Volume 13, Issue 2
Summer and Autumn, 2025
pp. 77-104

Journal of Applied Linguistics and Applied Literature: Dynamics and Advances

The Role of Individual Differences and AI Chatbots in EFL Learners' Metadiscourse Realization in Expository Writing

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Abstract

This study sought to explore how personality traits (extroverts and introverts) affect EFL learners' utilization of interactional metadiscourse markers (IMMs) in expository writing when they use two AI chatbots, Gemini and Microsoft Copilot. Additionally, the study analyzed learners' experiences and preferences when the learners interact with these chatbots to understand their perceptions and overall satisfaction. The participants consisted of 150 advanced language learners randomly assigned to four experimental groups: Gemini extroverted learners, Gemini introverted learners, Microsoft Copilot extroverted learners, Microsoft Copilot introverted learners, and a control group. Throughout eight sessions, the participants in the Gemini group utilized the Gemini AI platform on their computer monitors to investigate IMMs, while the Microsoft Copilot groups were exposed to IMMs through Microsoft Copilot AI companion. The control group was taught using traditional methods, which involved reading the designated instructional materials. The results of a one-way analysis of covariance (ANCOVA) procedure revealed that the introverted advanced participants in the Gemini group surpassed the other groups in the posttest focused on recognizing and identifying IMMs, with statistically significant differences among the groups. In the posttest, there was also an improvement in both Microsoft Copilot advanced introverted and extroverted learners in realizing IMMs in expository writing. The Gemini advanced extroverted group and the control group performed poorly compared to the other groups. Semi-structured interview results analyzed through MAXQDA (version 2022) suggested that Microsoft Copilot adeptly supports both advanced extroverted and introverted learners in refining their expository writing skills by facilitating metadiscourse development.

Keywords: expository writing, Gemini, metadiscourse, microsoft Copilot

ARTICLE INFO

Research Article
Received: Wedensday, February 12, 2025
Accepted: Thursday, September 11, 2025
Published: Wedensday, October 1, 2025
Available Online: Thursday, September 11, 2025
DOI: https://doi.org/10.22049/jalda.2025.30323.1762

Online ISSN: 2821-0204; Print ISSN: 28208986

Introduction

The adoption of artificial intelligence (AI) in language learning has paved the way for improved educational experiences, particularly in EFL. AI chatbots, in particular, have garnered significant attention for their potential to provide personalized learning experiences, offering immediate feedback and engaging learners in interactive dialogues (Pan, 2024). These chatbots leverage advanced natural language processing techniques to simulate human-like conversations, which can be especially beneficial for language learners seeking to improve their skills outside the traditional classroom environment. As education increasingly moves towards digital platforms, understanding how AI chatbots can influence language learning outcomes, especially in advanced EFL learners, has become a critical area of inquiry (Schütze, 2024). The potential of the two advanced AI tools, Gemini and Microsoft Copilot, was explored to transform educational practices and enhance learning experiences. Gemini, a cutting-edge AI communication assistant, has been designed to facilitate interactive and engaging learning environments by providing tailored support in language acquisition, collaborative tasks, and virtual teaching settings. With its ability to adapt to individual learners' needs, Gemini fosters personalized learning journeys, encouraging students to overcome challenges and achieve their academic goals. In parallel, Microsoft Copilot offers a versatile suite of capabilities aimed at streamlining academic processes, such as essay composition, data analysis, and project management (Bialkova, 2024).

AI-powered tools have increasingly demonstrated their capability to revolutionize language learning by enhancing key areas such as vocabulary learning, reading comprehension, and speaking skills (Lytras et al., 2025). However, their impact extends beyond these foundational aspects and goes into more complex dimensions of academic proficiency, such as effective academic writing. One critical area within academic writing is metadiscourse, which refers to the use of language to organize, comment on, and guide the interpretation of discourse (Hyland, 2019). Metadiscourse plays an essential role in ensuring clarity and engaging the audience, particularly in academic settings where precision and interaction are paramount. According to Hyland's interpersonal metadiscourse model, this concept can be divided into two dimensions: the interactive dimension, which focuses on addressing the reader's needs and awareness, and the interactional dimension, which emphasizes the writer's engagement with the audience through metadiscourse markers (see Table 1). By providing real-time feedback and tailored suggestions, AI tools can empower learners to master these dimensions, thereby improving their capability to create coherent, audience-aware academic texts.

Table 1

Hyland's Interactional Metadiscourse Framework (Hyland, 2019, p. 58)

Interactive metadiscourse	Description	Examples
Transitions	the connections in clauses	moreover; however
Frame markers	discourse functions or arrangements	lastly; to sum up
Endophoric markers	details in other sections of the text	given below
Evidentials	data derived from other sources	based on x
Code glosses	develop propositional interpretations	like; including
Interactional metadiscourse	**Description**	**Examples**
Hedges	avoid making any commitments	maybe; about
Boosters	focus on assurance	absolutely; clearly
Attitude markers	a clear position on the matter at hand	sadly; I understand
Self-mentions	author mention	you; your
Engagement markers	establish a rapport with the audience	review; note

IMMs hold significant importance in academic writing, as they help create a dynamic interaction between authors and their readership (Izquierdo & Pérez Blanco, 2023). Writers employ various linguistic strategies to express their stance and argument while also establishing a rapport with their audience. With the use of IMMs, authors can enthrall readers, direct them effortlessly, and impact their grasp of the material (Hyland & Jiang, 2022). However, advanced EFL students who are non-native speakers sometimes exhibit a tendency to excessively employ IMMs in their writing (Paltridge & Prior, 2024). Advanced EFL learners, who are typically expected to possess a higher level of metadiscourse awareness and skill, can benefit significantly from interventions that target these aspects of writing.

Recent academic studies have emphasized the critical function of metadiscourse in achieving coherence and persuasiveness in argumentative texts, making it a key focus for educators aiming to improve writing proficiency. For instance, Wei (2024) emphasizes that the effective use of metadiscourse can enhance the clarity and persuasiveness of written arguments, thereby contributing to better academic performance in writing-intensive courses. Despite the potential benefits of AI chatbots, the effectiveness of these tools can vary widely among individual learners. Factors such as learners' cognitive styles, motivation, and prior knowledge can significantly impact how individuals engage with and derive benefits from AI interventions. Cognitive styles, which refer to the preferred ways in which individuals process information, can significantly impact how learners engage with AI chatbots (Fields, 2024). For instance, field-dependent learners may prefer more

structured and guided interactions, while field-independent learners might benefit from more exploratory and autonomous engagements. Understanding these individual differences is crucial for designing AI-powered educational resources designed to meet the needs of various learners.

