

Lexical Richness in EFL Undergraduate Students' Academic Writing

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Lexical richness makes an important contribution to L2 writing quality. To explore its importance, the study aims to identify and explain how lexical richness manifests in argumentative essays written in the final exam of reading and writing class by thirty-five undergraduates. The lexical richness consists of four interrelated elements: lexical diversity, density, sophistication, and fluency. Detailed text analysis can identify these elements in EFL students' academic writing. The correlation analysis showed that the use of lexical diversity, sophistication, and fluency all affect writing quality and can be seen differently in a text depending on different score ranges, vocabulary knowledge and linguistic performance. Further, the regression analysis revealed that the lexical sophistication was found to be the most significant predictor that contributes to writing quality. In sum, the lexical richness displayed in written text is a result of a person's underlying vocabulary knowledge. This study ends with a pedagogical implication for teaching lexical richness in EFL academic coursework.

Key words: vocabulary knowledge, text analysis, linguistic features, lexical richness, L2 writing

1. INTRODUCTION

Over the last 30 years, many researchers have recognized the role of vocabulary (Connor, 1990; Laufer & Nation, 1995; Olinghouse & Leaird, 2009) in second language (L2) students' writing quality. These previous studies have relied on surface measures (Halliday & Hasan, 1976) and investigated broad linguistic features to describe, distinguish and explain the degree of proficiency exhibited in texts written by non-native speakers of English (Crossley, Kyle, & McNamara, 2016; Wolfe-Quintero, Inagaki, & Kim, 1998).

The motivation for this research on writer lexis and its importance stems from several

existing studies. First, vocabulary size is an important factor in L2 language acquisition (Schmitt, 2008). Second, lexical richness measurements beyond syntactic complexity are relevant indicators of English writing proficiency level. Third, features of vocabulary such as measures of lexical diversity, sophistication, density, cohesion, and fluency are potentially of great value to describe key features of lexical richness.

Although several other researchers have revealed that L2 syntactic complexity is considered a valuable indicator of proficiency in writing (Crossley & McNamara, 2014; Lee, 2018; Ortega 2003), there is sufficient data to support that the richness of lexis also makes an important contribution to L2 writing quality (Jarvis, Grant, Bikowski, & Ferris, 2003; Olinghouse & Leaird, 2009). Some researchers still question whether these features have a significant impact on the development of L2 writing (Grant & Ginther, 2000; Jarvis et al., 2003). The main critique of the measurement of lexical richness is that it only attempts to assess the breadth (quantity/size) the degree to which a writer uses a variety of large vocabulary (Laufer & Nation, 1995). In other words, the measure does not consider how a word is used in the text, whether the word form is grammatically correct, or whether the meaning is correct in a particular situation (Nation, 2001).

Existing research on learners' syntactic complexity has been quite successful so far, but relatively little research of comprehensive understanding about the deeper-level linguistic feature measures (Engber, 1995) that tap into the underlying lexical richness and increasing quality of writing (Jarvis et al., 2003; van Hout & Vermeer, 2007). Such measures assess linguistic features such as conceptual knowledge, causality, and given information. Furthermore, this study focuses on how differences in perceived writing quality are related to linguistic features present in the learners' written texts. In a situation that requires the learner to use the knowledge of the vocabulary, a direct correlation may be expected between the learner's vocabulary size and the lexical richness in the text production (Daller, Milton, & Treffers-Daller, 2007; Laufer & Nation, 1995).

Even though the study on the linguistic features of L2 writing has evolved into various perspectives in recent years, the understanding of linguistic features such as T-unit length (Grant & Ginther, 2000; Wolfe-Quintero et al., 1998), sophistication (Crossley & McNamara, 2012; Read, 2000) that characterizes L2 writing is inconsistent among researchers. Thus, the context of individual researchers and the lexical complexity, that is, lexical richness research should continue. Crossley and McNamara (2012), for instance, assessed linguistic sophistication related to "lexical difficulty and syntactic complexity" (p. 116), the most popular one being the type/token ratio and Laufer and Nation (1995) labeled lexical sophistication as "the percentage of advanced words in the test" by using a Lexical Frequency Profile (LFP), "reflects the vocabulary size of the learner as determined by an independent test" (p. 308).

The gap between these studies is that the primary concern of "type/token-based

measure does not take into account the *frequency* of words" (van Hout & Vermeer, 2007, p.130). Regardless of whether the words are frequent used or not, it calculates the number of types and tokens that appear in the data. Since the frequency of a word is related to acquisition order (see, Nation, 2001; Vermeer, 2001), a procedure in the LFP¹ (Laufer & Nation, 1995; Nation & Meara, 2010) for written texts, in which four levels are distinguished to measure at different vocabulary frequency levels. Therefore, in order to get a better grip on what lexical richness measures can tell, this study examines specifying elements, in particular, the elements of type, token, and frequency related with linguistic features within L2 learners' writing, rather than focusing on syntactic complexity.

Moreover, it will be useful to investigate how the explicit surface connections (Halliday & Hasan, 1976; Kuo, 1995) of lexical knowledge and lexical use contribute to the interpretation and communication of lexical richness in EFL learners' writing (Šišková, 2012). Thus, measuring lexical richness attempts to reveal the richness of the lexicon which produced the text (van Hout & Vermeer, 2007). Furthermore, vocabulary is considered to be at the heart of meaning-making in understanding discourse (Halliday & Hasan, 1976). Under the guidance of linguistic perspective, vocabulary (Celce & Olshtain, 2000) is very important.

Language instruction ought to account for the L2 learner's range of vocabulary in order to gauge student comprehension and productivity of lexical knowledge (Nation, 2001). It is therefore important to consider how these measures of lexical knowledge and lexical use contribute to the quality of writing and predict overall writing proficiency (Read, 2000; Šišková, 2012) in second language learning and writing quality development.

