

## Writing scientific articles for undergraduate students: A need analysis

Khairun Nisa, Syahrul Ramadhan, Harris Effendi Thahar

Doctoral Program in Language Teaching, Faculty of Languages and Arts, Universitas Negeri Padang, Padang, Indonesia

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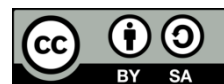
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### ABSTRACT

Excellent and appropriate teaching materials are based on the results of needs analysis. They significantly affect students' ability to write scientific articles and increase their knowledge and understanding of scientific papers required by indexed and reputable journals. This article explores the target needs (i.e., necessities, lacks, and wants) for teaching materials based on accredited journal criteria for scientific article writing. The design used is a case study. The data were collected using a questionnaire about target needs based on the theory of Hutchinson and Waters, namely lacks, necessities, and wants, and a focus group interview. The results showed that students must learn about teaching materials to write scientific articles to improve their writing quality. Regarding the students' lack of learning material for writing scientific articles, 85.53% indicated students' lack of IMRAD or introduction, method, result and discussion, and conclusion format research articles. According to students' perceptions, restating the research objective and approach and creating a research gap is the most difficult. Among 72 participants, 80% mentioned learning how to write based on the IMRAD format creating a research gap found to be the most critical skill they want to learn in the new course and then followed by summarizing and presenting data.

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### Corresponding Author:

Khairun Nisa

Doctoral Program in Language Teaching, Faculty of Languages and Arts, Universitas Negeri Padang

Prof. Dr. Hamka Street, UNP Campus, Air Tawar, Padang 25131, West Sumatra, Indonesia

Email: nisakhairun2206@gmail.com

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## 1. INTRODUCTION

Writing is a productive skill that students in language learning must master. Writing is a skill that expresses ideas or thoughts based on experience in written form [1]. Writing is a vehicle for communicating people's thoughts, feelings, and opinions [2]. Writing skills involve students' cognitive abilities in the form of ideas realized in a series of words arranged in symbols and writing [3]. In addition, students' ability to write will affect their learning achievement [4]. In other words, students explore thoughts and feelings about an object, choose what things to write about, and write them down so that readers can easily understand them. So writing is one of the activities that involve the expertise to present ideas and the ability to string words to produce readings that are easily understood by the reader and have a positive effect on the reader.

One of the writing skills that students must master is writing scientific papers. Scientific paper is a report or writing that examines a problem by someone by fulfilling scientific rules and ethics that are confirmed and obeyed by a scientific community [5]. Scientific works have several types: essays, reports, undergraduate theses, graduate theses, and dissertations [6]. The term scientific writing is commonly used to refer to the publication of original research in journals as scientific papers in a standard format, such as review papers, summarizing and integrating previously published articles [7]. The readers' perspectives are essential aspects of good scientific writing. These include taking them in and guiding them through a sequence of thoughts

without any gaps or missing links in developing ideas and providing them with logical information that anticipates their questions [8].

The ability to write scientific articles is a skill that students must possess at the university level. Each course requires students to write papers, conduct field research, conduct laboratory research, or write books [9]. Students must also have writing skills to complete the bachelor's degree requirements, including writing a thesis and scientific articles [10], [11]. Therefore, students are required to be able to write reports, articles, thesis, or final project. Writing scientific papers will make it easier for students who will later complete their graduate or doctoral education [12]. It follows that the ability to write scientific papers is critical for educators today and in the future when they want to further their education because students must write a thesis or publish an article in an accredited journal to graduate.

The fact that is currently happening is that students' writing skills are generally considered lacking. Dubicki [13] supports this statement by stating that many students struggled to write a rigorous research paper despite completing research assignments for other classes. The most difficult challenge for students is coming up with ideas for the final project, writing scientific papers, and gathering reading materials [14]. Other problems related to their students' concerns stem from their specific knowledge of what they will be working on and the limitations of their linguistic abilities [15], [16]. The capacity to adequately and appropriately incorporate source material into written compositions is a skill that educators have long recognized as being a significant obstacle for students learning to write for academic reasons [17]. Generally, students struggle with scientific writing; they struggle to find topics and cannot use suitable reading source materials, so the composition of students' writing is inaccurate.