Studies have highlighted both the benefits and areas for improvement of AI chatbots in language learning (Esfandiari & Allaf-Akbary, 2024b). Recently, chatbots have been increasingly used as virtual instructors to enhance language proficiency and communicative abilities (Zhang et al., 2023). Tai and Chen (2024), for example, found improvements in speaking fluency and pronunciation accuracy among beginner EFL learners. However, the impact on advanced learners' metadiscourse in argumentative writing is still underexplored, presenting an opportunity for further research. This study aims to understand how AI chatbots can support higher-order writing skills in advanced EFL learners. Ongoing advancements in AI technology and natural language processing make it essential to continuously evaluate these tools' efficacy in language education.

Despite the growing body of research, there remains a significant gap in understanding the specific ways in which individual learner differences affect the success of AI chatbot interventions in advanced EFL learners' metadiscourse realization in argumentative writing. This study seeks to bridge this gap by exploring how factors such as learners' cognitive styles influence the effectiveness of AI chatbot interventions. The central research questions guiding this inquiry are:

1. Is there any difference between the effects of Microsoft copilot and Gemini AI chatbots on advanced EFL learners' utilization of IMMs in expository writing across personality traits?
2. What are the perceptions of advanced extroverted and introverted EFL learners on the effectiveness of Gemini and Microsoft Copilot AI chatbots in enhancing their use of IMMs in expository writing?

Literature review

Generative AI in Language Education

Generative AI in language education transforms traditional teaching by offering innovative content creation, translation, and pedagogical strategies. Studies highlight its impact on curriculum design, engagement, and innovation (Bonner et al., 2023; McCallum, 2024). Generative AI models improve translation and localization, making education more accessible in multilingual classrooms (Lee et al., 2023). However, accuracy and cultural sensitivity issues persist. Its use in gamification and storytelling boosts engagement, but teacher training gaps remain (Jeon & Lee, 2023; Kasneci et al., 2023; Moorhouse & Kohnke, 2024). To overcome challenges like inadequate infrastructure and resistance to new technologies, comprehensive professional development and policy frameworks are needed. Generative AI creates personalized, adaptive learning environments, enhancing engagement and critical thinking (Pentina et al., 2023; Du & Daniel, 2024). Language learning theories support AI integration, with tools like Gemini AI and Microsoft Copilot demonstrating tailored, adaptive support for effective learning (Bielza & Larrañaga, 2020; Ding & Zou, 2024; Gibson & Ifenthaler, 2024; Mishra

& Kumar, 2020; Sherkuziyeva et al., 2023). Gemini AI, developed by Google, and Microsoft Copilot cater to different user needs and environments with their advanced features and integrations (Kristina, 2025).

Interactional Metadiscourse

Writers use IMMs to engage readers and convey their messages effectively. Investigations into metadiscourse have mainly focused on academic written performance, chiefly research articles (RAs). For example, studies by Ädel (2023) and Liu and Tseng (2021) have examined the nature and function of metadiscourse markers across various disciplines. The aims and findings of the two studies highlighted a focus on advancing understanding of academic discourse and communication. The first study proposed a *move* approach to metadiscourse, developing a functional taxonomy to analyze spoken student presentations, while the second explored paradigmatic variations in hedging and boosting strategies across narrative inquiry and grounded theory research. Together, their findings underscored the significance of functional discourse analysis and rhetorical strategies in improving the effectiveness of academic communication across spoken and written contexts.

Additionally, research has explored IM in other genres, such as advisory letters during the COVID-19 pandemic (Yang, 2021), focusing on analyzing how metadiscourse is used in letters of advice issued by governments and hospitals during the COVID-19 pandemic, centering on its role in engaging readers across different participant groups. The findings of Yang's study reveal variations in the use of *engagement markers*, *boosters*, and *attitude markers*, highlighting distinct communicative styles adopted by the two agencies to address diverse audience needs in a crisis context. Regarding stance markers in COVID-19-related articles, Shen and Tao (2021) compared the use of stance markers in English medical RAs and newspaper opinion columns, finding that stance markers were significantly more frequent in newspaper columns due to their conversational and persuasive nature. Despite this difference, both genres shared similarities in the most commonly used stance markers, influenced by the topic's content and the tentative nature of claims during the early COVID-19 pandemic. Bernad-Mechó & Valeiras-Jurado (2023) also emphasized the role of TED Talks and YouTube science videos in effectively engaging diverse audiences. The study examined how TED Talks and YouTube science videos employed multimodal engagement strategies to effectively disseminate scientific knowledge. It highlighted the use of visual aids, gestures, speech, and other semiotic resources to captivate diverse audiences and enhance the understanding of complex scientific concepts

Previous research has examined the use of metadiscourse in various genres such as reputable newspapers, instructional manuals, and advertisements, offering insights into its rhetorical function. Studies by Esfandiari and Allaf-Akbary's (2024a) study, for instance, delved into how learners with distinct personality factors utilize metadiscourse features to optimize course materials. Esfandiari and Allaf-Akbary investigated how learning-oriented language assessment (LOLA) influences the use of IMMs among ectenic and synoptic EFL learners. The findings revealed

that ectenic learners outperformed synoptic learners in employing IMMs, while both groups benefited from LOLA in enhancing their integrative writing tasks.

El-Dakhs et al. (2022) explored the effects of explicit versus implicit instruction on EFL learners' use of IMMs in writing and examined learners' perceptions of these instructional approaches. Involving 120 Arab female undergraduates, the research employed a mixed-methods design, with participants divided into explicit instruction, implicit instruction, and control groups. The findings revealed that while explicit and implicit teaching positively influenced certain markers (e.g., self-mentions and directives), the effects were limited. Learners considered both methods helpful but often found it challenging to apply what they learned due to task demands.

Triki (2024) examined how expert linguists use exemplification and reformulation as metadiscourse strategies, revealing a balance between disciplinary norms and individual style. The analysis of 90 works from six linguists highlighted notable stylistic individuality, with no consistent patterns tied to career stages. The findings underscored the nuanced interaction of discipline and personal expression in academic writing. Izquierdo and Pérez Blanco (2023) explored the role of IMMs in building rapport and solidarity within informational-persuasive discourse, focusing on English and Spanish languages. Using a contrastive analysis of online tea descriptions, the research highlighted how linguistic strategies like *direct address* and *directives* vary across languages. The English language tends to rely on *self-mentions*, while the Spanish language emphasizes *inclusive we*. The findings highlighted the cultural and rhetorical nuances in how metadiscourse fosters connection and persuasion.

