

## **The Contribution of Vocabulary Knowledge to Summary Writing Quality: Vocabulary Size and Lexical Richness**

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### **Abstract**

Vocabulary knowledge plays an important role in writing. Previous research has examined the relationship between various aspects of vocabulary knowledge and independent writing performance and limited attention has been given to integrated writing such as summary writing. Our study investigated the contribution of two aspects of vocabulary knowledge (vocabulary size and lexical richness) to summary writing quality. In addition, we examined the extent to which lexical richness measures relate to summary writing quality among students who have smaller vocabulary sizes and students who have larger vocabulary sizes. We addressed these questions by administering a lexical decision test called the LexTALE and analyzing lexical richness and writing quality in the summary writing of 73 English as a Foreign Language (EFL) learners of English. The results revealed a strong positive correlation between vocabulary size and summary writing quality indicating that a larger vocabulary size is associated with higher-quality summaries. However, most measures of lexical richness did not show a significant correlation with summary writing quality. Interestingly, the relationship between lexical richness measures and summary writing quality varied when learners were put in two groups with different vocabulary sizes. Implications of the findings of the study for language teaching pedagogy and for research on the complex relationship between vocabulary knowledge and summary writing are discussed.

**Keywords:** vocabulary knowledge, summary writing, vocabulary size, lexical richness, integrated writing quality

Vocabulary knowledge is difficult to define. As Milton and Fitzpatrick (2017) put it “Knowing a word is an elusive concept and we are still unable to capture, in a simple description, everything that knowing a word might involve” (p.1). According to Nation (2022), knowledge of a word involves not only knowing its form but also its meaning and use. Adding to the

complexity is that each of these aspects is divided into three further parts. Form includes spoken form, written form, and word parts. Meaning includes form and meaning, concepts and referents, and associations. Use includes grammatical functions, collocations, and constraints on use (register, frequency). Furthermore, each of the nine aspects can fall along either a receptive or a productive dimension. The receptive dimension involves the ability to recall the word meaning when encountering the word form in listening or reading. The productive dimension involves being able to use the word form in speech or writing. Vocabulary was also conceptualized in terms of two main components called depth and breadth (Milton, 2009; Webb, 2000). As Webb (2020) put it, breadth refers to knowing “the form-meaning connections of words”, which is also called vocabulary size (i.e. the number of words known), and depth refers to “how well a word is known” (Webb, 2020, p.6). Thus, it has proven impossible to test all aspects of vocabulary knowledge.

Vocabulary size is the aspect of vocabulary knowledge that has received increased attention in the literature as it has been considered a reliable measure of second language learners’ (L2) proficiency (David, 2008; Janebi Enayat et al., 2018; Zhou, 2022). Vocabulary size explains a significant portion of the variance in reading (72%), writing (39%), and listening (52%) scores (Alahmadi & Foltz, 2020). According to Milton (2008) measuring vocabulary size “can help give a much better impression of the scale of learning which is taking place than is possible with other measures of language proficiency” (p.334). Nevertheless, Laufer and Nation (1995) emphasize that in order to give a complete picture of vocabulary knowledge, researchers should also investigate how learners put vocabulary to use. The degree to which learners use vocabulary in a rich and diverse way is referred to as lexical richness. Lexical richness is a multifaceted construct that has been studied from three dimensions: diversity, density, and sophistication. Diversity refers to “the range or variety of vocabulary” used in a text (McCarthy & Jarvis, 2007, p. 459). Lexical sophistication is a measure of the percentage of sophisticated or less common words in a text (Read, 2000). Lexical density refers to the proportion of content words (i.e. nouns, verbs, adjectives, and some adverbs) in a given text (Johansson, 2008). Lexical richness can be exhibited in students’ speaking or writing samples.

Existing studies in L2 writing research emphasize the positive relationship between various measures of lexical richness and writing quality (Engber, 1995; González, 2017; Guo et al., 2013; Kim et al., 2018; Kyle & Crossley, 2016; Maamujav et al., 2021; Yang et al., 2023). Additionally, researchers generally agree that the relationship between lexical richness and writing quality may vary depending on the type of writing (Johansson, 2008; Olinghouse & Wilson, 2013; Sadeghi & Dilmaghani, 2013; Wang, 2014). This is because different types of writing entail different cognitive and linguistic demands (Abrams, 2019; Plakans, 2009). In independent writing tasks (e.g. essays), learners are expected to read a prompt and express their ideas and opinions without relying on sources. However, in integrated writing, learners must incorporate information from the given sources into their new text. Previous research has deepened our understanding of the context-dependent nature of lexical richness.

To date, the majority of research in L2 writing has focused on independent writing tasks (e.g. expository essays, argumentative essays, stories), with some studies also investigating the relationship between lexical richness and integrated writing quality (e.g. Golparvar & Abolhasani, 2022; Kyle & Crossley, 2016; Maamujav et al., 2021). Additionally, previous studies that have investigated the contribution of lexical richness in integrated writing tasks have predominantly done so by examining TOEFL iBT integrated essays. In these types of

writing, learners are required to select specific ideas (quotations, statistics, claims) that are useful for supporting their main ideas from the source text (Plakans, 2009). Fewer studies have focused specifically on the relationship between lexical richness and L2 summary writing where learners are expected to “manipulate” the source text by changing the structure of the sentences and using synonyms without changing the original meaning (McDonough et al., 2014, p. 20). As a result, a limited amount of empirical data exists that explores the specific relationship between lexical richness and summary writing quality (Baba, 2009; Zhang & Ouyang, 2023).

In this paper, we build on the existing body of research on the relationship between lexical richness and summary writing quality. Our approach involves not only assessing the contribution of lexical richness but also exploring the contribution of the size of the learners’ vocabulary to summary writing quality. Additionally, we will investigate whether the relationship between lexical richness and summary writing quality changes based on learners’ vocabulary size. So far, results from past research have shown that the relationship between lexical richness and L2 writing quality may vary depending on the topic (Lavallée & McDonough, 2015; Yu, 2009), genre (Olinghouse & Wilson, 2013), L1 background (Jarvis, 2002), and proficiency (Wang, 2014). To the best of our knowledge, the role of vocabulary size has not received scholarly attention when investigating the relationship between lexical richness and writing quality. While it is widely acknowledged that differences in vocabulary size exist among learners due to differences in exposure and time of studying (Milton & Treffers-Daller, 2013), it is not clear if the relationship between measures of lexical richness will change depending on the learners’ vocabulary size. Finding such evidence is important as it may add further insights into the intricate relationship between lexical richness and writing quality as well as contribute to our understanding of whether to consider vocabulary size in the design of summary writing tasks.

