focus is more on performance outcomes rather than learners' perceptions [9]. EFL students were reported to confidently rely on AI tools for grammar correction and idea generation, but were concerned about becoming excessively dependent [10]. [11] Hui Yuon and Salam (2025) highlighted the importance of preventing overreliance on AI suggestions by emphasizing the need to develop feedback literacy. Students are encouraged to use feedback critically, as it can help to foster learner autonomy, as reported by Nur Hannan Zulkefli and Ismail (2025) [12]. In addition to this, Lo (2025) [13] reported on his studies specifically on Malaysian ESL students that AI writing assistants could promote self-regulated learning that allows students to be more in control of their learning strategies and motivation in becoming more effective in improving writing skills, particularly when it is guided by instructors.

Accordingly, this study examines tertiary-level ESL students' perceptions of AI-mediated formative feedback in academic writing courses at a Malaysian public university. The study focuses on students' perceptions of the effectiveness of AI writing tools as formative feedback, the extent to which AI feedback supports learner autonomy and affective aspects of learning, and students' confidence in evaluating and exercising judgment over AI-generated feedback. By focusing on students' self-reported perceptions, this study aims to provide empirical evidence to inform learning-oriented assessment practices and the responsible integration of AI writing tools in Malaysian higher

education, complementing existing review-based research on AI-supported learning and assessment in universities [14][15].

2. Methodology

This study adopted a quantitative survey research design to examine tertiary-level ESL students' perceptions of AI-mediated formative feedback in academic writing courses. A survey approach was considered appropriate as the study aimed to capture students' self-reported perceptions, attitudes, and evaluative judgments regarding the use of AI writing tools as part of formative assessment practices, rather than to measure learning outcomes or causal effects.

2.1 Participants and Context

The participants comprised 210 undergraduate students enrolled in English academic writing courses at a Malaysian public university. These courses focused on developing students' academic writing skills and permitted the use of AI writing tools as supplementary support during drafting and revision stages. Participation in the study was voluntary, and respondents completed the survey anonymously after being informed of the purpose of the study. Only student-side responses were included in the analysis.

2.2 Instrument

Data were collected using a structured questionnaire consisting of Likert-scale items. All items were measured on a five-point Likert scale ranging from 1 (Very untrue of me) to 5 (Very true of me). The questionnaire items were adapted from Yoon (2019)[16], with contextual modifications made to reflect the use of AI writing tools and formative feedback practices in Malaysian higher education. The instrument was designed to measure students' perceptions of AI-mediated formative feedback across three main dimensions:

- 1) *Perceived Effectiveness of AI Formative Feedback*, which examined students' views on the usefulness of AI feedback in identifying language issues, supporting revision, and improving writing quality;
- 2) *Learner Autonomy and Affective Support*, which explored the extent to which AI feedback supported independent learning, confidence, revision practices, and reduced anxiety in writing tasks; and
- 3) *AI Feedback Literacy and Judgment*, which assessed students' confidence in evaluating and exercising judgment over AI-generated feedback rather than accepting it uncritically.

In addition, selected items examined students' perceptions of feedback immediacy and their willingness to continue using AI tools as part of learning-oriented assessment practices. One negatively worded item related to feedback literacy was reverse-coded prior to analysis. Items addressing ethical concerns, plagiarism, social influence, or lecturer perspectives were excluded to maintain a clear focus on student perceptions.

2.3 Data Analysis

Data were analysed using SPSS. Descriptive statistics, including means, standard deviations, and response distributions, were computed to summarise students' perceptions of AI-mediated formative feedback. Internal consistency reliability was examined using Cronbach's alpha to assess the overall coherence of the student perception items. Pearson correlation analysis was conducted to examine the relationships between perceived effectiveness of AI formative feedback, learner autonomy and affective support, and AI feedback literacy and judgment. Statistical significance was evaluated at the .05 level, and correlation results were interpreted as indicators of association rather than causation.

2.4 Ethical Considerations

Participation in the study was voluntary, and informed consent was obtained prior to data collection. Respondents' anonymity and confidentiality were maintained throughout the study, and the data were used solely for research purposes.

3. Results and Discussion

This section presents and discusses the findings of the study based on the structure of the questionnaire and the key dimensions examined. The results are organised according to students' perceptions of (i) the effectiveness of AI-mediated formative feedback, (ii) learner autonomy and affective support, (iii) feedback timing and immediacy, (iv) willingness to continue using AI for learning, and (v) the relationships between these dimensions. Quantitative results are reported using descriptive statistics and correlation analysis, followed by cautious interpretive commentary to situate the findings within learning-oriented assessment perspectives.

