



LEXICAL DENSITY AS IMPROVEMENT INDICATOR IN THE WRITTEN PERFORMANCE OF EFL MAJORS



 **Abdalla Elkheir Elgobshawi**^{1*}

 **Mohammed Aldawsari**²

¹*Department of English, College of Science and Humanities Prince Sattam bin Abdulaziz University, Saudi Arabia.*

Email: abd.mohammed@psau.edu.sa

²*College of Science and Humanities, English Department Prince Sattam bin Abdulaziz University, Saudi Arabia.*

Email: mh.aldawsari@psau.edu.sa



(+ Corresponding author)

ABSTRACT

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This study assesses lexical density in the written performance of a controlled sample of Saudi undergraduates majoring in English as a Foreign Language (EFL). It explores the relationship between lexical density and the quality of written performance by measuring lexical density in sample texts of learner's final exams. Linguistic content analysis was used on these texts to categorize terms and to find links between them. Each document's functional and content terms were counted and divided by the total words in the text to compute lexical density. The study reveals that the lexical density in the written performance of Saudi EFL undergraduates is categorized as less dense than that of their higher-level peers, indicating an increase in lexical density as students are upgraded to higher levels of study. The lexical density varies according to a learner's proficiency because the data obtained show differences between the lexical density scores of the two samples. The findings also suggest that the length of a text does not always imply that the content is lexically rich. The study provides evidence of the possibility of improving EFL learners' reasoning performance when this performance is characterized by lexical density. The study urges that raising teachers' awareness about lexical density and how it affects writing could also be a pedagogical implication of the current study.

Contribution/ Originality: This study contributes to the literature relevant to the assessment of the quality of the written performance of language learners. The study provides evidence that measuring text lexical structure by employing the method of lexical density could also be a significant index of the EFL learner's efficiency and writing proficiency.

1. INTRODUCTION

Ure (1971) introduced the word 'lexical density for describing lexical words' ratio to the total words in either written or spoken language forms. In general, lexical density is calculated as the proportion of word tokens, which are content words instead of function words. The lexical label *item*, as opposed to the lexical label *word*, would better align with the purpose of the current study. Halliday (1989) explained lexical items as constituents of variable length instead of words in the usual sense as they comprise more than one word, such as "call off" functions as a single lexical unit.

Li and Zhang (2021) explained that lexical density is helpful in differentiating texts' levels alongside the written-oral continuum. Denser information is packed by written language as compared to the spoken counterpart, as it is "reflective" instead of "active" in nature. The term lexical density is also frequently used when comparing aspects of

spoken and written guises of language. Spoken language has a lower lexical density than written language. It contains more function words, and the information is less packed. Conversational language comprises a smaller proportion of content words instead of written language because written language is more informative rather than conversational Halliday (1989). Malvern, Richards, Chipere, & Durán (2004) stated that the difference between spoken and written language is in terms of robustness and density of the language used for communicating.

Lexical density is also used to measure proficiency progress and identify differences in the abilities of foreign language learners. This application is based on the postulation that the advancement of learners is determined through the number of lexical words used in their writing.

1.1. Research Objectives

This study assessed lexical density in the written performance of a controlled sample of Saudi EFL undergraduates. It also explored the association between lexical density and the quality of written performance on the basis of scores attained by the learners in final exams. The study aimed at achieving the following two objectives:

1. To trace the impact of lexical density on learners' writing abilities.
2. To explore how the length of a written text could predict its lexical density.

1.2. Research Questions

The study addresses the following two questions:

1. Does lexically dense text indicate an improvement in the learner's written performance?
2. To what extent does the length of a written text determine its lexical density?

1.3. Problem Statement

Generally, the teaching of writing skills is devoted to reinforcing grammatical intricacy at a later stage of the language learning process, when an individual is learning new language structures or advanced text patterns. As a result, learners are more likely to become fully absorbed in deciding whether a given structure is well or ill-formed rather than making it more creative. Writing is expected to reveal the occurrence and frequency of lexical words rather than structure or function words. Written tests and assignments are sources from which researchers can track the impact of lexical density on a learner's written performance over time. Assuming that lexical density indicates improvement in language proficiency, this study compares and contrasts the lexical density of the written performance of two samples of the same population: first- and fourth-year EFL students.