## **Review of the Literature**

### **Vocabulary Size**

One of the primary research foci in the area of vocabulary knowledge is the size of learners’ vocabulary which is the quantity of words known by language learners (Nation, 1990). Vocabulary size is often measured through tests focusing on the recognition or recall of certain words. Various vocabulary size tests have been proposed that tap into learners’ word recognition ability including the traditional pen-and-paper Vocabulary Size Test (Nation, 1990), The New Vocabulary Levels Test (Schmitt et al., 2001), The Updated Vocabulary Levels Test (Webb et al., 2017), the Yes/No Vocabulary Test (Meara & Buxton, 1987; Meara & Jones, 1987), the revised version of the Vocabulary Level Test (Schmitt et al., 2001), the Eurocentres Vocabulary Size Test (EVST) (Meara & Jones 1987, 1990), the LexTALE (Lemhöfer & Broersma, 2012) which was designed for L2 learners, and the more recent intelligent vocabulary size test (IVST) (Xia et al., 2023). Despite differences in test formats, researchers generally believe that measuring vocabulary size can shed light on learners’ language proficiency and predict their ability to engage in effective communication across different language skills (Laufer & Goldstein, 2004; Nation, 2022; Schmitt, 2010).

Researchers found that vocabulary size is closely associated with language skills (i.e. speaking, listening, reading, writing) (e.g. Milton & Treffers-Daller, 2013; Miralpeix & Muñoz, 2018; Stæhr, 2008;). For instance, a study by Stæhr (2008) investigated the relationship between

secondary school learners' scores on the VLT and the skills of listening, reading, and writing. The study involved 88 participants from secondary schools in Denmark who took the standardized national school leaving examination. Stæhr (2008) found that vocabulary size was an important predictor of language performance correlating more strongly with writing ability than with listening ability. Similarly, a study by Miralpeix and Muñoz (2018) investigated the relationships between Yes/No receptive vocabulary size test scores and different language abilities (reading, writing, listening, and speaking) in upper-intermediate/advanced EFL learners. Results showed that at a higher proficiency level, vocabulary has a stronger relationship with writing ability and a moderate correlation with reading, speaking, and listening. These results aligned with earlier research by Milton et al. (2010) who tested the relationship between IELTS sub-section scores and vocabulary size. However, Milton et al. (2010) tested not only the learners' ability to recall how the word looks (orthographic ability) but also how the word sounds (phonological ability). Results showed that orthographic test scores correlated positively with reading, listening, and writing scores on the IELTS test. Further, the results suggested a significantly large correlation between writing and orthographic test scores ( $r = .76$ ). Generally, these studies underscored the importance of vocabulary size for writing ability. Obtaining high scores in writing requires having a large vocabulary size.

Some other studies that can be considered more central to our study have also demonstrated the central role played by vocabulary size in writing (e.g. Dabbagh & Janebi Enayat, 2019; Kiliç, 2019; Mujtaba et al., 2021; Sukying, 2023; Yang et al., 2019). For example, Dabbagh and Janebi Enayat (2019) measured the vocabulary size (also called breadth) of 67 Iranian undergraduate students. The participants were asked to produce two descriptive paragraphs to further explore their writing performance. Analysis revealed that vocabulary size correlated positively ( $r = .434$ ) with descriptive writing scores. Additionally, vocabulary size emerged as a significant predictor accounting for 19% of the variance in the participants' descriptive writing performance. A more recent study by Sukying (2023) measured the relationship between two multiple-choice vocabulary size tests (the VST and the NVLT) and argumentative essay scores of 53 postgraduate students at a university in Thailand. Results demonstrated a moderate relationship ( $r = .47$ ) between vocabulary size and overall writing performance. In addition, the vocabulary component on the rubric showed a moderate correlation of  $r = 0.41$ . However, vocabulary size was found to contribute to only 1% of the variance in writing performance.

Fewer studies examined the relationship between vocabulary size and writing scores in integrated writing contexts. One exception is a study by Baba (2009) that explored the relationships between different aspects of English lexical proficiency and the ability of 68 EFL Japanese upper-intermediate university students to write two summaries in English. The researcher found a positive relationship between vocabulary size ( $r = .40$ ) and holistic scores of a summary writing task. It was also found that vocabulary size was more closely tied to reading comprehension highlighting the need for further research into the relationship between vocabulary size and summary writing quality. However, as acknowledged by the author, the study suffered from several methodological limitations. The study relied on a difficult summary task. In addition, the test used to assess vocabulary size was a multiple-choice test designed originally for native speakers.

Taken together, previous studies indicated that writing requires a large vocabulary size. However, there are still gaps and inconsistencies in the extant literature. One important gap is the scarcity of research investigating the contribution of vocabulary size to summary writing. For the current study, it is hypothesized that a larger vocabulary size will relate positively to summary writing quality.

### **Lexical Richness**

Another important aspect of vocabulary knowledge is lexical richness which is often referred to as “the quality of vocabulary knowledge reflected in a text” (Hao et al., 2023, p. 1). It has been described as a multidimensional construct that includes at least three components: diversity, sophistication, and density (Read, 2000). Over the years, scholars have adopted various indices to measure lexical richness from multiple perspectives as well as used various software. In this section, we review the different measurements of *diversity*, *sophistication*, and *density*.

*Lexical diversity* is also called lexical variation which indicates the degree of repetitiveness in a given text (McCarthy & Jarvis, 2010). Traditionally, researchers used Type/Token Ratio or TTR to account for lexical diversity. This measure computes the ratio of different word types to the total number of words or tokens (Cimino et al., 2013; Malvern & Richards, 2012; McKee et al., 2000). However, TTR has been criticized for being sensitive to text length as longer texts may contain more words that are repeated (Vermeer, 2000). In order to measure texts of different lengths, Malvern and Richards (1997) proposed two measures that are independent of text length: Voc-D and MTLD (Measure of Textual Lexical Diversity). The two measures were further developed and implemented by McKee et al., (2000). The process of how the Voc-D and MTLD are calculated is complicated. The details can be found in Malvern et al., (2004). Below we provide a summary of the calculation process:

Voc-D is based on repeated calculations of the type-token ratio (TTR) over 100 random samples of 35-50 tokens. MTLD is a more complex measure of lexical diversity that takes into account the length of the text. It is designed to provide a more accurate measure of vocabulary diversity for texts of different lengths. The MTLD score is calculated by dividing the text into segments of a certain length and then calculating the average lexical diversity across all segments. Studies by Jarvis (2013), Malvern et al., (2004), and McCarthy and Jarvis (2010) demonstrated that both Voc-D and MTLD can be valid and reliable measures of lexical diversity without the problems of text length found with previous TTR methods.

