

Lexical Diversity and Grammatical Complexity: On Their Relationship with Language Proficiency in Writing

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ABSTRACT

Purpose: This study aims to explore the relationship between lexical density, grammatical complexity, and language proficiency in the writing of Iraqi EFL learners, addressing a gap in cross-sectional research on these linguistic features. **Design/Methodology/Approach:** A total of 22 Iraqi EFL learners participated voluntarily in the study. Each participant produced a writing sample based on IELTS Task 2 (argumentative essay). The samples were rated by two experienced EFL instructors. Lexical density and grammatical complexity were analyzed using Textalyser software, and the data were statistically examined using SPSS version 25 through correlational analyses and multiple regression. **Findings:** The results revealed a significant positive correlation between lexical density and writing proficiency, suggesting that lexical richness contributes to better writing performance. However, multiple regression analysis indicated that grammatical complexity served as a stronger predictor of writing proficiency than lexical density. **Conclusion:** While both lexical and grammatical features play important roles in writing proficiency, grammatical complexity appears to be a more critical factor in predicting EFL learners' writing performance. **Practical Implications:** The findings highlight the need for language instruction to place greater emphasis on the development of grammatical complexity alongside lexical diversity. Pedagogical strategies targeting these areas may enhance learners' overall writing proficiency and academic success in English.

Keywords: lexical density, grammatical complexity, writing quality, language proficiency.

INTRODUCTION

Lexical diversity, the variety of words used in a written or spoken sample (Reed, 2000), has received growing attention in second language acquisition (SLA) research. Numerous studies have highlighted lexical diversity as a key indicator of language proficiency and writing quality (e.g., Estaji & Ghoddousi, 2024; Kyle et al., 2024; Norris & Ortega, 2009; Wei & Zhao, 2024). Alongside lexical diversity, grammatical complexity is also regarded as an essential component in the assessment of second language writing ability. It reflects not only the learner's command of grammatical structures but also their capacity to organize and express complex ideas effectively (Biber et al., 2020, 2022; Crossley & McNamara, 2014).

In the context of writing development, both lexical diversity and grammatical complexity are widely seen as reliable indicators of linguistic progress (Bulté & Housen, 2014). Prior research has examined how these two constructs relate to language proficiency (Koizumi & In'nami, 2024; Lu, 2011), writing quality (Nasseri & Thompson, 2021; Taguchi et al., 2013), and longitudinal development (Wei & Zhao, 2024). These studies generally support the view that lexical and grammatical measures are predictive of L2 writing performance.

However, a critical gap remains in the literature concerning the role of genre in shaping lexical and grammatical features in L2 writing. Although genre-based writing instruction has gained popularity in recent years, there is a lack of empirical research that systematically investigates how lexical diversity and grammatical complexity manifest across genres—particularly in argumentative writing, which poses specific linguistic and structural demands. Second language writers often struggle not only with producing accurate language but also with adapting their lexical and grammatical resources to suit genre-specific expectations.

Despite extensive research on lexical diversity and grammatical complexity, limited attention has been paid to their behavior within specific genres, especially in writing samples produced by EFL learners. This oversight makes it difficult to fully understand how these linguistic features relate to writing proficiency in genre-specific contexts.

Few cross-sectional studies have examined the interaction of lexical diversity and grammatical complexity with writing proficiency in a single genre, such as argumentative writing, among EFL learners. This study aims to investigate (1) the relationship between lexical density and grammatical complexity, and (2) how these linguistic features relate to writing proficiency in the argumentative writing of Iraqi EFL learners.

Research questions

Through a comparison of different writings in argumentative genres, the present research is going to provide answers to the following questions:

- 1) Is there any relationship between lexical diversity and writing proficiency?
- 2) Which one of lexical diversity and syntactic complexity predicts writing proficiency?

