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Exploring the Interplay of Vocabulary Size, Depth, and Reading Performance among Engineering Students in an ESP Context

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ABSTRACT

The primary objective of this research is to examine the impact of vocabulary size and vocabulary depth on reading performance in an English for Specific Purposes (ESP) context. To this end, we administered three tests to a group of 92 engineering students enrolled at the National Graduate School of Arts and Crafts (ENSAM) in Meknes, Morocco. The tests included the Vocabulary Size Test developed by Nation and Beglar (2007), the Words Associate Test designed by Read (1998), and a reading performance test with a high-reliability score of .87. The collected data was subjected to statistical analysis using linear regression and Pearson correlation. The findings revealed significant correlations between both vocabulary size and vocabulary depth with reading performance. Interestingly, the results indicated that vocabulary depth exhibited a stronger predictive association with reading performance compared to vocabulary size.

INTRODUCTION

In the realm of language education, the dynamic relationship between vocabulary knowledge and reading comprehension remains an area of perpetual interest and exploration. For learners of English as a foreign language, a robust and diverse vocabulary is a key determinant of their ability to comprehend and engage with academic texts effectively. In specialized academic and professional contexts, such as ESP, the significance of vocabulary size and depth becomes even more pronounced. Understanding the intricate interplay between these facets of vocabulary knowledge and their impact on reading performance is of utmost importance for language instructors seeking to optimize language learning outcomes. This study delves into the complex relationships between vocabulary size, vocabulary depth, and reading performance among engineering students in an ESP context at the National Graduate School of Arts and Crafts (ENSAM) in Meknes, Morocco. By employing rigorous data analysis techniques, including Pearson correlation statistics and multiple linear regression, the study seeks to unravel valuable insights that hold significant implications for language teaching and learning in specialized academic settings. Through an investigation of these key language components, educators can craft targeted instructional approaches to foster well-rounded vocabulary development and enhance the reading comprehension abilities of engineering students, thus empowering them for success in their academic and professional pursuits.

LITERATURE REVIEW

The literature surrounding vocabulary knowledge and its impact on reading comprehension has been a focal point

in language education and applied linguistics. Extensive research has explored the vital role that vocabulary plays in the reading abilities of learners of English as a foreign language. Additionally, language teaching theoreticians have emphasized the significance of effective vocabulary instruction in language education. This literature review presents a comprehensive selection of relevant studies that illuminate the importance of vocabulary size and depth besides their influence on reading performance, particularly in the context of ESP.

Early seminal work by Anderson and Freebody (1981) established that a reader's general vocabulary knowledge significantly predicts their comprehension of a text. This was further reinforced by Nagy (1988), who highlighted the fundamental nature of vocabulary in understanding diverse texts and called for vocabulary instruction to be an integral part of language education. This consensus on the significance of vocabulary in reading performance paved the way for further exploration into effective vocabulary teaching methods.

The significance of vocabulary knowledge in facilitating reading comprehension has been firmly established through extensive research in the field of second language acquisition (SLA) (Nation & Coady, 1988; Laufer, 1992, 1996; Wallace, 2007). Notably, the dimension of vocabulary breadth, representing the size of a learner's vocabulary, has been recognized as a crucial factor in overall second language proficiency (Henriksen, 2006; Schmitt, 2010) and, more specifically, in reading competence (Laufer, 1992, 1996; Laufer & Ravenhorst-Kavlovski, 2010). Vocabulary breadth encompasses the number of words a learner knows and has been consistently linked to better language proficiency and reading comprehension skills.

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Conversely, the other dimension of vocabulary knowledge, namely depth or quality, has not received as much comprehensive investigation, although its significance in overall second language vocabulary competence has been acknowledged (Meara, 1996; Read, 2000). Vocabulary depth refers to how well a learner knows the words in their repertoire, encompassing aspects like nuanced meanings, collocations, and various contextual usages. While vocabulary breadth focuses on the quantity of words, vocabulary depth delves into the quality of the knowledge that learners possess for each word. However, despite its importance, research exploring the impact of vocabulary depth on reading performance has not been as extensive as that focused on vocabulary breadth.

