AI- Assisted Academic Writing in ESL Context: A Corpus- Based Linguistic Analysis

Ghulam Rasool
Assistant Professor, Department of English, Govt. Graduate College Zafarwal, Punjab, Pakistan
Email: professor.ghulamrasool@gmail.com
Amal Farooq
MS Scholar, Department of English, University of Sialkot, Punjab, Pakistan
Email: amalfarooq31@gmail.com

Abstract
This paper analyses the use of artificial intelligence in language education in the field of ESL academic writing based on theory of Second Language Acquisition and Corpus Linguistics. It seeks to research the effectiveness of AI-assisted writing aids in the academic writing performance of the learners and particularly how AI affects lexical diversity, syntactic complexity, grammatical accuracy, cohesion and writing quality. The study adopted the qualitative case study approach, analyzed undergraduates at Government Graduate College, Zafarwal who were chosen through purposive sampling. Data were gathered using AI-assisted and non-assisted writing samples, unstructured interviews and think-aloud protocol. The linguistic analysis, using corpus methods, evaluated lexical density, syntactic richness, cohesiveness and accuracy whereas thematic analysis was used to evaluate perception, confidence, and metalinguistic knowledge of the learners. The results have shown that AI-aided writing was more efficient concerning lexical diversity, sentence complexity, sentence structure, and cohesion and the students had more self-belief, motivation and perceived awareness of the language usage. According to think-aloud procedures, AI facilitate decision-making, but excessive dependence will result in paraphrasing and low creativity rates. These findings indicate that AI inclusion in strategies and educational methods can be effective to achieve learning outcomes, growth in autonomy, and improvement of creativity and analytical thinking. The study concludes that AI-supported technologies may be an effective method to improve ESL academic writing and curriculum building and further studies in AI-enhanced language learning.
Keywords: *AI in writing, writing academic English, Corpus analysis, perception of learners, cognitive scaffolding, complex syntax, lexical variety.*

Introduction
1.1 Background of the Study
The increasing rate of artificial intelligence has changed the area of academic writing in a significant way, particularly among the English as a second language learners. These software writing aids, such as grammar checkers, automatic paraphrasers, and large language models have become more available, allowing students to write linguistically marked academic text more easily. The technological change poses some significant questions that are related to language development, authorship, and academic

writing in an ESL context. Therefore, the corpus-supported linguistic study of AI-aided academic writing has become highly opportune and mandatory.

Corpus linguistics provides an empirical and methodical system of enquiring language through examination of large amounts of original text (McEnery and Hardie, 2012). The studies based on corpus have always been used in ESL research to find the patterns of errors, lexical choices, and syntactic structures by learners (Granger, 2008). However, with the implementation of AI-assisted writing, a new aspect is added to the language of the learner, with the human productive element often mixed with machine-inspired hints. This blend of composition undermines traditional views of native and non-native competence, since AI tools can mask the common mistakes of the learners and also create new linguistic models.

According to recent empirical research, AI writing aids can bring positive improvements in grammatical form and lexical sophistication in ESL texts and, at the same time, decrease the cognitive involvement of the writing process in learners (Ranalli, 2018; Strobl et al., 2019). In addition, AI-created or AI-aided texts are also typically characterized by their unique linguistic features, such as formulaic words, uniform discourse stratification, and lower syntactic flexibility. These features are subject to evaluation through the corpus-based approaches, which allow performing comparative analyses of AI-assisted and non-assisted texts on the basis of various linguistic levels, including complexity, cohesion, and lexical diversity. Although the use of AI in educational institutions is becoming more common, even the current research shows a significant gap concerning the impact of AI support on the linguistic nature of ESL scholarly writing, especially when it comes to situations that involve minimal exposure to English. The current studies mainly focus on pedagogical, as opposed to the linguistic, analysis. In this way, a corpus-based linguistic study can provide more information regarding how AI transforms learner language and academic discourse practices.

The current paper will attempt to close this gap by investigating the state of AI-aided academic writing in ESL settings using a corpus-based methodological approach. Analyzing language usage patterns will allow the research to play a role in the ongoing research on the topic of AI in language learning and academic dishonesty, as well as to offer practical implications to ESL teaching and testing.

1.2 Scope and Significance of the Study

The paper explores AI-related composition of scholarly papers in ESL with the help of a corpus-based language model, lexical variety, syntactic simplicity and grammatical correctness (McEnery and Hardie, 2012; Granger, 2008). It is limited to written academic writings done with and without the aid of AI, which makes it possible to compare the emergent patterns of language in a comparative way. Using the tools of corpus, the study provides measurable and objective data about the effects of AI on the practices of ESL writing (Biber et al., 1998).

This may be seen as a great value of the given study because it does not only contend to the field of corpus linguistics but also to the second-language acquisition in the area of the under-explored effects that the AI has had on the second-language acquisition (Ranalli, 2018; Strobl et al., 2019). It also provides pedagogical implications to be applied by ESL teachers to help them understand whether AI is beneficial or harmful in language acquisition. Also, the research will guide academic policy on ethical applications of AI in writing, particularly in writing classrooms in developing ESL settings where there is not much research on the same (Hyland, 2019).

1.3 Statement of the Problem

The ongoing adoption of artificial intelligence (AI) in the academic writing sector has triggered fundamental transformations on how ESL learners write their texts. Whereas these tools enhance grammatical correctness and lexical level, they also blur the boundary between language produced by a

student and the language produced through the help of a machine. This effect brings up questions of the authenticity of student writing, nurturing of students to be independent in their writing and the trustworthiness of orthodox assessment. Additionally, AI-supported writing has the capability of covering common learner mistakes, which makes it difficult to evaluate the actual language competency (Ranalli, 2018).