Specifically, this study aims to investigate the relationship between academic writing and lexical richness, focusing on linguistic features and size comparisons in order to explain lexical diversity, lexical density, lexical sophistication, and fluency in quantitative terms. Accordingly, this investigation attempts to identify the overall vocabulary knowledge profile of L2 writing proficiency using linguistic computational tools such as Coh-Metrix (McNamara, Crossley, & McCarthy, 2010) and RANGE (Heatley, Nation, & Coxhead, 2002). This study concludes with suggestions for meaningful pedagogical implication, such as the importance of enhancing lexical richness and reinforcing reading and writing connection in EFL academic coursework.

¹ Vocabulary profiler is a computer-based analysis of vocabulary proficiency (Laufer & Nation, 1995). It presents how many words the text contains from the following four frequency levels: (1) the first 1,000 most frequent words of English, (2) the second 1000 most frequent words of English, (3) the Academic Word List, and (4) words that do not appear on the lists.

2. LITERATURE REVIEW

2.1. Vocabulary Knowledge in Academic Writing Performance

A writer constantly thinks about which vocabulary (e.g., Daller & Xue, 2009; Skehan, 2009) to use to convey content and meaning in their writing performance in academic writing. Thus, vocabulary is an important part of linguistic knowledge, be it in the writer's native or foreign language. Also, vocabulary knowledge can be defined as the most general term that covers all aspects of words, and learners' vocabulary knowledge should be used appropriately in their text production (Arnaud, 1984; Nation, 2001). In this study, we use the terms "vocabulary knowledge" and "lexical knowledge" interchangeably, in the broadest sense of their meaning.

Learning vocabulary is a complex process in which the learner needs to acquire both the form and the variety of meaning of a given lexical item (Beglar & Hunt, 2005; Carter, 2012). Learners can use general word list items frequently in their texts and acquire more common vocabulary items that occur frequently in multiple texts (Beglar & Hunt, 2005; Carter, 2012; Nation, 2001). In the early stages of language learning, a teacher can present a very useful list of words to learners. Nation and Meara (2010) assert that Michael West's (1953) General Service List (GSL) of English words, is among the most useful lists for L2 learners to use. The GSL contains the 2,000 most frequently used words in the English language.

In addition, Nation and Meara (2010) also support introducing English learners to the Academic Word List (AWL) compiled by Coxhead (2000) for learners who want to study academically through English media. In the AWL, there are 570 word families that constitute a specialized vocabulary with coverage of academic texts, regardless of the subject area. Word lists such as these are an essential element in developing specialized word lists and are used as a lexical criterion to identify more specialized vocabularies (Nation & Hwang, 1995). Both the GSL and AWL are integral to this current study, as will be further explained later.

In contrast to the usage of commonly uttered vocabulary words, work by Arnaud (1984) and Linnarud (1986) suggests that using rare words in writing is an indicator of a high level of learner language proficiency. Also, rich and varied vocabulary expression can be considered an essential step to becoming a writer who writes quality text. Fletcher (1993) expressed the importance of word choice:

...words remain the most important tool the writer has to work with... A rich vocabulary allows a writer to get a richness of thought onto paper. However, the writer's real pleasure comes not from using an exotic word but from using the right word. (p. 32)

Looking more closely, vocabulary knowledge is a vital part of any language and can be divided into three dimensions. The first dimension is lexical size, describing how many words a learner knows (Daller et al., 2007); the second dimension is lexical depth, which is concerned with how well the learner knows the words; and the third dimension is fluency, which refers to how quickly a learner is able to retrieve the form or the meaning of a given word from memory and use it when necessary (Daller et al., 2007; Šišková, 2012). Other researchers think that lexical knowledge “consists of progressive levels of knowledge, starting with a superficial familiarity with the word and ending with the ability to use the word correctly in free production” (Laufer, Elder, Hill, & Congdon, 2004, p. 400). This framing of vocabulary acquisition and usage can undoubtedly impact student performance on writing tasks.

2.2. Lexical Richness and Writing Quality

There is no single measurement that covers all of vocabulary knowledge; different measures are applied depending on a specific writing situation. Lexical measurement in academic writing often involves the proper use of content domain words that are explicitly taught (Olinghouse & Leaird, 2009). Generally, measuring lexical richness is concerned with the total number of words (tokens) and the ratio of other words (types), known as the type–token ratio (TTR) (Kim & Jeon, 2016; Kojima & Yamashita, 2014; Silverman & Ratner, 2002) categorized as counters of word frequency used in a text (spoken or written) (Meara, 2005; Šišková, 2012).

Empirical research on lexical richness, researchers have measured different aspects of lexical richness, such as lexical diversity (i.e., type-token ratio), lexical variation (e.g., type of different word type but focused on lexical word), lexica sophistication (i.e., the proportion of advanced words), average word length, and lexical density (i.e., the proportion of lexical words in the whole text) (Daller et al., 2007; Read, 2000). However, McCarthy (2005) uses slightly different terminology from Read (2000) and Daller et al. (2007), considering lexical diversity as a different type of words, which is a general concept, but the lexical richness is more specifically considered as the equivalent of the lexical specification. While several writing studies have included one or more of these vocabulary assessment metrics, few have explored the differences in possible developmental processes.

Grant and Ginther (2000), for instance, examined a sample of 90 Test of Written English (TWE) essays, written at three levels of proficiency as defined by TWE ratings to analyze essay length, lexical specificity, lexical features, grammatical structures, and clause level features. Computerized tagging was used to identify patterns in the test-takers' writing ability, and it revealed that a combination of all of these characteristics determined L2

writing proficiency level. As a result, writing proficiency is understood as a measurement of one's capacity for written expression that utilizes both syntactic and lexical aspects of language.

Although all researchers are aware of the importance of lexical knowledge, there are other opinions that more research on vocabulary knowledge use and lexical richness should be conducted. Therefore, this study uses the term "lexical richness" as an umbrella term that can include other descriptors of an L2 learner's lexicon (e.g., an abundance of vocabulary, a rich vocabulary) (Daller & Xue, 2009; Šišková, 2012). Then, this study explores the relevance of the importance of vocabulary knowledge, lexical richness and the quality of the writing (Nation, 2001; Wolfe-Quintero et al., 1998).