In this context, it is essential to delve deeper into vocabulary depth, as a well-developed understanding of this dimension could shed further light on its role in enhancing reading comprehension abilities among language learners. Comprehensive investigations into the interplay between vocabulary breadth and depth are vital to better comprehend their collective influence on reading competence. Moreover, understanding the contribution of vocabulary depth to learners' overall language proficiency can provide valuable insights for language educators aiming to design effective vocabulary instruction programs.

As Meara (1996) and Read (2000) have recognized, vocabulary depth holds the potential to enrich learners' lexical knowledge, enabling them to comprehend texts more effectively. It allows learners to grasp subtle distinctions between words and use them contextually with greater precision. When learners possess a deep understanding of words, they can make more informed choices about which words to use, enhancing the clarity and sophistication of their expression. Furthermore, the ability to recognize collocations and comprehend nuanced word meanings contributes to learners' overall language competency.

In conclusion, while vocabulary breadth's importance in language learning and reading comprehension is well-documented, the dimension of vocabulary depth deserves further attention in research and pedagogy. Developing a comprehensive understanding of both vocabulary breadth and depth can inform language instructors' approaches to vocabulary instruction and empower learners to achieve higher levels of language proficiency and reading comprehension skills. By fostering vocabulary knowledge in both dimensions, educators can equip language learners with the necessary linguistic tools to navigate diverse texts and communicate effectively in real-world contexts.

Various crucial aspects must be taken into consideration when examining the relationship between vocabulary knowledge and reading comprehension. Beyond the type of texts being read, two essential factors come into play: the density of unknown words that learners can tolerate for effective comprehension and the necessary vocabulary size a learner must possess. Hu and Nation

(2000) conducted a study to determine the level of unknown words learners could handle in fiction texts for satisfactory comprehension. Their research involved 66 participants who had achieved mastery level at the 2,000-word level. Participants read fiction texts in which non-words were replaced at rates of 100%, 95%, 90%, and 80%. The results indicated that learners need to comprehend at least 98% of the text to achieve adequate comprehension, equivalent to a density of 1 in 50 unknown words. These findings align with prior research by West (1953) and Hirsch and Nation (1992) and are consistent with Bonk's (2000) observations that learners with less than 80% vocabulary familiarity tend to exhibit poor comprehension. Moreover, Schmitt, Xiang Ying, and Grabe (2011) conducted a study involving 661 participants, revealing a linear relationship between vocabulary growth and text comprehension. Their research highlights the significance of the threshold level for text comprehension, a notion supported by Bonk (2000), who noted that learners with vocabulary familiarity below 75% often struggled with comprehension. These empirical findings affirm that higher vocabulary knowledge positively correlates with improved text comprehension.

The next aspect to consider pertains to the extent of vocabulary required for learners to independently engage with authentic texts and grasp their content thoroughly. Previous studies by Schmitt (2000) and Laufer (1992) emphasized the importance of mastering the most frequent 2,000 words. However, Milton and Hopkins (2006) argued that learners would require vocabulary of around 4,500 to 5,000 word families to cope with the highest level (C2) on the Common European Framework of Reference (CEFR) reading descriptor, which corresponds to Band 9 on the IELTS or a score of 590 to 677 in the paper-based TOEFL. Nevertheless, there are debates concerning whether learners can achieve the skills outlined in the descriptors. More extensive vocabulary requirements were indicated by Hu and Nation (2000) and Nation (2006), estimating that learners need around 8,000 to 9,000 words to read novels and newspapers without external assistance. Graded texts designed specifically for language learners at different vocabulary levels demand lower vocabulary sizes. Consequently, it can be concluded that while some learners may manage with a smaller vocabulary size, a substantial range of approximately 8,000 to 9,000 words is necessary for learners to confidently comprehend a variety of authentic texts (Schmitt, 2008).

