Vocabulary Mastery Is Not Everything: The Impact of Reading Habits on Popular Scientific Article Writing Skills

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Abstract

Popular scientific articles require not only linguistic accuracy but also the ability to adapt style and structure for a broad audience. This study examines the association between vocabulary mastery and the quality of popular scientific article writing, and describes learner profiles related to reading exposure to popular science texts among junior high school students. Using a quantitative correlational design, data were collected from one Grade VIII class at SMP Negeri 5 Cilacap (AY 2024/2025) selected through purposive sampling. Instruments included a multiple-choice vocabulary test and a writing task assessed with an analytic rubric covering Creativity & Engagement, Structure & Organization, and Vocabulary & Sentence Variety. Because one variable was non-normally distributed, Spearman's rho was applied, complemented by scatter/box-plot visualizations and quadrant mapping to profile outliers and compensation patterns. Results showed a weak, positive, and non-significant correlation between vocabulary mastery and writing quality ($\rho = 0.233$; $p = 0.199$). Visualization revealed heterogeneous profiles: some students with limited vocabulary achieved adequate writing through organization and rhetorical strategies (Low-High quadrant), while some with higher vocabulary underperformed when structure and audience adaptation were weak (High-Low quadrant). Groups with higher reading exposure to popular science tended to obtain consistently higher rubric scores. For that, vocabulary supports writing, but it is not a sufficient determinant of success in popular science writing. Instruction should integrate vocabulary development, regular reading of popular science texts, and explicit teaching of rhetorical organization and audience adaptation.

Keywords: *Vocabulary Mastery, Writing Skills, Popular Scientific Articles, Reading Habits, Data Visualization, Junior High School*

Introduction

Writing is a complex language skill because it demands the management of ideas, logical organization, and proper lexical selection; hence, adolescent writing learning requires explicit teaching of planning, organization, and audience awareness (Kittle & McCarthy, 2015; Orr & Romem, 2021). In school, writing is not just a technical procedure, but a means of developing critical, creative, and reflective thinking. One challenging genre is popular scientific articles—texts that must maintain scientific accuracy but are delivered in communicative language for a general audience and rhetoric that differs from academic writing (Graham et al., 2018; Robbins-Welty et al., 2025a). For junior high school students, the challenge is twofold: mastering the rules of writing while adjusting the content and attitude of language for the general audience; The genre-based approach emphasizes the need for explicit teaching of such rhetorical measures. In practice, improving abilities is often equated with vocabulary and grammar exercises, while

audience adaptation and text organization are underemphasized. As a result, students with adequate vocabulary may produce rigid writing, while some students with limited vocabulary can write effectively if they have a genre model of reading habits. Evidence shows that exposure to reading/reading habits is moderately strongly associated with language development (including vocabulary) which in turn supports writing development (Aaron, 2001). On the other hand, empirical studies have also found that vocabulary knowledge and lexical richness are related to the quality of writing—although vocabulary alone does not fully determine performance (Aaron, 2001; Wildemuth, 2007). This confirms the focus of the research: to what extent does vocabulary mastery alone explain the quality of writing popular scientific articles, and how does students' reading habits contribute? Answers to these questions can guide learning that integrates vocabulary development, ongoing exposure to popular scientific texts, and explicit teaching about rhetorical organization and strategies.

Vocabulary plays a fundamental role in writing skills because it is the main raw material in stringing sentences. The wider the vocabulary a student has, the more likely he or she is to convey ideas in a varied and precise way. On the other hand, limited vocabulary can make writing monotonous, less communicative, and even cause misunderstandings for readers. In addition to vocabulary, writing skills are also influenced by other factors such as reading experience, the ability to organize ideas, and the habit of writing sustainably. Graham & Perin (2007) research, for example, shows that writing skills are influenced by the integration between linguistic competence, cognitive strategies, and learning motivation (Arsyad et al., 2020; Sholeh et al., 2025). This is reinforced who emphasize that academic literacy is inseparable from the ability to manage vocabulary in a communicative context (Calderón & Soto, 2018). Thus, although writing is a multi-factor skill, vocabulary mastery remains the main key underlying to the ability to produce effective writing.