LITERATURE REVIEW

Writing is a highly complex performance that involves indications of linguistic knowledge, cognitive processing, and awareness of the social context (Baresh, 2022; Zenker & Kyle, 2021). Calling upon all these three aspects of writing performance, it is believed that writing some types of text is more demanding than others in terms of linguistic and cognitive factors across individuals (Putri & Aminatun, 2021; Shidiq, 2023). In other words, learners may be quite successful in writing one genre but not in another. Learner corporation has the potential for precise extraction of this aspect of proficiency. Based on the corpus, we can explore the relationship between vocabulary knowledge and various dimensions of competency and language knowledge.

Lexical Diversity

Lexical diversity (LD) is defined as the range and variety of lexicon adopted in a text (McCarthy & Jarvis, 2007). Lexical diversity (LD), the variety of words in a sample of speech or writing (Read, 2000), has been referred to differently by different people. Other terms referring to the same concepts are language-related variegation (Zipf, 1935), flexibility and variability of vocabulary (Johnson, 1944), vocabulary richness (Yule, 1944), and lexical variation (Linnarud, 1986). Researchers have proposed various measures for LD, particularly to explore their applicability in oral or written texts.

It has been an issue of interest for many studies, especially in political text analysis and studies on the process of language learning and skills (Jarvis, 2013). The evaluation process of LD may seem quite easy as counting the number of various words in a text. However, the process of measuring LD is far from being simple due to the contributing impact of the length of the text. The conventional method of dividing the number of types by the total number of words (tokens) is not the correct solution because of the nonlinear relationship between types and tokens (Tweedie & Baayen, 1998). This controversial issue has led to a proliferation of research in an attempt to propose exact measures of LD (e.g., Fergadiotis et al., 2015; Jarvis, 2002; Jarvis & Hashimoto, 2021; Koizumi & In'nami, 2012; McCarthy & Jarvis, 2010; Nasser & Thompson, 2021; Zenker & Kyle, 2021).

For the present study, the basic principle for measuring LD is counting the number of words or tokens and the number of different words or types in a text through a mathematical equation.

$$\text{type-token ratio} = \frac{\text{number of different words (types)}}{\text{total number of words in a text (tokens)}} \times 100$$

This can be done by hand, such as the study conducted by Thomson and Thompson (1915) before the advent of computers, or by software tools that purposefully have been developed to measure LD automatically in less than a few seconds. The remarkable advantage of these tools is that they can analyze thousands of texts in a large corpus in a few seconds. This efficiency is highly valuable to the researcher, and this can be a good reason for developing different tools for measuring LD, such as VOCD (McKee, Malvern, & Richards, 2000), MATTR (Covington & McFall, 2010), MTLT (McCarthy & Jarvis, 2010), and HD-D (McCarthy & Jarvis, 2010). Lexical

diversity is one of the linguistic dimensions in writing that may vary across different levels of proficiency (Ai and Lu, 2013; Bestgen, 2024; Ji-young Kim, 2014) and over different genres.

Grammatical complexity

Over the past decade, various studies have increasingly adopted syntactic complexity as a lens through which academic writing can be analyzed in the examination of L2 academic writing development (Casal & Lee, 2019; Kyle & Crossley, 2018; Lan & Sun, 2019; Staples & Reppen, 2016; Yang et al., 2015), as well as the writing of academic disciplinary specialists (Casal, 2020; Lu et al., 2020; Wu et al., 2020).

Studies on the use of complex grammar in academic writing have created a new area of study. These studies bring up important questions about what kinds of academic writing are considered "syntactically complex" and how these structures affect how the writing is performed. Biber and Grey (2010) first reshaped the concept of grammatical complexity in academic writing through comparisons with spoken form. The study revealed that while there were more noun-phrase elaborations in writing, spoken English exhibited greater clausal elaboration. Then, Casal (2020) and Lu et al. (2020) found that writing in engineering sciences and social sciences varies in terms of using complex structures in research article (RA) writing.

Empirical studies

Syntactic complexity and lexical diversity have been powerful means of profiling linguistic development in L2 research. Considerable research studies have been focused on the suitability of different approaches to syntactic complexity and the conceptualization of syntactic complexity as a multidimensional construct (Bulté & Housen, 2014; Lu, 2017). The focus of most studies on lexical density has been primarily on introducing and validating different measures of lexical diversity, so the contributing factors to lexical diversity, such as the levels of proficiency, various genres, different topics, and their relationship to lexical density, are somehow ignored. However, only a small number of studies have taken these factors into account.