Although the use of AI in the ESL teaching process is widely implemented, there is still no systematic, corpus-based study examining the influence of AI aid on the composition writing of academic texts on its properties, structure, and linguistic aspects. Pedagogical or ethical aspects are primarily used in the existing literature, and more complex linguistic investigation is under-researched. This seeming absence prevents us from knowing whether AI can enhance the original development of language, or it is just a way to cope with the shortcomings of learners. As a result, a corpus-based research is imperative in the comparison of language patterns in the writing of AI-aided as compared to non-assisted ESL writing (McEnery and Hardie, 2012).

1.4 Aim and Objective of the Study

Aim

This study aims to discuss how AI-assisted tools can affect academic writing by ESL students through corpus based linguistic analysis. A specific goal of it is to compare AI-assisted and non-assisted texts, comparing them in terms of lexical diversity, syntactic complexity, and grammatical accuracy, evaluating their influence on the language development process and academic writing as a whole.

Objectives

- To examine the linguistics of AI-supported and non-supported ESL academic texts.
- To explore cognitive strategies and engagement rates of learners in the process of writing with AI assistance.
- To investigate the perceptions, attitude and experience of learners about AI-assisted writing.

1.5. Research Questions

This study is guided by the following research questions:

- How does AI-assisted writing influence the linguistic features (lexical diversity, syntactic complexity, cohesion, and grammar) of ESL academic texts?
- What cognitive strategies do learners employ when using AI-assisted writing tools?
- How do learners perceive the benefits, challenges, and impact on autonomy of AI-assisted writing?

1.6 Limitations and Delimitations of the Study

Limitations

The work is limited to a specific set of ESL scholarly works, which may not be the most accurate reflection of the entire range of learner demographics and proficiency levels. The focus on individual linguistic aspects, e.g., lexical diversity, syntactic complexity, and grammatical accuracy, exposes a danger of ignoring traces of other relevant writing aspects, e.g., creativity and critical thinking. In addition, the lack of uniformity in the nature and extent of the use of the AI tools by the participants can undermine the similarity of the empirical results. The analysis will also be determined by the corpus-analysis software available, which can also have technical restrictions. Therefore, the findings can be contextual and not fully applicable in other ESL instructional contexts.

Delimitations

In this study, the study strategically limits its study to academic texts of ESL written with and without AI-help, and focuses on linguistic evidences like lexical diversity, syntactic complexity and grammatical accuracy (Biber et al., 1998). It does not deal with spoken discourse, informal written dialogue or AI solutions other than text-based writing programs, thus retaining a small-scale corpus based analytic framework.

Literature Review

2.1 Background

The conventional writing process in academic writing with the introduction of artificial intelligence (AI) has significantly changed how ESL students treat texts. AI-based tools, such as grammar checkers, predictive text generation tools, and sophisticated language models can provide learners with real-time hints on vocabulary, syntax and coherence (Ranalli, 2018). These applications are finding a significant application in the ESL classroom thus assisting the learners who might face the difficulties of producing academically acceptable English due to insufficient exposure or mastery. By reducing errors and providing stylistic advice, AI tools can be used to improve the overall quality of the writing both as well as to affect the process of cognitive involvement of the learners in the writing process.

Corpus linguistics provides a methodological base of the study of AI assisted writing. Categorizing vast amounts of genuine texts, researchers have an opportunity to determine the tendencies of the vocabulary use, their syntax frameworks, and specifics of their discourse (McEnery and Hardie, 2012). ESL Corpus based analysis has historically been used to analyze errors made by learners, collocations as well as formulaic phrases and thus adds to a better evaluation of learning a second language (Granger, 2008). The emergence of AI-assisted writing places texts in a new dimension of corpus studies as texts will become a hybrid of machine and human-generated language. This blending poses doubt with regard to authorship, originality and identity of linguistic competence among ESL learners.

Recent research shows that AI-supported writing could be good at increasing grammatical correctness and lexical sophistication, but at the same time, it can lead to the fact that the learners become less dependent on their own language production, which can limit the depth of learning and problem-solving ability (Strobl et al., 2019). Besides, the generated suggestions, developed by AI, often follow the general trends, which can diminish the risk of style and creativity in academic writing. In turn, the linguistic impact of AI should be subjected to strict empirical research to unveil the benefits as well as the drawbacks of AI in ESL teaching.

Although the use of AI in the academic setting has been growing in value, there is limited research with a focus on corpus-based linguistic analysis of AI-aided ESL writing. Most of the research has revolved around methods of pedagogy, ethics or automated feedback mechanisms (Hyland, 2019). Therefore, there is a gap in the scientific understanding regarding the potential of AI support to affect text complexity, language characteristics, and discourse patterns. The results of such inquiries would prove to be fruitful to the teachers, curriculum developers, and policy-makers who aim to incorporate AI tools in an efficient manner without compromising language-development when teaching ESL.

2.2 Recent Studies

The most recent research on AI-aided academic writing has criticized its effect on ESL students writing, their language acquisition, and academic writing. In a study by Ranalli (2018), the author presented the use of automated writing evaluation (AWE) tools and found that the tools significantly enhanced grammatical accuracy and sentence-level accuracy among ESL students. However, the research also noted that more often than not, students were dependent on automated corrections and did not do much self-reflection or learn the underlying grammar rules. These results indicate that AI tools can

improve the quality of the surface level, but might not support deep learning of language, which is also reflected in further studies on AI-mediated writing (Strobl et al., 2019).

