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Measuring and enhancing lexical richness of middle school students' EFL written production

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ABSTRACT

Lexical richness, a common analytical measure of textual analysis in EFL writing research, is measured by three indices: lexical density, sophistication, and variation. Researchers have developed variant software such as AntWordProfiler to facilitate corpus-based analysis of lexical richness in writing. However, few studies have explored the lexical richness of middle school students' written English in China. The pre-stored corpus of word levels fails to accurately represent the lexical richness in the writings because the leveled word list is much larger than the students' acquired vocabulary. This study examines 239 articles written by middle school students in Zhejiang Province using AntWordProfiler, employing two different sets of BASEWORD lists: the pre-stored BASEWORD lists and the rearranged BASEWORD lists in accordance with the English Curriculum Standards for Compulsory Education (2022 Edition). The pre-stored BASEWORD lists within AntWordProfiler were used to assess the vocabulary richness of the students' articles; subsequently, rearranged BASEWORD lists were applied by AntWordProfiler. The results are presented in terms of lexical variation, lexical sophistication, lexical errors, and lexical density. A comprehensive analysis was conducted using these categories. The research found that homework writings were richer than exam writings, exhibiting higher lexical sophistication and fewer errors. However, they were similar in lexical density. The differences were particularly notable and may have implications for vocabulary teaching in middle schools.

Contribution/ Originality: This study is one of the few investigations that have examined middle school students' EFL written production through a multidimensional analysis of lexical richness using AntWordProfiler. It contributes to the existing literature by integrating lexical variability, sophistication, density, and errors to provide a comprehensive assessment framework.

1. INTRODUCTION

Lexical richness is one of the key determinants of a writer's vocabulary size (Laufer & Nation, 1995) and is also seen as a crucial indicator of writing proficiency (Fan, Yang, & Huang, 2023). It substantially contributes to the quality of L2 writing (Ha, 2019) and is commonly employed as a measure in textual analysis within L2 writing research. Through its usage, distinct variation in vocabulary employed by students can be discerned, thereby assessing the practical mastery of vocabulary (Park & Walker, 2022).

In the context of language learning, vocabulary is regarded as a vital element (Nation, 2006). Over decades, a substantial amount of research conducted in English as a second language (ESL) or foreign language (EFL) learning has corroborated the correlation between vocabulary knowledge and comprehension and found a strong correlation between vocabulary knowledge and language proficiency (Cheng & Matthews, 2016; Lange & Matthews, 2020; Matthews & Cheng, 2015; Qian & Lin, 2020; Rie, 2012; Schmitt, Jiang, & Grabe, 2011; Van Zeeland & Schmitt, 2013). Additionally, such studies have proven the impact of the breadth of vocabulary knowledge on the comprehension of specific text types (Dang & Webb, 2014; Kim & Chon, 2018; Nation, 2006; Nurmukhamedov, 2017; Nurmukhamedov & Sharakhimov, 2021; Tegge, 2017; Webb & Macalister, 2013). Thus, given the strong links between vocabulary and language proficiency, it can be seen that lexical richness, as a measure of vocabulary, holds considerable weight in the sphere of language learning and comprehension.

Exploration of lexical richness has piqued interest across linguistics and computational linguistics fields, particularly because it offers a valuable tool for assessing a learner's lexical capabilities. Lexical richness encompasses several aspects, as outlined by Read (2000), such as lexical diversity, lexical density, lexical sophistication, and error count. Specifically, the concepts of lexical diversity and density allow for the exploration of the unique characteristics of individual texts, as these attributes fluctuate with each word type. As defined by Read (2000), lexical sophistication is the ratio of rare or advanced words in a text, while lexical density measures the proportion of lexical words in a text. Therefore, it is assumed that advanced learners tend to use more sophisticated, diverse, and appropriate words in their writings (Zhang, Chen, & Li, 2021).

In countries like China, where English is learned as a foreign language, middle school students are assumed to have developed proficiency in speaking, reading, and writing, having been exposed to the language for over four years. However, there is a scarcity of research delving into the lexical richness of written EFL output as analyzed through computational indices.

Additionally, there is often ambiguity surrounding students' vocabulary development. Given these circumstances, a thorough examination of the developmental features of lexical richness in middle school students' writing is of paramount importance, further reinforcing the significance of lexical richness as a measure of language proficiency and comprehension.

1.1. Research Questions

1. What level of lexical diversity, sophistication, density, and errors was displayed in middle school students' writing?
2. Is there a significant relationship between writing quality and any of the elements of lexical richness?
3. What enlightenment can we gain from the measurement of lexical richness?