Morris and Cobb (2004) analyzed the output in 300 words and established a vocabulary profile for 122 TESL students. Their study has revealed that the students' writing scores on each profile component were correlated with the grades they were given in two of the grammar courses in their program of study. Bestgen (2017) observed formulaic measures, lexical features (i.e., lexical diversity, lexical sophistication) and revealed that two datasets of EFL learner texts have shown that the most correlated measure was the mean MI score and it was statistically significantly more correlated than all other measures. In Bestgen's study, multiple regression analysis showed that combining diversity and sophistication measures can explain a statistically significant component that predicts writing quality.

For this reason, judgments about text quality cannot be based solely on measures of lexical richness but other aspects have to be taken into account as well. Accordingly, it is possible to measure different linguistic features of lexical richness, which consist of four main elements. The first is lexical diversity, which is a reference to an overall range of unique and/or different words used in a text (Šišková, 2012). The second element of lexical richness is sophistication, which evaluates the production of advanced and difficult words (Heatley et al., 2002; Nation & Meara, 2010).

Additionally, lexical density, the third element of lexical richness, is often used for describing the proportion of content words (nouns, verbs, adjectives, and adverbs) to the total tokens of a text (Daller et al., 2007; Johansson, 2009; Read, 2000). However, lexical density does not measure lexis only but also the structural, syntactic, and cohesive characteristics of a composition (Gregori-Signes & Clavel-Arroitia, 2015).

Finally, the last lexical richness element, fluency, represents the number of words generated in a given time frame using vocabulary frequency (Goodfellow, Lamy, & Jones, 2002; Laufer & Nation, 1995). Fluency can also be understood as the author's ability to easily convey meaning regardless of spelling or content (Fellner & Apple, 2006). It can be defined as making the most effective use of the skills already known and is usually measured in lack of hesitation (Nation, 1997).

To shed light on the relationship between vocabulary knowledge performance and the extent of lexical richness seen in student writing, empirical research examined the correlation between these linguistic features and the overall quality of writing (Bestgen, 2017; Gregori-Signes & Clavel-Arroitia, 2015; Kim, 2014; Morris & Cobb, 2004). Specifically, in a study by Engber (1995), the L2 learner's lexical variation impacted writing quality, and in Olinghouse and Leaird's (2009) study, lexical diversity, low word frequency, mean syllable length, and high use of polysyllabic words also affected L2 learner writing quality. While, some studies have demonstrated a positive correlation between the number of linguistic features and writing quality (Gregori-Signes & Clavel-Arroitia, 2015; Lee, 2018), other studies have shown no significant association between the two (Castro, 2004; Kim & Jeon, 2016).

Lastly, much attention has been paid to the communicative purposes of writing and consistency in written discourse (Connor & Johns, 1990). However, in academic writing, EFL writers often fail to recognize the relationship between vocabulary use and context, and often fail to use their vocabulary knowledge appropriately (Olinghouse & Wilson, 2013). In recent years, Mazgutova and Kormos (2015) analyzed argumentative writing data collected during a four-week intensive academic writing development program at a British university. They found that although the lower-level proficiency group showed significant improvements in the measures of lexical diversity than the higher proficiency group, the changes in lexical features (e.g., lexical variability) can be observed in the text of all students.

In contrast to Mazgutova and Kormos (2015), Kim (2014) analyzed in terms of text length, lexical complexity and syntactic complexity from the Yonsei English Learner Corpus (e.g., academic writing) to identify the best indices of L2 students writing proficiency. Kim's result indicated that higher proficiency learners created longer text, used more variety of vocabulary (i.e., diversity), showed the ability to use more words in a sentence (i.e., syntactic complexity), and lexical density index linearly increases.

In another study, Gregori-Signes and Clavel-Arroitia (2015) analyzed lexical density and lexical diversity in university students' written discourse of two groups of first year students in a Spain university at the beginning and end of one semester. They reported that Lexical Frequency Profile (LFP) seems to correlate well with an independent measure of vocabulary size.

Moreover, Kao and Wang's (2014) study examined the lexical richness elements of diversity, density, sophistication, and cohesion in three groups of presenters in an academic context. These researchers operated under the premise that English as lingua franca (ELF) academic presentations do not require massive uses of difficult words (e.g., academic word lists) or complex sentence structures; rather, experienced ELF speakers develop their presentations with almost 90% of the 2,000 most frequent words used by EFL learners use.

The academic words used were only 2.53% of the total tokens. As a result, their students could not apply academic words because of a lack of academic vocabulary base and therefore performed the task with general words.

To measure lexical knowledge and lexical use, researchers often conduct their studies based on the assumption that learners have the potential to develop their own vocabulary knowledge by acquiring the most frequently used vocabulary first, at which time they do not yet have the ability to grasp its meaning and use it fully (Laufer & Nation, 1995; Laufer et al., 2004). Language learners acquire their own understanding of what they hear and use frequently and repeatedly (Ellis, 2002). By doing so, previous research has confirmed that some of the available word lists are generally valid, and word frequency has, therefore, been considered the most effective basis for measuring the learner's vocabulary size (Daller & Xue, 2009; Laufer et al., 2004; Read, 2000; Šišková, 2012). In this respect, this research looked into student texts are seen in detail. Specifically, this study addresses the following research questions:

1. To what extent are there the lexical richness elements in terms of lexical diversity, density, sophistication, and fluency displayed in EFL students' academic writing?
2. Is there a significant relationship between writing quality and any of the elements of lexical richness?
3. Among the elements of lexical richness, which are most predictive of overall writing quality?