Hyland (2019) explored the topic of second-language writing in the digitally mediated setting and focused on the pedagogical consequences of AI assistance. The writer believed that AI tools can be used to scaffold the writing process, especially when learners have limited exposure to academic English because they require immediate feedback about vocabulary choice, cohesion, and style. However, he warned against the excessive use of AI-generated recommendations, which would decrease the chances of aggressive creativity and critical thinking in learners. Therefore, the balance between AI aids and free writing is a decisive issue in ESL education.

The corpus-based research provides empirical data related to the linguistic impacts of AI-aided writing. Biber, Conrad, and Reppen (1998) found out that syllabic complexity, lexical variety and discourse markers patterns could be revealed by corpus analysis, which are vital in determining language proficiency. Based on this approach, Granger (2008) studied learner corpora in order to gain knowledge about frequent error patterns and formulaic sequences. Using similar corpus-focused methods of AI-assisted writings will allow researchers to compare the linguistic characteristics of the AI-affected writing with the standard output of the learners to determine the nuances of the AI-WinForms language use.

The empirical research on the comparative results between the writing with AI assistance and without has also been developed recently. As an example, Li and Chen (2021) compared their essays that were generated with the assistance of AI tools and without them and found that essays that were generated with AI were characterized by a higher lexical level as well as a lower prevalence of syntactic mistakes but a lower degree of sentence structures variability. Similarly, Johnson and Smith (2022) investigated the AI-supported writing in higher education and found an increase in the cohesion and readability scores, though with certain limitations to the original voice and stylistic uniqueness of students. These results suggest that AI solutions can be used to normalize writing styles, which presumes them to have benefits in terms of clarity and restrictions in the use of expressive language.

The other field of research questions the ethical and scholarly consequences of AI-aided writing. Certain researchers claim that as much as AI improves the quality of writing, it will cast very valid concerns on authorship, plagiarism and academic integrity (Zhang, 2020). Learners of the ESL language, specifically in the setting of developing conditions, can form an addiction to the use of AI, thus, threat to their future writing capacity. In turn, the understanding of the linguistic influence of AI, placed into the context of a corpus one, can guide not only the practice of education but also the institution.

These new researches highlight a twofold impact of AI-assisted writing in ESL settings, increasing technical skills in writing, such as grammar, vocabulary, and cohesion, but limiting learner autonomy, time-creativity, and linguistic diversity. In spite of such insights, systematic corpus-based studies are few, hence justifying the need to have more empirical studies to criticize the insidious influence of AI on language properties and academic writing (McEnery and Hardie,†2012).

2.3 Research Gaps

Empirical, corpus-based studies of AI-aided ESL writing are severely lacking, especially regarding the topics of lexical variety, syntactic richness, student control, style and genre and language acquisition.

2.3.1 Methodological Gaps

Even though studies on AI-supported ESL writing have grown in number, their methodological constraints exist particularly in corpus-based analysis. A significant proportion of research is based on small-scale samples or case studies, thus preventing generalization and missing the complete linguistic patterns in different groups of learners (Li and Chen, 2021; Johnson and Smith, 2022). Further, large part of the literatures is based outwardly results like grammatical correctness or lexical sophistication without

considering deeper aspects of linguistics like syntactic complexity, cohesion, or discourse markers (Biber et al., 1998).

The lack of consistency in operationalization of AI assistance is another drawback in terms of methodological deficiency. All AI tools are treated as the same tool in some of the studies, which is not accurate in practice as these tools vary in functionality such as grammar correction and style suggestions to full-text generation. This homogeneity makes it hard to compare studies across studies and is likely to obscure the specific linguistic effects of particular AI applications (Ranalli, 2018).

Moreover, studies to date tend to use manual or simple automated scores of analyses that do not ensure the ability to detect more subtle trends of language use. Beyond conventional corpus methods like AntConc or Sketch Engine can provide more accurate measure of linguistic characteristics; however, very few studies are using the tools systematically to compare AI-aided and non-aided texts (McEnery and Hardie, 2012).

To fill these methodological gaps is necessary that can supply solid, empirical information on how AI can impact ESL academic writing to ensure that research can be replicated and provided with pedagogical value.

2.3.2 Conceptual Gaps

Although the level of research on AI-supported academic writing in ESL settings has increased, there are major deficiencies in terms of conceptual development. The majority of papers available are based on the assumptions about the practical utility of the AI tools, namely, the enhanced text quality and grammar, advancement of vocabulary, and other elements, but they do not interrogate the theoretical problems associated with the conceptual bases of language learning and linguistic development (Hyland, 2019; Ranalli, 2018). An example is that, as much as AI can contribute to vulnerable accuracy, not much effort has been directed towards the impact of the dependence on AI on the underlying qualities of writing, such as cognitive engagement, critical thinking, the formation of a unique voice by a learner. This gap means that there is a small theoretical knowledge about the effect of AI assistance and processes of second-language acquisition.

The other gap in conceptualization is the hybrid nature of AI- assisted texts. AI-mediated writing brings on a mixture of human and machine language, questioning the traditional notions of writing authorship, originality, and linguistic competency (Zhang, 2020). Although there are scholars who admit such problems, not many studies examine the implication of such problems to the identity of ESL learners as writers or the pedagogical models on which writing instructions are based.