*Lexical sophistication* is a measure of the percentage of sophisticated or less common words in a text. Read (2000) defines lexical sophistication as a “selection of low-frequency words that are appropriate to the topic and style of the writing, rather than just general, everyday vocabulary. This aspect of the range of expression also includes the use of technical terms and jargon...” (p. 200). Lexical sophistication is relevant to lexical richness because not all people can use and understand advanced words. Laufer and Nation (1995) proposed the Lexical Frequency Profile (LFP) to reliably estimate lexical sophistication in speech or writing. The LFP includes four different frequency categories: the first 1000 most frequent words, the second 1000 most frequent words, the words in the Academic Word List (AWL) (Coxhead, 2000), and words not found in any of the previous three categories (off-list). The percentage of off-list or AWL words is taken as a measure of lexical sophistication in a given sample.

*Lexical density* refers to the ratio of content words (i.e. nouns, verbs, adjectives, and some adverbs) and functional words (pronouns, prepositions) in a given text (Johansson, 2008). Lexical density can be measured by taking the number of content words and dividing them by the total number of words. According to Johansson (2008), lexical density measures the information packaging in a text. A text that includes 100 words and 60 of them are content words can be said to have 60% density. Lexical density may be negatively associated with lexical diversity. In other words, a text may have high lexical diversity (containing many different types of words) but low lexical density (containing only a few content words).

### **Previous Studies on the Relationship Between Lexical Richness and Writing Quality**

Lexical richness has been investigated extensively in independent writing contexts (Gómez Vera et al., 2016; Olinghouse & Leaird, 2009; Olinghouse & Wilson, 2013) and integrated writing contexts (Baba, 2009; Golparvar & Abolhasani, 2022; Guo et al., 2013; Jiang et al., 2022; Kim et al., 2018; Kyle & Crossley, 2016; Zhang & Ouyang, 2023). In independent writing contexts, some studies consistently have found that measures of lexical richness correlate positively and contribute to L2 writing quality. For example, Lee et al., (2021) investigated the contribution of 4 indices of lexical richness to the writing quality of reports and letters of advice written by Chinese adolescent writers. Results demonstrated that lexical richness measures explained 77.78% of the variance in the writing quality of the letters of advice and 80.77% of the variance in the writing quality of the reports. Yang et al. (2023) analyzed the lexical richness of two hundred and seventy expository writing samples drawn from Spoken and Written English Corpus of Chinese Learners Version 2.0. The results of correlation analysis between the lexical richness indices and the overall writing quality showed that while all three measures of lexical richness i.e., lexical density, sophistication, and diversity significantly correlated with the EFL expository writing quality, two indices of lexical diversity explained most of the variance in the sample. Yang et al. (2023) reported that the combination of two indices of lexical diversity (Number of Words and Noun Variation) could explain 38.5% of the variance in EFL expository writing scores.

Further research has demonstrated the importance of lexical diversity in L2 independent writing (Engber, 1995; González, 2017; Roessingh et al., 2015; Yang et al., 2023). For instance, Engber (1995) analyzed sixty-six placement essays written by students from mixed language backgrounds in the intermediate to advanced range of an intensive English program. Results showed significantly large correlations between diversity indices and holistic essay scores but not with density. Indeed, density was unrelated to writing quality across different writing tasks (Ha, 2019; Knoch et al., 2014; Yang et al., 2023). González (2017) reached similar conclusions by analyzing a collection of TOEFL iBT independent essays written by 104 multilingual English learners enrolled in advanced second language writing courses at various intensive English programs and 68 monolingual English-speaking university students in a first-year composition course. Results from a binary logistic regression revealed that lexical diversity has a significantly greater impact on writing scores than lexical sophistication.

However, some studies found more significant associations between lexical sophistication and L2 independent writing quality. For example, Krzemińska-Adamek (2016) assessed the degrees to which the holistic scores of 65 compositions written by English philology students correlated with their lexical richness measures. The study found positive correlations between holistic scores for the compositions and lexical sophistication, but not between holistic scores and lexical diversity. Zhang et al. (2022) supported this idea further, highlighting the influential

role of lexical sophistication in predicting writing quality. The study investigated the predictive power of lexical richness measures (lexical density, lexical diversity, and lexical sophistication) on the quality of L2 argumentative and expository essays. The results indicated that lexical density and diversity were not strongly related to writing quality in both genres (argumentative and informative). On the contrary, lexical sophistication was the primary predictor of writing quality. This led Zhang et al. (2022) to conclude that some genres could encourage learners to use less frequent words in their writing which was in line with Olinghouse and Wilson (2013) who previously found that lexical sophistication as measured by off-list words predicted writing quality in informative texts more than narrative texts.

Overall, although lexical richness measures are intended to measure the same construct, previous studies in independent writing contexts suggested that the different lexical richness measures do not correlate with writing quality in the same way. Further, the relationship between lexical richness and writing quality appeared to be context-dependent and may be influenced by differences in the task requirement (e.g. structure, tone, conventions, rhetorical devices) exerted by the different genres.

Past research that has examined the relationship between lexical richness and writing quality in integrated writing tasks (e.g. TOEFL Essays, graph-based writing, summary writing) has shown that the magnitude of the relationship between lexical richness and writing quality differs across task types. With respect to lexical sophistication, a number of studies have found weak associations between lexical sophistication and TOEFL integrated essay scores (Gebril & Plakans, 2016; Guo et al., 2013; Kim et al., 2018; Kyle & Crossley, 2016). Using 480 samples from the reading–listening–writing TOEFL iBT tasks, Gebril and Plakans (2016) revealed that lexical sophistication was significant but had the lowest correlation to holistic essay scores. Similar results were reported by Kyle and Crossley (2016) who further compared indices of lexical sophistication in independent and integrated writing tasks. Results further confirmed the differences between the two types of writing. It was suggested that while lexical sophistication measures can be important in independent tasks, they may not be strong predictors of essay quality in source-based tasks due to the importance of comprehending the source text.