In summary, the relationship between vocabulary knowledge and reading comprehension is multifaceted, involving considerations of vocabulary density and vocabulary size. Learners need to understand a significant proportion of the text to achieve comprehension, highlighting the importance of a sufficiently large vocabulary. Therefore, educators must focus on equipping learners with extensive and meaningful vocabulary knowledge to enhance their reading skills and enable them to engage with diverse, authentic texts effectively.

In the specific context of ESP, where language learning is tailored to meet the academic and professional needs of specific disciplines, the importance of vocabulary knowledge becomes even more pronounced. (Durrant, 2019) ESP courses, catering to engineering students, demand specialized language skills to navigate technical texts and communicate effectively within their field. Therefore, understanding the interplay between vocabulary size, depth, and reading performance is particularly crucial for language instructors preparing engineering students for academic and professional success in ESP contexts.

This reviewed literature emphasizes the pivotal role of vocabulary knowledge in reading comprehension, especially within the specialized context of ESP for engineering students. Vocabulary size and depth are shown to be critical factors influencing reading performance. As educators strive to equip engineering students with the necessary language tools, a comprehensive approach to vocabulary instruction is essential. By fostering a rich and nuanced vocabulary repertoire among learners and honing their lexical inferencing abilities, language instructors can empower engineering students to excel in their academic pursuits and effectively communicate within their professional domain in ESP contexts.

METHODOLOGY

This section outlines the data collection tools and procedures, participants, and data analysis employed in this study.

Data Collection Tools

Vocabulary Size Test: The Vocabulary Size Test developed by Nation and Beglar (2007) was utilized to assess the students' vocabulary size. The test has undergone rigorous validation and reliability testing by Beglar (2010), resulting in a high-reliability score of .96, signifying strong validity and consistency. The test comprises 14 sets of vocabulary items, with each set containing 10 representative items. Each item represents 100 words, making each set an assessment of 1000 words with 10 representative items. Notably, the test primarily measures receptive vocabulary knowledge, specifically the vocabulary required for reading comprehension. Each item is presented in a context-independent multiple-choice format, providing four options for test-takers to select the most suitable definition. It is crucial to highlight that the test-takers cannot infer the item's meaning from the provided sentence, as the sentence lacks contextual clues. In total, the Vocabulary Size Test measures knowledge of 14,000 words through 140 items.

Words Associate Test: To gauge the depth of vocabulary, the Words Associate Test by Read (1998) was administered. Adapted by Qian (1999), the test demonstrates strong reliability, with Qian (2002) reporting a reliability score of 0.88. Previous reliability checks conducted by Read (1993) on the original version of the test indicated a reliability level of at least .90. The test comprises 40 stimulus words,

all of which are adjectives and presented in a context-free manner. Below each stimulus word, there are 8 options, and test-takers are tasked with selecting 4 options that closely correspond in meaning to the stimulus word or form appropriate collocations with it.

Reading Achievement Test: As an additional data collection tool, a reading achievement test was developed by the researcher specifically for this study. The test consists of 6 paragraphs, each containing 30 items, including 10 multiple-choice questions. To ensure the reliability of the test, it was initially administered to 65 students, and the obtained data were analyzed using ITEMAN. The test demonstrated a reliable level of consistency with a reliability score of .89, surpassing the critical value of .70.

Participants

The study involved a total of 92 engineering students enrolled at the National Graduate School of Arts and Crafts (ENSAM) in Meknes, Morocco. These students were selected as the target population for investigating the relationships between vocabulary size, vocabulary depth, and their impact on reading performance in an ESP context.

As shown in Table 1, out of the total 92 participants, 45 were male, representing approximately 49% of the sample, while 47 were female, making up approximately 51% of the sample. The study aimed to maintain a relatively balanced representation of both genders to minimize any potential gender-related biases that could influence the research findings.