1.4. Research Significance

Little research exists about the impact of lexical density on learners' writing abilities and the extent to which it can indicate improvements in their writing proficiency. This study contributes to relevant research because it attempts to trace the impact of lexical density on learners' writing abilities which, consequently, will contribute to the language teaching and learning processes. The study results would be helpful for individuals associated with the language learning process, like scholars, publishers, teachers, syllabus designers, etc. In addition, the study results would provide researchers in the field with baseline information about how lexical density in EFL students' writing increases/changes over time

2. LITERATURE REVIEW

The term *lexical density* frequently appears in research relating to the assessment of vocabulary and research that features the quality of written performance of foreign and second language learners. The majority of the definitions of lexical density do not radically deviate from that of Ure (1971), who first introduced the term for describing lexical words' ratio to the total words in either written or spoken forms of language. Some of these definitions consider

grammatical and lexical criteria when applying the term for linguistic analysis. Thus, lexical density is observed as a statistical measure of used vocabulary. It refers to “the ratio of content to grammatical function within a clause” (Paltridge, 2012). Nunan (1993) stated that the number of lexical or content words per clause measuring the content words’ proportion in a sentence or text is referred to as lexical density. It focuses on percentage of lexical words that are nouns, verbs, adverbs, and adjectives in the given text.

Lexical density can be seen as a tool that marks the nature of the text when written language performance is the target of linguistic analysis. According to Li and Zhang (2021) a text is more written-like, with an increased lexical density. Also, the lexical density increases in case when movement of text is aligned with continuum from spoken to written text. Al-Wahy (2017) stated that these perspectives of lexical density do not define lexical density’s concept; rather, it states its assessment:

"It is more illuminating to describe lexical density as a text's level of richness in terms of ideas, information, and meaning. Lexical density is defined as "the density with which the information is delivered" by Lexical density is therefore primarily the density of a text's informative and conceptual weight, as manifested by content words rather than function words."

A lexically dense text comprises various lexical words compared to the total words (lexical words plus functional words) because they primarily convey information. Apart from the vocabulary size, lexical richness is affected by different factors in writing, such as writing skills, topic familiarity, and communicative purpose. For instance, there are chances of marked change in lexical richness in someone’s writing due to a change of topic. It might be impossible to attain reliable measures of richness if uncontrollable factors other than one’s vocabulary knowledge affect lexical richness. This effect makes little use of the measures to teachers or researchers (Laufer & Nation, 1995).

A comparative analysis of lexical diversity and density was done by Gregori-Signes and Clavel-Arroita (2015) among the written work of groups of learners at different levels. The findings demonstrated that a consistent measure of lexical richness could be acquired across two pieces of writing by a single student. These findings show that lexical richness knowledge provided through trustworthy qualitative and quantitative assessments provides instructors with a complete depiction of lexical progress.

Kondal (2015) studied the effects of lexical density on language performance. The results depicted that proficiency of the written scripts represents the lexical variety and density, which plays an effective role in language performance, and that lexical density leads to improved proficiency levels for the learners. These levels can be identified based on lexical density and variety in their writing. This suggests that more emphasis must be put on studying English vocabulary if their language is richer and more varied in lexis.

Studies indicate that lexical density in academic writing improves a student’s writing. Lexically sparse writing uses fewer content words, so the text must be written in a complex way to communicate its meaning adequately. A skilled academic writer uses words appropriate to the topic but selects more precise ones to sharpen his ideas. Conversely, a writer at a lower proficiency level uses many words and writes in a complex way, resulting in less lexical density.

Syarif and Putri (2018) confirmed that students’ language learning progress, especially in writing, can be recognized via lexical density analysis. The study revealed that grammatical complexity significantly contributed to lexical density. The study showed that complexities arose as students had limited knowledge regarding use of language in writing academic texts. The data analysis of Syarif and Putri (2018) also found that the level of lexical density was adequate. It met a minimum standard for that proficiency, while the level of grammatical intricacy was high. This result is slightly different from existing theories narrating that higher lexical density is due to the lower grammatical intricacy of a text. Results also showed that grammatical intricacy and lexical density are positively correlated.

Uzun (2019) concluded that lexical richness is a part of writing performance and that the variability in word choice may result in higher L2 writing performance. The study inferred that syntactical and content-related measures,

like grammatical accuracy and writing fluency, may interfere with this relationship. Therefore, solely measuring writing performance, lexical indicators may prove inaccurate and insufficient. For this reason, and as already proposed in the relevant literature, lexical, syntactic, contextual, and sociodiscoursal features should be considered when measuring L2 writing performance.