In line with the exploratory nature of the study, the discussion focuses on patterns of student perception and associations between constructs, rather than causal claims or measured learning outcomes. The integrated presentation of results and discussion is intended to provide a coherent account of how students experience and make sense of AI-mediated formative feedback in academic writing contexts, while maintaining a clear distinction between empirical findings and interpretive insights.

3.1 Reliability of the Questionnaire

Prior to reporting the main findings, the internal consistency of the questionnaire was examined to establish the reliability of the student perception items. Reliability analysis indicated a high level of overall internal consistency across all student-side items measuring perceptions of AI-mediated formative feedback, with a Cronbach's alpha coefficient of $\alpha = .91$. This value exceeds commonly accepted thresholds for reliability and suggests strong coherence among the items included in the analysis. The high reliability coefficient indicates that the questionnaire items consistently captured a common underlying domain related to students' perceptions of AI-mediated formative feedback in academic writing contexts. On this basis, the dataset was considered suitable for subsequent descriptive and correlational analyses reported in the following sections.

3.2 Perceive Effectiveness of AI-mediated formative feedback

Following the establishment of overall internal consistency, the findings are presented and discussed according to the main sections of the questionnaire, beginning with students' perceptions of the effectiveness of AI-mediated formative feedback in academic writing.

Table 1
Perceive Effectiveness of AI-mediated formative feedback

Item	Mean (M)	SD
AI writing tools provide useful feedback on grammar and vocabulary	5.09	0.92
AI writing tools help me identify and correct my mistakes	5.15	0.93
Using AI writing tools has helped me expand my vocabulary and improve word choice	4.95	0.89
AI writing tools help improve my writing skills	4.84	1.01
Composite: Perceived Effectiveness of AI Formative Feedback	5.01	0.81

Results indicated generally positive student perceptions regarding the effectiveness of AI-mediated formative feedback in academic writing. The composite mean score for perceived effectiveness was high ($M = 5.01$, $SD = 0.81$), indicating that students largely perceived AI feedback as useful in supporting their writing processes. Given the use of a six-point scale, these mean scores reflect strong levels of agreement rather than neutral tendencies. At the item level, students reported particularly strong agreement that AI writing tools helped them identify and correct language-related issues. The highest mean was observed for the item "AI writing tools help me identify and correct my mistakes" ($M = 5.15$, $SD = 0.93$), followed closely by "AI writing tools provide useful feedback on grammar and vocabulary" ($M = 5.09$, $SD = 0.92$). Students also expressed positive perceptions of AI feedback in supporting vocabulary development ($M = 4.95$, $SD = 0.89$) and improving overall writing skills ($M = 4.84$, $SD = 1.01$).

These findings indicate that students primarily perceived AI-mediated feedback as serving a diagnostic and revision-oriented function, which is central to formative assessment. From an interpretive perspective, the results suggest that AI writing tools were valued for providing actionable information that supports learners in recognising gaps between current performance and desired writing outcomes. This aligns with feedback models that emphasise feedback as guidance for improvement rather than as evaluative judgment [3].

The consistently high mean scores across items further suggest that students viewed AI feedback as supporting iterative revision and language awareness, which are key features of learning-oriented assessment. This interpretation is consistent with perspectives that highlight feedback practices that enable learners to engage actively with feedback and self-monitor their progress [14]. At the same time, it is important to note that the findings reflect students' perceived effectiveness of AI feedback rather than measured improvements in writing performance, underscoring the need for cautious interpretation.

3.3 Learner Autonomy and Affective Support

As illustrated in table 2, results indicated generally positive student perceptions regarding the role of AI-mediated formative feedback in supporting learner autonomy and affective aspects of academic writing. The composite mean score for learner autonomy and affective support was high ($M = 4.65$, $SD = 0.81$), indicating that students generally perceived AI feedback as contributing positively to their independent learning and emotional experiences during writing tasks. At the item level, students reported the strongest agreement with the statement "Using AI writing tools has increased my confidence in writing" ($M = 4.79$, $SD = 0.97$). Positive perceptions were also evident for AI-assisted support in tracking writing progress ($M = 4.70$, $SD = 0.99$) and enhancing students' ability to self-correct errors ($M = 4.54$, $SD = 0.94$). In addition, students reported reduced anxiety when engaging in writing assignments after using AI writing tools ($M = 4.55$, $SD = 1.03$).