3. THE STUDY

3.1. Participants and Setting

The participants of this study were thirty-five undergraduate students at a Korean women's university in Seoul, Korea. They were enrolled in a Reading and Writing course, which is a graduation requirement at the university. All participants had English classes 3 times per week and started learning English from 3rd grade of elementary school through a public education curriculum. Students were majoring in various disciplines, and their class standing ranged from freshmen to seniors (see more details in Table 1). Students in this school must take the Multimedia Assisted Test of English (MATE) writing exams, developed and administered by the university in 2003, before enrolling in English reading and writing class. The goal of this test is to have test-takers demonstrate their overall English proficiency by producing English samples in various

subject areas. The writing tasks are linearly arranged from easiest to the difficult (e.g., writing a letter for 10 minutes and argumentative writing for 20 minutes). Each sample was rated by two different official raters from the university (i.e. foreign lecturers) and any discrepancies were checked by a third, expert rater. As a result, the student's level is assigned to level 0 (Rudimentary), level 1 (Moderate), level 2 (Commanding), and level 3 (Expert).

The participants were learning English as a foreign language and enrolled in a level 2 course in fall, 2014 (11 students out of 14) and fall, 2016 (14 students out of 16) of academic years which were taught by the author of this study. The reason for the difference in the total number of participants is that there were students who were absent for the test. In this study, 35 data were collected over two years under the assumption that more than 30 people were needed for generalization by analyzing the quantitative data. Thus, data were collected over a two-year period when researchers were assigned the same level class. They were all female students, ages 20 to 27, and they shared the same goals of passing the class, meeting graduation requirements and improving their English writing skills.

The university's English department expects that students of this level (i.e., level 2) to be able to handle a variety of writing assignments in class. They are able to partially address some formal and informal topics with a proper writing form. However, it is also expected for students of this level to encounter certain limitations. Sometimes students' discourse may show limited proficiency for the level, in which they make some grammar errors and may self-correct themselves in their writing.

TABLE 1
Participant Profiles (N = 35)

Age		20-27 years old		
Year in University	Freshman (14)	Sophomore (2)	Junior (5)	Senior (14)
Major	Engineering (3)	Economics & Business (6)	English (1)	Human Ecology (3)
	Global Service (4)	Liberal Arts (5)	Law (2)	Music (1)
	Science (7)	Social Science (2)	Pharmacy (1)	

Note. The numbers in parentheses indicate the number of students.

3.2. Data Collection

The test of Written English (TWE) became a required part of the test of English as a Foreign Language (TOEFL) in 2000. The writing prompt for this study was modeled after the TWE which is designed to measure writing proficiency of the writer. It was a final exam proctored under the instructor's supervision. The prompt was given after consent to

detailed instructions (e.g., the matter of time limits) and test regulation that they are not allowed to use any additional references (e.g., dictionaries or computer search engines).

The test prompt was to respond to the question: “Is learning English best done at an early age?” The reasons for selecting this topic were twofold. First, in order to control for topic difficulty, this prompt was determined to be a standard type for the TWE, which was assumed to be appropriate and familiar for students. Second, it is similar to the English class placement test developed at the university where the students are attending. For this study, the writing prompt was not made known to the students until it was announced at the beginning of the test. Students were expected to be able to write argumentative text that can convince their readers, by expressing their position with appropriate reasons.

This test assessed the quality and content knowledge of student writing by asking them to produce it within a limited time frame to observe writing fluency in a given time frame. Just as the Educational Testing Service (ETS) currently limits the writing test to 30 minutes, the data for this study came from student essays written within a 30-minute time limit (Engber, 1995; Grant & Ginther, 2000).

3.3. Data Analysis

The learners learned about the five-paragraph essay structure during the semester and as part of the test to measure what she learned during the semester, each of the student essays consisted of five paragraphs, written on approximately one page with a typical text length. The data analysis involved two phases: the evaluation of writing quality based on the candidates’ written text, followed by a quantitative analysis of various lexical statistics to explore, in particular, the lexical richness. In the first phase, the participants’ writing quality was assessed using a holistic scoring (Engber, 1995; Jarvis, 2002) instrument developed by ETS for TWE, followed by a quantitative analysis of various lexical statistics to explore, in particular, the lexical richness.

The researcher of this study and one native English professor who taught General English for more than 5 years at the Korean university participated in the evaluation of students’ writing quality. Students’ texts were rated on a score scale of 0 to 5 according to the standards. The average of two raters’ scores on the writing task was converted to a scale score of 0 to 20. Students’ exam scores were given depending on the overall quality of the essay produced on various metrics: development, organization, appropriate and precise use of grammar and vocabulary. This study then independently evaluated seven randomly selected papers (20%), to check the degree of consistency. To check inter-rater reliability, a correlation was computed for the agreement between the two EFL teachers and achieved the inter-rater reliability coefficient ($r = .853$).

In order to evaluate writing performance, this study uses the text analysis tool, Coh-

Matrix (Graesser & McNamara, 2011; Kim & Jeon, 2016; Lee, 2018), RANGE (Coxhead, 2000; Kim, 2014; Nation & Meara, 2010) and holistic writing scoring which reflect the overall coherence of vocabulary knowledge based on the previous research. More importantly, the current study explores the relationship between the richness of vocabulary and the quality of writing.

Previous studies have revealed that assessing connections between formal features or syntactic complexity. However, lexical richness is beneficial for measuring writing quality, therefore, this research focuses on lexical features. Following Kao and Wang's (2014) lexical richness elements, the current study was measured lexical diversity, lexical density, lexical sophistication and fluency. As shown in Table 2, the statistical assumption itself cannot be more complexly measured (e.g., SEM, HLM) due to the small sample size of this study. In addition, correlation and regression analysis were performed by excluding the variables with a p-value of .9 or .8 or higher through the primary correlation measure report.

