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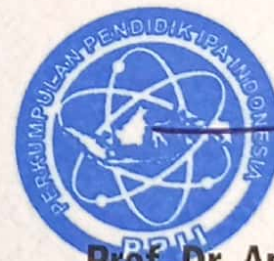
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# Inquiry based learning on the ability to write scientific material on plant physiology in pre-service biology teachers

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**Abstract.** The aims this research are to determine the effect of the inquiry learning on the ability of scientific writing pre-services Biology teachers. This research used quasi experiment method. The subject was consists of 29 pre-service teacher on 5th semester in one of university in Palangkaraya. The results showed that the ability to write scientifically on student plant physiology material averaged 77.257% with good criteria. It is suggested to develop inquiry-based learning toward to improve of scientific writing skills on other subject matter in college.

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## Introduction

Learning using inquiry models provides opportunities for students to hypothesize, design experiments, collect and analyze data and draw conclusions based on scientific evidence [1]. Inquiry learning model is learning that involves students' abilities to the maximum to find out systematically, logically, analytically so that students can formulate their own findings with confidence [2]. Efforts to implement inquiry-based learning in biology laboratories are able to foster a positive attitude towards science and scientific attitudes [3]. Inquiry learning models fosters complex ideas such as questions arise after observing, developing curiosity and encouraging authentic scientific practice [4]. Learning that is able to arouse curiosity and encourage students to problems solve with scientific evidence in line with inquiry skills. Increasing the competitiveness of universities in following developments in the industrial revolution era 5.0 needs to be pursued innovative and kreatif solutions that are in scientific thinking and scientific discovery.

The application of inquiry learning models is a necessity for pre-service biology teachers', because in the learning process it is required to be able to reason in scientific procedures as a true scientist. One of the goals of 21st century education is to prepare students to understand deep knowledge and apply high order thinking skills to overcome challenges in a changing society [5, 6]. Writing articles is a means of expressing yourself and conveying the results of research that has been carried out in accordance with expertise. Analyzing and writing articles not only teaching pre-service biology teachers' to convey their ideas, but also encourages students to share their findings [7]. Articles can play an important role in teaching and improve pre-service biology teachers' skills in developing scientific writing [8]. The pre-service biology teachers' get scientific questions followed by conducting scientific investigations and report the results in the form of articles. Based on this description, it is important to do the ability improve the scientific writing of pre-service biology teachers' through inquiry learning models.

### Experimental Method

This research is a qualitative descriptive research at one of the universities in Palangkaraya. This research involved 29 sixth semester pre-service teachers. Research subjects were taken with the consideration that they were enrolled in plant physiology courses. The instruments used in this study included questionnaires on student responses to quality in writing articles and the assessment of article writing using scores based on indicators of writing style, substance content and novelty values. The Data analysed using quantitative descriptive technique.

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### Result and Discussion

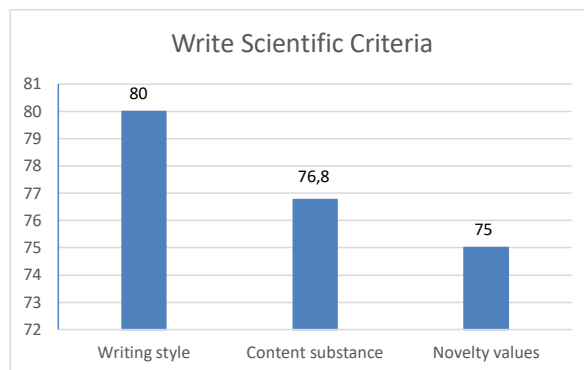
The results of data analysis show that the results of the assessment of pre-service teachers articles obtained by pre-service biology teachers can be averaged 77.257% with good criteria as shown table 1.

**Table 1. Write Scientific Criteria Percentage**

Indicator	Percentage (%)	Criteria
Writing style	80	Very good
Content substance	76,77	Good
Novelty values	75	Good
Average	77,26	Good

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The percentage of assessment of pre-service biology teachers' articles in figure 2 shows that the highest percentage of the criteria for writing style is 80% and the criteria for content substance are 76.77%, and the novelty values 75%



**Figure 1.** Pre-service teachers the inquiry learning on the ability of scientific writing

Figure 1 shows the 5th semester writing biology teacher's scientific writing skills in the Tadris Biology Program. As shown in Figure 1, the criteria for writing style are 80% with very good categories. In general, pre-service biology teachers can do the aspects of writing style, including: the effectiveness of the title, the inclusion of the author's name and institution, abstracts, key words, systematic preparation of chapters, the use of supporting instruments, reference and citation and references to references, instructions for prospective writers, terminology and language. Learning plant physiology applies a research-based inquiry model in the practicum. Plant physiology material consisting of basic plant physiology and advanced plant physiology is associated with actual phenomena that occur in the environment or the surrounding environment in everyday life. Inquiry learning models that uses an

approach to constructivism can train students to formulate problems and hypothesize to then look for evidence by conducting investigations or research. Pre-service biology teachers' are given a topic of plant physiology to be proven in experiments and simple research, then the results of the study are reported in articles with write style according to the edusains journal IAIN Palangka Raya.