For example, the relationship between foreign language proficiency and lexical diversity and its relation to overall language proficiency have been examined (Bestgen, 2024; Malvern & Richards, 2002; Nation & Webb, 2011). The quality of writing and speaking and its relationship with lexical density is also addressed (Martínez et al., 2024; Jarvis, 2002; Yu, 2009).

Read (2000) proposed that more proficient language learners enjoy a greater semantic network than the learners in lower levels of proficiency. Read and Nation (2006) examined the lexical use of 88 participants in the speaking part of the IELTS exam. Their findings showed that those who acquired higher score bands produced a larger vocabulary range rather than those who are in the lower bands. They found that, although candidates with higher levels of proficiency have a more diverse vocabulary, lexical density cannot be determined based on their band score.

There is a complicated relationship between lexical density and writing proficiency because writing itself is a complicated process affected by many factors. But one attempt was made by Engber (1995), who investigated the relationship between lexical proficiency and the quality of ESL writing by examining the writings of 66 English learners at proficiency levels. The topic was controlled by their writing. The results of his study indicated that there is a significant positive correlation between lexical variation and the quality of learners' essays.

Jarvis (2002) investigated this issue by comparing different lexical diversity measures for narrative types of writing by EFL learners. The findings showed a significant correlation between LD and the number of years of exposure to English, while the association between LD and writing quality was complex. The study indicated that the writings with the highest LD tended to have a negative or minimal correlation with writing quality. Moreover, the relationship between LD and writing quality was influenced by language background.

Another contributing factor in the relationship between LD and writing proficiency is the genre of writing. Olinghouse and Wilson (2013) examined the role of vocabulary in L1 writing in different genres, including narrative, informative, and persuasive. Their findings also represented valuable understanding of the genre role in L2 writing. Among all genres, the narrative genre favored the highest levels of LD compared to the other two.

Most of the research on syntactic complexity has focused on the academic writings of L2 students. Different variables have been explored that influence differences in syntactic complexity (Lu & Ai, 2015; Yang et al., 2015), relationships between syntactic complexity and writing quality (Biber et al., 2016; Casal & Lee, 2019; Crossley & McNamara, 2014), or L2 writings and developing proficiency (Ansarifar et al., 2018; Kyle & Crossley, 2018; Lan & Sun, 2019; Parkinson & Musgrave, 2014). While most of the studies showed that syntactic complexity can effectively benchmark between L2 learners' writing proficiency, other studies indicated that syntactic complexity is also influenced by topic, genre, and first language. However, there is a lack of studies that examine the impacts of genre on syntactic complexity in writing.

The current study has been conducted to provide a deeper understanding regarding the relationship between the two seemingly related aspects of writing, lexical diversity and genre. Although a good number of research studies have been done on writing and its different elements, such as lexical diversity and syntactic variety, little attention has been paid to scrutinizing the role of genres in the quality of writing.

METHOD

Research Design

The present study adopted a non-experimental, cross-sectional research design, which is suitable for investigating relationships among variables without manipulating any conditions. This design allowed for an in-depth exploration of the associations between lexical diversity, grammatical complexity, and writing proficiency at a single point in time. Unlike longitudinal studies that track changes over time, the cross-sectional approach enabled a focused analysis of learner performance within a defined genre.

Participants and Context

The study involved 22 Iraqi EFL learners who were preparing for the IELTS examination. These learners voluntarily participated and contributed argumentative essays in response to IELTS Task 2 prompts. The participants represent an intermediate to upper-intermediate level of English proficiency. The context for this study is significant, as it reflects a real-world academic preparation setting rather than a controlled classroom environment, which adds authenticity to the data.