Ha (2019) found that lexical sophistication was the most influential factor contributing to higher writing quality, which aligns with current writing theories. This level of fluency allows authors to focus more on higher-order components of text composition, like selection, generating idea, content revision, and organization (van Gelderen, Oostdam, & van Schooten, 2011). The correlation analysis depicted that lexical diversity, fluency, and sophistication affect writing quality and can be interpreted differently in a text based on vocabulary, linguistic performance, and different score ranges. Further, regression analysis depicted lexical sophistication as the most significant predictor of writing quality. The study concluded individual's underlying vocabulary knowledge determines the lexical richness displayed in written text.

The studies mentioned above provide evidence of the potentiality of using lexical density as an indicator of improving EFL writing performance. The current study seeks further evidence of this potentiality by tracing the written compositions of a controlled sample in two successive writing courses.

3. METHODOLOGY

In this study, the lexical structure of the text (e.g. number of words, the ratio of content words to function words etc.) is measured by using the method of lexical density. Generally, lexical density is calculated using the type-token ratio (TTR). This ratio divides the total number of words (tokens) in a text by the number of various words (types). The functional and content words were counted in the entire text, and that number was divided by the number of words in a text to extract lexical density from the research sample scripts. The method of computing lexical density was proposed by Ure (1971) using the following formula:

$$\text{Lexical density} = \frac{\text{No. of lexical items} \times 100}{\text{Total no. of words}}$$

In this study, lexical density was measured using *Textalyser*.

Descriptive writings of 60 Saudi EFL undergraduate college students were used as the data for this study. The sample comprised two groups of 30 students enrolled in two successive writing skills courses. The sample selection was based on the hypothesis that an EFL learner's writing performance develops proportionally as they progress in their study program. The written scripts analyzed were extracted from final exam answers from the writing courses.

4. RESULTS AND DISCUSSION

The current study traced lexical density in a corpus of short essays written by a controlled sample of EFL undergraduate college students from Prince Sattam Bin Abdulaziz University in Saudi Arabia. This was done to investigate whether this written performance had statistically significant correlations to their writing performance.

As mentioned earlier, the sample included 60 learners divided into two groups of 30 each. The selected sample was homogeneous regarding the academic status of its subjects. The two samples were successive batches that must have completed two successive writing courses. The first course introduced basic writing skills, and the second was about developing paragraphs. Table 1 and 2 present the statistical data about lexical density score in written performance of selected sample of 60 learners.

Table 1. Lexical density of students' writing -1.

Doc. No.	Number of total words	No. of Content Words	No. of Function words	Lexical Density Score
Doc. 1	124	78	46	62.90
Doc. 2	89	52	37	58.43
Doc. 3	169	98	71	57.99
Doc. 4	166	96	70	57.83
Doc. 5	85	47	38	55.29
Doc. 6	163	89	74	54.60
Doc. 7	145	78	67	53.79
Doc. 8	170	91	79	53.53
Doc. 9	136	71	65	52.21
Doc.10	89	46	43	51.69
Doc.11	76	39	37	51.32
Doc. 12	132	67	65	50.76
Doc.13	123	62	61	50.41
Doc.14	148	75	73	50.68
Doc.15	189	95	94	50.26
Doc.16	132	66	66	50.00
Doc.17	156	77	79	49.36
Doc.18	93	45	48	48.39
Doc.19	118	56	62	47.46
Doc.20	43	20	23	46.51
Doc.21	106	49	57	46.23
Doc.22	111	51	60	45.95
Doc.23	177	81	96	45.76
Doc.24	144	65	79	45.14
Doc.25	124	55	69	44.35
Doc.26	112	49	63	43.75
Doc.27	164	72	92	43.90
Doc.28	224	97	127	43.30
Doc.29	116	49	67	42.24
Doc.30	192	78	114	40.63
Average	133.87	66.47	67.40	49.82%

The score range of lexical density was categorized as follows:

- < 50%: not dense.
- 50–59%: less dense.
- 60–69%: dense.
- 70%: very dense.

Table 2. Lexical density of students' writing -2.