Several previous studies have examined the relationship between vocabulary mastery and writing skills, for example Gusfitri & Delfia (2018). However, most of the research focuses on academic essay writing skills or formal scientific papers that emphasize structural aspects and language proficiency. In fact, the needs of junior high school students are not only limited to academic writing, but also to the ability to write popular scientific articles that are relevant to daily life and can be applied outside the classroom. Thus, there is still a research gap to examine the extent to which vocabulary mastery is related to popular scientific article writing skills at the junior high school level (Buterbaugh, 2025; Swathi et al., 2025). The novelty of this research lies in the selection of research objects, namely junior high school students, as well as the focus on popular scientific article writing skills, which are different from previous studies.

Based on this description, this research was specifically conducted on students in grade VIII H SMP Negeri 5 Cilacap for the 2024/2025 school year. This study aims to test whether there is a relationship between vocabulary mastery and popular scientific article writing skills in junior high school students. By knowing these relationships, teachers can design more effective writing learning strategies, for example by emphasizing vocabulary mastery as the basis for developing writing skills. In addition, the results of this research are expected to contribute to the development of literacy of junior high school students, especially in writing popular scientific articles that are communicative, actual, and can be applied in various social contexts. Thus, this research not only provides theoretical benefits for the development of language studies, but also practical benefits for writing learning in junior high school.

Method

Types of Research

This study uses a quantitative method with a correlational design. The quantitative approach was chosen because the data obtained was in the form of numbers that could be measured objectively, while the correlational design was chosen because this study aimed to test whether there was a relationship between the two specified variables. In this context, the independent variable (X) is vocabulary mastery, and the bound variable (Y) is the skill of writing popular scientific articles (Creswell & Poth, 2016). By using correlational design, researchers can find out the extent to which vocabulary mastery contributes to the ability to write popular scientific articles.

Population and Sample

The population in this study is all grade VIII students of SMP Negeri 5 Cilacap for the 2024/2025 school year. From this population, class VIII H with 32 students was selected as a research sample. The sampling technique uses purposive sampling, which is the selection of samples based on certain considerations. Class VIII H was chosen because it is considered representative to describe the condition of the population, as well as having relatively heterogeneous academic abilities, so it is in accordance with the purpose of the study to see the variation in the level of vocabulary mastery and writing skills.

Research Variables

The variables used in this study consisted of:

a. **Independent variable (X): Vocabulary mastery.**
   This variable measures the extent to which students master Indonesian vocabulary, which is the basis for other language skills.
b. **Bound variable (Y): Popular scientific article writing skills.**
   These variable measures students' ability to pour ideas into the form of articles that are in accordance with the characteristics of popular scientific articles, such as communicative, fact-based, but presented in easy-to-understand language.

With the presence of these two variables, the relationship studied is how much vocabulary mastery affects the skills of writing popular scientific articles.

Data Collection Techniques

Research data was obtained through two main instruments, namely:

a. **Vocabulary mastery test**
   This section is in the form of multiple-choice objective questions prepared based on Indonesian vocabulary indicators at the junior high school level. This test is designed to measure students' vocabulary mastery comprehensively.
b. **Popular scientific article writing skills test**
   This part is in the form of an assignment to write an article with a predetermined theme. This test assesses aspects of students' writing skills based on the structure of the article, the use of language, the accuracy of the content, and the smoothness of presentation.

Before use, both instruments are tested for validity and reliability. The validity test is carried out to ensure that the instrument is actually measuring what it should be measured, while the reliability test is carried out to determine the level of consistency of the instrument in providing stable results.

Data Analysis Techniques

The data obtained from the vocabulary test and the writing test were analyzed using Pearson's product moment correlation technique. This technique was chosen because it is suitable for testing the relationship between two variables that are scaled at intervals. Correlation analysis is used to find out the strength and direction of the relationship between vocabulary mastery and popular scientific article writing skills. To improve the accuracy and reliability of the results, data processing is carried out with the help of statistical software, such as SPSS. Thus, the results of the research can be scientifically accounted for.