Weisi and Zandi (2024) examined how L2 speakers at different proficiency levels (beginner, intermediate, and advanced) use metadiscourse markers during the IELTS speaking test. Using a mixed-method concurrent transformative design, the research analyzed 36 YouTube videos of test-takers' performances. Results showed that higher proficiency levels correlated with increased frequency and variety of metadiscourse markers, with advanced speakers using a broader range. Additionally, IMMs were more commonly employed than interactive ones across all levels. Ma and Jiang (2025) investigated how visual metadiscourse in PowerPoint slides enhanced audience engagement during Three Minute Thesis presentations. By analyzing multimodal elements, the research highlighted how presenters used visuals to guide understanding and foster interaction. The findings revealed that effective visual strategies, such as clear structure and complementary imagery, play a crucial role in turning passive listeners into active participants, emphasizing the importance of visual design in academic communication. Liu and Cheng (2025) examined the use of IMMs in Chinese live streaming commerce, focusing on how sellers engage and persuade their audience. The reults highlighted linguistic strategies like s*elf-mentions*, *directives*, and *attitude markers* that foster a sense of connection and trust. The findings emphasized the cultural and pragmatic aspects of communication in live streaming, offering insights into effective discourse strategies in e-commerce.

Despite the extensive exploration of metadiscourse, it remains a complex concept without a definitive framework. The research brings to light the importance of metadiscourse markers in academic communication, assisting readers in structuring, analyzing and evaluating the provided information.

The current body of research extensively covers the function of AI chatbots in developing language learning and their impact on EFL learners. However, there is a noticeable gap in the exploration of how individual learner differences, such as extroverted and introverted EFL learners, influence the efficiency of AI chatbots in developing advanced EFL learners' metadiscourse realization in argumentative writing. While studies have demonstrated the positive aspects of AI chatbots in providing personalized feedback and facilitating interactive learning, they often overlook the nuanced ways in which individual learner characteristics can affect the uptake and utilization of metadiscourse markers. Addressing this gap is crucial for developing more tailored and effective AI-driven language learning interventions that serve the wide-ranging demands of advanced EFL learners, thereby enhancing their argumentative writing skills.

Method

Participants

Convenience sampling, as outlined by Dörnyei and Dewaele (2022), was used to initially select a group of 178 Iranian EFL learners aged between 34 and 39 for this study. These participants were chosen from the University of Mohaghegh Ardabili and Islamic Azad university, Ardabil branch, which are renowned for their advanced EFL programs. To assess their English proficiency, the researchers administered the Michigan Test of English Language Proficiency (MTELP). Based on the findings, the participant count was decreased to 152, all advanced Master of Arts (MA) students, with a mix of males and females. At the end of the treatment period, two participants who had missed more than two sessions were also excluded from the subsequent statistical analysis. Therefore, the final number of the participants was reduced to 150 learners, 30 in each group. Most of these students had Turkish as their first language. Due to the universities' policy against separating learners into different groups, the participants attended the English language institute at the Academic Center for Education, Culture and Research (ACECR), Ardabil Branch, and were divided into four experimental groups and one control group.

In alignment with ethical research practices, participants were fully informed about the purpose, procedures, and implications of the study before their involvement. Consent was obtained from all participants prior to their contribution through signing a form, ensuring that their participation was voluntary and based on an understanding of their rights and the study's objectives.

Instruments

Data were collected using the specified instruments, with additional information about these assessments provided.

MTELP

The MTELP is divided into three multiple-choice sections: 40 conversational grammar questions, 40 vocabulary questions (covering sentence completion or synonyms), and 20 reading comprehension questions. The test takes 100 minutes to complete, and learners who score above 70% are deemed advanced language learners (Phakiti, 2003). Research by Johnson and Lim (2009) has verified the test's reliability and validity. In this study, the KR-21 formula was utilized to assess reliability, producing a reliability value of 0.74.

Eysenck's Personality Inventory (EPI)

The EPI aims to evaluate learners' personality traits, specifically focusing on introversion and extroversion. This instrument includes 57 yes / no questions. Scoring is straightforward: More “Yes” responses indicate greater extroversion, while more “No” responses suggest higher introversion (Agarwal & Misra, 2025). The reliability of the personality inventory, measured by Cronbach's Alpha, is reported to be 0.79. Additionally, two experts in personality psychology have verified the content and face validity of the EPI.

Microsoft Copilot and Gemini AI

Microsoft Copilot, based on ChatGPT, enhances productivity and creativity by providing contextually appropriate assistance through an intuitive chat interface (Rahman, 2024). It processes user inputs with natural language processing to offer relevant responses and explanations for IMMs (Minnick, 2025). Gemini AI, developed by Google, handles multiple input modes like text, audio, and video, offering creative and productive assistance through context-aware support and interactive feedback (ELSenbawy et al., 2025). Its versatility allows it to integrate and process different content types, beneficial for various applications from education to professional use.

Likert Scale Questionnaire on AI-powered Chatbots Preferences

The researcher-designed questionnaire consisted of 15 items (initially 22, but reduced to 15 after identifying problematic items). These were administered to all participants in the four experimental groups following the posttest to gauge their opinions on the treatment. The questionnaire aimed to gather participants' views on the instructions provided by Microsoft Copilot and Gemini. Due to its researcher-made nature, the items required piloting. During this phase, five items were modified as learners found them unclear. This phase involved 11 participants who were representative of the study's target population. An expert review was conducted to ensure the content validity of the questionnaire. Cronbach’s alpha reliability coefficient was found to be 0.72. To establish construct validity, an exploratory factor analysis was performed (see Table 2). The researchers carried out an Oblimin rotation analysis on the responses from the four experimental groups, comprising 120 participants. With a value of 0.52, the Kaiser–Meyer–Olkin (KMO) measure indicated sufficient sampling adequacy, while Bartlett’s test demonstrated significance ($p = 0.00, < 0.05$).

Table 2

Exploratory Factor Analysis for AI-powered Chabot's Questionnaire

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.52
Bartlett's Test of Sphericity	**Approx. Chi-Square**	631.34
	df	10
	Sig.	.00

Table 3 shows that six components satisfied Kaiser's criterion with eigenvalues of one or greater. Collectively, these components accounted for 73.06% of the variance.