In addition to that, studies do not always consider contextual factors, including the level of proficiency, learning environment, or cultural context to support or oppose the impact of AI tools on writing practices (Strobl et al., 2019). This is because it is important to understand these factors in context to create theoretically viable models of AI-aided language learning that put into consideration variation in the experience of learners.

To overcome these conceptual gaps, it will be necessary to employ an integrative research methodology that unites the corpus based linguistic analysis of these studies with theoretical insights of second-language acquisition, digital literacy and educative technology. This kind of research will give a deeper insight into the way AI is transforming the use of language, learner agency, and academic writing in the ESL setting.

2.4 Theoretical Framework

The current research is based on the theory of Second Language Acquisition (SLA) and the Corpus Linguistics one, and this approach offers a twofold approach to studying the processes of AI-aided academic writing when it comes to ESL. The SLA theory focuses on cognitive, social, and interactional

aspects of learning a second language and how learners develop the competencies of the grammatical structures, vocabulary, and discourse by being exposed, practicing, and receiving feedback (Ellis, 2015). It is possible to regard AIs-based tools as digital facilitators in the process and propose corrective feedback, lexical recommendations, and structural support that follow the principles of SLA input and interaction.

This is supplemented by Corpus Linguistics theory as it provides an empirical basis of the investigation of actual language usage. It allows systematic examination of large bodies of texts in order to discover the pattern of lexical choice, syntax complexity and the features of discourse (McEnery and Hardie, 2012). Application to AI-assisted writing Corpus-based analysis can enable the researcher to compare machine-influenced texts with non-assisted learners to determine how AI technology affects linguistic structures and style of writing.

It is possible to combine the SLA and corpus linguistics theories to enable this study to carry out analysis of the cognitive and linguistic aspects of AI-assisted writing. SLA theory explains how we learn a language, as well as how learners interact with it, whereas corpus linguistics offers a methodological rigor in the processes of measuring and analyzing the textual characteristics and, therefore, develops a thorough framework of investigating how AI affects ESL academic writing.

2.5 Conceptual Framework

The conceptual framework of the study describes the connections between AI-aided writing tools and the academic writing with English as a Second Language (ESL) students with a mediation of linguistic and cognitive factors. The AI systems produce immediate feedback, grammatical fixes, and lexical suggestions, which directly influence the textual linguistic features of lexical richness, syntactic complexity, and grammatical accuracy (Ranalli, 2018). In addition, these tools regulate the level of cognitive interaction as a result of which the problem-solving skills, critical reasoning, and rhetorical plans of the learners are affected (Hyland, 2019).

The conceptualization of the framework is the AI assistance where it is regarded as an exogenous variable and academic writing performance as an endogenous one where linguistic pattern, learner autonomy, and contextual modifiers are the mediators between them. Corpus based inquiry allows systematic research on the linguistic changes that AI technologies cause and thus highlights differences between AI aided and unaided ESL texts. The discussed methodological approach explains the pedagogical and linguistic implications of the implementation of AI development in the context of the ESL academic writing and provides the understanding of language development processes and the role of the instrument on the speech of learners.

2.6 Analytical Framework

The current analytical system utilizes a corpus-based linguistic approach to the systematical analysis of ESL academic writing created with and without the help of AI. Corpus-analysis tools like Ant Conc and Sketch Engine are then used to analyze textual data to measure lexical diversity, syntactic complexity, grammatical accuracy, cohesion and discourse markers (Biber, Conrad, and Reppen, 1998). These linguistic indices are measurable boxes of quality of written output and AI systems impact.

The paradigm is a combination of analytical methods of comparison and description. The appraisal of the differences between the texts with and without the help of AI is related to the comparative analysis and thus demonstrates the extent to which AI technologies alter the language patterns, stylistic features and structural components. Descriptive analysis simply represents long-term trends in linguistic features of each text classification, which reflects the effect of AI on learner language production.

This model allows to make a highly rigorous evaluation of AI-assisted writing by combining quantitative measurements of the corpus with qualitative understanding. It will therefore add towards a deeper

insight into the linguistic changes that have been brought by AI and how the changes will impact ESL students in terms of writing, writing autonomy, and writing academic discourse.

Research Methodology

The study uses qualitative case study approach to how the AI-assisted writing impacts the academic writing of English as Second Language (ESL) students. The sample consists of a convenience sample of ESL students of higher education who have used AI writing tools regularly. The unstructured interviews, think-aloud protocol and writing samples with AI assistance are utilized in data acquisition. These are followed by later thematic coding, which corresponds to Creswell and Poth (2018) to identify trends in the experiences of learners, their cognition techniques, and their ideas concerning AI-assistance. Such an approach to the methodology provides subtle, context-focused data on how AI tools impact writing, learner autonomy, and linguistic acquisition.

3.1 Research Design

The current study uses a qualitative case-study research design to examine the impacts of AI-based writing aids on academic writing of EFL students. The case-study method will be particularly warranted to study complex and context-related phenomena and, therefore, help to comprehend the experience, thoughts, and interactions of learners with AI tools in depth (Yin, 2018). The study focuses on a limited group (bounded with scopes) of ESL students of higher education actively using AI-friendly writing tools and thus, allowing the exploration of the writing process of the student group in a letter detail.

The qualitative instruments (unstructured interviews, think- aloud instructions, and the samples of AI-assisted academic texts) are used to gather data. Unstructured interviews are aimed at eliciting the perceptions, attitudes, and difficulties of learners with the use of AI tools and think-aloud protocols would allow capturing real-time strategies and decision-making of learners in the course of the writing task. Linguistic and structural patterns are to be analyzed using the textual evidence that is given by comparative samples of AI-assisted and non-assisted writing.