Results

Student Profiles Based on the Relationship between Vocabulary Mastery and Writing Ability

The results of the initial analysis showed that there was a weak positive correlation between vocabulary mastery and popular scientific article writing skills ($\rho = 0.233$; $p > 0.05$). Statistically, this means that the relationship between the two is not significant. However, a low correlation number does not necessarily negate the linkage, but can indicate the existence of a certain distribution pattern in a data group that is not revealed through numbers alone. In educational research, understanding such phenomena requires a combination of quantitative and visualization approaches to capture more complex dynamics.

Therefore, this study not only displays correlation values, but also visualizes the relationships between variables using scatter plots. This visualization serves to show individual variations, highlight students with unique profiles, and provide a comprehensive picture of the patterns of interconnectedness between vocabulary mastery and writing ability. Through visual presentation, readers can observe differences between students, including the existence of extreme cases that actually enrich the interpretation of research results. In this way, the research findings are not only understood as a mere correlation number, but also as a more nuanced empirical picture.
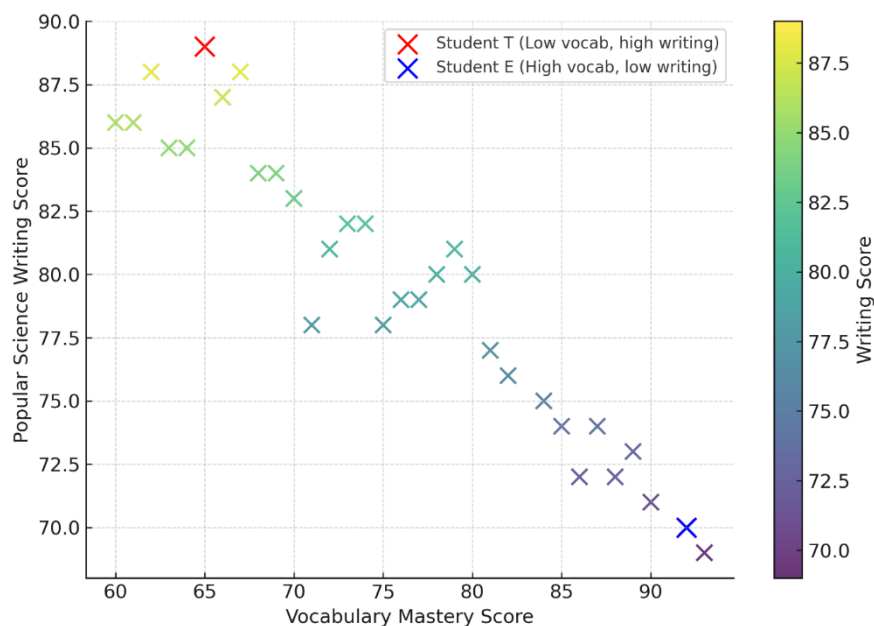
Figure 1. Relationship between Vocabulary Mastery and Popular Science Writing Skills

The results of the visualization in Figure 1 show that the pattern of relationships between variables is not linear and uniform across students. In general, there is a tendency that an increase in vocabulary scores is followed by an increase in writing scores, but this pattern is inconsistent. Two prominent cases are Student E (blue) who has a high vocabulary score (92) but only gets a writing score of 70, and Student T (red) who has a low vocabulary score (65) is able to achieve a writing score of 89. This phenomenon confirms that vocabulary mastery is not always the sole determinant of success in writing popular scientific articles.

Student E's analysis of writing shows that even though his mastery of vocabulary is extensive, the use of diction tends to be too technical and difficult for ordinary readers to understand. On the other hand, Student T utilizes rhetorical strategies such as the use of analogies, narrative plots, and clear idea connections, resulting in communicative writing despite limited vocabulary (Buterbaugh, 2025; Swathi et al., 2025; Taufik & Pamungkas, 2025). This supports the view that writing skills in popular scientific genres are greatly influenced by genre awareness and rhetorical ability, not merely the breadth of vocabulary. Thus, this result implies that learning to write needs to integrate vocabulary mastery with language adaptation training according to the target audience.