Table 3

Factor Extraction Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Rotation Sums of Squared Loadings[a]	
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.22	21.52	21.52	3.22	21.52	21.52	2.474
2	2.17	14.51	36.04	2.17	14.51	36.04	1.988
3	1.66	11.07	47.12	1.66	11.07	47.12	2.162
4	1.45	9.71	56.83	1.45	9.71	56.83	1.672
5	1.36	9.06	65.90	1.36	9.06	65.90	2.146
6	1.07	7.16	73.06	1.07	7.16	73.06	1.285
7	.88	5.88	78.95				
8	.78	5.22	84.17				
9	.62	4.19	88.37				
10	.55	3.69	92.06				
11	.32	2.16	94.23				
12	.29	1.93	96.17				
13	.24	1.60	97.77				
14	.17	1.18	98.96				
15	.15	1.03	100.00				

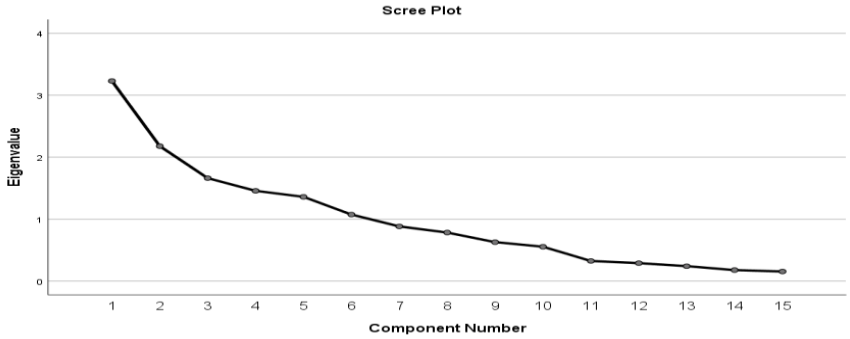
Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

The scree plot (Figure 1) indicated the exclusion of two components from the analysis output.

Figure 1

The Distribution of the Extracted Factors



The two extracted factors accounted for 36.04% of the total variance. Considering this contribution to be low, we aimed to optimize the effectiveness and quality of the questionnaire by removing specific items. Through an examination of the component matrix, we pinpointed factors contributing to variations in each component. After reviewing items with cross-loadings, we excluded seven items from the set.

Interview

Qualitative semi-structured interviews were utilized to investigate the perceptions of advanced extroverted and introverted EFL learners regarding the influence of Gemini AI and Microsoft Copilot AI chatbots on their use of IMMs in expository writing. Five participants were chosen from each of the four experimental groups: extrovert Gemini AI, introvert Gemini AI, extrovert Microsoft Copilot, and introvert Microsoft Copilot. The interviews, consisting of five open-ended questions, sought in-depth insights into participants' experiences with the chatbots, including their perceived benefits, comparative effectiveness, personality-based interactions, satisfaction with feedback, and suggestions for improvement. The collected interview data were transcribed and subjected to a systematic coding process, assessing coherence, redundancy, and segment labeling.

Procedure

Upon completing the MTELP, we identified 150 advanced learners as the main participants for the research. These participants were then divided into five groups: an extroverted Gemini group, an introverted Gemini group, an extroverted Microsoft copilot group, an introverted Microsoft copilot group, and a control group, each consisting of 30 participants. Before commencing the main study, a pretest was conducted to assess their writing performance and evaluate their expository writing skills. They were assigned to write on two topics including *The Impact of Social Media on Mental Health* and *The Benefits of Renewable Energy Sources*, generating

at least two paragraphs (each containing 250 words) per topic to evaluate their understanding and utilization of IMMs. The pretest results showed that participants struggled with the correct use and realization of IMMs. Subsequently, participants in four experimental groups underwent eight treatment sessions, each lasting 70 minutes, twice a week. During the initial session, the researchers expanded IMMs by concentrating on the example sentences provided below.

Sentence 1: I *firmly believe* that our team can achieve the project goals on time, and I am *confident* in my ability to lead us to success. (Boosters)

Sentence 2: I *think* it *might be somewhat* beneficial to integrate more hands-on activities into our curriculum. (Hedges)

Following expository types of paragraphs, the researchers selected 16 instructional manuals (*iPhone User Guide*, *Samsung Galaxy User Manual*, *Sony Bravia TV Instruction Manual*, *Toyota Camry Owner's Manual*, *Microsoft Office User Guide*, *Adobe Photoshop Manual*, *LG Washing Machine User Manual*, *Bosch Dishwasher Instruction Manual*, *IKEA Furniture Assembly Guide*, *Canon EOS DSLR Camera Manual*, *Fitbit Fitness Tracker User Guide*, *Peloton Bike Instruction Manual*, *Amazon Echo User Manual*, *Nest Thermostat Installation Guide*, *Dyson Vacuum Cleaner Instruction Manual*, and *Nikon Digital Camera User Manual*). In every treatment session, learners studied two instructional manuals to learn how to identify IMMs. The Gemini groups and the Microsoft Copilot groups approached learning IMMs in their expository writing through differentiated methods tailored to their tools' capabilities. Since Gemini benefits from multimodal capabilities, Gemini group can significantly enhance metadiscourse learning by providing diverse and engaging content delivery methods. In treatment sessions, Gemini used audio and video to describe complicated metadiscourse concepts, simplifying their comprehension. Gemini AI analyzed spoken and written discourse, providing detailed feedback and examples. Learners interacted with IMMs through audio explanations, video demonstrations, and interactive text analysis exercises. Peer review sessions facilitated constructive feedback exchange. In contrast, Microsoft Copilot groups received an overview of IMMs with structured information and examples from Copilot. They participated in guided writing exercises with step-by-step instructions and real-time feedback. Practice sessions involved writing prompts focused on IMMs, followed by detailed feedback from Copilot. The two scenarios of the AI chatbots provided to the groups were as follows:

Gemini Scenario: Learning Engagement Markers

Text, Audio, and Video Content:

Introduction:

Written explanation of engagement markers, making writing interactive. Examples include "you see", "consider", "note that".

Audio Explanation:

Audio clip explaining engagement markers' importance and use. Example: "You can use phrases like 'you see' to engage your audience."

Video Demonstration:

Video showing a speaker using engagement markers, with visual annotations highlighting each marker. Example: "Consider this".

Interactive Practice:

Text Analysis:

Learners used Gemini AI to add engagement markers to a text and received feedback. Example: “note that”, “let's consider”.

Role-Playing:

Students wrote paragraphs and received real-time feedback from Gemini AI on engagement markers. Example: “as you can see”.

Feedback and Assessment:

Written Feedback:

Detailed feedback from Gemini AI on the use of engagement markers. Example: “Try adding 'you can see that' to engage readers.”

Quiz:

Gemini AI generated a quiz for identifying and adding engagement markers to sentences.

Microsoft Copilot Scenario

Using Microsoft Copilot, the teacher created a lesson plan and Copilot helped students generate text-based explanations of engagement markers like "consider this" and "note that." During the lesson, students wrote paragraphs on their laptops, receiving real-time feedback from Copilot within Word, which suggested engagement markers and highlighted their effective use. After class, students reviewed their work with detailed comments and alternative phrasing from Copilot, enhancing their understanding and application of engagement markers. The control group learned about IMMs through traditional methods and textbook reading. During the posttest, all participants wrote two paragraphs for each topic, similar to the pretest. The correlation coefficient indicated inter-rater reliability values for the pretest and the posttest were 0.81 and 0.76, respectively. The researchers administered a questionnaire to gather participants' feedback. The assessment of writing performance was subjective, given the existence of multiple valid methods for crafting each expository paragraph. An inter-rater scoring method was employed, with two raters focusing on learners' accurate use of IMMs to ensure consistency and minimize subjectivity.

