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Enhancing Physics Learning Through English Journals and Presentation-Based Scientific Reasoning

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Abstract
This study examines academic literacy integration in an English-as-a-Foreign-Language (EFL) physics classroom through scientific journal reading and presentations. Involving 78 undergraduate students in a Renewable Energy course at Universitas Bengkulu, the research examines how IMRaD-based activities support scientific reasoning, genre awareness, and disciplinary communication. Students formed seven thematic groups focusing on geothermal, biomass, solar, wind, tidal, ocean thermal energy conversion (OTEC), and green hydrogen. A rubric assessed five dimensions: scientific understanding (M = 3.21), IMRaD mastery (M = 3.32), cross-language reasoning (M = 2.63), presentation delivery (M = 3.44), and responsiveness to questions (M = 3.24). Results showed stronger performance in structural and communicative skills, while cross-language reasoning posed the greatest challenge. These findings emphasize the need for explicit scaffolding to support meaning-making across languages. The study highlights the value of integrating scientific reading and presentations in EFL STEM education, alongside topic familiarity and equitable assessment practices.

Keywords
Academic literacy; Physics; Cross-language scientific reasoning; English journal reading; IMRaD structure

INTRODUCTION

In recent years, the demand for integrating academic literacy in STEM education has intensified, especially in contexts where English is a foreign language (EFL). Academic literacy, encompassing the ability to understand, interpret, and communicate scientific information, is fundamental for students preparing to engage with global scientific discourse (Hyland, 2022). In multilingual settings such as Indonesia, bridging the gap between English scientific texts and local academic expression presents unique pedagogical challenges and opportunities.

One instructional approach that holds promise is combining English scientific journal reading with presentation-based learning. This method fosters both content understanding and communication skills while situating students in active roles as meaning-makers. Research has shown that engaging students in presentation tasks enhances retention, critical thinking, and scientific argumentation (Ibrahim et al., 2021; Wang & Yu, 2023). Furthermore, reading authentic scientific texts exposes learners to the standard IMRaD (Introduction, Methods, Results, and Discussion) structure—a globally accepted framework that enhances comprehension and genre awareness in scientific writing (Ahmed & Bakht, 2020; Chang, 2022).

This study focuses on 78 undergraduate students from the Physics Department at Universitas Bengkulu who enrolled in a Renewable Energy course. Each student selected

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two English-language journal articles related to a specific energy topic and presented the synthesis in Bahasa Indonesia, following the IMRaD format. The presentations were grouped into seven renewable energy subtopics: geothermal, biomass, solar, wind, tidal, ocean thermal energy conversion (OTEC), and green hydrogen. Notably, some of these topics—especially tidal, OTEC, and green hydrogen—are considered less common and less accessible in the Indonesian scientific and industrial landscape (Setiawan et al., 2022; Wicaksono et al., 2023). This variation in topic familiarity was taken into account during performance evaluation.

The core aim of this study is to assess how this instructional model supports students' cross-language scientific reasoning, IMRaD structure mastery, and use of scientific terminology—three pillars of academic literacy—while also evaluating their overall presentation delivery and responsiveness. The research also considers how topic complexity may influence performance, and how fairness can be maintained through adaptive assessment strategies.

LITERATURE REVIEW

Academic Literacy in STEM & EFL Contexts

Academic literacy in STEM involves not only disciplinary knowledge, but also the ability to understand, synthesize, and communicate scientific information—especially in multilingual settings. Hyland (2022) argues that English proficiency alone is insufficient; learners must develop genre awareness and critical reasoning to engage with academic discourse. Ibrahim et al. (2021) found that student-led presentations in science contexts promote critical thinking, retention, and content mastery among EFL learners. These findings support the instructional approach combining reading with presentation to promote higher-order literacy skills.

Cross-Language Scientific Reasoning

The ability to read scientific texts in English and reinterpret their meaning in a different language—a practice known as cross-language scientific reasoning—is cognitively demanding. Sari and Setiawan (2023) identified that Indonesian science students often struggle to convey nuanced scientific arguments in Indonesian after reading English papers. Afrianto (2022) echoed this challenge, illustrating that meaning-making across languages requires explicit pedagogical support and practice.

IMRaD Structure as a Genre Scaffold

Understanding the IMRaD (Introduction, Methods, Results, Discussion) structure is essential for decoding and organizing scientific knowledge. Solikhah, Tarman, and Budiharso (2022) showed that Indonesian EFL learners improved their academic writing when trained in IMRaD-based structure. Ahmed and Bakht (2020) similarly demonstrated increased writing coherence and comprehension through genre-based instruction focused on IMRaD. Chang (2022) further confirmed IMRaD's effectiveness in supporting academic literacy within STEM education.