Besides the difficulties students face in writing scientific papers, several researchers have discussed the rules of writing articles. However, few focus on teaching materials for writing research articles. For instance, Yundayani and Ardiasih [18] focused on the students' needs analysis of the English writing for academic purposes (EWAP) materials, including confirming the quality of the task-based material design that improves the students' EWAP skills. Yuvayapan and Bilginer [19] used an online questionnaire to investigate the academic writing needs of Turkish postgraduate students in the departments of English language teaching and English language and literature. Schillings *et al.* [20] analyzed students who generally found interventions are beneficial to improve academic writing skills based on the students' perceptions, such as feedback and feed-forward information. In addition, Rakedzon and Baram-Tsabari [21] reported on a study that used a quasi-experimental design to test whether an academic writing course in English could improve graduate students' academic and popular science skills. Lastly, Hasanuddin, Emzir, and Akhadiah [22] conducted research to improve students' scientific writing through collaborative learning using blended learning-based technology.

The aspects of writing scientific papers for students have not received attention in developing teaching materials. In contrast, these aspects are vital to equip students to fulfill one of the requirements to get a bachelor's degree, where they must write research articles that must be published in the online journal of the study program. Due to this reason, this study discusses the students' need for teaching materials to write scientific articles. The aspects covered will follow the target needs (necessities, lacks, and wants). This study is expected to have a significant impact on the learning of Indonesian language courses. Students identify their needs, and teachers create instruction that meets those needs. It can also be established as a practical teaching consideration with learning materials that focus on the outcomes of good student scientific work that must be applied to teaching.

## 2. RESEARCH METHOD

The design used in this research is a case study. Data was collected using a questionnaire distributed to 72 students of the Indonesian Education Study Program at Universitas Asahan who had completed the Bahasa Indonesia/Indonesian Language course. The final product of this course is to make an article that will be published in accredited journals. The questionnaire distributed is a closed questionnaire adapted from Cai [23] and based on the theory of Hutchinson, Waters, and Hyun [24]. The questionnaire items were divided into three major sections: necessities, lacks, and wants (see Appendix). The respondents must choose one of the available answers and several options that fit them [25]. The data were analyzed by finding the average for each statement item and grouping it into five categories, namely very low, low, medium, high, and very high.

In addition, a focus group interview is the second step in collecting the data after getting the survey data. The interview was conducted in the Indonesian language, their native language. The interview was recorded and transcribed then the researcher translated it into English. The participants are students who agreed to be interviewed voluntarily.

### 3. RESULTS AND DISCUSSION

The level of student needs regarding teaching materials for writing research articles based on the criteria of accredited journals is revealed. The results showed that three aspects should be considered to decide what the student needs for learning material in writing research papers. Those three principles are discussed.

#### 3.1. Necessities

Necessities refer to what students must do to know and perform effectively in the target situations [25]. It relates to what position students will function in obviously about future direction. Thus, analyzing the target situation should be implemented to find the students' necessities. This target situation analysis consists of a test involving knowledge and tasks to seek students' abilities and skills and enlighten their needs for any particular purpose. This explanation was achieved by referring to the statement items followed by answer choices with levels of least important, unimportant, moderately important, important, and very important in this sub-component section. This study's necessities analysis differs from previous studies, which generally only focus on the importance of academic writing for students. Instead, this study shows the components of an exciting way of writing, how to write an outline, and how to write systematically. Table 1 summarizes the findings of an analysis of student needs regarding the importance of writing scientific papers.