Table1: Participants' distribution according to gender

Gender	Frequency	Percent
Male	45	49
Female	47	51
Total	92	100

By including a diverse group of engineering students from ENSAM and ensuring equal representation of both genders, the study seeks to enhance the robustness and generalizability of its results. Analyzing the data in terms of gender distribution will provide valuable insights into any potential differences or similarities in vocabulary size, vocabulary depth, and reading performance in the ESP context between male and female engineering students.

Data Collection Procedure

The data collection procedure involved administering three tests to the participants in a controlled setting. First, the Vocabulary Size Test was administered, and participants were instructed to carefully select the option that best described the meaning of the stem word in all 14 sets of items. Since no context was provided, participants had to rely solely on their vocabulary knowledge to choose the correct answers. They were given a total of 60 minutes to complete the test.

Following the Vocabulary Size Test, the Words Associate Test was administered, allowing 35 minutes for completion. Participants were instructed to choose four out of eight options provided under each stimulus word. These options included synonyms or words with close meanings to the stimulus word, as well as nouns that frequently form collocations with the stimulus word. Lastly, the reading achievement test was administered, with a time limit of 40 minutes. Participants were informed that only correct answers would be considered, and incorrect answers would not affect their scores. Throughout the data collection process, participants were informed that they were participating in a study on vocabulary and that their identities and test scores would remain confidential. They were assured that the results would be used solely for research purposes.

Data Analysis

The data obtained from the participants were subjected to statistical analyses using SPSS 28. Descriptive statistics were utilized to describe participant demographics, including gender distribution. To investigate the effects of vocabulary breadth and depth on reading performance, linear regression was employed. Additionally, multiple linear regression was used to determine whether vocabulary breadth or depth better predicted students' reading performance. Furthermore, Pearson correlation was utilized to assess the correlation between vocabulary breadth and depth, providing insights into the relationship between these two variables. Through these data analysis techniques, the study aimed to gain a comprehensive understanding of the impact of vocabulary size and vocabulary depth on reading performance in the ESP

context among engineering students at ENSAM.

RESULTS

In this section, we present the results of our study that aims to investigate the relationship between vocabulary size, vocabulary depth, and their impact on reading performance in an ESP context among engineering students at the National Graduate School of Arts and Crafts (ENSAM) in Meknes, Morocco. The participants were assessed using the Vocabulary Size Test by Nation and Beglar (2007) to measure their vocabulary size and the Words Associate Test adapted by Qian (1999) to assess their vocabulary depth. Additionally, a reading achievement test developed by the researcher was employed to gauge the students' reading performance. Through rigorous data analysis, including Pearson correlation statistics and multiple linear regression, we explore the correlations between vocabulary size and depth, vocabulary size and reading performance, and depth of vocabulary and reading performance. Furthermore, we examine the relative effects of vocabulary size and depth on reading performance. These findings offer valuable insights into the intricate interplay between vocabulary knowledge and reading comprehension abilities, providing implications for language instruction in specialized academic and professional contexts.

The Relationship between Size of Vocabulary and Depth of Vocabulary

The relationship between the size of vocabulary and depth of vocabulary was examined using Pearson correlation statistics. The results are presented in Table 2.

Table 2: The relationship between vocabulary size and vocabulary depth

		Vocabulary size	Vocabulary depth
Vocabulary size	Pearson Correlation	1	.536**
	Sig. (2-tailed)	.536**	.000
Vocabulary depth	Pearson Correlation	.000	1
	Sig. (2-tailed)		

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

The analysis revealed a significant positive correlation ($r = .536, p < .01$) between the size of vocabulary and the depth of vocabulary. This suggests that students with a larger vocabulary size tend to have a deeper understanding of vocabulary as well.

The Relationship between Vocabulary Size and Reading Performance

The association between vocabulary size and reading performance was explored using Pearson correlation statistics. The results are presented in Table 3.

Table 3: The relationship between vocabulary size and reading performance

		Reading score	Vocabulary size
Reading score	Pearson Correlation	1	.485**
	Sig. (2-tailed)		.000
Vocabulary depth	Pearson Correlation	.485**	1
	Sig. (2-tailed)	.000	

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

The analysis demonstrated a significant positive correlation ($r = .485, p < .01$) between the size of vocabulary and reading performance. This indicates that students with a larger vocabulary size tend to achieve higher scores in reading comprehension.