These findings suggest that students perceived AI-mediated feedback as supporting not only cognitive aspects of writing but also affective dimensions such as confidence and emotional regulation. From an interpretive perspective, the results indicate that AI feedback may facilitate greater learner autonomy by enabling students to engage more independently with revision processes and monitor their own progress. This aligns with learning-oriented assessment perspectives that emphasise the importance of feedback in fostering self-regulation and learner agency [4]. The relatively high mean scores across items further suggest that AI feedback may help reduce affective barriers commonly associated with academic writing, such as anxiety and uncertainty, particularly in second language contexts. However, as with the previous subsection, these findings reflect students' perceived support rather than direct evidence of changes in writing performance or emotional states. The results therefore highlight students' subjective experiences of AI-mediated feedback, underscoring its potential role as a supportive learning resource when integrated responsibly into academic writing instruction.

Table 2
Learner Autonomy and Affective Support

Item	Mean (M)	SD
Using AI writing tools has increased my confidence in writing	4.79	0.97
AI-assisted formative assessment improves my ability to self-correct errors	4.54	0.94
AI-based assessment helps me track my writing progress over time	4.70	0.99
Since using AI writing tools, I feel less anxious when doing writing assignments	4.55	1.03
Composite: Learner Autonomy and Affective Support	4.65	0.81

3.3 Learner Autonomy and Affective Support

Based on table 3, results indicated positive student perceptions regarding the timing and immediacy of AI-mediated feedback in academic writing. The mean score for the feedback immediacy item was high ($M = 4.64$, $SD = 0.90$), indicating that students generally perceived AI writing tools as providing timely and relevant feedback that supported their writing processes. Given the use of a six-point Likert scale, this mean reflects a strong level of agreement rather than a neutral response pattern. From an interpretive perspective, this finding suggests that immediacy represents a key affordance of AI-mediated feedback from the students' perspective. Timely feedback enables learners to respond to suggestions during drafting and revision stages, thereby supporting iterative engagement with writing tasks. Such immediacy is particularly valuable in formative assessment contexts, where feedback is most effective when it is available while learners are actively engaged in the task. The positive perception of feedback immediacy observed in this study aligns with learning-oriented assessment perspectives that emphasise the importance of prompt and actionable feedback in supporting self-regulation and continuous improvement. In contrast to delayed feedback, immediate AI-generated feedback may reduce uncertainty and cognitive load, allowing learners to address issues as they arise during the writing process. Nevertheless, as with other findings in this study, the result reflects students' perceived benefits of feedback timing rather than objective measures of learning outcomes.

Table 3
Learner Autonomy and Affective Support

Item	Mean (M)	SD
AI tools provide immediate and relevant feedback that helps me improve	4.64	0.90

3.3 Willingness to use AI for Learning

Table 4 presents the results for willingness to use AI for learning.

Table 4
Willingness to use AI for Learning

Item	Mean (M)	SD
AI writing tools should be integrated into English writing courses	4.65	1.12
AI-powered formative assessment should be combined with human feedback	4.79	0.94

Results indicated generally positive student attitudes toward the continued use of AI writing tools as part of academic writing instruction. Students expressed agreement that AI writing tools should be integrated into English writing courses, with a mean score of $M = 4.65$ ($SD = 1.12$). This suggests that, overall, students were receptive to the inclusion of AI tools as a regular component of their learning experience. In addition, students demonstrated strong agreement with the view that

AI-mediated formative feedback should be combined with human feedback ($M = 4.79$, $SD = 0.94$). This finding indicates that while students valued the support provided by AI writing tools, they did not perceive AI feedback as a replacement for instructor input. Instead, students appeared to favour a complementary model in which AI-generated feedback supports learning alongside human guidance.

These results suggest that students' willingness to continue using AI for learning is accompanied by an awareness of the limitations of automated feedback. The preference for combining AI and human feedback reflects a balanced and responsible orientation toward AI integration, aligning with learning-oriented assessment approaches that emphasise the pedagogical role of instructors in guiding interpretation and use of feedback. Taken together, the findings indicate that students are open to the sustained integration of AI writing tools in academic writing courses, provided that such tools are embedded within a structured instructional framework. This highlights the importance of guided implementation strategies that position AI as a supportive learning resource rather than an autonomous or standalone solution.