The research study employs the triangulation approach that combines various data in order to promote increased credibility and richness of insight. The thematic analysis is utilized in order to recognize repetitive tendencies, themes and understanding of the role of AI in the language use, learner autonomy, and writing planning. This case-study design provides an overarching view of the pedagogical and linguistic implications in relation to AI-assisted academic writing among ESL students through the synthesis of the contextual, cognitive and textual evidence.

3.2 Research Instruments

To conduct the qualitative case study researching AI-aided ESL academic writing, the following instruments are used:

- Unstructured Interviews
- Think-Aloud Protocols

3.2.1. Unstructured Interviews

The unstructured interviews are one of the main methodological tools that provided the information about the experiential, perceptual, and strategic interaction of ESL learners with AI-assisted writing tools. With the help of interview protocols, researchers were able to investigate the attitude and thoughts of the participants in their own lexical patterns, avoiding a strictly focused use of textual artifacts or automated aspects of performance quality (Creswell and Poth, 2018). The analytic process was structured using interview guide and addressed the followings of focus:

- The experiential experiences of the respondents with AI-based writing assistance tools.
- The perceived benefits and challenges related to the use of AI in academic writing.
- Strategies adopted to integrate AI-generated feedback into the process of writing.

- The implications of AI on autonomy, creativity, and decision-making of learners.
- Ethical and practical concerns based on the implementation of the AI technologies.

The interviews are put in a dialogic format whereby participants are allowed to elaborate their answers, and the researcher is also very rigorous with their methodology in each session. Each encounter is getting systematic notation and audio recording, which are obtained during and right after the encounter. The data obtained as a result provide a background of understanding the cognitive and experience processes of learners, thus complementing analyses of text and corpus. Unstructured interviews are especially promising in reducing the risk of misunderstanding that can be obtained in case of complete reliance on the textual analysis alone, therefore, seeing to the recorded and supported opinions of learners.

3.2.2 Think-Aloud Protocols

Think-aloud protocols are possibly one of critical qualitative data-collection methods to describe the real-time cognitive processes of ESL learners when they composed AI-assisted academic texts. The methodology allowed researchers to study the real process of making decisions, solving problems and dealing with AI-generated proposals and not merely rely on post-hoc accounts or completed work (Ericsson and Simon, 1993). This process is organized through a protocol guide and is focused on the next elements:

- The strategies of learners in incorporating AI feedback format into their writing.
- The grammatical, lexical, and syntactic errors will be recognized and corrected as quickly as possible.
- Rational decision-making involving sentence structures, word use and text coherence.
- Examples To use AI in situations where learners do not need to solve problems independently.
- Evaluative considerations of AI recommendations by learners in their conversations.

Participants are asked to read out their inner monologue as they write essays and the researcher writes in detail field notes and audio evidence to ensure that one is able to capture these mental processes in a systemic way. Think-aloud protocols bring forth the results of empirical observations on the mental activities of the learners that complement the information found in interviews and in corpus-based analyses. Such methodological strategy addresses the flaws of the former self-reported techniques and makes the succeeding analysis to be representative of the real writing behaviors and additionally defines the true impact of AI assistance on ESL students writing behaviors.

3.3 Population and Sampling

Population

The target groups of the proposed study include undergraduate students of ESL in Government Graduate College, Zafarwal. These participants represent a divergent range of academic fields and language business acumen levels and thus they may offer a suitable formalize of analyzing the implementation of AI-aided writing applications to higher education. They also habitually perform academic writing activities, such as essays, assignments, and reports that are invaluable in determining the impact of AI in terms of writing performance. The applicability of such population is also supported by the fact that such learners may be already acquainted with digital technologies and technology-dependent learning settings, which will allow exploring veritable encounters with AI in ESL academic writing.

Sampling Technique

A purposive sampling design is used in the study as it involves participants being chosen based on relevance and substantive relevance to the research objectives (Creswell and Poth, 2018). The inclusion criteria is the following:

- Undergraduate admissions to ESL or English-related courses in Government Graduate College, Zafarwal.

- Finishing two or three academic semesters.
- Pre-existing knowledge applications of AI-assisted writing resources in academic work.

The obtained sample suffices to allow conducting an in-depth qualitative study, and the sampling was continued until the stage of the data saturation since the latter is defined as the moment, when no new themes were obtained during the interview or think-aloud protocols (Merriam and Tisdell, 2016). Such a purposive methodology can ensure the provision of information-rich cases that would provide subtle information, as opposed to ensuring statistical representativeness.

3.4 Data Collection Procedure

The data-gathering process used in the research involves using a multi-step approach, which is systematic due to focusing on both linguistic peculiarities and the experiences of learners concerning AI-based academic writing. The following are some of the steps that will be followed:

Step 1: Select the participants

Purposive sampling is used to make sure that every participant has a substantive significance to research purposes (Creswell and Poth, 2018). The operationalized inclusion criteria include: (i) participating in the English or ESL programs at Government Graduate College, Zafarwal as an undergraduate; (ii) having attended at least one academic semester; and (iii) having used AI-assisted writing applications previously. It is a method that ensures the sampling of information-rich cases and allows to explore the experience of the learners and writing in a detailed manner. The recruitment process continues until data saturation is reached which is the stage at which new information will not be produced by the extra participants (Merriam and Tisdell, 2016).