To gain deeper insights into the participants' perceptions, five participants were purposively selected (Bui, 2024) from each experimental group (extrovert Gemini AI, introvert Gemini AI, extrovert Microsoft Copilot, introvert Microsoft Copilot) for the interview phase. The selection was based on their willingness to participate and their overall performance in the main study tasks, ensuring a diverse and representative sample within each group. This purposive sampling strategy aimed to capture a range of experiences and perspectives that aligned with the study's objectives.

Data Analysis

The answers to the research questions which are about the effects of Microsoft copilot and Gemini AI chatbots on advanced EFL extroverted and introverted learners’ utilization of IMMs in expository writing were analyzed using an ANCOVA. An ANCOVA procedure was conducted on the posttest scores of both groups to assess the impact of the two separate educational technique. Subsequently, the responses from the survey questionnaire regarding extroverted

and introverted advanced EFL learners' perceptions of Gemini and Microsoft Copilot AI chatbots were analyzed using frequency values. The interview data underwent a systematic coding process to assess coherence, eliminate redundancy, and assign appropriate segment labels. Utilizing Creswell's (2012) inductive approach, the researchers distilled the information into a set of key themes or categories to gain a deeper understanding of the learners' perceptions. These themes were then carefully reviewed and refined, with only the relevant ones retained and the irrelevant ones excluded. The coding process involved several iterative steps. Initially, open coding was used to generate a wide range of potential themes from the data. These preliminary themes were then reviewed, refined, and grouped into broader categories, ensuring that they captured the essence of the participants' responses. The final set of themes was carefully integrated into the study's findings, providing a nuanced understanding of how learners perceived the role of Gemini AI and Microsoft Copilot in enhancing their use of IMMs in expository writing.

Results

Investigating the First Research Question

The first research inquiry investigated how two different AI chatbots influenced advanced EFL learners' understanding and use of IMMs across personality traits. Table 4 presents the descriptive statistics related to learners' utilization of IMMs across the five groups. It demonstrates that, in the pretest, all groups had nearly identical average scores for metadiscoursal use. Nevertheless, the posttest results demonstrated a notable increase in average scores for the Gemini introverted advanced learners, Microsoft Copilot extroverted advanced learners, and Microsoft Copilot introverted advanced learners compared to their pretest scores.

Table 4

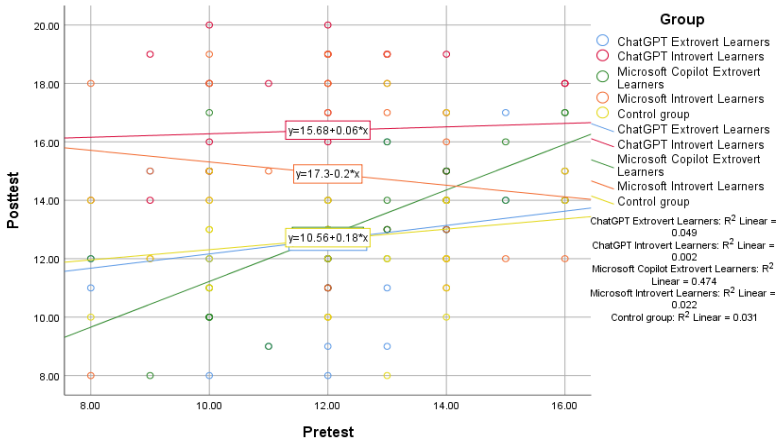
Descriptive Statistics of IMMs on Pretest and Posttest

	N	Mean	Std. Deviation
Pretest (Gemini Extroverted Learners)	30	12.20	2.28
Posttest (Gemini Extroverted Learners)	30	12.70	2.52
Pretest (Gemini Introverted Learners)	30	12.10	1.98
Posttest (Gemini Introverted Learners)	30	16.40	2.58
Pretest (Microsoft Copilot Extroverted Learners)	30	12.06	2.27
Posttest (Microsoft Copilot Extroverted Learners)	30	14.90	3.05
Pretest (Microsoft Copilot Introverted Learners)	30	12.12	2.26
Posttest (Microsoft Copilot Introverted Learners)	30	14.87	3.15
Pretest (Control)	30	12.03	2.14
Posttest (Control)	30	12.83	2.33

Before conducting a one-way ANCOVA, all required assumptions were verified. A single covariate was included in each analysis, making the assumption of covariate correlation unnecessary. Cronbach's Alpha was conducted to assess the reliability of the covariates, yielding a reliable measurement with a coefficient of r = 0.84. Figure 2 demonstrates that the linear relationship upholds the linearity assumption.

Figure 2

Scatter Plots of IMMs and the Covariate for Each Group



The pretest and group did not exhibit a significant interaction, as $F_{(1,149)}$ = 2.96 and $p > 0.05$. This corroborates the assumption of homogeneous regression slopes, as indicated in Table 5.

Table 5

Tests of Between-subjects Effects for Realization of IMMs to Check Homogeneity of Regression Slopes

Dependent Variable: Posttest					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	427.30[a]	9	47.47	7.78	.00
Intercept	570.35	1	570.35	93.57	.00
Group	106.74	4	26.68	4.37	.00
Pretest	30.56	1	30.56	5.01	.02
Group * Pretest	72.30	4	18.07	2.96	.17
Error	853.37	140	6.09		
Total	30485.00	150			
Corrected Total	1280.67	149			

a. R Squared = .334 (Adjusted R Squared = .291)

Following the verification of assumptions, a one-way ANCOVA was conducted to investigate the impact of two different AI chatbots on extroverted advanced EFL learners' understanding and use of IMMs. Two levels of AI chatbots implementation served as the independent variable, with the utilization of IMMs in writing being the dependent variable. The participants' pretest scores functioned as a covariate. The one-way ANCOVA results are displayed in Table 6.

Table 6

Tests of Between-subjects Effects for Realization of IMMs in Expository Writing

Dependent Variable: Posttest						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	354.99[a]	5	70.99	11.04	.00	.27
Intercept	583.88	1	583.88	90.83	.00	.38
Pretest	29.88	1	29.88	4.65	.03	.03
Group	329.16	4	82.29	12.80	.00	.26
Error	925.67	144	6.42			
Total	30485.00	150				
Corrected Total	1280.67	149				

a. R Squared = .277 (Adjusted R Squared = .252)

The main insights from the one-way ANCOVA, $F_{(4,149)} = 12.80$, $p < 0.05$, as shown in Table 6, reveal significant differences across the five groups in their utilization of IMMs on the posttest, after controlling for the pretest scores. This suggests that AI chatbots affect extroverted learners' use of IMMs differently. Furthermore, the strength of the relationship illustrates that 26% of the variance in realization of IMMs is caused by AI chatbots.