3.3 Relationship between Key Constructs

Pearson correlation analysis was conducted to examine the relationships between students' perceived effectiveness of AI-mediated formative feedback, learner autonomy and affective support, and AI feedback literacy. The analysis revealed several statistically meaningful associations among the key constructs as illustrated in table 5 below:

Table 5
Relationship between Key Constructs

Construct	1	2	3
1. Perceived Effectiveness of AI Feedback	1.00		
2. Learner Autonomy and Affective Support	0.73	1.00	
3. AI Feedback Literacy and Judgment	0.28	0.41	1.00

A strong positive correlation was found between perceived effectiveness of AI-mediated formative feedback and learner autonomy and affective support ($r = .73$), indicating that students who perceived AI feedback as more effective were also more likely to report higher levels of confidence, self-correction, progress monitoring, and reduced anxiety in writing tasks. This association suggests a close alignment between students' evaluations of AI feedback quality and their experiences of autonomous and affective learning support. A moderate positive correlation was observed between learner autonomy and AI feedback literacy ($r = .41$), indicating that students who reported greater autonomy and affective support were more likely to express confidence in evaluating and exercising judgment over AI-generated feedback. This finding suggests that learner autonomy may be associated with students' capacity to engage critically with AI feedback rather than accepting it unreflectively.

In contrast, the relationship between perceived effectiveness of AI feedback and AI feedback literacy was positive but weaker ($r = .28$). This indicates that perceiving AI feedback as useful does not necessarily translate directly into strong confidence in judging the quality or appropriateness of AI-generated suggestions. Taken together, these findings highlight the importance of learner autonomy as a mediating factor in the development of feedback literacy in AI-supported writing contexts. Importantly, all correlations represent associations rather than causal relationships. The findings therefore suggest interrelated perceptual patterns among effectiveness, autonomy, and feedback literacy, underscoring the need for pedagogical approaches that support not only access to AI feedback but also the development of students' evaluative judgment.

4. Conclusions

This study examined tertiary-level ESL students' perceptions of AI-mediated formative feedback in academic writing and provides empirical insights into how such feedback is experienced within a Malaysian higher education context. Overall, the findings indicate that students perceived AI-mediated formative feedback positively, particularly in relation to identifying language issues, supporting revision processes, and providing immediate and actionable guidance during writing tasks. These perceived strengths align closely with core principles of formative assessment and address practical challenges commonly faced in tertiary writing instruction, such as time constraints and delayed human feedback. In addition to cognitive support, AI-mediated feedback was associated with positive affective and self-regulatory outcomes. Students reported increased confidence, reduced anxiety, and enhanced learner autonomy when engaging with AI-supported writing tasks, suggesting that AI feedback may function as a supportive scaffold for independent learning in L2 writing contexts. However, the findings also reveal important limitations. While students who perceived AI feedback as effective tended to report greater autonomy, perceiving AI feedback as useful did not consistently translate into strong confidence in critically evaluating or exercising judgment over AI-generated suggestions. This highlights a gap in students' feedback literacy and underscores the importance of explicit instructional support to help learners engage critically with AI feedback rather than relying on it unreflectively.

It is worth noting that students expressed a clear preference for a complementary model of feedback in which AI-generated feedback is combined with human input. This preference reinforces the view that AI should be positioned as a supportive pedagogical tool rather than a replacement for instructor feedback. Taken together, the findings support a balanced and guided approach to AI integration in academic writing instruction, one that leverages the immediacy and diagnostic strengths of AI feedback while foregrounding the development of feedback literacy and informed learner judgment. Such an approach is essential for ensuring ethical, learning-oriented, and sustainable use of AI in higher education.

Several limitations should be noted when interpreting the findings of this study. First, the study relied on self-reported perceptions, which reflect students' experiences with AI-mediated formative feedback rather than objective measures of writing improvement. Future research could triangulate perceptual data with performance-based analyses of student writing to examine learning outcomes more directly. Second, the study was conducted in a single Malaysian public university, which may limit the generalisability of the findings. Future studies could involve multiple institutions or disciplinary contexts to explore whether similar patterns emerge across different higher education settings. Finally, AI feedback literacy was examined using a limited set of items focusing on students' confidence in evaluating AI feedback. Future research could develop more comprehensive and validated measures of feedback literacy and employ longitudinal or intervention-based designs to

investigate how guided instruction influences students' critical engagement with AI-generated feedback over time.

Acknowledgement

This research was funded by an international grant from Universiti Teknologi MARA (100-TNCPI/INT 16/6/2 (055/2024)).

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