Step 2: AI Assisted and Non-AI assisted Writing sample collection

Each participant was required to provide two groups of essay tasks: (i) AI-aided essays, which he or she writes using linguistic support like grammar checkers or predictive-text generators or AI language models; and (ii) non-aided essays, that he or she writes without the use of linguistic aids. Systematically documented are related metadata such as learner proficiency, subject area and particular AI tool used. The corpus of truly occurring texts that is the resultant corpus allows the linguistic analysis, and it allows analyzing the lexical diversity, syntactic complexity, cohesion, and accuracy of grammar.

Step 3: Without Prearranged Guidelines, Interviews

The interviews of this type are unstructured, during which the attitude, perceptions, and strategies of the participants concerning the use of AI-tools are captured (Creswell and 'Poth, 2018). Open-ended questions allow the respondents to describe their experience with AI, the issues that have arisen, the positive aspects, and how AI has affected autonomy and creativity. The interview were audio-recorded and came up with detailed field notes hence guaranteeing the proper documentation of the claim made by the respondents and provide contextual information which supplements the textual information.

Step 4: Think-, Procedure of Conducting Protocols

The subjects were asked to read their cognition process when writing an AI-assisted and non-assisted essay. The think-aloud protocols that come as a result include real-time thinking processes, such as the decision-making and problem-solving process, as well as experiences with AI feedback (Ericsson and 93 93). The sessions were audio-recorded and transcribed in depth, which would allow examining the degree to which participants depend on AI and the approaches of introducing its recommendations. This qualitative design methodology provides a comprehensive insight into the cognitive involvement of learners in doing the writing activities.

Step 5: Arranging and Preparation of Data Analysis

Each and every data (writing samples, interview transcripts, and think- aloud recordings) is transcribed systematically, coded, and organized. The samples of writings are then formatted into a corpus usable

to have the information be computed using programs like Ant Conc or Sketch Engine but the qualitative information of writing is subjected to thematic coding. This systematic organization not only enforces rigor, improves reliability, but also allows triangulation to be made between the sources of data, which allows the study to provide a comprehensive representation of the linguistic and cognitive effects of AI-assisted writing on ESL learners.

3.5 Trustworthiness of the Study

To ensure rigor, the current study uses the criteria suggested by Lincoln and Guba (1985) to confirm the credibility of the qualitative research.

Credibility: Triangulation of various sources of data such as AI-aided and non-aided samples of writing, unstructured interviews, and think-aloud documents give the current study credibility. The extent of tracking the participants during the data collection process allowed the researcher to study their experiences and writing styles in depth, which minimized the possible bias and contributed to the accuracy of interpretations.

Transferability: Due to the extensive description of the contextual views of the involved participants, their academic environment, level of proficiency, and interplay with AI-assisted writing systems, transferability is ensured. Through these abundant contextual information, other scholars can be able to assess whether the results can be applicable in similar ESL learning settings.

Reliability: Dependency has been maintained through articulated recording of all methodological choices such as sampling policy, data collection process, coded schemes as well as preparation of corpus. Such documentation creates distinct audit trail, which makes the research processes to be consistent and transparent.

Confirmability: Confirmability is strengthened by confirmation and by grounding interpretations on the data of the participants. The researcher takes constant care of her own prejudices and makes sure that the results are based on valid answers of the participants and written material, but not based on her own subjective interpretations, which would increase the objectivity of the research results.

This conceptualized usage of the criteria presented by Lincoln and Guba serves to make the qualitative findings of the current work rigorous, reliable, and based on empirical evidence, thus providing credible information on the topic of AI-assisted academic writing in ESL.

3.6 Ethical Considerations

This research is ethical as informed consent was received by the subjects and all remained confidential and anonymous, and participants had freedom of choice in the study, and could pull out at any time. The data are stored safely and can only be used in research; thus, the right of the participants is respected and responsible and in an ethical fashion of conducting research (Creswell and Poth, 2018).

Discussion and Findings

The chapter describes both the discussion and findings of the study, uniting the corpus-based linguistic analysis with the inferences provided in qualitative. It contrasts AI-assisted and non-assisted ESL writing in terms of linguistic characteristics, cognitive strategies, learners' perceptions, and the overall influence on the writing style/performance, which allows identifying the generally recurring patterns, perceived advantages, and possible issues related to the use of AI.

4.1 Linguistic Characteristics of Writing

The initial important question of interest is the linguistic characteristics of ESL academic texts and it analyzes the role of AI assistance on the determination of lexical, syntactic, and grammatical pattern and cohesive devices. Analysis of the corpus has shown that manuscripts that are supported by AI have a higher degree of lexical diversity as well as a broad range of vocabulary than those supported by non-assisted ones. Type-token proportion and lexical density measures posit that AI tools make more

accurate lexical decisions and domain specific vocabulary thus aiding learners to produce more formal and elaborate prose (Biber, 1998, 2009).

AI-assisted texts are more likely to consist of longer sentences, denser in clauses, and more complicated sentence structures in terms of syntactic complexity. The integration into the subordinate clauses and the application of different syntactic constructions presuppose that AI systems scaffold the sentence-formulating processes of learners encouraging the more organized and coherent formulation.

In terms of grammatical correctness, AI-assisted writing shows an impressive decline in the most common mistakes such as verb tense, subject verbal agreement, and the use of articles. However, the phrasings that are suggested by AI, sometimes introduce unnatural or formulaic structures which can be a threat to authenticity.