The learning process of plant physiology based on inquiry through scientific investigation in the laboratory, which is carried out is to convey phenomena and themes that need further investigation. This is what make pre-service biology teachers' interested in making a research related to plant physiology. Pre-service biology teachers' submit research topics to get further research approval from the lecturer. Next is guidance to express ideas and write in scientific articles. Providing inquiry-based feedback that encourages pre-service biology teachers' reflection to carry out further investigations [9]. Writing scientific articles as part of the final assignment of pre-service biology teachers'. Lecturer need to evaluate, improve and provide feedback to pre-service biology teachers'. Feedback is done outside the classroom with online media. Evaluation is done to improve the lecture program and develop the scientific writing competence of pre-service biology teachers'.

The results of the assessment on aspects of the writing style obtained a higher percentage than the assessment of substance content and novelty values, the assessment of the writing style with criteria is very good. Pre-service biology teachers' , at five semester they have taken the research methodology and have also been taught to make articles, so that they get very good grades on aspects of writing style. Based on the results of the questionnaire pre-service biology teachers' prefer to write articles rather than writing lab reports by hand writing.

Based on the results of content substance analysis, the value of 76.8 is in the good category. The substance aspects of the content include: scientific scope, insight aspirations, analysis and synthesis. Generally, in scientific writing pre-service biology teachers' have been able to focus on the scientific scope to be studied. Limitation of the problem is needed so that the scope of the research becomes clearer, more focused, and more specific. In the preparation of the paper the limitation is very important so that the problems studied are not too broad [10]. Pre-service biology teachers' synthesis and analysis need to be improved, because their abilities are still quite low. Data analysis is a series of study activities, groupings, systematization, interpretation and verification of data so that a phenomenon has value social, academic and scientific. Data analysis in essence can be understood as an activity to organize, sort, classify, code or sign, and categorize it so that an finding is based on focus or problem you want to answer [10].

The aspect of novelty values include: originality of the work, meaning of contribution to progress, scientific impact, ratio of reference sources, reference level of literature and conclusions, generally good categories, but the originality of the work needs to be improved because the ability of Pre-service biology teachers' for of the work original sub-aspects is still experiencing difficulties. Generally, pre-service biology teachers' difficulties in writing articles are pouring ideas in the form of scientific articles. Pre-service biology teachers' are not used to writing scientific articles, so the novelty value and substance content still needs to be improved.

This finding is in line with the results of previous studies that pre-service biology teachers' have weaknesses in expressing ideas, students lack confidence and fear of starting in making articles explaining and concluding [11]. the aspect of assessment of novelty value and content substance, it is necessary to add training in article writing including looking for literature to compare and find the novelty value from scientific articles that have been made [12]. Scientific writing is an important part of the academic field. Improving scientific writing skills requires skills and habits pre-service biology teachers. Developing scientific article writing skills needs to be done in special classes, such as attending workshops accompanied by reviewers or lecturers who already have many scientific publications. Pre-service biology teachers should be accustomed to reading and writing scientifically, learning about new research topics, increasing conclusion, knowing publication roadmaps and getting feedback and direct experience with expert writers [11].

Learning to use interesting models along with appropriate assessment strategies is a powerful way to make learning efficient. The study of plant physiology using the inquiry model it was felt interesting for pre-service biology teachers' they making able to develop scientific literacy skills which then the results of the study were contained in journal. Showed that analysis of covariance results an increase in writing

skills and the significant writing improvement in writing assessment interventions using interesting techniques and appropriate assessment strategies [12].

The results of the study on the content substance aspects based on the ratio of primary reference sources should be greater than other sources, making pre-service biology teachers' look for as many primary reference sources as possible to strengthen the findings of their research. The success of pre-service biology teachers' in writing is influenced by the use of journal resources in assignments [11]. Writing articles uses primary reference sources to support pre-service biology teachers' skills towards academic literacy and make the results of writing that have a high degree of sophistication.