The Relationship between Vocabulary Depth and Reading Performance

To explore the relationship between the depth of vocabulary and reading performance, Pearson correlation statistics were utilized. The results are displayed in Table 4.

Table 4: The relationship between vocabulary depth and reading performance

		Vocabulary depth	Reading score
Vocabulary depth	Pearson Correlation	1	.472**
	Sig. (2-tailed)		.000
Reading score	Pearson Correlation	.485**	1
	Sig. (2-tailed)	.000	

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

The analysis revealed a significant positive correlation ($r = .472, p < .01$) between the depth of vocabulary and reading performance. This suggests that students with a deeper vocabulary knowledge tend to achieve higher scores in reading comprehension.

The Effect of Vocabulary Size and Vocabulary Depth on Reading Performance

To ascertain the relative effects of vocabulary size and vocabulary depth on reading performance, multiple linear regression was conducted. The results are presented in Table 5.

Table 5: The effect of vocabulary size and vocabulary depth on reading performance

	Beta	t	Sig.
Vocabulary depth	.324	5.878	.000
Vocabulary size	.281	5.073	.000

Dependent variable: reading score

Discussion and Implications

The findings of this study shed light on the complex interrelationships between vocabulary size, vocabulary depth, and reading performance among engineering students in an ESP context at the National Graduate School of Arts and Crafts (ENSAM) in Meknes, Morocco. Through rigorous data analysis, including Pearson correlation statistics and multiple linear regression, the study reveals valuable insights that have significant implications for language teaching and learning in specialized academic settings.

The first noteworthy result is the positive correlation between vocabulary size and vocabulary depth. This finding highlights that students with a larger vocabulary size tend to possess a deeper understanding of individual words, their meanings, and the various contexts in which they can be effectively employed. This has important implications for language instructors who can leverage this relationship to design comprehensive vocabulary development programs that promote both breadth and depth of word knowledge. By exposing students to a wide range of words and encouraging them to explore

the nuances of word meanings, educators can foster a more robust vocabulary repertoire among engineering students, enhancing their overall language proficiency.

Furthermore, the study demonstrates a significant positive correlation between vocabulary size and reading performance. This result underscores the pivotal role of vocabulary knowledge in successful reading comprehension. Engineering students with an extensive vocabulary are better equipped to comprehend and engage with complex academic texts, thus enhancing their academic achievement. To capitalize on this correlation, educators should prioritize vocabulary instruction as an integral component of ESP courses. Employing varied vocabulary learning strategies, such as explicit vocabulary instruction, extensive reading, and exposure to specialized academic words, can effectively enhance students' vocabulary size and consequently improve their reading proficiency.

Likewise, the positive correlation between vocabulary depth and reading performance unveils another critical aspect of vocabulary knowledge. Engineering students with a deeper understanding of individual word meanings are better equipped to infer the meanings of unfamiliar words encountered in a text, thereby enhancing their reading comprehension skills. Instructors can capitalize on this correlation by promoting strategies that develop students' lexical inferencing abilities. Encouraging learners to use contextual clues to deduce word meanings can empower them to navigate through challenging texts more effectively.

The multiple linear regression analysis provides additional insights, indicating that both vocabulary size and vocabulary depth independently predict reading performance. This suggests that both aspects of vocabulary knowledge play crucial roles in shaping students' reading comprehension abilities. Consequently, language instructors should adopt a balanced approach that addresses both vocabulary breadth and depth, ensuring comprehensive vocabulary development for optimal reading outcomes.

The results of this study provide valuable implications for language instructors working in ESP contexts. By understanding the interplay between vocabulary size,

vocabulary depth, and reading performance, educators can design targeted vocabulary instruction that optimizes language learning outcomes for engineering students. Fostering a rich and nuanced vocabulary repertoire among learners, coupled with honing their lexical inferencing abilities, can significantly enhance their reading comprehension skills and academic success. As engineering students embark on their specialized educational journey, a well-crafted vocabulary development program can serve as a fundamental pillar in supporting their academic and professional endeavors in the English language domain.

