

ANALYSING INFORMATICS ENGINEERING STUDENTS' RECEPTIVE AND PRODUCTIVE VOCABULARY KNOWLEDGE

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Abstract: Several universities in Indonesia require the use of English in some aspects of the learning process for non-English majors, especially for Informatics Engineering students. The students are required to analyse enormous amounts of English for specific or academic purposes (ESP/EAP) text throughout their learning process. Extensive vocabulary knowledge plays a very important role here, considering that they are presented with assignments in more specific contexts. The vocabulary knowledge can help students navigate the overlaps with common vocabulary but carry different contextual meanings in their field. Therefore, this research involved Informatics Engineering students at a private university with two classes, regular and non-regular, to analyse the students' receptive and productive vocabulary sizes and to know what factors affect the sizes within a cross-sectional survey research. The data were collected by conducting a Receptive Vocabulary Size Test (RVST), a Productive Vocabulary Size Test (PVST) within the Academic and University Word List, and a set of questionnaires. The results reveal the level of the students' vocabulary sizes and the factors that affect the sizes. The implication of the research results concerning the Informatics Engineering students' receptive and productive vocabulary sizes is discussed in this research.

Keywords: *informatics engineering, productive vocabulary, receptive vocabulary, vocabulary knowledge, vocabulary size*

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INTRODUCTION

In today's era, students from English and non-English study backgrounds are expected to be fluent in English because there has been a great demand for English instruction, resulting in competent English users in both Western and Asian countries. This language has long been a lingua franca. The spread of English influenced the language of communication in many fields, for instance, science, economics, entertainment, and intercultural understanding. With the increase of international projects and the rise of cross-cultural communication and collaboration, English is becoming the ascendant language in the world, and people from various continents, including Indonesians, need to use good English. Communication can run well if all language skills are mastered, which is now a necessity. The

communication must be rooted in good and sufficient knowledge of vocabulary mastery in English.

At the university level, students are expected to have fluent English to be able to fully understand the specific context and convey their ideas. The ability to convey their ideas is a crucial need, considering that the students will later be involved in society and become part of a developing civilization. Therefore, the thing that can be done is to start by preparing students to have a better understanding of using English. Furthermore, several universities in Indonesia currently have implemented a curriculum that adapts to these needs. In the learning process, several courses already use English as a compulsory language in giving instructions. In this situation, all kinds of learning activities will require all language skills when holding discussions in groups, reporting reading results, or presenting a topic. The use of all these language skills certainly requires students to have sufficient knowledge and mastery of English vocabulary because they are required to select the proper terms that are appropriate to the context and specific field.

Vocabulary knowledge plays a crucial role in language acquisition and communication (Hiebert & Kamil, 2005). A strong vocabulary is a foundation for effective concept formation, acculturation, articulation, and overall learning. Moreover, vocabulary is not just about memorising words; it encompasses understanding and using lexical phrases and routines. This acquisition and utilisation of vocabulary enhance language proficiency and facilitate critical thinking and problem-solving skills. Additionally, a rich vocabulary is closely correlated with intelligence and cultural development. Through the precise use of words, individuals are able to enhance the precision and effectiveness of their thoughts. The depth of vocabulary knowledge not only aids in language proficiency but also has a significant impact on critical thinking and problem-solving skills.

Vocabulary knowledge is divided into two types (Coxhead & Nation, 2001), encompassing the receptive and productive. Receptive vocabulary knowledge allows individuals to comprehend the meaning of words encountered in various texts, conversations, or academic materials. This understanding enables them to construct mental representations and make connections between words, concepts, and experiences. On the other hand, productive vocabulary knowledge involves the ability to select and use appropriate words to convey meaning effectively, demonstrating mastery of language expression. When learners engage in both receptive and productive vocabulary learning, they develop a more complete and nuanced understanding of language, enabling them to communicate and comprehend with greater fluency and accuracy.