Statistically significant differences were observed between *Gemini extroverted learners* and *Gemini introverted learners*; *Gemini extroverted learners* and *Microsoft Copilot introverted learners*; *Gemini introverted learners* and *Microsoft Copilot introverted learners* (see Table 7).

Table 7

Test of Between-groups Differences for Realization IMMs in Expository Writing

Dependent Variable: Posttest

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Gemini Extroverted Learners	Gemini Introverted Learners	-3.72*	.65	.00	-5.58	-1.85
	Microsoft Copilot Extroverted Learners	-.35	.65	1.00	-2.22	1.50
	Microsoft Copilot Introverted Learners	-2.22*	.65	.00	-4.09	-.36
	Control group	-.00	.65	1.00	-1.86	1.86
Gemini Introverted Learners	Gemini Extroverted Learners	3.72*	.65	.00	1.85	5.58
	Microsoft Copilot Extroverted Learners	3.36*	.65	.00	1.49	5.23
	Microsoft Copilot Introverted Learners	1.49	.65	.24	-.37	3.35
	Control group	3.71*	.65	.00	1.85	5.58
Microsoft Copilot Extroverted Learners	Gemini Extroverted Learners	.35	.65	1.00	-1.50	2.22
	Gemini Introverted Learners	-3.36*	.65	.00	-5.23	-1.49
	Microsoft Copilot Introverted Learners	-1.87*	.65	.06	-3.73	-.00
	Control group	.35	.65	1.00	-1.51	2.22
Microsoft Copilot Introverted Learners	Gemini Extroverted Learners	2.22*	.65	.00	.36	4.09
	Gemini Introverted Learners	-1.49	.65	.24	-3.35	.37
	Microsoft Copilot Extroverted Learners	1.87*	.65	.06	.00	3.73
	Control group	2.22*	.65	.00	.36	4.09
Control group	Gemini Extroverted Learners	.00	.65	1.00	-1.86	1.86
	Gemini Introverted Learners	-3.71*	.65	.00	-5.58	-1.85
	Microsoft Copilot Extroverted Learners	-.35	.65	1.00	-2.22	1.51
	Microsoft Copilot Introverted Learners	-2.22*	.65	.00	-4.09	-.36

Based on estimated marginal mean

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni

As presented in Table 7, the analysis revealed that with respect to the utilization of IMMs Gemini introverted advanced learners realized IMMs in expository paragraphs better than the other four groups. Both the Gemini extroverted group and the control group fell short of the performance levels achieved by the other groups. Additionally, in the posttest, there was an improvement in both

Microsoft Copilot introverted learners and Microsoft Copilot extroverted learners regarding the realization of IMMs in expository writing.

Investigating the Second Research Question

The second research question explored the perceptions of advanced extroverted and introverted EFL learners on the impact of Gemini and Microsoft Copilot AI chatbots on their use of IMMs in expository writing. Five participants among each experimental group were required to address the following five semi-structured interview questions:

1. How did Gemini AI and Microsoft Copilot help you improve your use of IMMs in expository writing?
2. Which chatbot (Gemini AI or Microsoft Copilot) was more effective for IMMs and why?
3. How did your personality (extrovert/introvert) influence your interaction with each AI and their interactive features?
4. How satisfied are you with the feedback and support from Gemini AI and Microsoft Copilot?
5. What improvements would you suggest for each AI chatbot to better assist with IMMs?

After obtaining the data transcriptions, the researchers divided them into four groups: extrovert Gemini AI, introvert Gemini AI, extrovert Microsoft Copilot, and introvert Microsoft Copilot text data. The data were then coded for coherence, redundancy, and segment labeling. Following Creswell's (2012) inductive process, the data were narrowed down to a few key themes/categories to deeply understand the writers' perceptions. After generating these themes, the researchers reviewed and refined them, keeping the relevant ones and discarding the irrelevant ones. A sample coding from, introvert Gemini AI, extrovert Microsoft Copilot, and introvert Microsoft Copilot interview transcripts is presented in Table 8.

Table 8

A Sample of Introvert/Extrovert Gemini and Microsoft Copilot Interviews

Codes	Introvert Gemini AI (text data)	Themes
• **Enjoyment** • **Helpful feedback** • **Improvement in IMMs** • **Personalized feedback** • **Confidence** • **Clearer writing**	I enjoyed using Gemini AI; the immediate, helpful feedback showed me how to improve my use of IMMs, like using phrases such as "you see". As an introvert, I appreciated working at my own pace without the pressure of a live audience. The personalized feedback suggested alternative phrasings, boosting my confidence and helping me understand IMMs better with clear examples and explanations.	• Positive experience • Enhanced writing skills • Personalized and immediate feedback • Introverted learning preference

Codes	Extrovert Gemini AI (text data)	Themes
• **Lack of benefit** • **automated Feedback** • **Generic suggestions** • **Lack of Engagement** • **Need for dynamic interaction** • **Preference for human interaction**	I didn't find Gemini AI very beneficial. As an extrovert, I thrive on real-time, dynamic interactions, which the AI lacked. The feedback felt too automated and generic, failing to help me understand how to use IMMs effectively. I missed the interactive discussions and brainstorming sessions. The main challenge was the lack of personalized feedback. Suggestions for using IMMs were often vague or repetitive. I didn't feel like I was learning new techniques	• Limited Benefit • Engagement Issues • Feedback Quality
Codes	**Introvert Microsoft Copilot (text data)**	**Themes**
• **Somewhat Beneficial** • **Useful feedback** • **Need for more detail** • **Independence** • **Reflective learning** • **Repetitive suggestions** • **Room for improvement**	Working with Microsoft Copilot was somewhat beneficial. The AI provided useful feedback on incorporating IMMs, like suggesting phrases such as "consider this". While helpful, the feedback could have been more detailed and tailored to my writing style. As an introvert, I appreciated working independently and reflecting on feedback at my own pace. The automated suggestions for using IMMs were useful but sometimes repetitive. Instant feedback was great; yet more personalized guidance would have been beneficial.	• Moderate benefit • Feedback quality • learning Preferences
Codes	**Extrovert Microsoft Copilot (text data)**	**Themes**
• **Somewhat beneficial** • **Practical feedback** • **Lack of engagement** • **Repetitive suggestions** • **Instant feedback** • **Generic feedback**	Using Microsoft Copilot was somewhat helpful, providing practical feedback on IMMs. However, as an extrovert, I missed the dynamic interaction. The AI's suggestions, while useful, felt repetitive and didn't fully engage me. Overall, it was a decent experience but didn't meet my engagement expectations.	• Moderate benefit • Engagement issues • Feedback quality