Table 1. The result of necessities in writing scientific article materials

No.	Statements	Options					Total	Average	%	Category
		1	2	3	4	5				
1.	How important do you think writing scientific article skills are to your current courses?	0	0	12	46	14	290	4.03	80.56	High
2.	How important do you think writing a scientific article is to your future career in the long run?	11	22	11	17	11	211	2.93	58.61	Medium
3.	How important is it to have your academic work published during your study?	0	0	9	39	24	303	4.21	84.17	High
Average									74.44	High

As additional information, this study used content validity by expert judgments for all study instruments. Then, the researcher implemented member checking and conveyed the finding with detailed transcription to validate those instruments. Besides, the researchers also ensured the students that any of their responses to these instruments would not affect their academic achievement and were not related to the progress of the lecture.

As shown in Table 1, the students were asked to choose based on a 5-point scale (1 being the lowest value and 5 being the highest) how important they considered writing scientific articles to their current studies, future career, and publishing. The results generally indicate that the students considered writing scientific articles important, with the average score being 74.44 and categorized as high level. The score for learning to write scientific papers for publishing academic work is the highest, with a mean score of 4.21 (SD=0.65) and 84.17% in the high category, as students reported the need to register for courses and the requirement for graduation.

While the need to learn to write scientific articles for a future career is slightly lower (M=2.93, SD=1.34), it is somewhat higher for a future career current studies (M=4.03, SD=0.60). Among 72 respondents, 89% of students said they wanted to learn how to write scientific articles for the Bahasa Indonesia course. These findings were supported by other researchers who claim that producing high-quality scientific writing is critical for researchers and educators because it affects their future careers [26], [27]. From the explanation, it concludes that writing scientific articles has a big role in the educational process of fulfilling the students' learning needs for their current and future careers. In addition, there were additional data to prove this result from the interview session. The student said they were interested in learning the materials about writing scientific articles.

*"I think writing scientific articles is essential, so I am interested in learning how to do good academic work."* (Student 3)

*"I am interested to learn this material because it challenges me through writing. So, I need to think critically about organizing the research content and how to write coherently."* (Student 9)

*"I want to be a lecturer, so I think I need to learn about this topic. Learning to write scientific papers excited me and attracted my attention so that I could understand it more to achieve my dreams."* (Student 16)

Based on the interview results, the students were interested in learning to write scientific articles. One of them said that writing scientific articles were important. It helps them know more about constructing an excellent academic paper. Meanwhile, another student was interested to learn because it challenges them to think critically in writing a good scientific article. In addition, other students felt interested and enthusiastic to learn to write scientific papers to achieve the future career they want. It implies that some students were interested in learning to write scientific papers. It helps them think critically and acknowledge how to write a good scientific report.

The statement is in line with the result of other researchers who found that critical thinking is crucial in enhancing students' writing ability [28], [29]. The items in the previous statement need to be balanced in teaching materials based on the existing score. The results generally imply that the students' imposed needs for learning to write scientific papers are enormous. Thus, they need teaching materials that can improve their knowledge of writing acceptable in accredited journals.

### 3.2. Lacks

Second, the target needs to address the shortage of students. The difference between students' target and actual progress defines their lack [30]. The target situation and students' current conditions differ. Niemiec [31] suggested that teachers run a parent staff association (PSA) to determine what children lack. The placement test calls it. Then, PSA evaluates pupils' current knowledge and linguistic skills. This sub-component was revealed by referring to the introduction, method, result and discussion, and conclusion (IMRAD) format and statement items followed by answer choices with very easy, easy, moderately easy, difficult, and very difficult. Table 2 describes the results of the analysis of the level of student deficiency regarding the format of a research article.