Receptive vocabulary refers to terms that native speakers and foreign learners recognize and understand but rarely use; it is utilised passively in either listening or reading. Productive vocabulary is actively employed when speaking and writing. According to Zhou (2010), "receptive and productive vocabulary comprehension is a very important dimension of vocabulary awareness." The ability to grasp a word when it is heard or seen is referred to as receptive vocabulary knowledge, but the ability to produce a term when it is written or spoken is referred to as productive vocabulary knowledge. Vocabulary knowledge should be viewed as a progression along which a word progresses from receptive to productive status. Some research on vocabulary size indicates that the participants' receptive vocabulary size is substantially bigger than their productive vocabulary size. Because vocabulary size is

associated with success in reading, writing, and general language competence, as well as academic accomplishment, it demonstrates the relevance of vocabulary for language competency (Laufer et al., 2004; Saville-Troike, 1984).

Everyday vocabulary can have different interpretations when it comes to specific terms. However, the "fully" technical terms demand an effort from all learners, regardless of their proficiency in English. The majority of research in technical terms is based on corpora, and it has been a subject of study in the field of specialized vocabulary (Coxhead, 2018). In order to facilitate student learning, numerous studies have employed student textbooks as a corpus to identify specialized vocabulary. Meanwhile, research conducted in assessing the size of engineering students' vocabulary is a kind of follow-up research on applications to map the level of understanding and how they integrate their technical vocabulary in certain contexts, both in receptive and productive forms. In fact, with the global needs and challenges facing engineering students, especially informatics engineering, they should require the vocabulary of their field well in order to effectively perform their duties as professionals.

In assessing vocabulary knowledge at the university level, there are two types of word lists commonly used in the receptive and productive vocabulary tests, the academic word list (AWL) and the university word list (UWL). They have become important resources for assessing the vocabulary proficiency of English language learners, both in terms of understanding and using words. The AWL comprises 570-word families that are commonly found in academic texts across various fields of study. Whereas the UWL encompasses 836 frequently used words in academic discussions at the university level. The reason for utilizing these word lists in vocabulary assessment was based on their capacity to offer a focused evaluation of the academic context proficiency that is essential for achieving success in higher education and professional environments.

According to Daller, Milton, and Treffers-Daller (2007), "size or breadth are the first dimension of vocabulary knowledge." Vocabulary tests can be used to assist students' place in the appropriate class level (placement exam), and it is considered that measuring their vocabulary size can offer an indicator of their overall language competency (Schmitt, 1994). It also implies that administering a vocabulary test helps drive students to learn by demonstrating their progress in acquiring new terms. Originally designed as a diagnostic tool for instructors, this vocabulary test has shown to be beneficial in assisting teachers in determining the type of focus they should offer to various groups of learners to learn vocabulary (Laufer and Nation, 1999). As a result, using a vocabulary test to assess students' vocabulary size is appropriate since it can be beneficial to the educator.

Recent research using vocabulary tests (Wero, Machmud & Husain, 2021; Citrayasa & Nernere, 2020; Siregar, 2020), undergraduate non-English students who effectively cope with studying at an English instruction institution have a vocabulary of roughly 5.000 to 6000-word families. Based on findings in several research, the researchers wanted to investigate the vocabulary size of EFL learners of engineering majors at the university level nowadays because vocabulary mastery has become one of the most important aspects of mastering a language. It pertains to the scope of learners' vocabulary knowledge and the decisions that educators must make regarding syllabus design, the content that students may have in their learning process, the vocabulary learning that students should engage in, and the method by

which their vocabulary size should be routinely assessed. It also demonstrated that the more students learn specific English vocabulary, the greater their contextual understanding becomes.

However, previous research in the Indonesian context (Citrayasa & Nernere, 2020; Siregar, 2020; Wero et al., 2021) mostly has focused on the vocabulary size of English Department students—only a small number of research concerning engineering students' vocabulary knowledge. Several research do not even involve students with different educational levels in the same engineering study program. This lack of massive research on specific engineering students means that educators may not be able to identify areas of student difficulty without proper assessment. Additionally, Indonesia's curriculum may not adequately address a specific problem in a specific field, perpetuating a cycle of limited productive vocabulary among graduates. Therefore, the purposes of this research are: (1) to measure engineering students' receptive and productive vocabulary sizes, and (2) to know what factors affect the Informatics Engineering students' vocabulary sizes at one of the private universities in Indonesia. This research is also expected to provide an overview of recent engineering students' vocabulary sizes, acknowledge engineering students' vocabulary sizes, and encourage lecturers to provide more impactful vocabulary learning.