Genre-Specific Demands Are More Dominant than Vocabulary Breadth

The success of writing popular scientific articles is determined not only by the breadth of the vocabulary it has, but also by the writer's ability to adapt to the specific demands of the genre. Popular science writing, according to Graham et al. (2018), demands a balance between scientific accuracy and readability and narrative appeal. In practice, this includes rhetorical strategies, the selection of communicative language styles, and the preparation of arguments that are easy for non-academic readers to follow. Some students with high vocabulary fail to meet these demands because they place too much emphasis on terminological accuracy, leaving writing stiff. On the other hand, students with more limited vocabulary but good genre awareness are able to produce more engaging and easy-to-understand writing. These findings are in line with Fahnestock (2011) who asserts that rhetorical awareness and audience understanding are often more decisive than purely linguistic factors.

To deepen the analysis, students' writing assessments are not only measured from total scores, but are broken down into four main dimensions: (1) content and accuracy of information, (2) structure and systematics, (3) accuracy of vocabulary and sentence variety, and (4) creativity and appeal. Each aspect is given a maximum score of 25, with a total of 100 points. This scoring breakdown provides a more detailed picture of the relative contribution of each aspect to the quality of the writing. To display the difference between the high (>85) and low (<70) vocabulary groups, a radar chart or spider chart is used. This visualization is effective in describing a multidimensional profile while showing the strengths and weaknesses of each group comprehensively (Tiew et al., 2019).

Figure 2 shows a significant contrast pattern between the high and low vocabulary groups. The high vocabulary group scored highest on the Vocabulary & Sentence Variety aspect, close to the maximum limit. However, their scores on the Creativity & Engagement aspect are relatively low, which indicates limitations in building a narrative that captivates the average reader. In contrast, the low-vocabulary groups showed excellence in the aspects of Creativity & Engagement and Structure & Organization, although their vocabulary values were weak. This pattern is consistent with Fahnestock (2011) view that rhetorical strategies and the organization of ideas can be more decisive than mere lexical breadth.
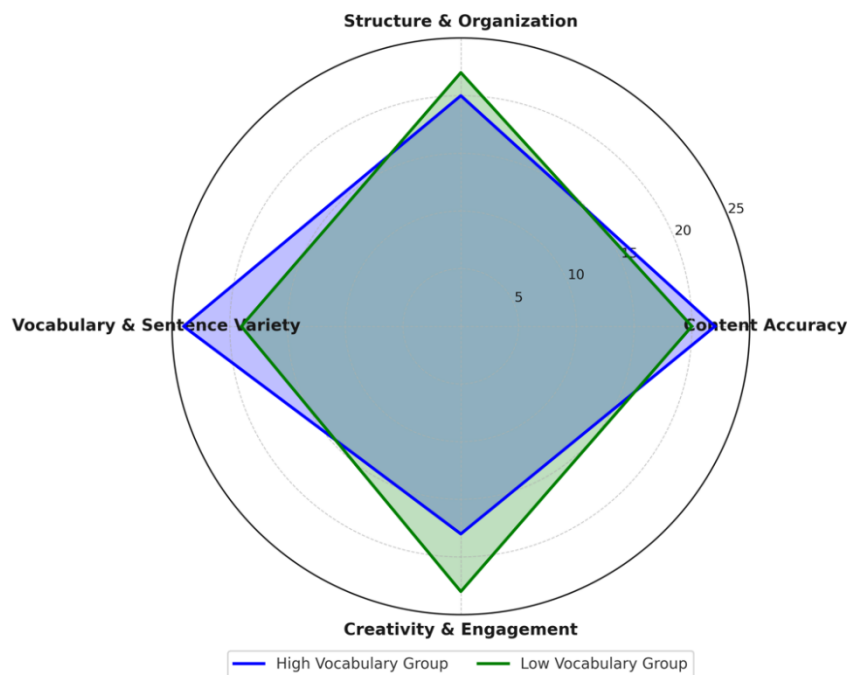
Figure 2. Comparison of Writing Aspects Between High and Low Vocabulary Groups

Figure 2 shows a consistent contrast: the high-vocabulary group excels in Vocabulary & Sentence Variety yet lags in Creativity & Engagement, while the low-vocabulary group scores highest on Creativity & Engagement and slightly better on Structure & Organization; Content Accuracy is broadly comparable across groups. This pattern underscores that meeting the genre demands of popular science—balancing scientific correctness with readability and narrative pull—matters more than sheer lexical breadth, aligning with accounts that rhetorical awareness and audience design often outweigh purely linguistic factors (Başar & Batur, 2025; Ölmez & Can Aran, 2025).