Doc. No.	Number of total words	No. of Content Words	No. of Function words	Lexical Density score
Doc. 1	165	110	55	66.67
Doc. 2	101	62	39	61.39
Doc. 3	147	91	56	61.90
Doc. 4	132	80	52	60.61
Doc. 5	152	89	63	58.55
Doc. 6	168	98	70	58.33
Doc. 7	120	70	50	58.33
Doc. 8	146	84	62	57.53
Doc. 9	172	98	74	56.98
Doc.10	195	112	83	57.44
Doc.11	101	57	44	56.44

Doc. No.	Number of total words	No. of Content Words	No. of Function words	Lexical Density score
Doc. 12	118	66	52	55.93
Doc.13	149	82	67	55.03
Doc.14	163	88	75	53.99
Doc.15	201	106	95	52.74
Doc.16	149	79	70	53.02
Doc.17	136	72	64	52.94
Doc.18	137	72	65	52.55
Doc.19	126	66	60	52.38
Doc.20	227	116	111	51.1
Doc.21	215	108	107	50.23
Doc.22	258	127	131	49.22
Doc.23	145	70	75	48.28
Doc.24	116	56	60	48.28
Doc.25	181	87	94	48.07
Doc.26	168	79	89	47.02
Doc.27	205	96	109	46.83
Doc.28	170	79	91	46.47
Doc.29	176	80	96	45.45
Doc.30	118	51	67	43.22
Average	158.57	84.37	74.20	53.56%

Normality tests are commonly used to determine if a data set falls into a normal distribution. In the current study, the normal data distribution was confirmed using the Kolmogorov-Smirnov test (Table 3 and 4, Figures 1–3). The *p-value* shows no statistical significance because the *p-value* was 0.200 (>0.05). These values indicate that the data are normally distributed because the significance is greater than 0.05.

Table 3. Tests of normality of each group.

Group	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
first group	0.097	30	0.200*	0.974	30	0.642
second group	0.093	30	0.200*	0.980	30	0.838

Note: * This is a lower bound of the true significance.
^a Lilliefors significance correction.

Table 4. Tests of normality of the two groups.

The two groups together	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
	0.066	60	0.200*	0.983	60	0.572

Note: * This is a lower bound of the true significance.
^a Lilliefors significance correction.

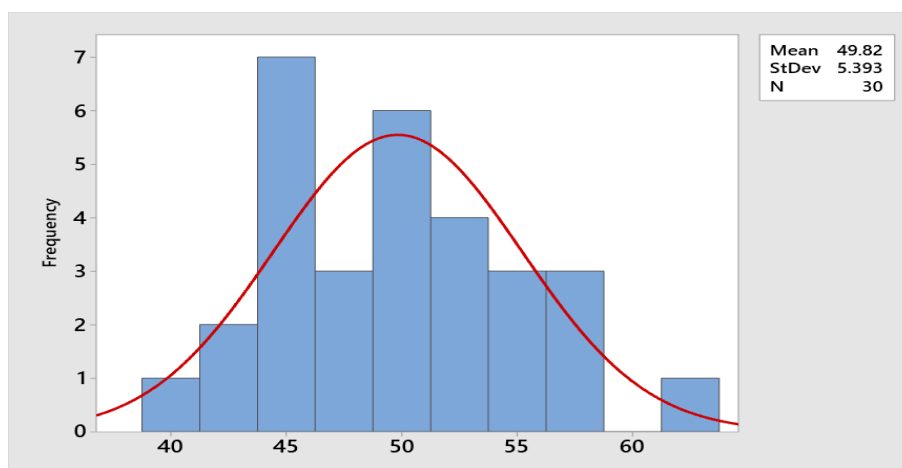


Figure 1. Test of normality of the first group.