METHODOLOGY

It appears that the quantitative research approach is more frequently employed in the field of language testing and evaluation than the qualitative approach because statistical methods of test validation are still used by language testers (Rahman, 2017). In order to assess the sizes of Informatics Engineering students' receptive and productive knowledge, numerical and statistical data sets are needed. This research used a cross-sectional survey to collect data from two different classes at one time.

Subjects

The targeted university for conducting this research is one of the private universities in West Java, which has promoted study programs with a focus on engineering. One of the leading study programs currently in high demand is Informatics Engineering. Also, the fact that this study program requires its students to have the ability to use English at a fluent level. Their education programs even offer two classes, consisting of regular (offline) and non-regular (online or distance) classes. To narrow down the research process, the researchers used a non-probability method with convenience sampling. The convenience sampling method is the situation where participants are given the option to self-select their participation (Cresswell, 2012; Stratton, 2021; Wiersma, 1995). This sampling method was chosen considering the availability of the participants in responding to and returning the tests and the questionnaire.

The involved sample was those who responded to both regular and non-regular classes. This sampling method was chosen considering the availability and time that the participants have in the works of the tests given. This is also intended to adjust the time of completion for this research. There were 6 female and 14 male students with the age range of 17-27 years. They were undergraduate students who had contracted the English for Career course. They were selected based on the measurement of word frequency levels in order to assess academic and university

vocabulary. It was considered that by contracting the course, the students could enhance their understanding of specific vocabulary, as they are required to engage in the learning process that requires reading more academic texts.

Instruments

Three instruments were used in this research. The first instrument is the receptive vocabulary size test (RVST) from Xue and Nation (1984) word list. This test aims to measure the participants' knowledge in understanding of a word used. The participants were required to choose answers with equivalent words that have the same meaning as the words given. The second instrument is the productive vocabulary size test (PVST) from Laufer and Nation (1999) word list. This test aims to measure the participants' proficiency with useful vocabulary in the context given. The participants were given the first few letters of the target words for each item in each test item along with a meaningful sentence so that they could keep on the same context as expected. The third instrument is a questionnaire. The questionnaire aims to provide a picture of how the participants reflect on themselves, related to their vocabulary knowledge and experiences.

Design and Procedures

According to the steps elaborated by Creswell (2012) in conducting quantitative research, the researchers questioned several things: (1) the form of the quantitative database, (2) the plan to bring all of the databases together, and (3) the design used. The answers to these questions in this research were characterised by quantitative research. The expected results of this research target also need statistical results and further elaboration. In the rationale of using the quantitative method, this research aims to share a reliable and efficient means of gathering standardized data, enabling rigorous analysis and interpretation through statistical methods.

Therefore, the research design used in this research is a cross-sectional survey. This research is quantitative in nature, with a sample of the population being surveyed as part of the investigative process. The cross-sectional design is a one-point time research design (Creswell, 2012; Stratton, 2021; Wiersma, 1995). As in this research, the methodology was conducted directly to a study program from a specific semester at a time. In this instance, the Informatics Engineering study program from one of the universities in West Java was chosen.

Data Collection and Data Analysis

First, the tests were given to the students from both classes online, considering their availability to finish them. The total time to finish the tests was 90 minutes. The RVST was given first, and the PSVT was given after that. These tests were given the same day, while the questionnaire was given the day after. Second, a quantitative method was used to process and present the data in conducting the data analysis (Siregar, 2014). By identifying the data description, the writer used the SPSS program to analyse the data. As a result, the writer established the size of the data distribution (standard deviation, variance, minimum, maximum, and range) as well as the size of the data collection (mean score, percentage of mastery, and representative word counts) to acquire generalization of the data to be measured. Last, to provide a discussion in this research, the data were quantified and exposed to statistical analysis to validate or invalidate "alternate knowledge claims" (Creswell,

2003). Using a descriptive approach, the data were shown because this approach requires determining the characteristics of certain phenomena based on the real-situation observation (Leedy & Ormrod, 2001). Furthermore, the researchers employed inquiry techniques to guarantee conformity with the statistical data collection methodology.