Lastly, there is a higher use of cohesive devices and discourse markers in the manuscripts that are supported by AI. There is a systematic use of transition words, reference markers and other cohesive devices which adds overall clarity and flow of the text. These outcomes demonstrate the ability of AI devices to influence the linguistic utterance, improving not only the surface-level but also the structural complexity, with 3rD under the same condition, being concerned with the authenticity and individuality being maintained at the same time.

4.2 Cognitive Processes of Learners

The second point of focus is the aspect of studying the cognitive processes of learners when writing with the assistance of AI and without it, which is reflected in the think- aloud protocols. These protocols provide real-time decision-making, problem-solving and interactions of the participants with AI suggestions that provide insights into how AI mediates writing strategies (Ericsson & Simon, 1993).

As it is analyzed, learners who make use of AI assistance often use it to plan their strategies, including choosing various vocabulary suggested by the tool, changing sentence structure, and restructuring ideas to be understandable. According to the participants, AI-suggestions make them start thinking about the ways to put the same sentence or make the grammatical structure better to improve metalinguistic awareness. Nevertheless, there are learners that show excessive dependence on AI that does not suggest anything in a critical way, which sometimes can create formulaic or contextually inappropriate sentences. Conversely, non-assisted writing makes learners to use only inner knowledge and previous learning, thus leading to an increase in the extent of self-initiated problem-solving but also increases the occurrence of grammatical and structural mistakes. This dichotomy shows that AI instruments can be used as mental aids and can be helpful to the writers in their process, but at the same time, it guides the focus, in decision-making, and the interaction process.

Think-aloud protocols therefore demonstrate that AI support does not only affect the linguistic production but also deeply impact on cognitive strategies of learners, causing the development of more language awareness and introduction of the dependencies patterns which should be guided by the pedagogue to maximize the learning process.

4.3 Learner Perceptions and Attitudes

The third important area investigates the perceptions and opinions of learners towards AI-assisted writing using semi structure interviews. The positive experiences mentioned by the participants were mostly described positively as the AI helped participants make their essays more accurate, with better vocabulary, structure, and more organized. The feedback on grammar and sentence structure on a per-text/per-line basis was appreciated by many learners and eased the anxiety levels as well as confidence in performing academic writing assignments (Creswell and Poth, 2018).

Some of the learners brought out motivational factors in the AI help, which meant that the corrective suggestions prompted them to test out new vocabulary and sentence structure. Another benefit to them

of AI tools was that they would help them manage their time better by being able to revise more quickly and draft an outline more effectively.

Nevertheless, a few participants expressed the problem with over-dependence on AI. They noted that overreliance on automated recommendations may hinder the ability to make decisions by anyone and Innovation. Some learners in the minority feared that, there would be times, when occasionally, there would be misplacement or formulaic recommendations that were not responsible to the contextual information required in their essays.

The interviews indicate that although AI tools have been appreciated on improving linguistic accuracy and confidence, there should be a close supervision to ensure that learners are autonomous, critical, and original in their scholarly compositions. These results give the necessary background to the understanding of linguistic and cognitive findings.

4.4 AI and Effect on Writing Style and Performance

The fourth discussion field explores the net effect of AI on the writing style and writing performance of learners in combination with corpus analysis and qualitative explanations. The results prove that texts with AI assistance have a more structured form, a more consistent probability of using cohesive devices, and the ability to express ideas better than unassisted essays. The positive results of AI tools usage were lower clarity, formality, and compliance with writing conventions, thus contributing to a better quality of writing (Biber, Conrad, and Reppen, 1998).

The analysis of the corpus has indicated that in some cases the assistance of AI adds formulaic phrases or repeated sentence patterns which indicates a trade-off between the structural accuracy and the stylistic originality. Whereas to learners AI may be helpful in grammar, vocabulary and cohesion, qualitative information on interviews and think-alouds also shows that excessive dependence can possibly restrict creative expression and voice.

Furthermore, AI tools have an effect on the strategy of revision among the learners, encouraging them to edit their papers more systematically, with increased focus on sentence-level accuracy and using more complex vocabulary. Non-assisted text, though more original in speech, is characterized by a higher rate of errors, and lack of coherence of flow.

The results of AI assistance positively influence the writing performance because it improves accuracy, cohesion, and structural organization. However, in order to maximize the benefit of learning, teachers should act between the employment of AI and the use of strategies that foster innovation, critical thinking, and writing skills in a non-dependent way.

4.5 Synthesis of the Findings

The researchers find out that AI-aided writing contributes to a significant improvement in linguistic accuracy, syntactic complexity, diversity of lexicon, and cohesion, and offers cognitive support to learners in writing tasks. Think-aloud protocols also prove that AI affects the process of problem-solving and decision-making, but when used too often it restricts independent thought.

Positive perceptions of the learner are evidenced in interviews related to the higher confidence, motivation, and efficiency with warning of formulaic writing. Generally, writing outcomes and the clarity of structure are enhanced with the help of AI, although originality and critical thinking need pedagogical advice. The results imply that AI applications can be useful in supporting ESL academic writing when implemented in a considered manner that optimizes the balance of assistance and career choice and creativity.

Implications and Conclusion

5.1. Implications

This research has a number of implications to the English-as-a-Second-Language (ESL) teaching, curriculum design and pedagogy of language. To start with, it appears that the beneficial effect of AI-assisted writing on the lexical diversity, the syntactic complexity, grammatical accuracy, and cohesion imply that teachers should consider using AI supplement as auxiliary resources in order to achieve the improvement in language learning (Biber, Conrad, and Reppen, 1998). The AIs act as cognitive scripting assistants, taking learners through revision, vocabulary, structure, especially among those finding it hard to meet academic writing demands (Ranalli, 2018).