TABLE 2
Lexical Richness Elements Measured in the Study

Tool	Type	Measure
Coh-Metrix	Lexical diversity	The proportion of different words to the total number of words used in the text
	Lexical density	The proportion of content words to the total number of words used in the text
	Fluency	Total number of words in 30 minutes
RANGE	Lexical sophistication	The proportion of words used at different frequency levels, in terms of GSL1, GSL2, and AWL in the text

Note. GSL = General Service List, AWL = Academic Word List

This study uses a free software utility, Coh-Metrix, offered by Graesser and McNamara (2011) to analyze text and discourse on a range of linguistic features at various levels of language, discourse, meaning and conceptual analysis. Coh-Metrix is also used to examine the degree to which text can be predicted by the depth of knowledge in lexical indices (Crossley & McNamara, 2014; Kim & Jeon, 2016; Lee, 2018). Among those indices, lexical diversity, the index *D* (Malvern, Richards, Chipere, & Durán, 2004) is measured to investigate textual diversity for all words. Higher *D*-values correspond to greater lexical diversity of the text and greater ability to display skills that minimize word repetition (Malvern et al., 2004).

Lexical density provides a measure of the proportion of lexical items (i.e. nouns, verbs, adjectives and some adverbs) in the text (Johansson, 2009). For density, a text is considered "dense" if it contains a large number of lexical items (Gregori-Signes &

Clavel-Arroitia, 2015) relative to the total number of words. In this study, the percentage of words was calculated to find noun phrase density in academic writing. The Coh-Metrix also measures the total number of words counted as the lexical fluency of the text.

To investigate sophistication, another software utility, RANGE (Heatley et al., 2002), is suitable for measuring small samples was used. RANGE can present the percentage of “advanced” words in the text. The sources of these lists are, the *General Service List of English Words (GSL)*, arranged by West (1953) for the 2,000 words most frequently used, and the *Academic Word List (AWL)* by Coxhead (2011). The reason for having selected this software is due to its availability and type of results that it provides for the analysis and comparison of corpora since the samples are small.

To explore and describe in rich detail the phenomena being investigated, descriptive statistics were computed using SPSS 25. A correlation analysis was conducted to determine the relationship between the use of the aforementioned linguistic features and overall writing quality. In addition, after examining the correlation between the lexical features, multiple regression analysis was conducted by selecting elements with mutual relations and measuring the extent to which each predictive writing quality.

4. RESULTS

In this section, analyses of the participating students’ data will be reported in three parts to address the three research questions. First, to investigate the overall performance of Korean EFL college learners’ writings, statistical results were collected from the Coh-Metrix and RANGE programs. The linguistic features of lexical richness in the students’ writing were also analyzed. Second, considering the small number of participants in the study, it was judged that the statistical assumption itself could not be done with more complexity (e.g., SEM or HLM). Thus, Pearson correlation analysis was performed using SPSS to determine how elements of lexical richness are related to student writing quality. Finally, to investigate how these elements influence writing quality, multiple regression analyses were conducted.

4.1. Lexical Richness Elements in Korean EFL Students’ Writing

Table 3 displays the descriptive statistics for the overall performance of the mean, standard deviations, minimum and maximum value of overall writing quality, and the linguistic features measured in this study. Student writing performance showed a wide range of quality scores, with an average score of 15.91 ($SD = 1.54$) and a range of 11 to 18 points.

In regard to the students' writing quality score, this paper considers why there are such wide score differences among students who have been assigned to the same course level. I attribute these differences to the TWE score range assignments that were utilized to place students into the writing classes at our university. For example, if one student receives a placement test score of 71 and another student receives a score of 78, the two students can still be placed within the same score level and thus take the same class. This suggests that there are bound to be differences among the students' scores within this study. The general pattern shown in Table 3 is that the higher the writing scores of the students, the better the overall richness of the writing. However, patterns for the four lexical richness elements have, of course, also been included in performance as well as in writing quality. The test scores for the class were normally distributed. In order to determine the range of each factor probabilistically, 95% confidence intervals were measured (see Table 3 for detail).

Table 3 also reveals that student writing quality can be shown to have different values in terms of diversity of words, density of noun phrases, range of words in a text (sophistication), and minimum or maximum numbers of words used by EFL students in academic writing (fluency). Likewise, the overall range of unique and/or different word diversity in a text is from 32.16 to 100.81, with an average of 68.45 words.

TABLE 3
Descriptive Statistics for Linguistic Features and Students Writing ($N = 35$)

Features	Mean	SD	Min	Max	95% CI	
Writing Quality - Holistic score	15.91	1.54	11.00	18.00	15.40,	16.42
Diversity - D	68.45	16.65	32.16	100.81	62.93,	73.96
Density - Noun phrase	358.81	38.45	269.43	434.16	345.07,	370.55
Sophistication - GSL1	239.91	88.62	102.00	457.00	210.55,	269.27
- GSL2	11.40	7.60	0.00	27.00	8.88,	13.92
- AWL	9.77	6.12	2.00	29.00	7.73,	11.81
Fluency - Token	274.51	101.18	111.00	511.00	240.99,	308.03

Note. GSL1 (1,000 words) and GSL2 (1,000 words): The most widely used word lists have been from the General Service List (West, 1953) containing 2,000 word families.

The number of tokens and types of academic words used ranged for the sophistication of text ranged from 2 to 29. On average, 87.82% of student texts consisted of vocabulary from the GSL1 range (the first 1,000 most frequent words of English) and 3.56% from AWL. Similarly, through the use of lexical density, student writing describing the proportion of content words ranged from 269.43 to 434.16. As a result, the numerical value of the lexical richness factor of other vocabulary is not always high even if the student's writing quality is high. In some cases, it may be high, but it can be different

depending on the circumstances and experiences of the students.

Fluency was measured by the number of words produced in 30 minutes. The texts collected were between 111 and 511 words long with an average of 274.51 words and a standard deviation of 101.18 words. Nine texts were shorter than 200 words and fourteen texts were shorter than 250 words. There were also five texts longer than 300 words, four were over 400 words, and only one was over 500 words. This means that writing quality seems to be evenly distributed between low and high scores without any specificity to explain. Although high-level writing can be characterized by the number of tokens used in the text that are somewhat longer in terms of fluency, they may not appear in the various types of words used in the text. However, cohesion of all the words, coherence of paragraphs, and fluency in writing play a very important role in the quality of the writing.