2. LITERATURE REVIEW

2.1. Preliminary Research on English Learners' Lexical Richness

Lexical richness is widely believed to be a primary tool for gauging learners' vocabulary proficiency. It involves extensive research, including but not limited to the dimensions (Laufer & Nation, 1995) and qualification (Fan et al., 2023) of lexical richness. Laufer and Nation (1995) made a strong case for the correlation between lexical richness and both vocabulary size and language proficiency. They proposed the usage of computer programs such as the Lexical Frequency Profile for determining the proportion of high-frequency general service and academic words in learners' writing.

In Korea, several quantitative studies have utilized Read's method to examine learners' lexical richness. Researchers, including An (2017), Bai (2014) and Kyung (2021) have measured learners' lexical richness by their native language. They identified several factors that influence lexical sophistication, including learners' competence,

type of text, topic difficulty, and text length. Concurrently, other studies by Won, Wang, Zhu, and Wang (2017) and Kim (2022) have assessed the lexical richness of Korean learners' writing with the aim of testing the feasibility of using lexical richness as a metric for language level. These studies found that the learners' competence level was positively correlated with their lexical density in their writing. It's important to note that the measurement of lexical richness has proved instrumental in unearthing a learner's underlying vocabulary knowledge (Ha, 2019; Kwon, 2009; Park & Walker, 2022). Both lexical diversity and density can serve as indicators to understand the distinct characteristics of individual texts, given the variances that exist between different types of texts.

When measuring lexical richness, factors such as learners' native language, language proficiency levels, and academic grades were taken into account (Demir-Vegter, Aarts, & Kurvers, 2014; Zhang et al., 2021). Demir-Vegter et al. (2014) pointed out that lexical richness varied depending on the quality of input and learning environments. Building on this, Zhang et al. (2021) conducted an exploration of lexical richness in L3 writing among Chinese beginner learners of English. Their findings revealed that these learners generally exhibited low lexical richness, with a limited and predominantly high-frequency vocabulary usage. Similarly, Zhang et al. (2021) focused on the developmental patterns of lexical richness in the English writing of Chinese beginner learners. They recommended explicit vocabulary instruction that highlights various lexical features in both spoken and written English. Additionally, they suggested increasing linguistic exposure through supplementary reading and tasks such as paraphrasing sentences with a broader range of lexical words.

In conclusion, prior research has primarily focused on the methodologies for measuring lexical diversity and its correlation with other language competencies. With the ongoing refinement and advancement of research techniques, a growing body of studies is now turning its attention to the diverse facets of lexical richness and its significance in the language learning process.

2.2. Lexical Richness Measures

Lexical richness is closely related to language proficiency, and it can be quantified through various metrics. Read (2000) proposed an intriguing perspective, suggesting that as learners become more proficient, they tend to use fewer synonyms, superordinates, and other related words, perhaps reflecting a more nuanced and efficient use of language. Lexical diversity, which reflects the range of expression in language use, is often evaluated using the Type-Token Ratio (TTR) (Lu, 2012; McCarthy & Jarvis, 2010; Read, 2000). TTR is a straightforward formula that divides the number of different words (types) by the total number of words (tokens) in a given text. The rationale behind TTR is that a higher diversity of vocabulary is indicative of a more proficient and extensive lexicon. However, it is important to note that TTR has its limitations, particularly in its inability to account for the qualitative aspects of words, such as word difficulty (Crossley, Salsbury, McNamara, & Jarvis, 2010). To address some of the limitations of TTR, researchers have introduced the Corrected TTR (CTTR), which is calculated as types divided by the square root of two times the number of tokens (Lu, 2012). CTTR has been found to correlate with learners' proficiency levels more accurately than TTR, and it is less affected by text length (Fan et al., 2023). This metric provides a more nuanced view of lexical richness, taking into account both the diversity and the complexity of vocabulary use. In summary, lexical richness is a crucial aspect of language proficiency that can be measured through various metrics. While TTR remains a useful tool for assessing lexical diversity, its limitations must be acknowledged. Corrected TTR offers a refined approach that takes into account both quantitative and qualitative aspects of vocabulary use, providing a more comprehensive understanding of lexical richness in language learning.

Previous research has mostly centered on various indices for measuring lexical richness. Read (2000) suggested a comprehensive framework for measuring lexical richness, encompassing four dimensions, namely, lexical variation, lexical sophistication, lexical density, and lexical error. McCarthy and Jarvis (2010) further contributed to this field by utilizing three measures of lexical richness: textual lexical diversity, vocabulary type-token ratio (TTR), and

hypergeometric distribution. Their research provides valuable insights into the reliability and validity of these measures for assessing lexical diversity. Building on these foundations, Crossley et al. (2010) explored the relationship between computational indices, such as TTR, word length, noun phrase length, and lexical proficiency in language learner texts. Their research investigated the effectiveness of these indices in predicting learners' vocabulary development. Lu (2012) reviewed the use of learner corpora in researching lexical richness, emphasizing the importance of investigating differences between first- and second-language learners in this area. This review provided an overview of previous studies and suggested future research directions, highlighting the evolving nature of research on lexical richness. More recently, Malvern and Richards (2017) focused on the measurement of lexical diversity among young children using a revised version of the Developmental Profile (DP). Their study examined the efficacy of the revised DP in assessing lexical richness in children's language development, contributing to our understanding of lexical richness across different age groups.