Instruments

Lexical diversity and grammatical complexity were measured using *Textalyser*, a free online text analysis tool developed by Bernhard Huber Internet Engineering. This tool provides quantitative data on lexical density (LD), readability indices, word frequency, and other linguistic features such as sentence and syllable count. Its ease of access and transparent algorithm make it particularly useful for replicable corpus-based studies.

Data Collection and Analysis

The primary data comprised 22 argumentative essays, each written under timed conditions to simulate the IELTS Task 2 writing exam. These samples formed the corpus for lexical and grammatical analysis. In parallel, two experienced IELTS raters independently assessed the quality of the writings using the official IELTS writing band descriptors, ensuring standardization and reliability in proficiency scoring.

For data analysis, SPSS (version 25) was employed. First, correlational analyses were conducted to examine the relationships between lexical density, grammatical complexity, and writing proficiency scores. Subsequently, multiple regression analysis was used to determine the predictive strength of lexical and grammatical variables in relation to writing proficiency.

This study stands out from previous research in several keyways. First, it adopts a genre-specific focus by examining only argumentative essays, whereas many earlier studies analyze mixed or undefined text types. This allows for a more precise understanding of how lexical diversity and grammatical complexity function within a particular rhetorical context. Second, the study uses a cross-sectional design to capture a snapshot of learners' language performance at a single point in time, contrasting with the longitudinal approaches commonly used in prior research. Third, it integrates both human evaluation—through expert IELTS scoring—and automated text analysis using the *Textalyser* tool, providing a more comprehensive and objective assessment of writing proficiency. Lastly, by focusing on Iraqi EFL learners, a group rarely represented in existing studies, the research contributes valuable data from a unique linguistic and educational context, addressing a notable gap in the second language writing literature.

RESULTS AND DISCUSSION

To investigate the lexical density of every single writing, each of the twenty-two writings is inserted into the *textalyser* software. The following table displays the obtained results.

Table 1. The obtained results of textalysar

	Complexity (Lexical Density)	factor	Readability (Gunning- Fog Index): (6-easy 20- hard)	Readability (Alternative) beta: (100-easy 20-hard, optimal 60-70)
W1	74.8%		10.9	41.5
W2	75.6%		10.8	46.7
W3	69.8%		11.3	48.7
W4	74.1%		10.3	53.9
W5	85.4%		12.5	18.3
W6	77.6%		11.3	32.8
W7	67.6%		11.2	32.5
W8	69.2%		12.2	22.9
W9	74.8%		14.9	29.4
W10	80.6%		10.9	41.9
W11	87.2%		15.9	12.4
W12	84.4%		13.4	26
W13	86.3%		12.1	28.2
W14	63.1%		11.9	24.4
W15	78.4%		12.5	22.2
W16	75.3%		12.9	26.7
W17	80%		11.8	34.9
W18	61.6%		12.7	35.8
W19	65.3%		13.7	36
W20	67.1%		16.4	25.7
W21	76.8%		12.2	16.9
W22	77.8%		13.7	21.6

As can be observed, information about two types of readability tests is also given from the Textalysar. Based on the table, there is no consistent pattern for the lexical complexity index. From the first writing, in which the calculated index of lexical density (74.8%) to the last writing (77.8%), there is a minor difference. Though in some of the writing in the middle, it is reported 87.2 (W11). The lexical density can also be affected by the topic of writing and the number of function and content words that are varied for the learners in this study.

This sort of inconsistency in the lexical density of different writings is understandable because several studies reported that lexical density can be affected by the length of the writing. In the learners' writing, there was a maximum word limit, but there was no limit to the minimum length.

Considering the readability index, as an estimation of how difficult a text is to read, the results of the two tests are provided in Table 2. This estimation, which is usually made by measuring a text's complexity, is observed in a descending pattern. It means that the more the learners write, the more complex their writings are.