However, a study by Maamuujav et al. (2021) revealed a strong correlation between lexical sophistication and holistic scores on text-based analytical essays written by Spanish-speaking L2 students (7th-12th grades) from a public school in a western state of the United States. It was found that two indices of lexical sophistication (i.e. age of acquisition and percentage of words covered by the AWL) contributed significantly to writing quality. These findings were supported by Zhang and Ouyang (2023) who analyzed a corpus of 1224 writing samples collected from intermediate EFL learners on two integrated writing tasks (i.e., story completion and summary writing). Results showed that three lexical sophistication indices explained 25.7% of the variance in the summary writing scores. It was suggested that summary writing encourages learners to rely more on paraphrasing skills leading to the use of more sophisticated words.

Additionally, the relationship between lexical diversity and writing quality was found to vary significantly across different writing tasks. In summary writing, Baba (2009) reported non-significant correlations between scores on summaries written by undergraduate Japanese students and measures of lexical diversity. It was suggested that the contribution of reading ability and text length in summary writing was more important than the use of diverse words

in summary writing tasks. On the contrary, in graph-based writing, in which the prompt is based on a visual graph rather than linguistic input, Golparvar and Abolhasani (2022) reported a positive correlation between measures of lexical diversity and the content and language use scores. In other words, graph descriptions with more diverse vocabulary tended to obtain higher scores which was explained by the design of the rubric that encouraged raters to award high scores for the use of more diverse vocabulary. These results were supported by Zhang and Ouyang's (2023) study which analyzed the lexical diversity indices in the continuation task which requires learners to continue a story based on a prompt. Results found that diversity was strongly associated with the continuation task scores. In such tasks, learners are less dependent on source text input and more preoccupied with finding a wide range of vocabulary to express their ideas.

The preceding review highlights four aspects relevant to the present study. First, there is no doubt that vocabulary size is a strong predictor of L2 writing quality. Second, different measures of lexical richness relate to writing quality differently. Third, a majority of the studies reviewed relied on a specific selection of tasks. Overall, research in integrated writing contexts was dominated by the analysis of TOEFL iBT essays which makes the generalization of previous results difficult. Fourth, while previous studies acknowledged that the relationship between lexical richness and writing quality is not straightforward and can be determined by task type (Kyle & Crossley, 2016) and genre (Olinghouse & Wilson, 2013), none of the studies reviewed above have considered variation in vocabulary sizes. According to Meara and Bell (2001) "people with big vocabularies are more likely to use sophisticated words than people with smaller vocabularies" (p.4). Therefore, vocabulary size may play a role in determining the relationship between lexical richness and summary writing quality as learners may differ in their vocabulary exposure. Yet, it is not clear whether this observation can be confirmed. A thorough examination of how vocabulary size affects the relationship between lexical richness and writing quality is missing from the literature. As such, the examination of the relationship between lexical richness and summary writing quality in learners with different vocabulary sizes will allow for an extension of previous research studies.

The current study adds to the extant literature by first examining the contribution of lexical richness measures and vocabulary size to students' summary writing. Second, the study examines the relationship between lexical richness and summary writing quality in two groups with different vocabulary sizes. The study will specifically seek to answer the following questions:

1. To what extent do measures of lexical richness and vocabulary size contribute to overall summary writing quality?
2. To what extent do lexical richness measures relate to summary writing quality among students who have smaller vocabulary size and students who have larger vocabulary size?

## **Method**

The study investigated the role of vocabulary size and lexical richness in summary writing. In particular, we assess university students' vocabulary size and analyze their summary writing in terms of lexical richness. We applied a four-trait analytic rubric to analyze four criteria of writing quality. Institutional review board approval was obtained for this study. Below, we

describe the participants, the summary task, the vocabulary size test we used, the lexical richness measures, the writing rubric, and the analyses conducted.

## Participants

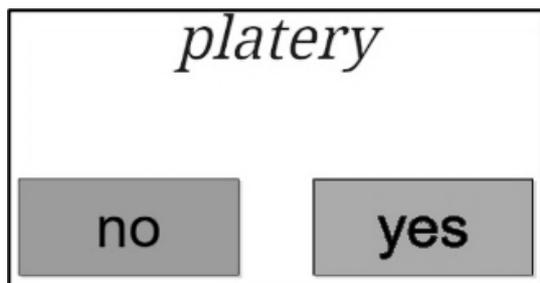
Participants in this study were 73 first-year students enrolled in a General Education program at a state university in Abu Dhabi. This program encompasses various subjects, including humanities, social sciences, and natural sciences which were designed to equip students with a broad base of knowledge, skills, and competencies that all university students need. The subjects were shared by all students who were pursuing one of four majors: IEM (Integrated Emergency Management), BCM (Business Continuity Management), HLS (Homeland Security), or PAS (Policing and Security).

Participants were selected using convenience sampling according to their accessibility and availability to the researcher. Their L1 was Arabic and their average Emirates Standardized Test (EmSAT) score was 1300 which is equivalent to the B2 level in the Common European Framework of Reference for Languages (CEFR) benchmark (United Arab Emirates Ministry of Education, 2022). Specifically, 79.45 % of the students scored at the B2 level while 20.54% scored at the C1 level.

## Instruments

**Vocabulary size measure.** As shown in the review of the literature different studies have used various instruments to measure vocabulary size. The choice of the instrument depends on the researchers' understanding and the practicality within the specific context. In the current study, in which the objective was to collect information about the ability to recognize the form of a word and recall its meaning, the LexTALE developed by Lemhöfer & Broersma (2012) seemed to be the most appropriate instrument for three reasons. First, the test was developed specifically for learners of English as a second language (Unlike previous vocabulary recognition tests which can be considered difficult for L2 learners because they contain many test items). Second, the test is economical and easy to administer as it takes only 5 minutes. Third, the test is a reliable and valid format for assessing vocabulary size (e.g. Nakata et al., 2020; Vermeiren & Brysbaert, 2024). According to the test designers: "LexTALE provides a useful and valid measure of English vocabulary knowledge of medium- to high-proficient learners of English as a second language" (Lemhöfer & Broersma, 2012, p. 340).

The test is composed of 40 words and 20 non-words. Students are asked to indicate whether each word is an English word or not in the same way as vocabulary recognition tests. The following is an example:



**Figure 1. An example of the LexTALE test item.**

The results of a LexTALE vocabulary test consist of a percentage that indicates the test-taker's vocabulary size. The higher percentages suggest a larger vocabulary size while lower percentages indicate a smaller vocabulary size. The average score of a large group of Dutch and Korean advanced learners of English was 70.7 (Lemhöfer & Broersma, 2012). Therefore, in the current study, participants with scores above 70.7 would be deemed to have a vocabulary size larger than the average, while those with scores below 70.7 would be considered to have a vocabulary size smaller than the average within the sample.