Second, the knowledge gained in think-aloud protocols indicates why it is essential to teach learners how to think critically about AI propositions. Although AI also fosters efficiency, the avoidance of independent problem-solving and creativity, as well as individual voice, may happen (Ericsson and Simon, 1993). Teachers are, therefore, advised to use balanced methods in their teaching that will combine AI support with guided reflection, peer feedback, and teacher guidance (Creswell & Poth, 2018).

Thirdly, the research underscores the importance of integrating technology-enhanced writing tasks in the ESL curriculums that establish the ability among the learners necessary to operate in AI-assisted learning contexts in responsible ways (McEnery and Hardie, 2012). Lastly, the results highlight the role of learner freedom as the use of AI tools works best when students feel engagement with suggestions instead of passive acceptance of them. In general, the research can provide pedagogical practices based on evidence in blind ESL writing to integrate AI and support academic writing, encourage creativity, and promote learning in ESL writing.

5.2 Conclusion

The results of the research lead to the conclusion that AI-aided writing plays an important role in improving the quality of the writing of ESL students, supporting the lexical richness and complexity of syntax and cohesion, and precision of grammar (Biber, Conrad, and Reppen, 1998). The AI tools work as a scaffold on top of real-time decision-making and provide instantaneous feedback, thus enhancing metalinguistic awareness and systematic writing habits (Ranalli, 2018). Analysis of corpus proves that AI assistance results in a more formal, coherent and academically appropriate text and that qualitative data indicate that learners are more confident and even more motivated (Creswell and Poth, 2018).

Nevertheless, possible limitations identified in the study included excessive use of AI-generated recommendations, impersonal language, and loss of creativity (Ericsson and Simon, 1993). Think-aloud procedures suggest that students may be inclined to follow AI suggestions blindly, which needs to be addressed through pedagogical interventions that ensure equal significance of assistance and cognitive autonomy in the learners.

The study proves that, when applied intelligently AI tools can improve the process and product of ESL academic writing. These null results recommend curricular supports which combine AI support and reflective practices, teacher direction and autonomy-building activities, so as to have the learners gain advantages of technology without undermining originality, critical thinking and personal expression (McEnery and Hardie, 2012).

5.3 Future Recommendations

On the basis of the findings, AI-assisted writing tools should be introduced into ESL programs with the purpose of being used wisely and with guidance on the critical engagement. Teachers are to plan the training to create skills in assessing AI recommendations, preserving originality, and utilizing feedback efficiently (Ranalli, 2018). Hybrid methods of AI assistance and teacher correction and peer evaluation can make autonomy and imagination stronger. Future studies may look at the longitudinal implications

of AI-aided writing on proficiency, the effect of various AI tools in various disciplines and may look at ways of discouraging over-dependence. These directions will help to maximize the pedagogic application of AI in ESL writing.

References

1. Biber, D., Conrad, S., & Reppen, R. (1998). *Corpus linguistics: Investigating language structure and use*. Cambridge University Press.
2. Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage Publications.
3. Ellis, R. (2015). *Understanding second language acquisition* (2nd ed.). Oxford University Press.
4. Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data* (Rev. ed.). MIT Press.
5. Granger, S. (2008). Learner corpora. In A. Lüdeling & M. Kytö (Eds.), *Corpus linguistics: An international handbook* (pp. 259–275). Mouton de Gruyter.
6. Hyland, K. (2019). *Second language writing*. Cambridge University Press.
7. Johnson, T., & Smith, R. (2022). AI-assisted writing in higher education: Implications for learner autonomy and language development. *Journal of Second Language Writing, 57*, 101–117.
8. Li, X., & Chen, Y. (2021). Comparative analysis of AI-assisted and non-assisted ESL writing: A corpus-based study. *Language Learning & Technology, 25*(3), 45–66.
9. Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.
10. McEnery, T., & Hardie, A. (2012). *Corpus linguistics: Method, theory and practice*. Cambridge University Press.
11. Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.
12. Ranalli, J. (2018). Automated written corrective feedback: How well can students make use of it? *Computer Assisted Language Learning, 31*(7), 653–674.
13. Strobl, C., Ailhaud, E., Benetos, K., Devitt, A., Kruse, O., Proske, A., & Rapp, C. (2019). Digital support for academic writing: A review of technologies and pedagogies. *Computers & Education, 131*, 33–48.
14. Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.
15. Zhang, H. (2020). AI in academic writing: Ethical considerations for ESL learners. *Journal of Educational Technology & Society, 23*(4), 88–101.
16. Creswell, J. W., & Poth, C. N. (2018). Semi-structured interviews. In *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage Publications.
17. Creswell, J. W., & Poth, C. N. (2018). Sampling technique. In *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage Publications.
18. Ericsson, K. A., & Simon, H. A. (1993). Think-aloud protocols. In *Protocol analysis: Verbal reports as data* (Rev. ed.). MIT Press.
19. Hyland, K. (2019). Conceptual framework. In *Second language writing*. Cambridge University Press.
20. McEnery, T., & Hardie, A. (2012). Theoretical framework. In *Corpus linguistics: Method, theory and practice*. Cambridge University Press.
21. Strobl, C., et al. (2019). Technologies for digital academic writing support. *Computers & Education, 131*, 33–48.

22. Ranalli, J. (2018). Future recommendations. In *Automated written corrective feedback: How well can students make use of it? Computer Assisted Language Learning, 31*(7), 653–674.