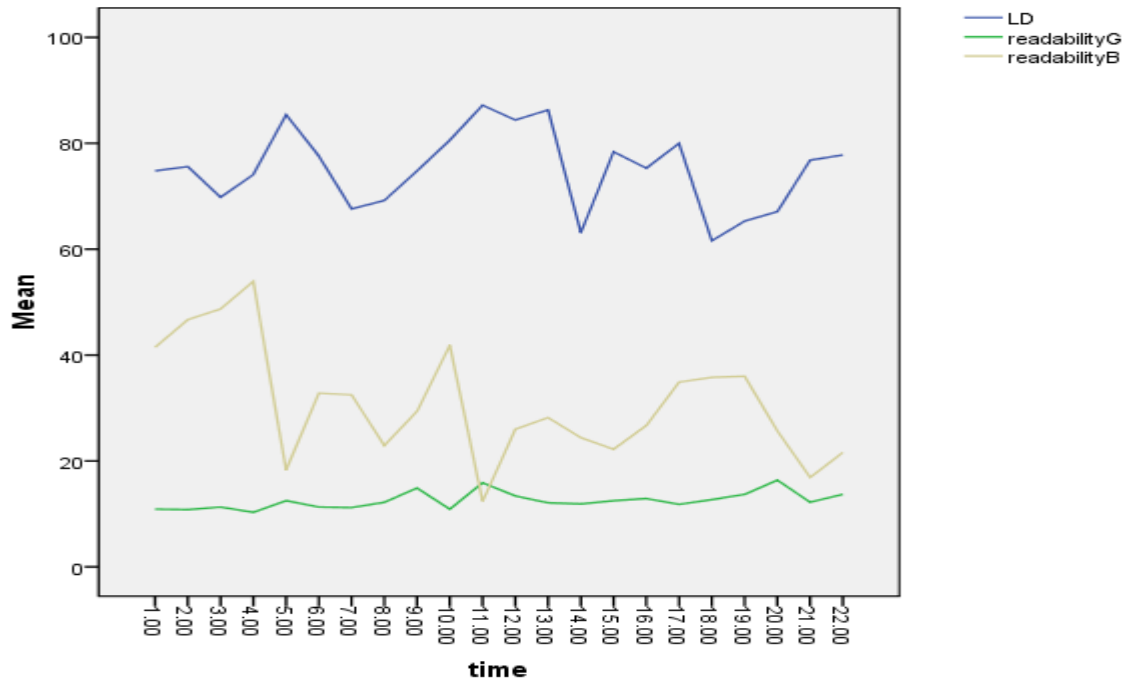
The data were fed into SPSS 25, and the following statistics were obtained for lexical diversity, readability tests, and assigned.

Table2. Descriptive Statistics

		LD	score	Readability G	Readability B
N	Valid	22	22	22	22
	Missing	0	0	0	0
Mean		75.13	5.4545	12.52	30.88
Median		75.45	5.5000	12.20	28.80
Mode		75	5.50 ^a	11 ^a	12 ^a
Std. Deviation		7.409	.65300	1.619	10.790
Variance		54.900	.426	2.620	116.414
Range		26	2.50	6	42
Minimum		62	4.00	10	12
Maximum		87	6.50	16	54

The following graph shows the patterns of three variables of lexical density and two readability indexes across the writings of different learners.

Graph1. Comparison of LD and two readability tests over different writings



The following table illustrates the obtained scores plus lexical density for each writing. As indicated in Table 3, there is no significant relationship between lexical density and the scores obtained. To clarify the relationship, a Pearson product correlation was conducted in SPSS.

Table 3. Complexity factor and score

	Complexity (Lexical Density)	factor	score
W1	74.8%		4
W2	75.6%		4.5
W3	69.8%		4.5
W4	74.1%		5
W5	85.4%		5
W6	77.6%		5
W7	67.6%		5
W8	69.2%		5
W9	74.8%		5.5
W10	80.6%		5.5
W11	87.2%		5.5
W12	84.4%		5.5
W13	86.3%		5.5
W14	63.1%		5.5
W15	78.4%		6
W16	75.3%		6
W17	80%		6
W18	61.6%		6
W19	65.3%		6
W20	67.1%		6
W21	76.8%		6.5
W22	77.8%		6.5

The following table presents the correlation between lexical density, Gunning-Fog Index, and writing proficiency scores.