Drawing from these prior studies, it is evident that lexical richness can be measured along three dimensions: lexical variability or diversity, lexical sophistication, and lexical density. For EFL learners, particularly beginner learners, lexical errors in writing are also a significant aspect that should be taken into account in the measurement of lexical variety. Therefore, the present study aims to investigate four measures in middle school students' writing samples: lexical sophistication, lexical variation, lexical density, and lexical errors. By considering these dimensions, the study seeks to provide a comprehensive assessment of lexical richness in middle school students' writing, building on the insights gained from previous research.

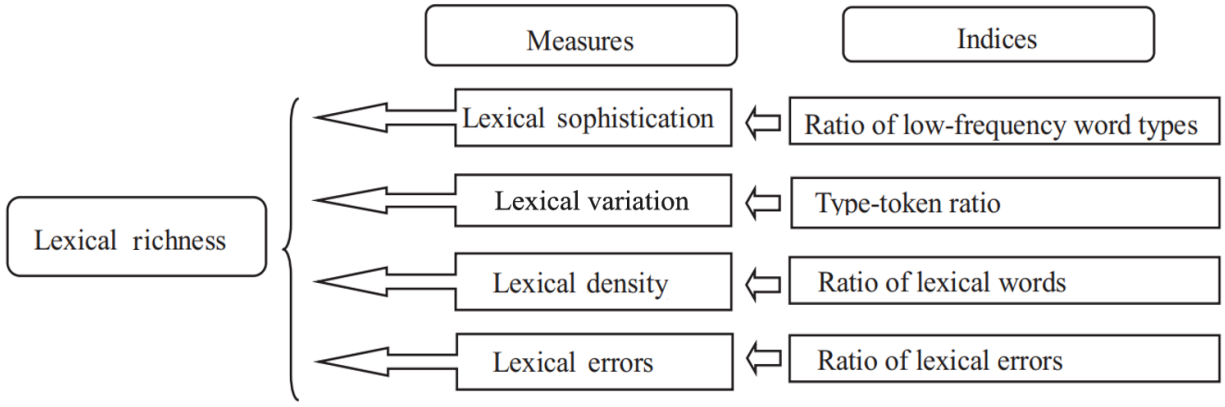


Figure 1. Multidimensional model of lexical richness.

Source: Zhang et al. (2021).

Figure 1 illustrates the multidimensional model of lexical richness, which integrates lexical variability, sophistication, density, and errors to provide a comprehensive framework for analyzing students' EFL written production.

3. METHODOLOGY

3.1. Sample and Sampling

The writing samples used in this study were written by Chinese students at middle schools. Most of the students grew up in the countryside of southeastern China, and their L1 was Mandarin Chinese. Before Grade 7, they had received formal English classroom instruction for about four years, with approximately four periods of instruction each week. In the first semester of middle school, their English writing lessons occurred once or twice every three weeks. Due to the adoption of the "Double Reduction" policy, students were not supposed to be given excessive homework. Therefore, in this study, homework writing was collected twice, and exam writing was collected once. Altogether, there were 239 articles.

3.2. Instruments

AntWordProfiler is a free, multilingual tool developed by Dr. Laurence Anthony. It is designed to conduct corpus linguistics research on vocabulary profiling, providing detailed information and insights about the lexical and grammatical features of a given text. The software runs on any computer with Microsoft Windows, macOS, or Linux operating systems.

AntWordProfile contains two tools. One of them is the main tool, the Vocabulary Profile Tool. The Vocabulary Profile Tool helps generate vocabulary statistics and frequency information about a corpus of texts loaded into the program. It can compare the files against a set of vocabulary level lists that can be plain frequency lists of "family lists" based on the research of Paul Nation, or a set of vocabulary level lists arranged based on the researchers' specific needs for investigation.

AntWordProfiler offers a wide range of linguistic analysis features, including word frequency, vocabulary richness, part-of-speech analysis, syntactic analysis, and so on. It is user-friendly in that it allows users to upload their text data and customize the analysis options to suit their specific needs. In addition, it also provides detailed reports and visual representations of the analyzed data, making it easy to interpret and explore the results. These strong points of AntWordProfiler match the investigation of the vocabulary richness of middle school students' writing.