**The summary writing task.** A summary writing task was used to tap into students' integrated writing performance and lexical richness and learners were reminded to use the full time to complete the task.

The summary writing task was chosen because it is widely used in many courses within the institution in which the study was conducted. One text containing arguments about the ban on plastic bags was used. The text (*Appendix A*) which consisted of 622 words was deemed appropriate to the students' English proficiency level. The Flesch-Kincaid Grade Level readability formula was used to confirm the suitability of the text for the student's proficiency level. The formula gives a text a score between 1 (very easy) and 100 (very difficult). Commonly a score between 70 to 80 is equivalent to school grade level 8. That is, the text should be fairly understandable by the average first-language-speaking adult.

The summary task was timed to push them to focus on task completion. Many writing examinations, such as the TOEFL integrated writing task which is similar to the task we used in the study, impose time constraints and students are often required to demonstrate their skills within a limited timeframe. Students were given 40 minutes to read the text and write the summary. This timeframe allowed students an adequate amount of time to both understand the content and write the summary. It was estimated that students would spend 20 minutes on reading the text and 20 minutes on writing the summary. Previous studies have provided similar timeframes for their participants (Zhang & Ouyang, 2023).

**Lexical richness measures.** Based on Read's (2000) definition of lexical richness, three dimensions were chosen to assess students' written summaries: lexical sophistication, lexical density, and lexical diversity.

Lexical density was calculated as the ratio between content words (i.e., nouns, verbs, adjectives, adverbs) and all words in a text using the application *VocabProfile* (Cobb, 2002). Texts comprised of more than 60 percent lexical or content words can be considered moderately dense and informative, whereas texts with low-density percentages are vague and meaningless (Biber & Gray, 2010).

Lexical sophistication was calculated using the Lexical Proficiency Profile (LFP) which is a reliable tool proposed by Laufer and Nation (1995). The LFP shows percentages at different frequency levels: K-1 Words (1-1000), K-2 Words (1001-2000), AWL, and Off-list words (Nation, 2017). Summaries that contained fewer K-1 words and a higher proportion of AWL and off-list words were considered to have greater lexical sophistication. Therefore, in this study, we relied on specific frequency-related measures that represented the most stable and reliable measures to yield generalizable results.

Lexical diversity was measured using 2 indices: Voc-D and MLTD as discussed earlier instead of the traditional type-token ratio (Malvern & Richards, 2012). For the current study, students'

summaries were entered into Text Inspector (<https://textinspector.com>) which is a free web-based tool developed by Bax (2012) used to calculate lexical diversity indices that achieved reliable results in a previous study (Bax et al., 2019).

**Writing quality.** To measure the overall writing quality, we developed a multi-trait rubric which consisted of four criteria: Organization, Content, Language use, and Source use. These criteria were scored as Poor (1), Fair (2), Good (3), Very good (4). The criteria were chosen because effective integrated writing is generally characterized by generating relevant ideas from the source text and then paraphrasing and incorporating those ideas into an organized text. The rubric was revised by two expert researchers. This revision included clarifying and specifying the criteria for grading and addressing any ambiguous words. The revised rubric was then applied to a total of ten student papers taken from the same course repository to ensure that both raters had a clear and shared understanding of the criteria. The final rubric version is in Appendix B.

### **Data Collection and Analysis**

Before the start of the study, ethical approval was obtained from the Research Ethics Committee (REC) at the institution where the research was conducted. Students who were selected to take part in the study were informed about the general purpose of the study. They were also assured that the LexTALE and summary writing scores would not affect their course grades. After the participants completed the LexTALE, they were provided with the summary writing task which required them to read the text and then summarize the main ideas and key details in a 200-word paragraph.

The summaries were holistically scored by two expert raters based on the summary rubric which was specifically designed for the study (See Appendix B). The overall quality score was obtained by averaging the scores from the two raters. The correlation between the scores for the two raters was significant and high ( $r = .89, p < .001$ ). After that, lexical richness indices were computed for each summary. Data were analyzed using SPSS software version 27.0. Correlational analysis was used to examine the relationship between vocabulary size, writing quality, and lexical richness. In addition, multiple regression analysis was conducted to assess the relative contribution of lexical richness and vocabulary size to overall writing performance. To understand the relationship between lexical richness and vocabulary size, the students were rank-ordered by their total LexTALE scores. Seven students who were on the median were dropped to have one group of students who were below the median ( $n=28$ ) and one group of students who were above the median ( $n=38$ ).

## **Results**

### **Descriptive Statistics**

In this section, the descriptive statistics of the student's vocabulary size and lexical richness are presented before the main analysis. Table 1 shows that the LexTALE mean score for the participants in this study was 63.54. The low standard deviation shows that there was little variation between the participants in their vocabulary size. This is probably because they consisted of a homogenous group enrolled in similar programs with little individual differences and similar interests.

In line with their vocabulary size, the lexical richness of the students' summary writing appeared to be moderate. As shown in Table 1, students' summaries exhibited a moderate lexical density with a similar number of content and functional words:

**Table 1. Lexical Richness in Students' Summary Writing.**

	Mean	Std. Deviation	Minimum	Maximum
Voc-D	77.58	27.25	21.42	156.37
MTLD	76.25	26.25	23.09	145.83
Lexical density	.55	.05	.44	.76
K-1 Words	68.89	19.46	1.01	88.89
K-2 Words	5.70	2.85	.00	11.00
AWL Words	8.60	3.26	2.55	18.40
Off-List words	11.72	5.79	1.00	31.71
Vocabulary Size	63.54	10.75	50.00	97.00

They also had a low lexical diversity with an average of 76.25 for MTLD suggesting that students' summaries were repetitive. The K-1 words covered 68.89% and K-2 words covered 5.70% of the summaries on average. Thus, both K-1 and K-2 words covered 74.59 % of the words in the summaries whereas words from AWL covered only 8.60% of the summaries. K-1 words tend to be basic words that are used in everyday communication, whereas words covered by AWL include more advanced words common in academic texts. In general, the AWL coverage in students' summaries was a little below the estimated figures (approximately 10 % in Coxhead, 2000; Nation, 1990) for the typical percentage of academic words used in academic texts. Students had a higher percentage of off-list words which indicates that the lexical sophistication of the students' summaries was quite high.