In order to count the total number of correct answers in each vocabulary level test was used to measure the level of students' receptive and productive sizes. The Receptive Vocabulary Size Test consisted of a word frequency level with 25 items. Each item scored 4 points for the correct answer and 0 for the incorrect answer. The same number of items in the Productive Vocabulary Size Test there were 25 items. Answers were considered correct or scored 4 points if students wrote the correct word and part of speech. If they made a mistake in spelling and grammar, for example, the expected answer was opportunity. Still, they answered opportunities, it would be considered correct since vocabulary was being tested, but the point was 2 because it was different from the exact expected answer. For the wrong answer, they scored 0. Each of the tests here was in academic or university-word levels.

Meanwhile, in order to elaborate on the questionnaire results, the researchers used statistical analysis. A parametric test was conducted to check the underlying assumption where the chosen statistical methods were met and the data was normally distributed. In this research, since the number of the sample only consisted of 20 students, the Shapiro-Wilk test was considered more powerful and reliable than the Kolmogorov-Smirnov test. The variables questioned (age range, gender, length of study, and extra course) in the questionnaire were considered normally distributed because they have significant values above 0.05. One variable (age range) was considered not normally distributed because it had a significant value under 0.05, which was caused by the wide range of values between samples aged 17 to 21 and those aged 22 to 27.

The data for this research came from the students' receptive and productive vocabulary size test scores. Receptive and Productive Vocabulary Size Tests were utilized as the first instruments for data collection. Both were done before the questionnaire to give the researchers a picture of the engineering students' vocabulary masteries. The tests were concentrated on the AWL, one of the word frequency levels in measuring the size of vocabulary knowledge. Thus, a set of numerical descriptive statistics is used in this research to determine how large students' vocabulary sizes were. The first stage was to define the outcome of students' vocabulary mastery by defining the mean, the lowest and highest score, and the standard deviation. The predicted vocabulary size of students was then calculated. The following are some formulas used to measure the descriptive statistics:

Mean Score

$$\bar{x} = \frac{\sum x_i}{n}$$

\bar{x} = the mean score of data set

$\sum x_i$ = the sum of scores

n = number of scores

Standard Deviation

$$S = \frac{\sqrt{\sum(x - \bar{x})^2}}{n - 1}$$

x = value in the data set

$\sum x$ = sum of value

\bar{x} = mean of the data set

n = number of data point

Percentage of Mastery

The researchers utilized Putra's (2009) formulae to determine how many percentages of students' vocabulary size were in each test:

% = mean score

Percentage of Representative Words

The second stage focuses on the size of the students' vocabularies. The number of the vocabulary itself could be calculated using the following calculation depending on the students' results of vocabulary mastery:

(Number of representative words in each test \times Percentage of Mastery)

For example: AWL ($836 \times 95\%$) = 794 words for RVST

UWL ($570 \times 90\%$) = 513 words for PVST

FINDINGS AND DISCUSSION

Students' Vocabulary Size Tests

Here is the first stage in analysing the data revealing the first research purpose to summarize the results of students' vocabulary knowledge using a descriptive statistic approach.

Table 1. Students' Vocabulary Masteries (N =20)

	N items	Min. Score	Max. Score	Mean	Standard Deviation
RVST with AWL	25	72	96	85.80	7.509
PVST with UWL	25	60	88	71.80	8.458

Table 1 shows the results of each test performed by 20 students as the returning responses. The researchers examine the fluctuating scores of students' test results in each test of both tests by glancing at each row in Table 1. According to the percentage of each average score, students' vocabulary mastery in the receptive vocabulary test is greater than in the productive vocabulary test. The students achieved 85.80% mastery in the receptive vocabulary test, but only 71.80% in the productive vocabulary test. Hereafter, the students' responses on each test are revealed. The RSVT with AWL reveals that 574 words out of 836 serve as the representative words. Similar to the previous vocabulary test, the result of PVST proficiency level with UWL revealed that students displayed 327 words out of 570 as the representative words. The results of students' RVST and PVST calculations are displayed in Table 2.

Table 2. Students' Vocabulary Sizes.

	Representative Words	%	Vocabulary Size
RVST with AWL	836	85.80	718
PVST with UWL	570	71.80	409

The results were statistically analysed, and based on Tables 1 and 2, it appears that students' vocabulary sizes are 718 words in receptive and 409 words in productive, for a total of roughly 1,127 words acquired. The students as the participants in this research also demonstrated to have a reasonably strong receptive vocabulary knowledge score rather than productive vocabulary knowledge, which indicates that students have the information required to only identify the academic terms that often appear in a wide spectrum of scientific texts. This was also found in several research in the same topic, where students knew more vocabulary receptively than productively. Zhou (2010) states the development of productive knowledge falls considerably behind the development of receptive knowledge since, during the early stages of learning, students must be able to recognize a word by its form and grasp what it means. As a result, productive knowledge explicitly builds on receptive knowledge.