CONCLUSION

In this comprehensive investigation, we delved into the intricate relationships between vocabulary size, vocabulary depth, and their impact on reading performance among engineering students in the ESP context at the National Graduate School of Arts and Crafts (ENSAM) in Meknes, Morocco. Through a meticulous examination of the data using Pearson correlation statistics and multiple linear regression, we have arrived at enlightening insights that bear significant implications for language teaching and learning in specialized academic settings.

The results of our study have underscored the crucial role of vocabulary knowledge in fostering effective reading comprehension skills. The positive correlations observed between vocabulary size and both vocabulary depth and reading performance emphasize the mutual reinforcement between breadth and depth of vocabulary knowledge. Learners with a more extensive vocabulary are likely to possess a deeper understanding of individual words while simultaneously demonstrating superior reading comprehension abilities. This reinforces the notion that vocabulary development programs should adopt a comprehensive approach, encompassing both the exploration of a wide range of words and the thorough exploration of their meanings and contextual nuances.

The positive correlation identified between vocabulary depth and reading performance highlights the significance of lexical inferencing skills. Engineering students equipped with the ability to infer word meanings from context exhibit heightened reading comprehension abilities, allowing them to navigate complex academic texts with greater ease. To cultivate such skills, educators must foster an environment that encourages learners to actively engage with the language, encouraging them to derive word meanings from contextual cues and fostering a deeper connection to the text.

The present study's findings also emphasize that both vocabulary size and vocabulary depth independently predict reading performance. Therefore, language instructors should adopt a balanced approach that addresses both aspects of vocabulary knowledge. Integrating explicit vocabulary instruction with extensive reading opportunities while promoting strategies for inferring word meanings will contribute to well-rounded vocabulary development, ultimately enhancing reading proficiency.

In conclusion, this study provides valuable contributions to the field of language education and ESP. By unraveling the intricate interplay between vocabulary knowledge and reading comprehension abilities among engineering students, we offer practical insights that can inform effective language teaching practices. Empowering learners with an extensive and nuanced vocabulary repertoire, coupled with the development of lexical inferencing skills, will undoubtedly bolster their academic and professional pursuits in the English language domain. As language educators strive to equip engineering students with the necessary language tools, our study's findings serve as a guiding beacon in fostering language proficiency and nurturing successful academic and career trajectories.

The present study explored the relationships between vocabulary size, vocabulary depth, and reading performance among engineering students in the ESP context. Through rigorous data analysis, including Pearson correlation statistics and multiple linear regression, the study has uncovered valuable insights with significant implications for specialized language teaching and learning. The findings highlight the importance of vocabulary knowledge in enhancing reading comprehension. The positive correlations between vocabulary size, vocabulary depth, and reading performance emphasize the mutual benefit of breadth and depth in vocabulary knowledge. This reinforces the need for comprehensive vocabulary development programs, focusing on a wide range of words and their contextual nuances. Additionally, the paper emphasizes the significance of lexical inferencing skills, as they positively correlate with reading performance. Encouraging students to infer word meanings from context can improve reading comprehension in academic contexts. Furthermore, it was shown that both vocabulary size and vocabulary depth independently predict reading performance. Therefore, language instructors should adopt a balanced approach that addresses both aspects of vocabulary knowledge. Integrating explicit vocabulary instruction with extensive reading opportunities and promoting word-meaning inference strategies will enhance overall vocabulary development and reading proficiency. In a nutshell, this research contributes valuable insights to language education and ESP. Empowering students with an extensive and nuanced vocabulary, besides developing lexical inferencing skills, will strengthen their academic and professional pursuits in the English language. As language educators aim to equip engineering students with essential language tools, the paper's findings could provide guidance for fostering language proficiency and supporting successful academic and career paths.

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