### **The Contribution of Lexical Richness and Vocabulary Size to Students' Holistic Writing Scores**

First, we calculated Pearson correlation coefficients to examine the relationship between lexical richness and summary writing quality. The results are displayed in Table 2:

**Table 2. Correlations Between Lexical Richness Measures, Vocabulary Size, and Overall Summary Writing Quality.**

Measure	Index	R	Sig. (2-tailed)
Vocabulary size		.619	.001
Lexical diversity	Voc-D	-0.14	0.238
	MLTD	-0.135	0.255
Lexical Density	LD	-0.157	0.184
Lexical sophistication	K-1 Words	0.025	0.831
	K-2 Words	-0.12	0.31
	AWL Words	-0.014	0.904
	Off-List Words	<b>-0.254*</b>	<b>0.03</b>

\* Correlation is significant at the 0.05 level (2-tailed).

Multicollinearity was not detected since the eigenvalues value for each measure was below 0.73 threshold which indicates that the variables being studied are not highly correlated with each other to the extent that they would cause problems in the analysis. As can be seen from

Table 2, correlations between measures of lexical richness and summary writing were not significant with only lexical sophistication (off-list words) ( $r = -.254, p = .03$ ) correlating significantly and negatively with summary writing quality. By contrast, summary writing quality was strongly correlated with vocabulary size ( $r = .619, p = .001$ ).

These results from simple correlation analyses provided a baseline for the relationship between aspects of vocabulary knowledge and students' overall summary writing quality. Based on these results, a stepwise regression analysis was calculated to assess the relative contribution of lexical richness on the one hand and vocabulary size on the other hand to overall summary writing quality. Results showed that vocabulary size accounted for 38% of the variance in students' writing quality ( $F(1,71) = 44.016, p < .001$ ). In comparison, lexical richness accounted for only 9.5% of the variance in the writing quality as indicated by the  $r^2$  value of 0.095,  $F(7, 65) = 0.971, p = .460$ . Results are presented in Table 3:

**Table 3. The Results of Multiple Regression Analysis.**

	<b>Standardized Coefficients <i>B</i></b>	<b><i>t</i></b>	<b><i>Sig.</i></b>	<b>VIF</b>
(Constant)		1.921	0.059	
Vocd-D	-0.106	-0.378	0.707	9.106
MTLD	-0.029	-0.113	0.91	7.877
Lexical density	0.031	0.203	0.84	2.726
Off-List	-0.152	-1.195	0.236	1.86

The results indicate that the variance in students' summary writing was predicted by vocabulary size more than by measures of lexical richness. Furthermore, the standardized coefficient  $\beta$  for off-list words suggests that lexical sophistication has a moderate negative effect on the summary writing scores.

**The Extent to Which Lexical Richness Measures Relate to Summary Writing Quality: Comparison of students with smaller vs. larger vocabulary size**

To provide insights into how lexical richness measures and summary writing quality are related in two different groups with different vocabulary sizes, we conducted correlational analyses with the lexical richness measures and writing quality for the students who scored high on the vocabulary size test (Group 1) and those who scored low (Group 2). Comparing the correlation coefficients of the two groups can reveal whether there are patterns of similarities or differences in how lexical richness and summary writing quality relate to each other. Table 4 illustrates correlations between lexical richness measures and writing quality for the two groups:

**Table 4. A Comparison Between Lexical Richness and Summary Writing Quality in Group 1 and Group 2.**

	Students with larger vocabulary size		Students with smaller vocabulary size	
Voc-D	$r=0.164$	$p=0.324$	$r=-0.344$	$p=0.073$
MTLD	$r=.325^*$	$p=0.047$	$r=-0.355$	$p=0.064$
Lexical density	$r=0.172$	$p=0.302$	$r=-.467^*$	$p=0.012$
K-1 Words	$r=0.071$	$p=0.672$	$r=0.058$	$p=0.77$
K-2 Words	$r=0.187$	$p=0.261$	$r=-.482^{**}$	$p=0.009$
AWL Words	$r=0.078$	$p=0.642$	$r=-0.064$	$p=0.746$
Off-List	$r=0.002$	$p=0.99$	$r=-0.362$	$p=0.059$

\* Correlation is significant at the 0.05 level (2-tailed). \*\* Correlation is significant at the 0.01 level (2-tailed).

The correlations in the two groups replicated some of the correlations for the whole sample with regard to Voc-D, K-1 words, and AWL words. However, three major differences between the two groups can be observed. First, results showed that MTLD correlated significantly and positively with writing quality for the students who had larger vocabulary size whereas it had non-significant associations with summary writing quality in the group with smaller vocabulary size. Second, significant but negative correlations were found between lexical density and summary writing quality in the writing of the group with a smaller vocabulary size. In comparison, no significant correlations were found between LD and summary writing quality of groups with larger vocabulary size. Third, the analysis revealed statistically significant but negative correlations between summary writing quality and the percentages of K-2 words (a measure of lexical sophistication) in the writing of the students who had smaller vocabulary size. Interestingly, off-list words did not correlate significantly with the summary writing quality of either the group with a large vocabulary size or with the group with a larger vocabulary size. Thus, when controlling for vocabulary size, results indicate that MTLD and LD appeared to play a more important role than off-list words.

## Discussion

The first research question aimed to investigate the contribution of vocabulary size and lexical richness to summary writing quality. The findings indicated vocabulary size as measured by the LexTALE was correlated strongly and positively with summary writing scores which suggests that students with a larger vocabulary size tend to produce high-quality summaries. This is in line with the results of previous studies indicating the importance of possessing a large repertoire of words in L2 writing (e.g. Baba, 2009; Dabbagh & Janebi Enayat, 2019; Milton et al., 2010; Stæhr, 2008; Sukying, 2023). Regression analysis suggested that vocabulary size could explain 38% of the variance in summary writing scores which is larger than the variance reported in the Dabbagh & Janebi Enayat (2019) and Sukying (2023) studies. This is perhaps because of the complex nature of the summary writing task which sets it apart from independent writing. Summary writing involves multiple reading and writing activities such as understanding the text, selecting the relevant ideas, paraphrasing, and organizing.

Therefore, it is not surprising to find a more robust relationship between vocabulary size and summary writing quality.