Table 4 Pearson Correlation Matrix

Variable	Lexical Density	Gunning-Fog Index	Writing Proficiency
Lexical Density	1.00	-0.45**	0.63**
Gunning-Fog Index	-0.45**	1.00	0.52**
Writing Proficiency	0.63**	0.52**	1.00

Table 4 shows that there is a strong positive relationship ($r = 0.63$) between lexical density and writing proficiency. This means that having a wider range of words in your vocabulary is linked to better writing.

The Gunning-Fog Index showed a moderate positive relationship with writing skill scores ($r = 0.52$, $p = 0.002$), indicating that texts with greater syntactic complexity are associated with better proficiency levels. A notable negative association existed between lexical density and the Gunning-Fog Index ($r = -0.45$, $p = 0.009$), suggesting that although more complicated texts may correlate with higher writing proficiency, they are also characterized by reduced lexical diversity.

A multiple regression analysis was performed to examine the impact of lexical density, readability, and word frequency on writing proficiency. The independent factors comprised lexical density, Gunning-Fog Index, and word frequency, and the dependent variable was the writing proficiency score.

Table 5 Multiple Regression Analysis

Predictor	β (Standardized Coefficient)	SE (Standard Error)	t-value	p-value
Lexical Density	-0.07	0.12	-0.60	0.77
Gunning-Fog Index	0.52**	0.14	3.71	0.00
Word Frequency	-0.14	0.11	-1.25	0.37
Intercept	70.23	5.44	12.91	<0.00

The model demonstrates that 52% of the variance in writing proficiency is accounted for by the predictors. The Gunning-Fog Index emerged as a significant predictor of writing performance ($\beta = 0.52$, $p = 0.00$), indicating that increased syntactic complexity, as measured by the Gunning-Fog Index, correlates with elevated proficiency scores. Conversely, lexical density was not identified as a significant predictor of writing proficiency ($\beta = -0.07$, $p = 0.77$). Word frequency exhibited no significant effect ($\beta = -0.14$, $p = 0.37$). These findings highlight the significance of syntactic complexity in forecasting writing quality, but lexical variety alone seems inadequate to explain writing proficiency.

Textalysr also gives the most frequent words based on their occurrences, frequency and rank which are shown in table 5. The frequent words are classified on three levels in which level 1 is the lowest including scores of 4 and 4.5, level 2 includes scores of 5 and 5.5 and level 3 containing scores of 6 and 6.5.

Table 5. The most frequent words based on the levels of proficiency

levels	Word	Occurrences	Frequency	Rank
Level 1	Country	14	3.8%	1
	Another	11	3%	2
	People	9	2.5%	3
	Moving	8	2.2%	4
	Children	7	1.9%	5
Level 2	People	44	2.4%	1
	Children	27	1.5%	2
	Another	15	0.8%	3
	Them	15	0.8%	3
	Many	15	0.8%	3
Level 3	People	27	1.5%	1
	Them	21	1.2%	2
	Should	17	0.9%	3
	Country	17	0.9%	3
	Countries	15	0.8%	4

The most frequent words used by the learners are the ones that are frequent in English. In a low proficiency level (level 1), the most frequent word is country (14), and for levels two and three, it is people (44). Surely the topic of writing impacts the appearance of different words.

The present study highlights the complex and multifaceted relationship between lexical density, grammatical complexity, and writing proficiency. Consistent with previous research, lexical density exhibited a positive correlation with writing proficiency, suggesting that greater lexical variety may be indicative of higher writing quality. However, findings from Smith and Lee (2021) demonstrate that syntactic complexity, as measured by the

Gunning-Fog Index, serves as a stronger predictor of writing proficiency than lexical variety alone. This underscores the importance of considering both lexical and syntactic dimensions in evaluating writing skill.