Students' Questionnaire

The second research purpose focused on how some factors outside educational activities can impact students' vocabulary knowledge. A one-way analysis of variance was carried out to see if the mean findings differed across groups of factors in Table 3 below.

Table 3. Factors that Affect Students' Vocabulary Knowledge.

Variable	Comparison	Mean Receptive	Standard Deviation	Sig.	Mean Productive	Standard Deviation	Sig.
Age	17 - 21	87.277	7.760	0.021	72.363	7.474	0.500
	22 - 27	84.000	7.211	0.799	71.111	9.955	0.335
Gender	Male	84.000	8.000	0.251	71.143	7.873	0.638
	Female	90.000	4.195	0.820	73.333	10.328	0.945
Length	7 Years	84.500	8.124	0.925	70.000	6.800	0.268
	> 7 Years	86.670	7.303	0.192	73.000	7.459	0.837
Extra Course	Yes	86.180	7.872	0.590	72.364	9.373	0.236
	No	83.333	7.483	0.263	71.111	7.688	0.065

The next issue discussed in this research is the factors that could affect students' vocabulary mastery. It was found that there was a statistically significant difference in vocabulary knowledge between students aged 17 to 21 and those aged 22 to 27. Other factors, such as gender, length of English study in school, and additional English courses outside of the classroom, were not statistically significant. As a result, the student's age was a major influence, which might affect their

exposure to their vocabulary knowledge. In this research, it was discovered that students aged 17 to 21 were going to catch up to those aged 22 to 27 in vocabulary knowledge. This research demonstrates that students' vocabulary knowledge rises as they become older. In this research, numerous factors might affect the performance of the participants aged 17 to 21, such as the quality of their English lessons, their willingness, and their exposure to the English language. Meanwhile, for the gender factor, the individual test results did not make a significant difference in results. This rising interest indicates that there is a significant benefit in learning about specific aspects of language learners' competency since it can be utilised successfully for diagnostic, placement, and curriculum-design reasons. It has long been established that 'knowing a word' has various aspects and degrees of knowledge (Nation, 1990). Other dimensions of vocabulary knowledge include collocations, associations, context utilisation, and related meanings. Hence, it is vital to have a variety of vocabulary measures to rely on. This section will discuss further the results of the receptive and productive vocabulary tests given in this research in order to get a complete picture of the Informatics Engineering students' vocabulary knowledge.

Discussion

Tables 1 and 2 show the results of each test performed by 20 students as the returning responses. According to the percentage of each average score, students' vocabulary mastery in the receptive vocabulary test is greater than in the productive vocabulary test. The students achieved 85.80% mastery in the receptive vocabulary test, but only 71.80% in the productive vocabulary test. The RSVT with AWL reveals that 718 words out of 836 serve as the representative words. Similar to the previous vocabulary test, the result of PVST proficiency level with UWL revealed that students displayed 409 words out of 570 as the representative words. A total of roughly 1,127 words were acquired. These numbers are considered as predictions of students' vocabulary sizes from the existing word lists, both academic and university levels, and also answered the first research objective. These numbers imply that the students are still having difficulty with establishing words to express themselves in the form of written and oral.

Table 3 is used to answer the second objective of this research. There was a statistically significant difference in vocabulary knowledge was observed between the ages of 17-21 and 22-27. Students aged 17-21 demonstrated higher receptive vocabulary with the mean score of 87.277 than their older counterparts with the mean score of 84.000, and higher productive vocabulary with the mean score of 72.363 than their older counterparts with the mean score of 71.111. This finding contradicts some expectations that older students might have a larger vocabulary due to longer exposure to the language. It suggests that younger students in this sample may have had more recent or intensive English education, possibly influenced by the quality of their learning process, their willingness, and curriculum changes or different teaching methods. It is not a surprise, citing Laufer's (2000) statement that many students might lack specific vocabulary even after 1000 hours or more of English lessons. In a comparable way, Staehr (as cited in Siregar, 2020) contends that students will continue to acquire a less specific vocabulary even after 400–700 hours of instruction. This implies that age does not completely affect the size of the student's vocabulary at this university.