Additionally, the results of this study provided evidence of the contribution of lexical richness to summary writing quality. A combination of seven measures of lexical richness accounted for only 9.5% of the variance in the summary writing quality. This is surprising given that some previous studies reported a larger proportion of variance (Lee et al., 2021; Yang et al., 2023). For example, Yang et al. (2023) found that lexical richness can explain a major proportion (38.5%) of the variance in EFL expository writing scores. This can be explained by the fact that expository essay writing is an independent type of writing that may encourage writers to use more sophisticated and diverse words due to its emphasis on presenting acquired knowledge. Hence, our study confirms previous findings that the extent of the contribution of lexical richness depends on the type of writing. It is also possible that the rubric we used in this study did not emphasize lexical richness and, therefore, the raters were drawn to focus on other writing aspects such as paraphrasing, organization, and selecting relevant ideas. Further research is warranted to confirm these findings.

In line with previous findings, our study did not find any significant relationship between lexical density and summary writing scores (e.g. Engber, 1995; Ha, 2019; Maamuujav, 2021; Knoch et al., 2014). This may suggest that the number of content words used does not seem to be a determining factor of summary writing quality. However, it is premature to draw a definitive conclusion regarding density.

With respect to lexical diversity, our results showed that both measures of lexical diversity (Voc-D and MTLD) were not significantly related to summary writing scores. It appears that the use of a wide range of vocabulary does not necessarily relate to higher summary writing quality. This result is partly in line with Maamuujav (2021) who, using a similar MTLD measure, concluded that lexical diversity has no associations with the overall writing quality of students' text-based essays. However, our results contradict previous studies that reported a significant relationship between lexical diversity and independent writing quality. One may argue that lexical diversity varies depending on the different task requirements as mentioned in the literature review (Kyle & Crossley, 2016; Olinghouse & Wilson, 2013).

The results are more surprising with respect to lexical sophistication measured using K-1, K-2, AWL, and off-list words. On the one hand, K-1, K-2, and AWL words showed non-significant associations with summary writing quality. This lack of correlation may be partly explained by the fact that K-1, K-2, and AWL words are known by most students and, therefore, can be used well. On the other hand, the less-frequent or off-list words showed a significantly negative correlation with summary writing quality suggesting that the lower-rated summaries included more of the less frequent words. Although the magnitude of the relationship is not large, this result is surprising given that many studies in both independent and integrated writing contexts found a strong positive correlation between lexical sophistication and writing quality through the use of less frequent words (e.g. Zhang et al., 2022). We may speculate that the students resorted to verbatim copying without a clear understanding of the meaning of those sophisticated words. It is also likely that students used sophisticated words to impress their teachers. However, it is difficult to draw any firm conclusions and we need to be cautious when interpreting these results which should be confirmed by further studies with a larger sample and different participants. It would be

valuable to gather qualitative data through interviews and focus groups to further explore why participants used or did not use sophisticated words.

The second research question aimed to compare the relationship between lexical richness and summary writing quality in two groups with different vocabulary sizes. The extent to which the relationship between lexical richness and summary writing quality varied by learners' vocabulary size was neglected in past research.

Our results demonstrated that vocabulary size may be an important factor to consider. Firstly, total correlation results showed that neither Voc-D nor MTLD (measures of lexical diversity) correlate significantly with summary writing quality. However, within-group correlations revealed a moderate positive and significant correlation between MTLD and summary writing quality for the learners with larger vocabulary size suggesting that MTLD is a much better predictor of summary writing quality when learners have more words at their disposal. One possible explanation may be that knowing more words enabled learners to choose their words more precisely leading to a more accurate communication of ideas. There is some evidence in the literature on the relationship between writing quality and lexical diversity when controlling for vocabulary size (e.g. Laufer & Nation, 1995). However, our results also show that having a smaller vocabulary size does not necessarily relate to low lexical diversity. This is because learners with a smaller vocabulary size are likely to have a multitude of other factors preventing them from writing effectively (e.g. limited knowledge of syntax, language proficiency, individual differences). Further research is warranted to investigate the confounding variables that might moderate the relationship between lexical diversity and summary writing quality.

Similarly, the total correlation showed a non-significant weak and negative relationship between lexical density as measured by the content/word ratio and summary writing quality. Despite the apparent unrelated correlation, within-group results suggested that lexical density correlated negatively and significantly with summary writing quality for learners with smaller vocabulary sizes. That is, summary writing scores tended to decrease when lexical density increased. Although the magnitude of the relationship is weak, it could be argued that due to their limited vocabulary size, these students relied heavily on copying the words from the source text. In contrast, there was no association between lexical density and summary writing quality when learners had more words at their disposal. Thus, some learners obtained high scores when they had high density whereas others obtained low scores when they had low density. The differences in the relationship between lexical density and summary writing quality across the two groups underscore the importance of considering individual differences and task requirements when interpreting results.

Lexical sophistication offers a somewhat different pattern: While the correlation coefficients for the 1000 most frequent words (K-1) and AWL remained non-significant and low for both groups, there is a significantly moderate and negative relationship between the use of the 2000 most frequent words (K-2) and the quality of summary writing among the group with a smaller vocabulary size. This means that learners with limited vocabulary size who relied on the 2000 most frequently used words tended to obtain lower summary scores. In other words, this result reflects their inability to use basic words appropriately. This was not the case for learners with larger vocabulary size who observed no particular relationship. It is possible that for these students the use of most frequently used words did not have a significant impact on the quality of their summaries as they had a broader repertoire of words. Future research is needed to confirm this speculation.

Surprisingly, while the total correlations suggested that off-list words may have a negative relationship with summary writing quality, albeit a weak relationship due to the low correlation coefficient, within-group correlations showed low and non-significant associations. As such, a question needs to be addressed: Why did we observe a negative relationship between off-list words (use of less frequently used words) when analyzing the data for the whole sample, but not when we introduced the variable of vocabulary size? We believe that the relationship observed in the whole sample was confounded by differences in vocabulary size. When we controlled for vocabulary size, the relationship between off-list words and the summary writing scores became no longer significant. This points to the complexity of this measure which captures differences between learners when they were in a larger group. The lack of correlation might also be explained by the individual differences within each group. Perhaps, within each group learners differed in their reading ability, paraphrasing, and even motivation which have exerted a more significant impact than vocabulary size. Therefore, these findings should be further examined with a larger sample to better understand the contribution of the use of off-list words.