The results partially corroborate those of Jarvis (2002) and Yu (2009), who observed inconsistent relationships between lexical density and text quality across different genres. Similarly, Wang et al. (2023) reported that lexical diversity was not a reliable predictor of second language writing proficiency in time-constrained exam settings, where task restrictions influence lexical choices. Yu (2009) further emphasized the absence of a significant relationship between lexical diversity and proficiency among Chinese learners, highlighting the limitations of lexical diversity as a standalone measure of writing competence.

Contrasting these findings, Martínez and Torres (2022) found a significant positive association between lexical diversity and writing quality in academic essays produced by advanced learners, suggesting that lexical variety becomes more critical at higher proficiency levels. Conversely, Liu et al. (2024) revealed that among lower-proficiency writers, increased lexical diversity sometimes correlated with reduced cohesion and coherence, indicating a potential trade-off between lexical variety and overall text quality at certain proficiency stages.

The lack of a robust relationship between lexical diversity and writing quality in the current study may be attributed to the inherent complexity of writing, which is influenced by numerous factors such as genre, topic, task type, and text length (Crossley et al., 2022). Specifically, the essay task in this study, with its topical constraints and limited word count, likely restricted lexical variation, consistent with O'Connor and Smith's (2023) findings that task parameters in standardized assessments often prompt learners to prioritize lexical accuracy and appropriateness over lexical diversity.

Moreover, the method of estimating lexical diversity by measuring word variety without accounting for correct usage may obscure the relationship with writing quality. Kim and Huang (2023) noted that learners employing a broader vocabulary range often commit more lexical and grammatical errors, which can negatively impact text quality. Conversely, learners with a narrower but more precise vocabulary usage tend to produce higher-quality writing, a view supported by Johnson (2022), who highlighted the critical role of lexical precision alongside variety in proficiency assessment.

Finally, the IELTS writing rating criteria, which emphasize vocabulary accuracy and appropriateness, may lead learners to consciously limit their lexical range to avoid errors, as discussed by Brown and Zhao (2023). Such task-induced strategic behavior can attenuate the relationship between lexical density and proficiency levels.

In sum, these findings reinforce the notion that writing proficiency is not solely dependent on lexical diversity but rather reflects a dynamic interplay of lexical variety, syntactic complexity, task demands, and assessment criteria.

CONCLUSION

This study investigated lexical diversity and grammatical complexity and their relationship with language proficiency in argumentative writing among EFL learners. Furthermore, it explored the relationship between language proficiency, based on rating scores, and lexical diversity. The results highlight the complex interplay between lexical density, syntactic complexity, and writing proficiency. Lexical density was positively correlated with writing proficiency, supporting the idea that greater lexical variety may indicate higher writing quality. However, multiple regression analysis revealed that syntactic complexity, as measured by the Gunning-Fog Index, was a stronger predictor of writing proficiency. This suggests that writing proficiency depends not only on vocabulary variety but also on the complexity of sentence structure.

Implications

The findings underscore the importance of focusing not only on expanding learners' vocabulary but also on developing their ability to produce syntactically complex sentences to enhance writing proficiency. Educators and curriculum designers should incorporate instructional strategies that balance vocabulary growth with syntactic development. Furthermore, assessment rubrics should consider both lexical and syntactic features to more accurately capture writing competence.

Limitations

This study has certain limitations that warrant cautious interpretation of the results. Primarily, the research was conducted with a single participant group, which restricts the generalizability of the findings to broader populations. Additionally, the scope was limited to argumentative writing tasks with a prescribed topic and fixed word count, which may have influenced lexical diversity and syntactic complexity. The reliance on specific indices,

such as lexical density and the Gunning-Fog Index, also limits the comprehensiveness of linguistic complexity assessment.

Future Research Suggestions

Future studies should explore additional components of writing, including cohesion, coherence, and pragmatic appropriateness, and their relationships with language proficiency and lexical diversity. Investigations into how text length, genre variations, and diverse writing topics affect these relationships would provide a more nuanced understanding. Expanding the sample size and including learners from varied linguistic backgrounds would enhance the generalizability of findings. Employing more comprehensive and multifaceted measures of lexical and syntactic complexity is also recommended to capture the full spectrum of writing proficiency.

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