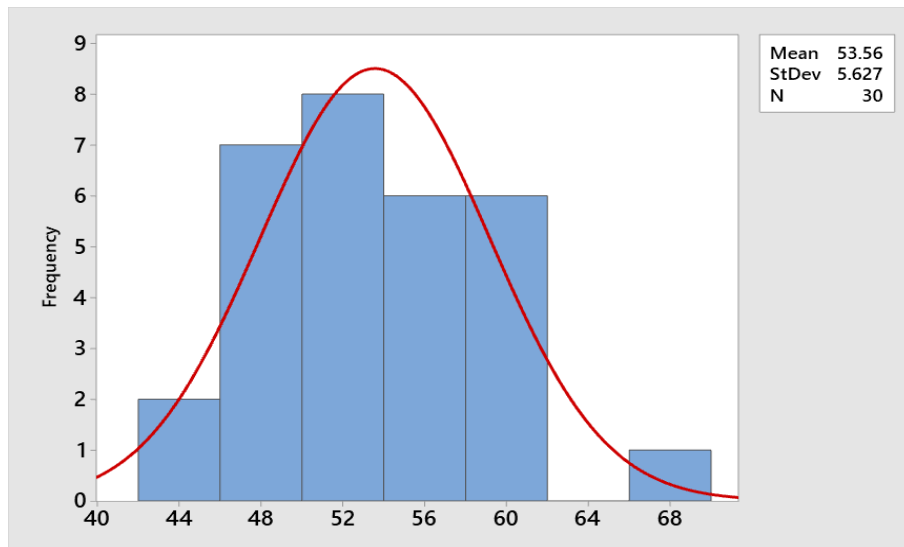


Figure 2. Test of normality of the second group.

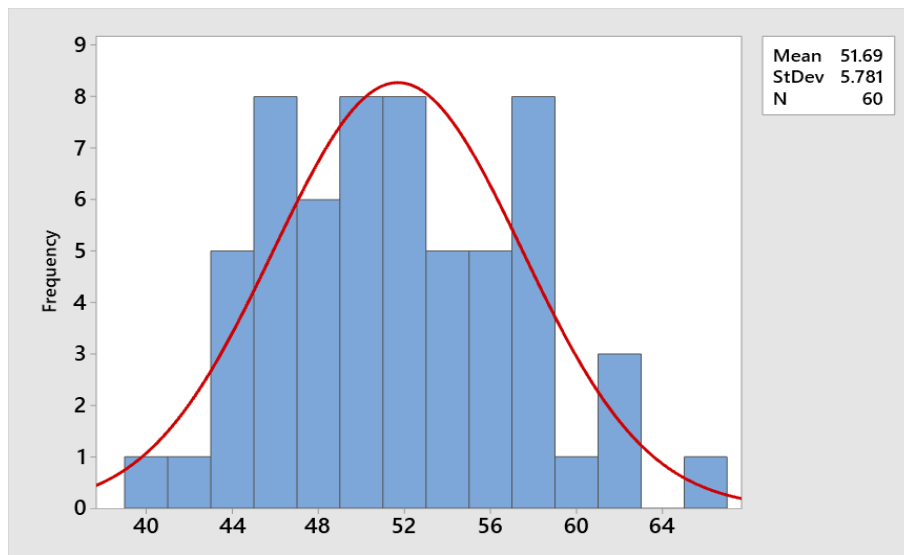


Figure 3. Test of normality of the two groups.

The F value (0.150) in Table 5 indicates that the sample is homogeneous and therefore suggests that the parametric t-Test is the appropriate statistical procedure that should be used to identify the difference between the two groups.

Table 5. Homogeneity of variances.

Levene Statistic	df1	df2	Sig.
0.150	1	58	0.700

Statistically significant differences were observed at the $\alpha \leq 0.05$ level of significance (p is 0.00) between the first group and the second group, favoring the second group, as shown in Table 6. The arithmetic mean is 53.569 (Figure 2) for the second group, while the first group has a mean of 49.82. The average difference between the two groups is 3.74, which is statistically significant and shows a significant improvement in the students' lexical density in the second writing sample.

Table 6. t-test.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 First - Second	-3.74200-	0.86847	0.15856	-4.06629-	-3.41771-	-23.600-	29	0.000

The results indicate that the student's lexical density of the written performance increased as they moved to a higher study level. This comes in line with previous research as students' lexical density correlates positively with students' level of proficiency (Gregori-Signes & Clavel-Arroitia, 2015). These results are further supported by the increase in the lexical density average shown in Table 2. The data of the first sample reported only one case of a lexically dense script (3%), while the second sample reported four cases (14%). This progress, though significant, does not provide a reliable conclusion about what the whole of the data reveals—the main body of the data was categorized as less dense (Sample 1: 50%; Sample 2: 57%).

The data show that the length of a text does not need to depict the lexical density of the content. In the first sample, documents 28 and 30 are rated as not having dense texts even though their lengths are much greater than others in the same sample. In contrast, the document that scored the highest dense in the same sample was below those of average text length (129 words). Similar evidence is reported in the second sample, as the document with the second highest lexical density score has the lowest word count.