## **Conclusion**

The present study adds to a growing body of literature on the contribution of vocabulary knowledge to L2 writing. We have demonstrated that vocabulary size as measured by the LexTALE (Lemhöfer & Broersma, 2012) is a better predictor of summary writing quality than lexical richness. We have shown that the relationship between certain measures of lexical richness and summary writing quality may change depending on the learners' vocabulary size. Consequently, examining the total correlation coefficients can lead to incomplete conclusions regarding the nature of the relationship between lexical richness and summary writing quality.

Practically and pedagogically, the study revealed the importance of vocabulary size as measured by the LexTALE to summary writing quality. Teachers should pay more attention to developing learners' vocabulary size since knowing more words receptively may facilitate summary writing. In terms of lexical richness, while initial correlational analysis demonstrated that most lexical richness measures did not correlate significantly with summary writing quality, further comparisons between the participants revealed changes in the relationship between lexical richness and summary writing quality depending on learners' vocabulary size. In the future, personalized and targeted instruction plans should be designed according to different vocabulary sizes. For example, if learners have a small vocabulary size, teachers could develop plans to help them improve their use of basic words, content words, and grammatical words. Similarly, if learners have a large vocabulary size, teachers could focus on helping them use more diverse words and learn how to avoid repetition.

As suggested in this study, vocabulary size provides a partial explanation of the differences in the relationship between lexical richness and summary writing quality. Future research should reconsider the moderating role of other variables such as reading and paraphrasing ability. For example, it would be useful to find out how learners select and paraphrase source text vocabulary since successful summary writing relies on how well learners paraphrase.

Nevertheless, this study has several limitations that should be addressed in future research. First, the study was based on a single summary writing task. There is a need to compare the relationship between vocabulary size and lexical richness in different integrated writing tasks given that different tasks might elicit different vocabulary (e.g. Olinghouse & Wilson, 2013).

Second, the study did not examine the specific role played by task requirements and individual differences. Vocabulary size alone is not sufficient to explain the variation in the relationship between lexical richness and summary writing quality. Third, the sample was limited in size which made it difficult to reach firm conclusions. A much larger sample is needed to confirm the specific contribution of vocabulary knowledge to summary writing.

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## **Appendix A**

### **The Reading Passage**

Plastic bags are one of the major causes of environmental pollution. Because plastic is a non-biodegradable material, it remains in the environment for hundreds of years and continuously spreads pollution. We need to ban plastic bags completely before it completely destroys our environment.

### **Countries that banned plastic bags**

Many countries around the world have either banned plastic bags or taxed them to reduce their use. This includes countries such as Tanzania, Kenya, Uganda, South Africa, Morocco, Malaysia, Bangladesh, Taiwan, England, Germany, Hawaii, New York, Italy, Scotland, Rhode Island and Maine. These measures have helped to overcome the problem of plastic bags to a great extent. But this problem has not been completely resolved yet because these measures have not been implemented properly.

Plastic bags are still available in the black market in some of these countries and are still being used illegally.

### **Reasons to ban plastic bags**

Although there are many reasons why plastic bags should be banned and due to this many countries have taken strict steps to reduce the use of plastic, some of these reasons are mentioned below:

- Land and water are constantly polluted by the waste that is spread through plastic bags.
- Due to plastic, the creatures living on Earth as well as sea creatures have also come under threat.
- Chemicals released from waste plastic bags enter the land and make it barren.
- Plastic bags also have a bad effect on human health.
- Plastic bags also cause problems of drainage of sewage and sewer.

### **Public should support plastic ban**

Although plastics have been banned by the Government of India in many states, people are still seen using them. Shopkeepers stop giving plastic bags to buyers for a few days and start using them again after a few days because no concrete steps are taken by the government regarding the production and distribution of plastic bags. This is the time when we too need to contribute to make this ban a success.

The educated people like us, while carrying out their responsibility in this context, should stop the use of plastic and motivate others for it. Below are some ways we can support the government in this matter:

### **Control access**

Because we are in the habit of using plastic bags, it is difficult for us to stop using them one by one. To be successful in this scheme, we have to understand its adverse effects on the

environment and control its use. With which we will lose the habit of using our plastic bags in a few days.

### **Adopt options**

Apart from plastic, there are many other environmentally friendly items that we can use. In place of plastic bags to bring goods from the grocery store, we can carry clothes or jute bags which can be used again and again while going to the market.

### **Recycle**

We should use the plastic bags lying in our house as many times as possible before throwing them.

### **Spread awareness**

Apart from this, the government should also create awareness among the people about the negative impact of plastic bags in the people and it should be banned by publicizing and spreading information about it verbally among people. We can also make the people working in our homes, those who clean cars and children aware about the problems related to the environment. Which may prompt them to stop using plastic bags.

### **The conclusion**

Problems arising from plastic bags are mostly ignored by us and are not seriously considered. Because the long-term effect of these small plastic bags used on a daily basis is not noticed by the people. We keep using these plastic bags for our convenience and completely ignore the harmful effects they have on the environment and the life of the earth.

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## Appendix B

### The Scoring Rubric

	<b>Very Good = 4</b>	<b>Good = 3</b>	<b>Fair = 2</b>	<b>Poor = 1</b>
<b>Content</b>	Can grasp all the main ideas.  Can develop the main points substantially by occasionally using secondary information.	Can grasp most of the main ideas. Includes somewhat incorrect information or information beyond the original text, but it does not substantially deviate from the original text.	Can grasp only limited main ideas. Cannot demonstrate an adequate development of the main points. Noticeably includes incorrect information beyond the original text.	Cannot identify main ideas. Cannot grasp main ideas correctly.
<b>Organization</b>	Writing is well-organized and all ideas are in a logical order.	Writing is organized but some ideas are not in logical order.	Writing is fairly organized but many ideas are not in logical order.	Writing is not organized. Students jumps from one idea to another.
<b>Source use</b>	Can actively demonstrate effective paraphrases where both sentence construction and vocabulary choice are different from the original text.	Can actively demonstrate effective paraphrases using vocabulary that is different from the original text. Seldom changes sentences.	Can only demonstrate paraphrasing using expressions from the original text.	Cannot demonstrate effective paraphrasing.
<b>Language use</b>	Proper grammar, usage Correct spelling Correct punctuation Correct capitalization	Few errors of grammar and usage  Mostly correct spelling, punctuation and capitalization	Errors in grammar, usage and spelling sometimes make understanding difficult  Some errors in punctuation and capitalization	Frequent errors in grammar, usage, spelling, capitalization and punctuation which make understanding difficult or impossible

Adapted from Yamanishi et al., 2019

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