Next, the prestored vocabulary level lists, including West's first 1,000 general service list and the second 1,000 general service list, and Coxhead's AWL570, were replaced by three vocabulary level lists, which were arranged according to the standards of the 2017 high school English curriculum revised in 2020. The three vocabulary level lists consist of BASEWRD1 (primary school), BASEWRD2 (middle school), and BASEWRD3 (high school).

3.3. Research Design

The compiled corpus of middle school students' writing was processed via AntWordProfile with a revised set of vocabulary level lists arranged for the targeted research purpose. These vocabulary level lists were revised according to The English Curriculum Standard of High School (edited in 2017, revised in 2020), formulated by the Ministry of Education in China. There are three BASEWORD lists, including the levels of primary school, middle school, and high school.

The results retrieved from AntWordProfile were analyzed in terms of four dimensions of lexical richness, i.e., lexical variation, lexical sophistication, lexical density, and lexical errors.

3.4. Data Collection

Two times of composition for homework and one time of composition for the exam were collected.

3.4.1. Collection of Compositions

Students were assigned the first composition when they started learning English in middle school for a month. There were altogether two instances of writing homework. The second one was collected two months later. Each time, they were required to write on a given topic without a limit on the number of words.

3.4.2. Collection of Exam Writing

After two months of learning in middle school, the students were tested in listening, reading, and writing. They were supposed to write on the same topic and without a limit on the number of words.

4. RESULTS AND DATA ANALYSIS

1)Lexical variation, also known as lexical diversity (Djiwandono, 2016) or lexical variability (Fan et al., 2023) refers to the scope of expression (Read, 2000) and is the type/token ratio (hereafter, TTR), namely, "the ratio in per cent between the different words in the text and the total number of running words" (Laufer & Nation, 1995).

Table 1. TTR and average coverage of homework and exam writing (1).

Activity	TTR%	Token coverage %	Level 1 %	Level 2 %	Level 3 %	Level 0 %
Homework	9.5	93.7	84.8	8.2	0.6	6.3
Exam	6.8	85.1	78.9	3.6	2.6	14.9

Note: The results were obtained based on the prestored BASEWORD.

Table 2. TTR and average coverage of homework and exam writing (2).

Activity	TTR%	Token coverage %	Level 1 %	Level 2 %	Level 3 %	Level 0 %
Homework	9.5	95.5	80.0	13.8	1.5	4.5
Exam	6.8	87.5	75.9	10.4	1.2	12.5

Note: The results were obtained based on the prestored BASEWORD.

The percentages shown in Tables 1 and 2 were retrieved by making use of AntWordProfiler with the prestored 3 BASEWORD lists and 3 rearranged BASEWORD lists.

Both tables revealed that the TTR of homework writing was higher than that of exam writing, which had a lower average token coverage as well. In addition, making use of different vocabulary level lists generated a difference in the third level, namely, homework writing had a lower percentage of academic words than that of exam writing, i.e., 0.6 vs. 2.6, as shown in Table 1, while Table 2 shows that there were more words of high school level found in homework writing than in exam writing.

2) Lexical sophistication is another dimension of measuring lexical richness. It refers to the proportion of low-frequency words (Fan et al., 2023) or advanced vocabulary (Read, 2000). The higher the level, the lower the frequency, and the more advanced, i.e., the words of Level 3 and Level 0. To distinguish between the two Level 3 categories, the original one refers to AWL570, and the rearranged one is for high school.

Table 3. Low-frequency word coverage of homework and exam writing.

Activity	The Prestored 3 BASEWORD Lists		The Rearranged 3 BASEWORD Lists	
	Homework	Exam	Homework	Exam
AWL570	0.6	2.6	0.2	0.0
High school			1.5	1.2
Not on the List	6.3	14.9	4.5	12.5

In the initial process, the word lists used as standards were awl_570 and words not on the list. The averages for homework were 0.6% and 6.3%, respectively, while for the exam, they were 2.6% and 14.9%, respectively.

Furthermore, in the second experiment, the word lists used as standards were awl_570, words not on the list, and BASEWRD_3DH7. The averages for the homework were 0.2%, 4.5%, and 1.5%, respectively, while for the exam, they were 0.0%, 12.5%, and 1.2%, respectively.

An additional investigation into the relationship between writing and word levels, as shown in Tables 4 and 5.

Table 4. Paired-samples correlations of writing and word levels.

		No.	Correlation	Sig.
Pair1	Writing & level 1	239	0.255	0.000
Pair2	Writing & level 2	239	0.612	0.000
Pair3	Writing & level 3	239	-0.445	0.000
Pair4	Writing & level 4	239	-0.704	0.000

Table 5. Paired-sample test of writing and word levels.