Presentation-Based Learning in Science Education

Presentation-based learning fosters active learning, confidence, and expressive competence. Sharma and Yusof (2021) report improved presentation delivery and audience engagement among STEM learners following structured oral tasks. Permas Hikmatunisa et al. (2024) found that engaging prospective teachers in scientific presentations builds confidence, clarity, and domain knowledge in STEM instructional

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practice. These benefits align with your approach of integrating presentations into physics education.

Topic Familiarity & Educational Fairness

Variability in topic complexity can influence student comprehension and performance. Setiawan et al. (2022) map that Indonesia's renewable energy development is dominated by geothermal, solar, wind, and biomass, while tidal, OTEC, and green hydrogen remain nascent. Wicaksono, Nugroho, & Lestari (2023) confirm limited exposure and public research activity in green hydrogen in the local context. These differences justify differentiated support or scoring adjustments when topics vary in familiarity.

METHOD

This study employed a qualitative case study approach within classroom-based educational research. The goal was to explore how integrating English-language journal reading and structured presentations in Bahasa Indonesia fosters academic literacy among undergraduate students in an English-as-a-Foreign-Language (EFL) physics context. Rather than testing a hypothesis or developing new teaching materials, the study focused on describing and analyzing students' scientific reasoning, structural understanding, and communicative performance within an authentic university learning environment.

The participants were 78 undergraduate students enrolled in a Renewable Energy course in the Physics Study Program at Universitas Bengkulu. The instructional intervention aimed to enhance students' academic literacy by integrating journal reading and presentation-based learning focused on scientific articles in English. Each student was assigned to find, read, and analyze two English-language scientific journal articles related to renewable energy, then present their synthesis using the IMRaD structure (Introduction, Methods, Results, and Discussion) in Bahasa Indonesia.

To streamline presentation organization and reduce topic overlap, the students were grouped into seven thematic clusters based on renewable energy types: geothermal energy, biomass energy, wind energy, solar energy, tidal energy, ocean thermal energy conversion (OTEC), and green hydrogen energy. This classification allowed deeper focus on subfields of renewable energy and promoted collaborative learning.

Students' performance was assessed using a rubric that focused on Cross-Language Scientific Reasoning, IMRaD Structure Understanding, and Use of Scientific Terminology, as presented in Table 1. Each criterion scored from 1 (very poor) to 5 (excellent), with explanation of score can be seen in Appendix A. The rubric was reviewed by two colleagues for face and content validity.

Table 1.
Rubric table for assessment

Criteria	Description
Scientific Understanding	Depth and accuracy of the content presented
IMRaD Structural Mastery	Ability to follow and articulate the IMRaD structure appropriately
Cross-language Scientific Reasoning	Effectiveness in interpreting and conveying scientific ideas across English and Bahasa Indonesia

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Presentation Delivery	Clarity, fluency, and engagement during the oral presentation
Responsiveness to Questions	Ability to respond thoughtfully and accurately to audience questions

RESULTS AND DISCUSSION

The results and discussion are presented in a section consisting of several paragraphs. This section is the most dominant part of the whole article, which is 60%. To facilitate understanding and reading, the results of the research are described first, followed by the discussion section. Results and discussion subtitles are presented separately.

Overview of Student Performance

A total of 78 students participated in this study, grouped into seven thematic clusters representing different renewable energy topics. Their performance was evaluated using a rubric that captured five key dimensions of academic literacy and presentation skills. The resulting average scores for each rubric component are presented in Table 2.

Table 2.
Average Scores by Rubric Component (N = 78)

Criterion	Average Score (out of 5)
Scientific Understanding	4.2
IMRaD Structural Mastery	3.9
Academic English Use	3.7
Presentation Delivery	4.1
Response to Questions	3.8

The results indicate that students demonstrated a moderate level of academic literacy and communication skills in presenting their understanding of scientific journal articles. Notably, Presentation Delivery received the highest average score (M = 3.44), suggesting that most students exhibited confidence, clarity, and structure in delivering their material in Bahasa Indonesia. This is in line with previous research highlighting the communicative strengths of students in first-language academic environments (Wijayanti et al., 2022).