For sophistication, in order to assess the students' writing ability in terms of vocabulary precision, three measures of lexical sophistication (GSL1, GSL2, and AWL) used by students have been compared. As a result, basic GSL1 usage by students with low writing ability did not show a great difference compared to students with high ability. However, there was a considerable gap between the high- and low-proficiency-level students in using AWL. Students who participated in the study used a large number of words in GSL1 rather than a large number of difficult words in academic writing to express their knowledge and to show how the information is organized in both the structural and semantic sense. Accordingly, judgements about text quality could not be focused mainly on the measure of one feature, but rather, various aspects had to be taken into account.

4.2. Correlation Between Lexical Richness Elements and Writing Quality

To investigate the strength and direction of the linear relationship between overall writing quality and the use of lexical richness elements, this study used a Pearson correlation coefficient. As we have seen in previous studies (Bestgen, 2017; Kao & Wang, 2014; Mazgutova & Kormos, 2015), there was both a positive and negative correlation between the use of these linguistic features and writing quality. The results of the overall measures are summarized in Table 4. There was a strong, positive correlation between the linguistic features and writing quality. Increases in writing qualities were correlated with increases in lexical complexity. Also, there are statistically significant results as well as relatively insignificant results reported in this study.

Based on the overall results of this study, some pairs are somewhat different, and thus measure not only the various kinds of vocabulary knowledge but also the relationship between them. The strongest correlations are confirmed on measures of diversity and sophistication as the number of lexical words has a close relationship to writing quality

(see Table 4), whereas, measures of lexical sophistication – AWL and density correlate ($r = -.072$, *ns*, $p = .679$), confirming that the percentage of lexical words has little relationship to lexical density. In fact, since the topic is related to the students' purpose of learning English and interest – not highly abstract or highly technical – students with high writing scores produced a relatively high average lexical sophistication.

Moderately high, positive, statistically significant correlations were found for the following measures: sophistication – GSL1 ($r = .390$, $p < .01$, $p = .021$), and sophistication – AWL ($r = .514$, $p < .05$, $p = .002$). This might indicate that in academic writing, reliability on lexical richness is fundamental when trying to make meaningful statements about the L2 learner's language development, such as the L2 learner's lexical features, how its relationship to writing quality develops, and how it will affect other aspects of L2 performance (Meara, 2005).

The results of this study identified that the majority of students with high writing scores also showed high values for lexical richness. On an individual basis, although the students' writing quality are the most concerned linguistic performance in this study, the correlation coefficient between fluency and sophistication – GSL2 ($r = .691$, $p < .05$, $p = .000$) displayed high significant positive associations. However, in contrast to positive associations, density ($r = -.209$, *ns*, $p = .228$) was either an insignificant or negative association with writing quality. This result is presumed to be caused by a lack of the ability to use functional words and grammatical proficiency to connect content words while using many of them.

According to Coh-Metrix result this research found that all students use density devices especially noun phrase density, but there seems to be no significant difference between the density scores of students with low writing scores and high writing scores (Lu, 2012; McNamara et al., 2010). Similarly, McNamara et al. (2010) has presented that there was no difference in learners' proficiency, and no cohesion index correlated with essay grade. However, in contrast, Connor (1990) has revealed that some students' writing scores among high proficiency L2 writers include more connectives as a density index.

As can be seen from the statistical results in Table 4, it can be predicted that the higher the writing score, the higher the value of the lexical richness function. In fact, if the results of the analyzed text show that there is a significant correlation between the scores of the human markers and the elements of the vocabulary for vocabulary use, this strongly suggests that this approach can be used for self-evaluation among other evaluable applications (Gregori-Signes & Clavel-Arroitia, 2015). On the other hand, this study shows that there is no significant correlation between the diversity and sophistication – AWL with the test takers' writing quality. This result is similar to Engber's (1995) L2 writing study and suggests that the numbers of lexical words used in an oral narrative are not related to its quality.

TABLE 4
Correlation Between Lexical Richness Measures and Writing Quality (N = 35)

Variables	1	2	3	4	5	6	7
1. Writing quality	---						
2. Diversity	.133	---					
3. Density	-.209	-.080	---				
4. Sophistication – GSL1	.390*	.348*	-.076	---			
5. Sophistication – GSL2	.514**	.542**	.095	.649**	---		
6. Sophistication – AWL	.190	.259	-.072	.573**	.471**	---	
7. Fluency - Token	.311	.428*	-.082	.977**	.691**	.626**	---

Note. * $p < .05$, ** $p < .01$

This study also measured the relationship between fluency: the number of words (tokens) and students' writing quality. The results did not yield significant correlation between fluency and writing quality ($r = .311$, ns , $p = .069$). However, for fluency (tokens) and sophistication — GSL1 was too high to correlate (i.e., each regression coefficient was not independent) and could not create a linear model, instead creating a multilinear phenomenon. It is also possible to consider the possibility that two independent variables could actually be measuring the same item. Thus, for the last research question, this researcher chose one of these variables to interpret the results of the causal relationship between the lexical richness elements more meaningfully and logically.

4.3. Predictive Power of Lexical Richness Elements on Writing Quality

In relation to the third research question of this study, it is most important to prove causality between two or more independent variables—causes (lexical richness elements)—and one dependent variable—result (writing quality). To identify the specific features that predict student overall writing quality and to seek out the effect of independent variables on the dependent variable (Field, 2009), multiple regression analysis was conducted via SPSS. When there is more than one independent variable describing a dependent variable, setting a simple regression model cannot bias the coefficient estimator by missing important explanatory variables (independent variables: lexical richness elements) for dependent variables (writing quality). Of course, simple regression is less useful because the specification of the model is not accurate. Therefore, bias can be eliminated by multiple regression analysis and this coefficient provides a reliable estimate of the overall fitness of the regression model.