		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
					lower	upper			
Pair1	Writing - level 1	-79.571	6.294	0.407	-80.373	-78.769	-195.459	238	0.000
Pair2	Writing – level 2	-6.976	5.374	0.348	-7.661	-6.290	-20.067	238	0.000
Pair3	Writing – level 3	0.126	1.898	0.123	-0.116	0.368	1.029	238	0.304
Pair4	Writing – level 4	-6.787	6.610	0.428	-7.629	-5.944	-15.872	238	0.000

Note: Levels 1 to 4 stand for the word level of primary school, middle school, high school, and over. When the value of p is less than 0.010, it means that there exist great differences.

Tables 4 and 5 displayed the correlation between writing and word levels. Students' lexical sophistication in homework writing and exam writing differ greatly across the three-word levels, except for Level 3.

3) Lexical density refers to the ratio of lexical words, namely, content words. The higher the ratio of lexical words, the higher the lexical density of the text content, and the more informative the content will be.

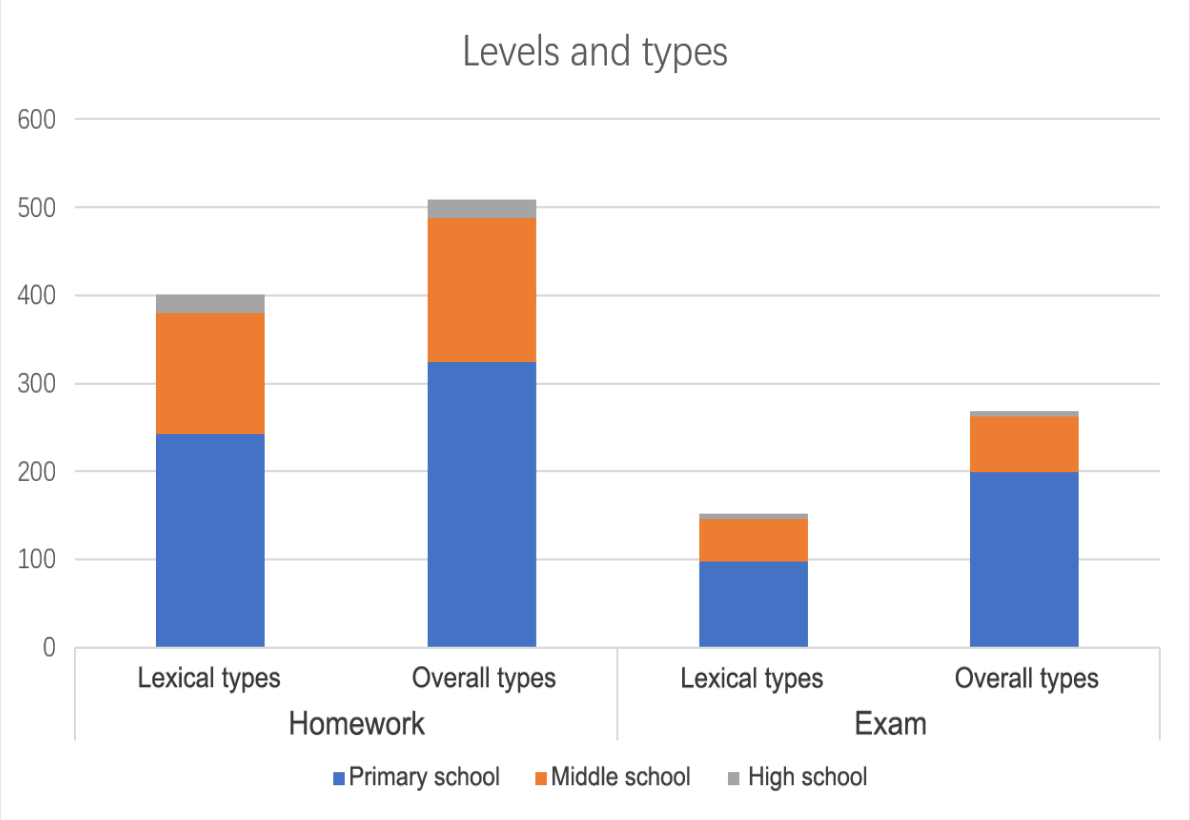


Figure 2. Levels and types of homework and exam writing.

Figure 2 illustrates the level of lexical type and overall type in students' writing. As shown in Figure 2, the blocks of lexical type and overall type in homework writing are wider than those in exam writing. it means that the lexical density of students' homework writing is higher than their writing in exams. This is also reflected in Figure 3. Lexical types of primary school take up the largest proportion among the three levels.