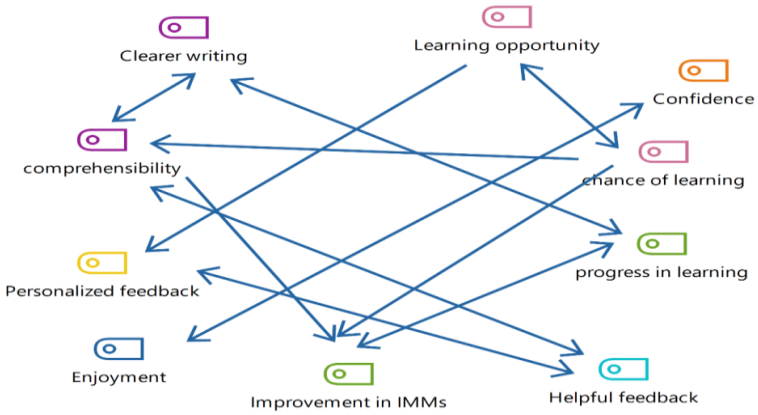
MAXQDA version 2022, an effective tool for qualitative research data, was utilized. After analyzing and summarizing the responses, codes and themes were developed.

In interviews with introverted participants using Gemini AI, they reported high enjoyment and appreciated the personalized feedback, which boosted their use

of IMMs and made their writing clearer. The AI also boosted their confidence in incorporating IMMs into expository writing. Overall, Gemini AI proved to be a valuable educational tool, enhancing both writing skills and the learning experience for introverted learners (see Figure 3).

Figure 3

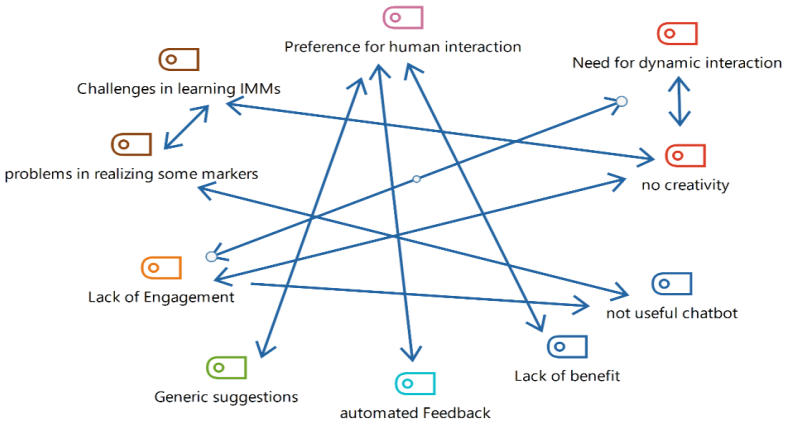
Themes and Codes from Introverted Participants Using Gemini AI through an Interview



In interviews with extroverted participants using Gemini AI, they generally found the tool lacking in benefit due to its automated feedback and generic suggestions. The AI's responses did not fulfill their need for dynamic interaction and engagement, crucial for their learning style. Many participants preferred human interaction, feeling the AI's feedback was impersonal and insufficient, making it challenging for them to learn IMMs effectively (see Figure 4).

Figure 4

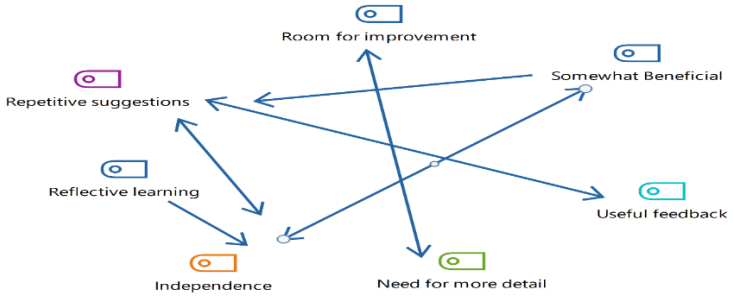
Themes and Codes from Extroverted Participants Using Gemini AI through an Interview



In our interviews with introverted participants using Microsoft Copilot, it was found that the tool was somewhat beneficial in enhancing their writing. Participants appreciated the AI's feedback, which enabled independent improvement and reflective learning. However, they agreed that more detailed and personalized feedback could better cater to their individual writing styles, as the suggestions often felt repetitive. Overall, while Microsoft Copilot supported introverted learners to some extent, increasing the detail and personalization of its feedback could make it a more effective tool (see Figure 5).

Figure 5

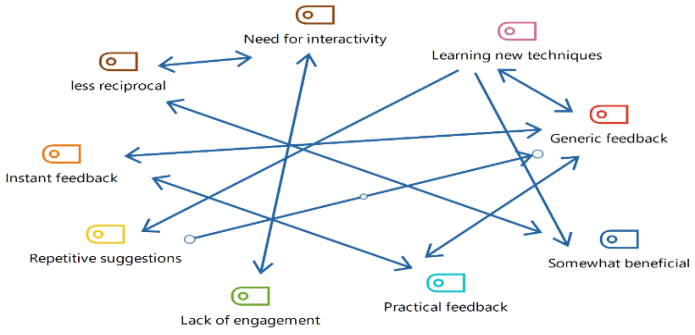
Themes and Codes from Introverted Participants Using Microsoft Copilot through an Interview



In our interviews with extroverted participants using Microsoft Copilot, the feedback indicated that while the tool was somewhat beneficial**,** providing practical feedback and allowing learners to pick up new techniques**,** it did not fully meet their needs. The participants appreciated the instant feedback, which helped them make immediate adjustments, but found the suggestions to be repetitive and generic. A significant lack of engagement was noted, with learners expressing a need for more interactivity to sustain their interest and enhance their learning experience. Overall, the extroverted learners felt that while Microsoft Copilot had some advantages, it could be improved by incorporating more dynamic and personalized interactions to better suit their learning preferences (see Figure 6).

Figure 6

Themes and Codes from Extroverted Participants Using Microsoft Copilot through an Interview



Discussion

The present study aimed to evaluate the effectiveness of AI-powered chatbots, Gemini and Microsoft Copilot, in facilitating advanced extroverted and introverted EFL learners' use of IMMs in expository writing. Statistical analysis revealed significant differences between extroverted and introverted advanced learner groups. Notably, Gemini introverted learners demonstrated superior ability in realizing IMMs in expository paragraphs compared to the other groups. These findings can be interpreted through several recent theories in language learning. According to the goal setting theory (Travers, 2022), learners' motivation and success are influenced by the goals they set for themselves. Introverted learners may have set more achievable and specific goals, which were effectively supported by the structured feedback from Gemini AI. On the other hand, extroverted learners, who thrive on social interaction and dynamic engagement, may have found AI feedback less motivating due to the lack of real-time interaction.