Table 2. The result of student lacks of writing scientific articles

Elements	Total	Means (difficulty)	%	Category
Abstract				
a) Creating research gap	327	4.54	90.83	Very high
b) Describing the research procedure	312	4.33	86.67	Very high
c) Summarizing the main results of the research	306	4.25	85.00	High
d) Evaluating the research	306	4.25	85.00	High
e) Using abstract forming expression	282	3.92	78.33	High
Introduction				
a) Defining the field of study	285	3.96	79.17	High
b) Setting the topic of study	315	4.38	87.50	High
c) Describing the study	282	3.92	78.33	High
d) Using linguistic aspects	306	4.25	85.00	High
Method				
a) Presenting the procedure for measuring research variables	300	4.17	83.33	High
b) Describing the data collection procedure	324	4.50	90.00	Very high
c) Describing data analysis procedures	303	4.21	84.17	High
Result				
a) Presenting meta-textual information	315	4.38	87.50	Very high
b) Presenting the results	324	4.50	90.00	Very high
c) Using hedging	303	4.21	84.17	High
Discussion				
a) Providing background information	324	4.50	90.00	Very high
b) Presenting result statement	303	4.21	84.17	High
c) Commenting on results or findings	303	4.21	84.17	High
Conclusion				
a) Restating the research objectives and approach	333	4.63	92.50	Very high
b) Summarizing findings	303	4.21	84.17	High
c) Evaluating research contributions	312	4.33	86.67	Very high
d) Recommendations for further research	306	4.25	85.00	High
Total	6774	4.28	85.53	High

The analysis results in Table 2 show that students' lack of IMRAD format research articles is in the high category, with an average of 4.28 (85.53%). From the data, eight statements are in the very high category, and 14 are in the high category. The statements in the very high category were 'creating research gap' (M=4.54), 'describing research procedure' (M=4.33), 'explaining data collection procedure' (M=4.50), 'presenting meta-textual information' (M=4.38), 'presenting results' (M=4.50), 'providing background information' (M=3.58), 'restatement of research objectives and approaches' (M=4.63), and 'evaluating research contributions' (M=4.33).

Based on the results of this analysis, we can conclude that the lack of what the student has not known is very high in writing scientific research articles. The students considered that they found it difficult to write scientific articles. Huerta *et al.* [32] added that the difficulties faced by students could be from internal problems, namely the level of anxiety, self-efficacy, and emotional intelligent (EI). From the explanation, it means that educators need to consider external factor, such as the IMRAD format, and internal factors related to students' psychological aspects. Therefore, material for writing scientific papers is needed to reduce the problems experienced by students as academics who should be able to produce scientific reports that can be published in accredited journals. Finally, this research has succeeded in showing that in the aspect of lacks, students tend to have difficulty writing in the discussion section, while other studies generally only investigate the level of needs of the teaching material for writing research articles.

### 3.3. Wants

Fundamentally, Hutchinson and Waters [25] claimed that refers to students' interests and desires and is related to perspective. "Wants" refers to what pupils want to know profoundly [33]. Other academics say it is explored to understand what pupils want in learning scenario analysis (LSA) [31]. This LSA analyzes teaching instruction, such as employing the best technique and strategy, transferring appropriate materials, and including a performance teaching style relevant to students' requirements. In this study, the researcher focused on materials preferences and the students' wants for a new writing course.

However, the students were asked to answer some short multiple-choice questions. The questions were related to the students' condition to achieve the target needs. Based on the first statement, most students perceived that they did not have a specific course or learning material to help them write scientific articles (87%). A focus group participant's comments reflect this lack of experience.

*"Other than their existing format and structure, we are not taught how to write academic genres such as research papers and theses in an appropriate language. We can only learn independently by imitating the model of research papers published in open-access journals. As a result, we lack confidence in our writing."* (Group A)

*"There are no special materials in Indonesian language courses for learning to write scientific papers. Even though our final project that was collected was the result of writing articles, we struggled to write good articles."* (Group B)

From the results of the interviews, the group representing all students stated that their lecturers did not teach specific material in writing scientific papers. They tended to do self-learning to fulfill the lecturers' writing assignments. Meanwhile, the other students mentioned that they do not get particular teaching that discusses writing scientific papers in Indonesian language course, even though the final task of this course is to produce scientific papers that will be published in accredited journals. They were never taught such skills and are thus unsure how to explore their ideas in writing for academic purposes. There has been no academic writing course with specific materials for writing scientific work for undergraduate students at this university. The lecturers believe that the students can acquire knowledge in writing academic papers by themselves. Whereas they need the research methods and primary structures that can guide the contents of research paper writing. It implies that the lecturer does not teach academic writing explicitly. Thus, undergraduate students with little experience in academic writing who need to write theses are only provided with several hours of lectures about the basic structure and the format of a thesis. It implies that students who do not have learning materials for writing scientific papers will have difficulty writing good articles.