There is also further evidence in the data of the first sample that the variation in text length does not determine its lexical density (Please see pair documents 5 & 6, 11 & 12, 18 & 17, and 19 & 20 in Table 2. Each of these pairs shows large differences in word count but convergence in the rates of lexical density.

The statistically significant difference between students writing samples 1 and 2 could be attributed to the content of the writing courses taught to the students in two different levels of study. Level one writing course focused on grammatical accuracy. Great emphasis was given to the mechanics of writing and syntactic structure so that learners could become familiar with the requirements and peculiarities of well-formed English text. Function/structure words are reasonably fit for this task of achieving a cohesive text. Research on particular function words, such as cohesive devices, reveals contradictory results. Liu and Braine (2005) reported similar results as the current study stating that there is significant relationship between quality of writing and frequency of cohesive devices. Their sample of undergraduate non-English majors likewise discovered a strong association between the number of coherent devices and the quality of argumentative writing. However, this is not consistent with the result of Alarcon and Morales (2011) as the results showed no significant relationship between quality of writing and cohesive devices. This was further confirmed by Higginbotham and Reid (2019) stating that cohesive devices and writing quality do not have a strong enough correlation to be employed as independent predictors of proficiency. However, the ratios of language kinds show a consistent trend.

The writing course taught in Level 2 (the second sample) covered paragraph writing, where coherence was verified by the lexical input in the learner's written performance. This lexical input serves content rather than form. It thus involves the use of content words, as evidenced by the increase of lexical density in the performance of the second sample. Similar results were stated by Uzun (2019) showing that L2 writing performance was significantly correlated with lexically-based variables such as lexical density and lexical sophistication.

The study findings align with the results revealed by Laufer and Nation (1995) and Gregori-Signes and Clavel-Arroitia (2015). Laufer and Nation (1995) stated that it is possible to attain a reliable measure of lexical richness with stability across two pieces of writing by similar students. In contrast, the study by Gregori-Signes and Clavel-Arroitia (2015) showed that the same students could get a consistent measure of lexical richness, constant between two pieces of writing. Moreover, students with higher proficiency levels tend to produce texts with higher lexical density.

The findings from the current study show some evidence of improvement in lexical density in the written performance of respondents as they moved up to a higher study level. Although this evidence could be interpreted in terms of the quantitative data obtained (by employing lexical density as a statistical method to measure text lexical structure), this method could also be a significant index of the EFL learner's efficiency and writing proficiency. This writing proficiency and development, as set for the current paper, does not seek syntactic text features but rather considers the lexical structure that serves the comprehension task of the text. In this regard lexical words, unlike function words encoding bulk of the propositional message content. Therefore, a high information load of lexical words is depicted through a large proportion of lexical words in a text (Li & Zhang, 2021).

Another evidence supporting this finding is González's (2017) implication that lexical density could also be an essential contributor to writing proficiency and quality. However, the results do not corroborate previous studies. As cited by Kim (2014) the students' lexical density and L2 proficiency levels are not significantly related. Findings further do not corroborate with Engber (1995) study, stating that the percentage of lexical words has little relationship to quality (Engber, 1995).

5. CONCLUSION

This study reveals that lexical density in the written performance of Saudi EFL undergraduate college students is generally categorized as less dense than that of their higher-level peers. Results indicate that lexical density varies according to a learner's proficiency because the data show differences between the lexical density scores of the two samples. The study also indicates that the length of a text does not determine the lexical density of the content.

In conclusion, the current study provides evidence for potential improvement of the writing performance of EFL learners when this performance is featured by lexical density. These findings could not, however, be generalized because most of the sample data contained short texts. An ideal future study would include both a larger population of students and longer text samples. Raising teachers' awareness about lexical density and how it affects writing could also be a pedagogical implication of the current study.

6. LIMITATIONS

There are two major limitations of this study, which need to be addressed by future studies. First, the study sample, though controlled and well identified, has an inadequate sample size. It could be a basis for further investigation in large-scale studies. Another limitation of the study is that lexical density is employed as a sole measure to assess writing performance improvement. The notion of lexical density in the current study is based on Ure's method, which is a quantitative rather than a qualitative one that calculates lexical words' ratio to the words for assessing the text's lexical density. As proposed by Linnarud (1976) this method does not evaluate writing performance but is used as a check to see if other evaluation methods can be packed up statistically.

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