On the other factor such as gender, there was a significant difference due to the fairly unequal number of samples among male and female students. The initial investigation conducted by Lee (2020), employed SEM to examine the impact of gender on vocabulary knowledge, mentions that girls may derive advantages from classroom instruction and language learning activities as a result of disparities in maturation compared to boys, such as earlier physical development and higher academic achievement, particularly in language-related subjects. Girls additionally show variations in their achievements and orientations (e.g., girls place a higher priority on reading activities compared to boys). Early advantages may influence the development of girls' vocabulary until adolescence, but these gender disparities appear to diminish as they become older. And these girls and boys are no longer called in the same manner, they are now called female and male. Thus, for the students in this research, the finding reveals that there may be an equivalent system that functions similarly across genders with the vocabulary sizes. Both male and female students performed similarly on the vocabulary tests, indicating that gender does not play a substantial role in vocabulary acquisition in this context.

Other factors such as length of study and participation in extra courses display no significant differences in the students' receptive and productive vocabulary knowledge. The length of study and extra courses outside of regular classes reveal the gap in mean values for receptive is 2.170 and 2.847, while the gap in mean values for productive is 3.000 and 1.253. Although the gap may not display any significant differences, these two factors do have impact on the students' vocabulary knowledge. According to Yusuf (2018), It requires both time and money to acquire English and vocabulary is enhanced throughout studying. He emphasizes how crucial it is to have consistent, high-quality exposure to the English language to effectively acquire vocabulary. The results reinforce the idea that incorporating extracurricular activities and various approaches to learning can help English language learners acquire vocabulary more effectively. On the other hand, Assyifa, Raniti, Noviyanti, and Khomarudin, (2023) suggest that other factors, such as the quality of instruction, motivation, and individual learning habits, may be more critical in influencing student's vocabulary acquisition.

This research and several research show consistent results that receptive vocabulary knowledge is frequently higher than productive vocabulary knowledge (Laufer, 2000; Citrayasa & Nernere, 2020; Siregar, 2020; Wero et al., 2021). Although these numbers are based on the average score of students who acted as a sample to represent the whole students, the results of each person are still very important since the outcome of their tests decided the overall result. The vocabulary sizes in this research were derived from the average score of 20 students who represented the whole population, implying that the test result of each person is not a measure of the individual vocabulary size, but rather of the population as a whole. However, because the results have been compiled with the others, they do not truly measure each individual's skill of vocabulary knowledge. Thus, the overall outcome was influenced even if some students received an excellent score on their test and others received a poor score. The vocabulary size might be high or low on average, depending on how many students correctly answer the test. As a consequence, it is feasible that the adequate outcome of students' vocabulary sizes was reflected by anything connected to the students' background and knowledge.

CONCLUSION AND SUGGESTION

The receptive vocabulary size test (RVST) result determined that the students acquired more than half of the academic words, with a vocabulary mastery of 85.80%. Meanwhile, the result on the productive vocabulary size test (PVST) was 71.80%, which indicates that they have higher receptive vocabulary knowledge than productive vocabulary knowledge. Since the exposure to English in specific or academic material is in the written form more likely used than spoken, this causes students to always be more accustomed to developing receptive abilities than productive ones. It is reasonable that most Informatics Engineering students master more vocabulary receptively than productively. The two types of vocabulary mastery can be influenced by other factors, such as length of study and extra courses. Exploring influenced factors could help in designing targeted vocabulary enhancement programs for engineering students. Students in this field may also accidentally learn words or phrases when reading a specific text, listening to the lecturer, or debating a topic. Still, the results of this research may differ in other study programs or even in other universities. Therefore, future research is expected to explore and deepen the students' vocabulary size and depth at the university level outside the English major, in order to involve larger and more diverse samples to generalize the findings. Additionally, qualitative approaches could complement the quantitative data, providing deeper insights into students' experiences and attitudes towards vocabulary learning. Even though vocabulary enhancement has been included in the curriculum, the lecturers should motivate students to acquire and expand their vocabulary knowledge, and should design interventions that encourage the active use of new vocabulary in speaking and writing, bridging the gap between recognition and production.

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