On the other hand, students experienced boredom learning different materials delivered in the same monotonous way. The students do self-study without the teacher's teaching materials to understand well about writing academic papers, such as writing articles. The data of students' experience is shown in Table 3 for further detailed information. Following a discussion of students' experiences in Indonesian courses, as presented in Table 3, regarding teaching materials, the students agreed that using textbooks was critical for learning because they need academic material from textbooks.

Table 3. Teaching materials for Indonesian language course

Items	Total	Means	SD
The critical textbook used in class	282	3.92	0.76
Other supplementary handouts	277	3.85	0.80
Other supplementary authentic research papers as models	290	4.03	0.60
Supplementary exercises	211	2.93	1.34

According to the findings, 78% of students expect the lecturer will use textbooks in Indonesian language course in the future ( $M=3.92$ ,  $SD=0.76$ ). However, participants preferred research papers as supplementary handouts because they required a model (80%). According to the interview data, students gained more models as background knowledge before beginning to write papers or final assignments by analyzing and reading more research papers. Students believe that the supplementary handbook is unnecessary and that the textbook is sufficient. They require more examples of thesis or article writing to understand how to write correctly according to the existing format.

Furthermore, the students assumed that having an academic writing course (specifically research paper writing materials) for the Indonesian education program is very important nowadays (88%). Writing scientific articles is one of the critical skills that all university lecturers and students must have [34], [35]. The students reported that general writing skill is urgent to take a role in improving the students writing research articles quality (76%). When the college offers a new writing course, the most important five skills that students want to learn are related to general writing skills. Based on the result, 82% of students want to learn how to create a research gap (90%), design the research methods (69%), summarize and present data (74%), comment and discuss the data (70%), and write conclusions (63%).

Unlike other studies, this study discusses explicitly different components, especially in the aspects that have been mentioned earlier. This study revealed that among 72 participants, 80% mentioned learning how to write based on the IMRAD format creating a research gap found to be the most critical skill they want to learn in the new course and then followed by summarizing and presenting data. The previous explanation means that students need learning materials related to writing scientific papers to make writing reports and their undergraduate theses more accessible. As mentioned, lecturers consider some essential skills to help students understand how to write a good and correct scientific paper. Thus, students need teaching materials to improve their knowledge in writing good scientific papers. The statements must be prioritized in developing teaching materials for writing articles following the general format (IMRAD) for writing scientific papers.

#### 4. CONCLUSION

Based on survey results and focus group interview data, the needs of students at Universitas Asahan in academic writing have been suggested. Lectures reveal students' needs and difficulties in general academic writing skills, as has been done by previous research. This study examines perceptions and attitudes towards learning materials in previous Indonesian language course and prospective new subjects. The skills considered difficult by students are skills not taught in Indonesian language course related to the final project of the course, namely writing scientific papers. Restating the research objectives and approaches and creating research gaps are considered the most difficult academic writing skills, followed by presenting the data collection procedures and research results.

In the previous Indonesian language course, students were not taught how to write each part of the paper with the right steps and introduce the features and style of academic language. As a result, in the proposed new course, they would like to receive more assistance in these aspects. Considering these results, lecturers in the Department of Indonesian Language of Universitas Asahan in this context may need to consider changing their thinking from challenging to accessing additional learning materials that discuss how to write scientific papers. As a first step, they need to gradually replace outdated textbooks and develop new teaching materials according to students' needs.