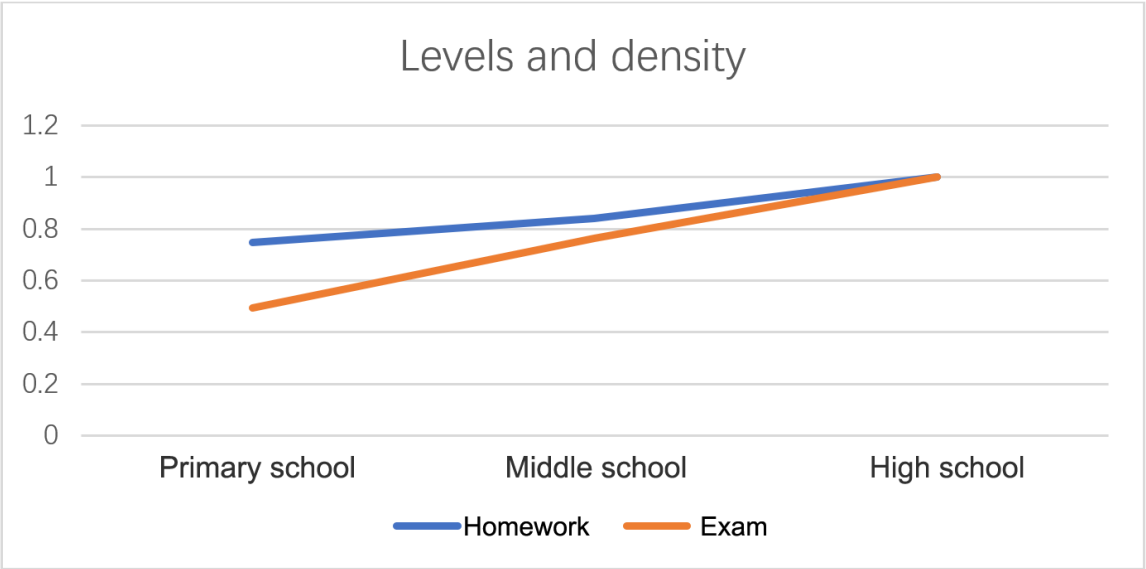
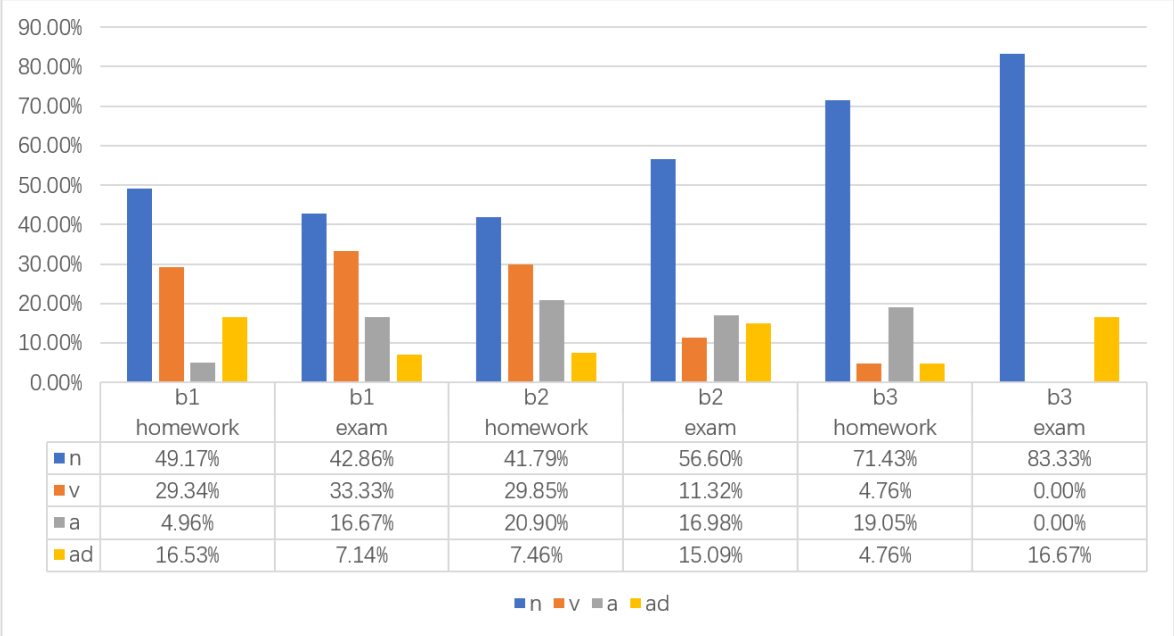


Figure 3. Levels and lexical density in homework and exams.

From Figure 3, it's clear to see that the lexical density in homework writing is higher than that in exam writing at different levels, except for high school. The words of high school in both types of writing are all content words, namely, nouns (n), verbs (v), adjectives (a), and adverbs (ad). What's more, it also shows that the density at different levels is rising for both types of writing.



	b1 homework	b1 exam	b2 homework	b2 exam	b3 homework	b3 exam
n	49.17%	42.86%	41.79%	56.60%	71.43%	83.33%
v	29.34%	33.33%	29.85%	11.32%	4.76%	0.00%
a	4.96%	16.67%	20.90%	16.98%	19.05%	0.00%
ad	16.53%	7.14%	7.46%	15.09%	4.76%	16.67%

Figure 4. Comparison between lexical words in homework and exam writing.