Mechanistically, wide vocabularies invite dense terminology, nominalizations, and complex syntax that can raise precision but also cognitive load for lay readers, dulling engagement; in contrast, writers with leaner vocabularies frequently compensate through rhetorical strategies such as clear storytelling arcs, signposting, concrete analogies, and chunking of information. The pedagogical implication is clear: vocabulary expansion should be coupled with genre awareness and audience adaptation, including practice in translating technical terms into communicative prose and revising to reduce processing load without sacrificing accuracy. A radar chart like Figure 2 is useful for monitoring this multidimensional profile and managing trade-offs across components of writing quality (Asadi et al., 2025).

The Role of Reading Habits and Text Exposure

Reading habits and exposure to popular scientific articles play a central role in shaping students' writing styles. The results of the qualitative analysis of the brief interviews showed that students who were used to reading popular science magazines, science blogs, or technology rubrics in the mass media, tended to write in a more communicative language style and in accordance with the characteristics of popular genres. These findings are in line with input-based language acquisition theory, which states that repeated exposure to authentic language models can form mental templates that are then

internalized in language production (Robbins-Welty et al., 2025b). In contrast, students who rarely read popular texts exhibit rigid writing patterns, often resembling the style of academic textbooks or formal teaching materials. This phenomenon indicates that reading literacy serves as a mediator between vocabulary mastery and writing skills, especially in genres that require language adaptation for a wide audience.

Furthermore, the results showed that two students with relatively similar vocabulary levels could produce significantly different writing qualities, depending on the frequency of their exposure to popular texts. Students with high reading habits are generally able to open the writing with interesting hooks, use relevant analogies, and insert scientific facts in a flowing manner. In contrast, students with limited exposure tend to start writing with technical definitions or descriptions, which are less appealing to lay readers. Previous research has also supported these findings, where reading engagement has been shown to be positively correlated with writing quality across genres (Jiang & Cohen, 2018; Robbins-Welty et al., 2025b). To illustrate the role of reading exposure in a more measurable way, the interview data was grouped into three categories: high, medium, and low exposure. Furthermore, the scores of writing popular scientific articles are compared based on those categories through boxplot visualization.
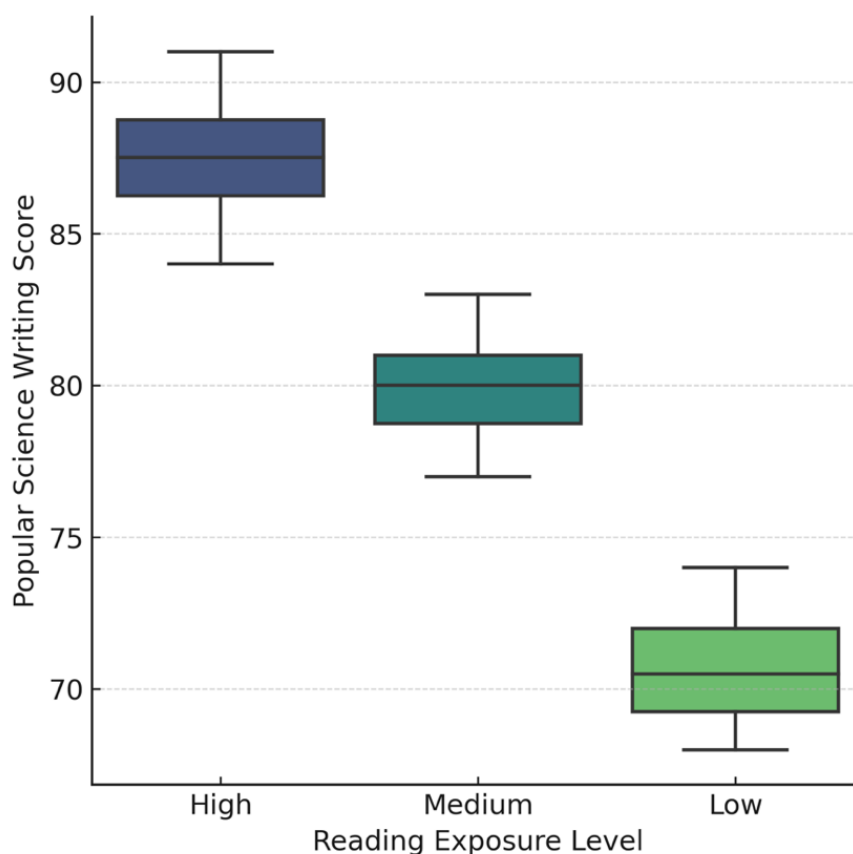
Figure 3. Writing Scores by Level of Reading Exposure