This study suggests that lecturers should pay special attention to the material and assess their students to increase and maintain student motivation in writing scientific papers for international publications that are not only accredited but also reputable to produce quality works. In addition, lecturers must support and guide students to control or demand each other. This study also suggests that Indonesian students realize the importance of writing for international publications. In this case, students have to read a lot and find topics and issues to be more sensitive to the surrounding environment. They can also practice writing regularly by blogging, journaling, or following international conferences to improve their ability and courage. This research reveals that the most challenging aspect students face when writing a scientific article for publication is how to claim knowledge and ideas. The further study must focus on a deeper investigation of ways to create understanding and how to overcome it so that undergraduate students can publish their works in reputable journal publishers.




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## BIOGRAPHIES OF AUTHORS






**Khairun Nisa**    is a lecturer at Universitas Asahan, North Sumatra, Indonesia. She is also a doctoral candidate in the Language Teaching Program with a concentration in Indonesian Language Education at Universitas Negeri Padang, West Sumatra. Her focus on research and publications is mainly related to the issue of Indonesian language and literature education. She can be contacted via email at nisakhairun2206@gmail.com.



**Syahrul Ramadhan**    is a postgraduate program lecturer as well as a professor of Indonesian Language Education at Universitas Negeri Padang, West Sumatra. His focus of research and publications is mainly related to the issue of Language Skills Learning. He can be contacted by email at syahrul@fbs.unp.ac.id.



**Harris Effendi Thahar**    is a postgraduate program lecturer as well as a professor of Indonesian Education at Universitas Negeri Padang, West Sumatra. His focus on research and publications is mainly related to the issue of Indonesian Literature Education. He can be contacted via email at harriseffendithahar@fbs.unp.ac.id.

## APPENDIX

## Necessities

No.	Statements	Options				
		1	2	3	4	5
1.	How important do you think writing scientific article skills are to your current courses?					
2.	How important do you think writing a scientific article is to your future career in the long run?					
3.	How important is it to have your academic work published during your study?					

Note: Least important (1)–Most important (5)

Are you interested in writing scientific articles?

1      2      3      4      5

Which one(s) of the following elements should be of priority to be taught in the Bahasa Indonesia course, especially in writing scientific materials? Please cross (x) the bullet. You can check more than one answer.

- Determining the theme
- Creating an outline
- Understanding written language form
- Making an interesting introduction
- Writing content systematically
- Writing down the main idea clearly
- Writing a good closing paragraph
- Editing



**Lacks**

No	Elements	Levels				
		1	2	3	4	5
Abstract						
a)	Creating research gap					
b)	Describing the research procedure					
c)	Summarizing the main results of the research					
d)	Evaluating the research					
e)	Using abstract forming expression					
Introduction						
a)	Defining the field of study					
b)	Setting the topic of study					
c)	Describing your study					
d)	Using linguistic aspects					
Method						
a)	Presenting the procedure for measuring research variables					
b)	Describing the data collection procedure					
c)	Describing data analysis procedures					
Result						
a)	Presenting meta-textual information					
b)	Presenting the results					
c)	Using <i>hedging</i>					
Discussion						
a)	Providing background information					
b)	Presenting result statement					
c)	Commenting on results or findings					
Conclusion						
a)	Restating the research objectives and approach					
b)	Summarizing findings					
c)	Evaluating research contributions					
d)	Recommendations for further research					

Note: Very easy (1)–Very difficult (5)

**Wants**

Is there any academic writing, such as a research paper writing course offered at your university for Indonesian Education students?

- Yes
- No

Do you think you must have an academic writing course (specifically research paper writing materials) for the Indonesian Education program?

- Yes
- No

What do you think the focus of the writing course should be more on?

- General writing skills
- Language problems

If a new writing course is offered, please choose the most important five skills that you want to learn in the new course:

- Writing introductions
- Searching for appropriate literature using databases and library resources
- Creating a research gap
- Designing the research methods
- Summarizing and presenting data
- Commentaries and discussions on the data
- Writing conclusions
- Writing references