Note: b1 stands for BASEWORD1; b2 stands for BASEWORD2; b3 stands for BASEWORD3.

Figure 4 indicated the detailed proportion of content words in homework and exam writing: 1) nouns constituted the major part in both types of writing; 2) In homework writing, there were more nouns and adverbs of BASEWORD1, while in exam writing, there were more nouns and adverbs of BASEWORD2 and BASEWORD3; 3) as for verbs and adjectives, students tended to use more of BASEWORD1 in homework writing assignments, while they usually applied more of BASEWORD2 and BASEWORD3 in exam writings.

Table 6. Paired-samples correlations of level, density, and lexical types.

		N	Correlation	Sig.
Pair1	level & density	6	0.896	0.016
Pair2	level & lexical T	6	-0.792	0.060

Table 7. Paired-sample test of level, density, and lexical types.

		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
					Lower	Upper			
Pair1	level - density	-78.713	18.190	7.426	-97.802	-59.624	-10.600	5	0.000
Pair2	level – lexical T	-90.167	89.056	36.357	-183.625	3.292	-2.480	5	0.056

Note: lexical T stands for lexical type; when the value of p is less than 0.010, it means that there exists a great difference.

According to the results of the paired-sample T test (shown in Table 6 and Table 7), the lexical density in writing varies at different levels ($p=0.000 < 0.010$), but the lexical types in writing do not differ significantly ($p=0.56 > 0.010$).

4) Lexical errors are inevitable in students' writing. It has been widely accepted in Second Language Acquisition or Foreign Language Acquisition that transfer from the learners' native language, particularly negative transfer due to significant linguistic and cultural differences between the source and target languages, mainly contributes to learners' errors. The larger the gap, the more errors occur. Lexical errors include spelling errors, semantic errors, syntactic errors, and errors related to learners' strategies (Cha & Song, 2006). Kang and Chang (2014) identified 11 types of lexical error categories. For the present study involving middle school students, four lexical error categories were sufficient given their limited language proficiency and knowledge.

Table 8. Lexical error categories.

No.	Categories	Descriptions	No. of errors	%
1	Spelling error	Misspelling of words (e.g., Thired, dont, etc.)	155	1.75
2	Semantic error	Misuse of words due to similar meanings (e.g., the holiday is very happy, etc.)	63	0.71
3	Syntactic error	Misuse of words in consistency with collocation, word class, etc. (e.g., an nice, going instead of go, etc.)	211	2.39
4	Learner's strategy error	Misunderstanding of expressions due to literal translation (e.g., If you have no shopping list, etc.)	188	17.69

Based on Table 8, it can be observed that students make fewer errors in the semantic domain (0.71%) but more errors in the construction of sentences and phrases (17.69%). Furthermore, it is noteworthy that the percentage of syntactic errors made by pupils is 2.39%, greater than the percentage of spelling errors (1.75%).

5. DISCUSSIONS

5.1. Lexical Variation

The discussion of the lexical variation in students' writing reveals some intriguing insights into their language use across different contexts. Firstly, a comparison of the TTR between exam and homework writing highlights the varied lexical diversity employed by students. In their homework, students exhibited exceptional proficiency, with an average token coverage of 93.7% (ranging from a maximum of 100% to a minimum of 85.2%). This indicates that the texts were relatively simple and easy to read, reflecting the students' comfort and confidence with the language. Moreover, the students demonstrated a remarkable ability to utilize the first words list, which comprises the basic

1,000 English language words. Their average performance for this level was 84.8%, suggesting a strong foundation in core vocabulary. Additionally, they showed a promising ability to use more advanced words listed in level 3. The average usage of the level 2 word list was 8.2%, and their engagement with the additional 1,000 words in this level indicates their potential for further growth in vocabulary development. However, when it comes to exam performance, while the lexical diversity was slightly lower than in their homework, it remained very good. The average token coverage for exams was 85.1% (with a maximum of 94% and a minimum of 60.8%), indicating that the texts were still easily readable. This suggests that, despite the potential pressure of taking an exam, students were able to maintain a high level of vocabulary use. In terms of specific word lists, students demonstrated an acceptable level of usage of the level 1 word list in exams, with an average of 78.9%. Interestingly, their performance with the second list of words was higher in exams than in homework. The exam usage average for this list was 3.6%, while the homework usage was 8.2%. This slight decrease in homework usage might be attributed to the different writing prompts or contexts in which the students were asked to write. Most impressively, the students showed a notable improvement in their use of third-level terms in exams compared to their homework. The utilization average for this list in exams was 2.6%, which is significantly higher than the average usage in assignments (0.6%). This indicates that students were able to apply their knowledge of more advanced vocabulary more effectively under exam conditions, perhaps due to the increased focus and concentration required during testing. In conclusion, the discussion of lexical variation in students' writing highlights their ability to use a wide range of vocabulary across different contexts. While there are some differences in performance between exams and homework, overall, students demonstrate a strong foundation in core vocabulary and a promising potential for further growth in vocabulary development.