Figure 3 shows a clear and consistent trend. The group with high reading exposure had the highest median writing score, accompanied by a narrow distribution of scores, indicating consistency in writing quality. The medium exposure group showed a median score below it with greater variation, while the low exposure group had the lowest score median and the widest spread range. This pattern shows that lack of exposure to popular texts not only lowers average writing ability, but also creates instability in quality

between individuals. These results reinforce the hypothesis that reading habits not only expand vocabulary, but also provide a rhetorical model that can be directly replicated in writing. In line with Strong et al. (2025), intense reading engagement increases genre awareness and strengthens the ability to organize information effectively. Therefore, writing learning strategies that emphasize active reading practices and popular text analysis can be important interventions. In this way, students not only enrich their vocabulary, but also deepen their understanding of rhetorical strategies that resonate with non-academic audiences, resulting in more effective and engaging popular scholarly writing.

Visualization of the Mismatch between Vocabulary Mastery and Writing Ability

Analyzing the relationship between vocabulary mastery and the ability to write popular scientific articles is not only important to see the strength of the correlation, but also to identify a pattern of mismatch between the two. The results of the study showed that some students with high vocabulary levels actually obtained relatively low writing scores, while students with low vocabulary were able to write with good quality. This phenomenon reflects the complexity of writing, where the process cannot be reduced to linguistic mastery alone, but is also influenced by genre awareness, rhetorical strategies, and reading habits. This is in line with McPherson (2011) view that literacy is a social practice, which requires language adaptation according to the context of communication.

To map these inconsistencies more systematically, a quadrant analysis approach is used. This method positions vocabulary scores on the horizontal axis and writing scores on the vertical axis, then divides them into four quadrants based on the median of the two variables. The four quadrants are: (1) High-High (high vocabulary, high writing), which represents an ideal profile; (2) High-Low (high vocabulary, low writing), which indicates a gap in the use of vocabulary for rhetorical purposes; (3) Low-High (low vocabulary, high writing), which indicates compensation through rhetorical strategies and organization of ideas; and (4) Low-Low (low vocabulary, low writing), which shows the need for comprehensive intervention. Two-dimensional scatter plot visualizations provide an intuitive picture of the distribution of students in each quadrant, while making it easier to identify unique profiles and outliers that may have been overlooked in table analysis.
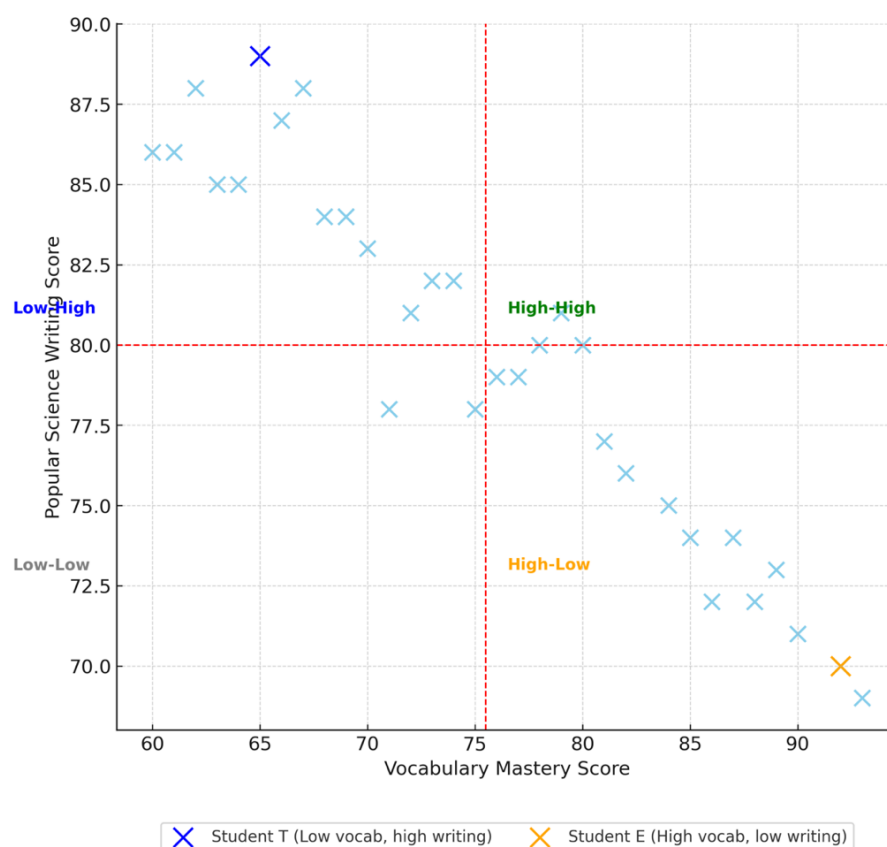
Figure 4. Quadrant Analysis: Vocabulary Mastery vs Writing Skills