Inquiry-based learning is able to develop writing skills even though it is not optimal in aspects of novelty value. Lecturers can use inquiry learning models to develop pre-service biology teachers scientific writing skills or other models. One learning model for developing writing skills is project-based learning [13]. Writing scientific articles must be part of the objectives of study programs, faculties and institutions, so writing scientific articles is not only a rule in the course, but also so that students get writing competence [14]. To develop scientific writing can be done by holding workshops conducted by study programs, faculties, or institutions. The results of the workshop are able to produce published papers and help students become better scientific writers [14, 15, 16].

#### Conclusion

Based on the result of data analysis, it can be concluded that generally the ability to write scientifically on plant physiology material averages 77.25% with good criteria. It is recommended implement inquiry-based learning to develop pre-service biology teachers' scientific writing skills in other subjects in study programs, faculties, and institutions. Evaluation and improvement need to be done to improve the ability to write scientifically by having a special workshop class that focuses on academic writing to improve the quality of content substance and novelty value.

#### Acknowledgments

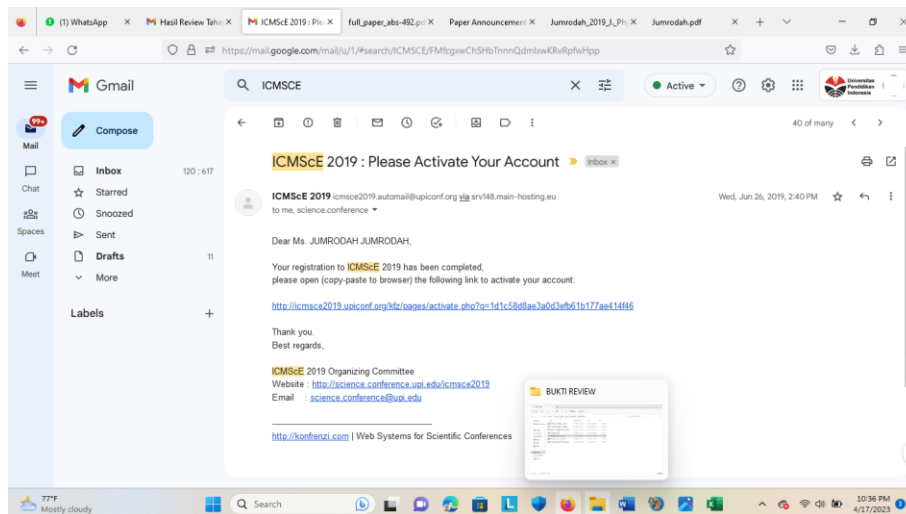
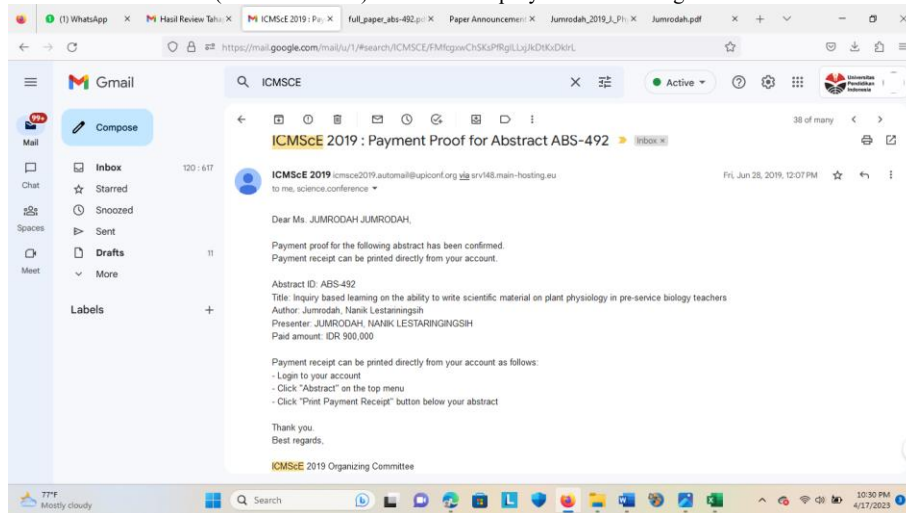
The authors would like to thanks for all the students who have participated in the data collection. The authors would also like to send a gratitude to the lecturers who have given the opportunity to conduct this research.

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Please use this "User ID" in all correspondence (instead of your name).

Email: [jum\\_rodah@student.upi.edu](mailto:jum_rodah@student.upi.edu)  
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The interface also shows a taskbar at the bottom with a search bar, system tray, and weather information (77°F, Mostly cloudy).