5.2. Lexical Sophistication

According to the data shown in Table 3, the gathered results can be illustrated as follows:

In homework writing, additional terms from AWL570 and high school were used. Nevertheless, exam writing contained extra terms that were not on the list. Given that it has been demonstrated that second language learners are more likely to express their ideas when they have a sufficient vocabulary, the AWL570 and high school figures show that students are willing to use more sophisticated words when working on homework (for AWL570, the average for both is 0.2% versus 0.0%, respectively), which was in accordance with the findings of Schmitt et al. (2011) and Failasofah (2018).

2) The average for words not on the list is 4.5%, compared to 12.5% for the homework and exam combined. This indicates that students may make mistakes on the exam because of interference from their mother tongue or transfer between their mother tongue and the target language (Khansir, 2012).

5.3. Lexical Density

Lexical density of homework writing and exam writing differs greatly: 1) Lexical words in homework writing tend to be more variable than those in exam writing. Lexical density of homework writing was higher than that of exam writing. For example, content words used in homework writing took up 43.97% of all tokens, while those that appeared in the exam added up to 43.31%. The ratio was very close. In terms of word classes like nouns, verbs, adjectives, and adverbs, some similarities and some differences were disclosed. Both types of writing have more nouns and more verbs, but the ratio of adverbs was higher than that of adjectives when students were doing homework, and the percentage of adjectives was higher when students were doing exam writing. The figures showed that the lexical density of homework writing was generally higher than that of exam writing.

2) The higher the level of words, the more content words are present in both types of writing. Arranged in terms of language level, the ratio of content words from the third basic word list, namely, 100%, ranked highest in both homework writing and exam writing. In exam writing, the lexical density of the second basic word list was higher

than that of the first, while in homework writing, the proportion of content words from the first basic word list was higher. The difference might be caused by the time allocated for completing the task. It is well accepted that students are supposed to accomplish their writing within a certain time limit, ranging from 15 to 30 minutes. On the other hand, without time limits, students tend to be more relaxed and may refer to assistance from others or reference books like dictionaries.

5.4. Lexical Errors

As stated in Table 8, it is evident that: 1) When translating literally, students make more mistakes in sentence structure (17.69%), which is related to the use of generative grammar. The emphasis now is on learning strategies, developmental processes, and target language structure as sources of error rather than interference (Irujo, 1986; Richards, 1972). Even though the students' percentage of semantic errors is now lower at 0.71%, EFL learners may still make many grammatical and semantic errors at this time. Regarding grammatical errors, students may be making mistakes in verb tense, agreement, auxiliaries, conjunctions, and word order, among other areas. Conversely, there are two types of semantic errors: mistakes at the word and phrase levels, as found in the study of Almahameed and Al-Shaikhli (2017).

2) Students' percentage of syntactic errors is 2.39%, higher than their percentage of spelling errors, which is 1.75%. This discrepancy is considered to be caused by EFL learners' frequent inability to comprehend the complexity of the English spelling system, which consists of both vowels and consonants (Al-Oudat, 2017).

6. CONCLUSIONS

To gain a deeper knowledge of the lexical richness of middle school students' EFL written production, the collected writing samples have been investigated thoroughly using the AntWordProfiler software program. The results obtained have been analyzed by considering the lexical variation of the TTR and Average Coverage of homework and exam writing, which have been tabulated twice by standardizing with the three pre-stored BASEWORD lists and the three rearranged BASEWORD lists. It was found that students' lexical variation was of a high level in both homework and exam contexts. Moreover, a lexical sophistication check-up was conducted by examining the categories of AWL570 and words not on the list. Both homework and exam writing samples were thoroughly searched, and the differences in outcomes were accurately reported. The significant findings have been illustrated to achieve the study goals.

Regarding lexical density, students performed differently in various situations, such as doing homework and sitting in an exam. It indicated that students' basic mastery of words across different classes, among which nouns were the best, varied. On the other hand, it also showed that future attention and stress should be placed on other word classes, such as verbs and adjectives, in middle school students English instruction.

The lexical errors have been checked and tabulated in percentages, such as spelling errors, semantic errors, syntactic errors, and learners' strategy errors. The results were compared and technically studied, and it was found that the outcomes were highly contributive to the paper's ultimate objectives.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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