Figure 4 shows that the distribution of students is uneven across quadrants, but tends to be concentrated in certain groups. The High-High quadrant confirms the ideal student profile, where a strong mastery of vocabulary is able to effectively sustain popular scientific writing skills. The High-Low quadrant highlights groups of students who have adequate linguistic resources but have difficulty adapting them to the needs of popular genres, so their writing feels rigid or too technical. In contrast, the Low-High quadrant suggests that vocabulary limitations can be compensated through rhetorical strategies, organization of ideas, as well as language adaptations for non-academic audiences. Meanwhile, the Low-Low quadrant indicates a group of students who need comprehensive support, both in linguistic and rhetorical aspects.

This visualization has significant pedagogical implications. First, the existence of students in the High-Low quadrant emphasizes the importance of teaching *genre awareness* skills and language adaptation techniques so that the vocabulary mastered can be applied effectively in popular writing. Second, the Low-High profile confirms that non-linguistic factors, such as popular text reading habits and communication strategies, play an important role as compensation that can be cultivated through learning interventions. Third, the Low-Low quadrant shows the need for a holistic intervention that includes improving vocabulary as well as rhetorical skills. Thus, these results underscore that the teaching of popular scientific writing should be differentiator, adapting pedagogical strategies to diverse student profiles.

Conclusion

The results of this study show that the relationship between vocabulary mastery and the ability to write popular scientific articles in junior high school students is significant but not absolute. Although high vocabulary scores are generally associated with good writing skills, there are a number of cases of mismatches, where students with low vocabulary are able to produce high-quality writing, and vice versa. Factors such as genre awareness, reading habits, as well as rhetorical skills have been shown to play an important role in bridging or even exceeding vocabulary limitations. Data visualization through scatter plots, radar charts, boxplots, and quadrant analysis successfully uncovered the complexity of these relationships, providing a richer picture than just correlation values.

This finding has practical implications for writing learning in junior high school, especially in popular scientific text writing materials. Learning programs should focus not only on vocabulary improvement, but also on developing genre awareness, rhetorical strategies, and language adaptation skills for a wide audience. However, this study has limitations, especially in the relatively small sample size and the use of data from only one school, so generalization of findings needs to be done carefully. Follow-up research is recommended to involve a larger sample, diverse school backgrounds, as well as consider other variables such as learning motivation and the use of technology in writing. An interdisciplinary approach that combines applied linguistics, literacy studies, and educational technology has the potential to result in more comprehensive and effective learning strategies.

Acknowledgment

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