Eysenck's theory of personality posits that introverts have higher cortical arousal levels, which predispose them to deeper, more reflective thinking (Ryckman, 2020). This reflective nature allows introverts to engage more thoroughly with content and structure their writing more effectively. The Gemini AI platform, with its advanced adaptive learning algorithms, provides a conducive environment for introverts to leverage their reflective and detailed-oriented cognitive styles (Basu, 2025). This combination enables introverts to better employ IMMs, such as self-mentions and boosters, thereby enhancing their credibility and confidence in writing. In contrast, extroverts, characterized by a preference for external stimulation and social interaction, may find the detailed and introspective task of metadiscourse realization less intuitive. Extroverts often engage in more spontaneous and broad communication styles, which might limit their effectiveness in using hedges and attitude markers. The Gemini AI platform, while offering robust communicative tools, may not fully mitigate these inherent extrovert tendencies, leading to their comparatively lower performance in metadiscourse realization (Soni, 2024). Bandura's social cognitive theory emphasizes the role of observational learning, self-regulation, and self-efficacy in skill development. Gemini AI leverages these principles by providing personalized feedback and adaptive learning pathways tailored to individual learners' needs (Hagger, et al., 2020). Introverted advanced learners, who prefer structured and meaningful interactions, may benefit more from this personalized approach, as it aligns with their natural learning preferences (Nave & Carducci, 2021). The AI's ability to provide immediate, targeted feedback helps introverts refine their metadiscourse use and internalize effective writing strategies.

The findings that both introverted and extroverted advanced learners using Microsoft Copilot made similar progress in metadiscourse realization in expository writing is intriguing, especially when considering the varied ways these personality types typically process information (Du & Daniel, 2024; Fields, 2024). Microsoft Copilot AI's adaptive nature can meet diverse learning styles (Minnick, 2025; Stratton, 2024). Microsoft Copilot might be effectively balancing different teaching tactics that appeal to both introverted and extroverted preferences, hence leveling the playing field. Microsoft Copilot's deep integration with Microsoft tools allows it to provide more contextually relevant suggestions based on user data from various

applications, whereas Gemini might not achieve the same level of contextual accuracy (Kristina, 2025). Copilot tends to excel in generating factually accurate content, which is crucial for expository writing, whereas Gemini's outputs might require more careful verification (Tafazoli, 2024). Copilot's advanced collaboration features facilitate better team communication and project tracking, which can benefit both introverted and extroverted learners working on group projects (Gibson & Ifenthaler, 2024). Copilot continuously offers tips to enhance writing quality, helping all learners, regardless of their personality type, develop their expository writing skills (Moorhouse & Kohnke, 2024). This study's findings are reinforced by those of Esfandiari and Allaf-Akbary (2024b), claiming that learners who used Copilot in a hands-on data-driven learning approach performed better in identifying and applying IMMs compared to those who used written texts.

The study also found that participants had positive perceptions of Copilot-supported learning methods, highlighting its potential in enhancing writing performance. Barrot (2023) views Microsoft Copilot AI as a trustworthy writing assistant, offering instant feedback to users throughout various phases of their writing journey. Microsoft Copilot, as an AI-powered tool, may be seamlessly incorporated into language learning situations, helping learners improve their overall language skills and address specific sub-skills crucial for language proficiency (Panini, 2024).

The interview findings provided valuable insights into the participants' perceptions regarding the impact of Gemini AI and Microsoft Copilot chatbots on their use of IMMs in expository writing. Extroverted learners highlighted the interactive features of both chatbots as particularly useful in enhancing their ability to use IMMs effectively, citing real-time suggestions and adaptive feedback as key contributors to their improvement. Introverted learners, on the other hand, appreciated the individualized feedback and structured guidance provided by the chatbots, noting how these features helped them overcome challenges in maintaining coherence and engaging with their audience in writing. When comparing the two chatbots, the participants generally viewed Microsoft Copilot as more effective in providing detailed feedback on the use of IMMs, while Gemini AI was praised for its user-friendly interface and ability to foster creativity in their writing. Moreover, participants emphasized how their personality traits influenced their interaction with the chatbots; extroverted learners tended to prefer more interactive and dynamic features, whereas introverted learners valued clear instructions and targeted support. These findings underscore the importance of tailoring AI-driven educational tools to address the diverse needs and preferences of learners.

Gemini AI is particularly well suited for introverted learners as it provides a user-friendly and intuitive interface that enables solitary brainstorming, creative writing, and idea generation (Ding & Zou, 2024). Gemini's capabilities help introverts engage deeply with content independently, offering varied perspectives and creative suggestions that enrich their learning experience (Su & Yang, 2023). On the other hand, Microsoft Copilot excels in supporting both learners with different personality types due to its seamless integration within Microsoft 365 applications and its robust collaboration tools (Yim & Su, 2024). While introverts benefit from its personalized and contextually relevant feedback that enhances solo

study, extroverts thrive using Copilot's advanced collaboration features, which facilitate team projects and clear communication. This versatility allows Copilot to address the distinct learning styles and preferences of both personality types, making it a more universally effective tool in educational environments (Pentina et al., 2023).

Conclusion

The current research suggests that Microsoft Copilot can significantly aid both extroverted and introverted advanced learners in enhancing their understanding of IMMs in EFL contexts. The findings showed that both groups of Copilot users performed well in the posttest because of factors including but not limited to the novelty effect. However, Gemini AI proved effective only for introverted learners in mastering IMMs in expository writing.

Among the limitations of this research is the small number of participants, lack of delayed posttest to assess retained learning of IMMs, and a focus solely on IMMs instead of interactive metadiscourse. All participants were advanced language learners, and the research relied on semi-structured interviews to gather data on their attitudes toward the AI chatbots. Alternative methods like think-aloud protocols and questionnaires could be explored to capture learners' attitudes more comprehensively. Further research should investigate the particular mechanisms behind AI's effectiveness, the various AI tools employed, and their impact on metadiscourse use in multiple language skills.

Though the study has certain limitations, it shows that AI-powered language learning tools can greatly enhance EFL learners' language acquisition. These tools offer a more engaging experience, increasing incentive and enthusiasm for future exploration. AI platforms, such as Microsoft Copilot, enable learners to follow mastering the language at their own tempo and from anywhere, promoting independence and autonomy. The research highlights the positive effect of AI-powered resources in EFL classrooms, stressing their role in providing customized and flexible learning opportunities. Learners experience increased confidence in language use due to prompt feedback, helpful critiques, and diverse sentence formations.

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