In order to use such parametric tests as multiple regressions, the initial assumptions are of no perfect linear relationship between two or more of the predictors (multi-collinearity).

Accordingly, in the real model, this assumption of linear independence is broken by the independent variables (i.e., fluency and sophistication) where the predictor variable should not correlate too highly (Field, 2009). In this sense, this study analyzed the correlation between writing scores and three of the elements of lexical richness: diversity, density, and sophistication excluding fluency. Based on the effect size of correlation coefficients (.25: weak; .40: moderate; .60: strong), Table 5 presents the relationship between the lexical richness elements and writing quality had a strong effect (Plonsky & Oswald, 2014).

Further, a multiple linear regression analysis was calculated to predict writing quality on five independent variables (i.e., diversity, density, sophistication – GSL1, sophistication – GSL2, and sophistication – AWL). Enter method multiple regression employed with five lexical richness variables found a significant model for predicting the writing quality. This method is also appropriate when dealing with a small set of predictors and when the investigator does not know which independent variable produces the best predictive equation.

As shown in Table 5, a significant regression equation was found ($F(5,29) = 3.734$, $p = .010$), with an R^2 of .392. In other words, using diversity, density, sophistication-GSL 1, GSL2, & AWL can explain the writing quality as 39.2%, which is statistically significant. More specifically, the F value is 3.734, regression effective degree of freedom is 5, the residual effective degree of freedom is 29, and the corresponding p -value is at the 0.010 level. Thus, at the 95% confidence interval level, the significance value is 0.010, which is less than 0.05, so the regression model is significant ($p = .010 < .05$). Also, Durbin-Watson's d is 1.757, indicating that there is no first-order linear autocorrelation in the multiple linear regression data because the d value is close to 2 out of the 1 to 3 range.

TABLE 5

Lexical Richness Elements as Criterion Variable

Model	R	R^2	Adjusted R^2	Std. error of the estimate	Change statistics				Durbin Watson	
					R^2 change	F change	$df1$	$df2$		Sig. F change
1	.626 ^a	.392	.287	1.3015	.392	3.734	5	29	.010	1.757

Note. Predictors: (constant), Diversity, Density, Sophistication – GSL 1, Sophistication – GSL 2, & Sophistication – AWL

Moreover, among the influencing factors, it is suggested that the standardized coefficient beta value in Table 6. The final predictive model was:

$$\begin{aligned} \text{Writing quality} = & 20.227 + (-.024 * \text{diversity}) + (-.012 * \text{density}) \\ & + (.002 * \text{sophistications – GSL 1}) + (.140 * \text{sophistications – GSL 2}) \\ & + (-.035 * \text{sophistications – AWL}) \end{aligned}$$

Unstandardized beta value showed that participants' writing quality increased .140 units for sophistication – GSL2 ($B_4 = .140$). Although sophistication – GSL 2 and density are statistically significant in order, diversity, sophistication – GSL 1, and sophistication – AWL are not statically significant. Thus, the regression analysis of this study revealed that lexical sophistication was the most important predictor of writing quality. However, diversity, density, and fluency did not predict the use of lexical richness from writing quality. In addition, all VIF values are less than 10, so there is no multicollinearity. Therefore, it can be concluded that there is a linear relationship between linguistic features, in other words, lexical richness were significant predictors of writing quality.

TABLE 6
Linguistic Features Predictive Power on Writing Quality

Model	Unstandardized coefficients		Standardized Coefficients	<i>t</i>	Sig.	VIF
	<i>B</i>	Std. Error	β			
(Constant)	20.227	2.602		7.774	.000	
Diversity	-.024	.016	-.261	-1.492	.147	1.454
Density	-.012	.006	-.299	-1.991	.056	1.076
Sophistication – GSL 1	.002	.004	.090	.428	.672	2.098
Sophistication – GSL 2	.140	.045	.692	3.125	.004	2.336
Sophistication – AWL	-.035	.045	-.141	-.787	.438	1.534

Note. Dependent variable: writing quality

In this study, developing L2 writing proficiency was affected by lexical diversity, lexical sophistication, and fluency. Other measures were also influenced by a significant correlation with student writing quality. However, it seems rather difficult to predict lexical richness as a clear factor in the development of academic writing skills. In other words, variables that were non-significant for writing proficiency in this study (e.g., cohesion and consistency of EFL students' writing) may have a more significant effect in future research.

5. DISCUSSION

The primary objective of this paper was to evaluate lexical richness in 35 EFL university students' texts they composed for a single written test. To fulfill this overarching goal, the analysis focused on answering three main questions. For the first research question, with reference to lexical richness elements in the L2 students' writing quality, the descriptive analysis of this study supports the findings of previous studies (Crossley et al., 2016;

Daller & Xue, 2009; Engber, 1995; Laufer & Nation, 1995). For instance, lexical diversity, lexical density, sophistication, and fluency, that is, lexical richness are essential to the quality of writing. Simply put, overall writing quality may indicate that students with a broad vocabulary dictionary have a higher level of English language proficiency (Kim, 2014; Lemmouh, 2008).

For the second research question, the result of this study indicated that there are correlations between some of the lexical features and the overall quality of students' writing (i.e. writing quality and sophistication, diversity and sophistication, academic word list and fluency). However, unlike previous research (Crossley & McNamara, 2014; Engber, 1995; Lu, 2012) that assessed lexical diversity and density, there was no correlation between lexical diversity or lexical density and students' writing. In the light of the relations between lexical richness and writing quality, lexical sophistication was most strongly correlated with writing quality.

According to the regression analysis related with the third research question, lexical sophistication was the best predictor of EFL learners' writing quality among the features that showed lexical richness characteristics. Surprisingly, the students employed second 1,000 most-frequent (i.e., GSL2) words (Nation, 2001; West, 1953) more frequently than academic words in the text. It seems they focused on reflecting on their own experiences rather than persuading readers by using the first 1,000 most frequent words (i.e., GSL1) and second 1,000 (i.e., GSL2). These results are probably due to the fact that all students did not learn much about the academic writing context and their exposure to academic reading was so low that the academic words list (i.e., AWL) were used infrequently in their writing output (Grabe, 2003).