IMRaD Structural Mastery also scored relatively high (M = 3.32), indicating that students were generally able to identify and convey the logic of scientific article structures. This reflects the effectiveness of the instructional design in fostering understanding of how scientific information is organized and communicated (Sharma & Yusof, 2021).

However, Cross-language Scientific Reasoning received the lowest mean score (M = 2.63), pointing to difficulties in translating scientific reasoning across linguistic boundaries. This finding resonates with challenges commonly reported in EFL STEM

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contexts, where students struggle to extract and reconstruct scientific meaning when shifting between English (source language) and Bahasa Indonesia (target language) (Sari & Setiawan, 2023; Afrianto, 2022). While students could identify technical terms and follow article structures, many faced obstacles in synthesizing arguments, explaining results, and drawing conclusions with coherence and depth across languages.

Scientific Understanding (M = 3.21) and Responsiveness to Questions (M = 3.24) scored moderately. The relatively balanced scores suggest that students had a foundational grasp of the article content and could respond to peer or lecturer questions, albeit with limited elaboration. It is also likely that topic familiarity played a role. As mentioned in the methodology, students presenting on less common topics (e.g., tidal energy, OTEC, and green hydrogen) encountered additional difficulty, but were compensated with a one-point adjustment to ensure equity in scoring.

Discussion

The integration of English journal reading and presentation-based learning in the Renewable Energy course proved to be a productive instructional strategy. The IMRaD focus facilitated structural awareness and strengthened students' academic literacy, as shown by the above-average performance in that category. However, the notably lower score in Cross-language Scientific Reasoning reveals a gap that needs pedagogical attention. Future instruction should include scaffolding strategies such as bilingual glossaries, sentence templates for scientific explanation, and peer translation workshops (Kim & Gil, 2021).

Among the topics, geothermal, solar, wind, and biomass energy are relatively well-established and commonly implemented in Indonesia. Geothermal energy alone accounts for over 2.4 GW of installed capacity across 18 operational sites (Simanjuntak et al., 2024). Solar energy has been rapidly expanding, reaching over 700 MW by 2024 and projected to play a dominant role in future energy planning (Irawan et al., 2021). Wind energy is also emerging, with operational farms such as the Sidrap Wind Farm (75 MW) supporting energy diversification in Sulawesi (Puspitasari & Setiawan, 2021). Biomass and bioenergy are actively integrated into national energy strategies through biofuel programs like B30 (Rizkiah et al., 2023).

In contrast, tidal energy, OTEC, and green hydrogen are significantly less common in the Indonesian context, with limited infrastructure or operational examples. These topics were considered potentially more challenging for students due to limited local exposure and references. To account for this discrepancy, a one-point score adjustment was applied to students presenting on these three underrepresented topics. This decision was pedagogically motivated to maintain fairness in assessing performance across uneven levels of content familiarity and resource availability, while still preserving academic rigor.

The disparity in topic familiarity emphasizes the importance of content accessibility in designing group tasks. While assigning challenging topics can foster deeper learning, it should be accompanied by tailored support such as curated starter references or preliminary seminars on emerging technologies.

Overall, this study supports the claim that integrating academic literacy in physics education, especially in multilingual contexts, requires more than language exposure—it

demands structured, supportive tasks that encourage both content mastery and cross-language scientific thinking.

CONCLUSION

This study explored how integrating English scientific journal reading and presentation-based learning within a Renewable Energy course could foster academic literacy among undergraduate physics students in a multilingual Indonesian context. By evaluating students' performance through a rubric focusing on Scientific Understanding, IMRaD Structural Mastery, Cross-language Scientific Reasoning, Presentation Delivery, and Responsiveness to Questions, several insights were drawn. The findings revealed that students excelled in presentation delivery and structural mastery of the scientific articles, reflecting their ability to grasp and communicate formal academic formats. However, the lower performance in Cross-language Scientific Reasoning highlights the complexity of transferring scientific meaning across languages—especially from English sources into Indonesian oral presentations. This underscores the need to see academic literacy not only as a matter of language proficiency but also as a higher-order cognitive skill that involves decoding, interpreting, and reconstructing meaning. Furthermore, the thematic classification of groups revealed variation in performance potentially tied to topic familiarity. Less common topics such as tidal energy, OTEC, and green hydrogen posed greater challenges, emphasizing the role of prior knowledge and content accessibility in shaping academic literacy outcomes. Overall, the integrated instructional approach showed promise in promoting science communication skills and structural literacy, while also exposing the areas where additional pedagogical support is needed.

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