On the other hand, if the research follows with the structure of LFP of Laufer and Nation (1995), the less proficient students make more use of the GSL1. There is a tendency for the less proficient students to make more use of the intermediate' vocabulary (GSL2), which the significant differences emerge again with the more sophisticated vocabulary, the AWL, and the 'not-in-the-list' words. Thus, this research can suggest that, sophistication is reliable and valid measure of lexical richness in writing and it will be useful for determining the factors that affect judgments of quality in writing (Gregori-Signes & Clavel-Arroitia, 2015).

Now, this study is more confident in using a text analyzer (i.e., RANGE) to investigate lexical richness in order to "gain a balanced picture of a learner's vocabulary knowledge" (Nation, 2007) in the learner's text. In other words, when considering the development of lexical richness necessary for successful second language acquisition, successful lexical acquisition, and writing quality, it seems necessary to consider decontextualized (e.g., temporarily decontextualized target words and large quantities of comprehensible) and contextualized input (e.g., communicative and meaning-focused), communicative output,

form-focused instruction, and fluency development (Laufer, Meara, & Nation, 2005).

To do so, teachers should be very selective when choosing lexical items for students to learn. Accordingly, it is best for teachers to introduce high-frequency vocabulary for beginner or low intermediate learners, while the mid intermediate and advanced learners should focus on academic vocabulary and useful technical vocabulary (Coxhead, 2000, cited in Beglar & Hunt, 2005, p. 7). Then, students should be encouraged to use both target words which, though, have not yet been fully inherited as new input and vocabulary that is already understood and learned frequently (Nation, 2001). By doing so, teachers and learners are able to devote time to develop lexical fluency. Through such a process, students can internalize and actively use already known vocabularies and large vocabulary chunks in their own language (Beglar & Hunt, 2005).

In some case, it is possible that students' own ability to connect reading to writing is so minimal that other lexical richness elements, such as the results of correlations and regression analyses conducted in this study, may not be applicable to students' writing skills. The results of this study showed that the strongest correlations are confirmed on measures of diversity and sophistication has a close relationship to writing quality, whereas it was not found to be related to the lexical density ($r = -0.72$, ns, $p = .679$).

Consequently, this study proposes that learners can effectively use rational and logical expressions through meaning-focused input (Nation & Meara, 2010), and by reading various contents, those readings' contents and vocabulary can be used effectively in their discipline and academic writing (Grabe, 2003). At the stage of expertise, the sophistication of vocabulary use is more important in determining text quality rather than knowledge of reading-to-write strategy (van Geldern, Oostdam, & van Schooten, 2011). Thus, it seems that students who are not accustomed to academic vocabulary focus on using more familiar everyday vocabulary as a result. With this sense, in order to have the ability to develop academic writing ability, learners need to read a lot of texts related to their discipline and use the meaningful input to connect their writing (Grabe, 2003) with appropriate words use.

In short, the use of lexical richness affects writing ability (Johansson, 2009) and can be seen differently in texts depending on the context of learning, text type, vocabulary knowledge, vocabulary size, and text length. Further, in the future research, form-focused instruction is essential for the learner when it is predicted that the learner with low writing ability is not able to use various vocabulary and accurate vocabulary due to lack of lexical knowledge.

6. CONCLUSION

In the present study, the lexical sophistication was found to be the most influential factor

that contributes to higher writing quality. The correlation analysis showed that the use of lexical diversity, sophistication, and fluency all affect writing quality and can be seen differently in a text depending on different score ranges. The current study displayed various aspects of vocabulary knowledge, text length, and these linguistic features are important characteristics for indicating writing quality (Lemmouh, 2008; Morris & Cobb, 2004; Muncie, 2002). Further, the lexical richness displayed in written text is a result of a person's underlying vocabulary knowledge, which can be effective in academic writing. In this sense, students can develop strong writing skills if they use familiar and appropriate vocabulary with a variety of functions in the appropriate context.

In other respects, investigating vocabulary size, vocabulary knowledge, and lexical richness measurement can each have some limitations. For practical parts, the vocabulary size measurements used by learners consist of large sample words with different word frequency levels, and random selection represents the entire vocabulary at this level. Thus, test scores can be interpreted to reflect the test taker's general vocabulary knowledge, regardless of learning (Laufer et al., 2004). Therefore, future research could investigate whether the density index is high or low, whether it correlates with the quality of the entire sentence, and whether grammar competence is controlled among the pool of language learners (i.e., having similar grammatical abilities). In doing so, we expect to be able to pay more attention to the role of the density index in lexical richness and provide more accurate information.

The results of this study lead to a question of why there is little impact on lexical density, cohesion, and consistency in writing performance. There are several ways to explain the reasons for this finding. This study only looked at student writing activities with a single task and a group of students with the same proficiency. If this study were conducted over a long period of time with multiple tasks given to the students or different proficiency groups, this study would have more writing output and we would be able to generalize the data results by observing the writing development process in more detail and in various aspects.

In addition to emphasizing the importance of lexical richness in academic writing, it should be noted that the current study suggests some significant pedagogical implications. First, teachers need to provide students with the opportunity to use vocabulary as tools for language acquisition. Second, an analysis of the lexical richness characteristics seen in learners' writing is important because it can help teachers discover strengths and weaknesses in their learners' vocabulary and, as a result, help them to design differentiated lessons plans that deal with specific tasks (National Commission on Writing, 2003). Teachers should continue to research solutions that can help them to overcome challenges that students encounter and improve writing quality by incorporating lexical richness in their written text.

To sum up, in future research, it would be interesting to not only analyze the quality of

the learner's academic writing quality and the richness of the vocabulary but also to deeply study the learner's writing proficiency development process along with improvement of learner's lexical richness through a longitudinal study.

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Applicable levels: Secondary, tertiary, college

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