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Effect of the number of practicum courses programmed on the scientific attitude of biology education students in South Kalimantan

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Abstract

Practical activities are one of the activities that can improve science process skills and influence scientific attitudes. A scientific attitude is important for biology education students to have as pre-service biology teachers. This research aims to analyze differences in scientific attitudes between groups of students with differences in the number of practicum courses that have been programmed and to analyze the effect of the number of practical courses that have been taken on the scientific attitudes of Biology Education students in South Kalimantan Province, Indonesia. The type of this research is quantitative. The research subjects were 245 Biology Education students in South Kalimantan from Lambung Mangkurat University, Antasari Islamic State University Banjarmasin, and PGRI University Kalimantan. Data were collected using a scientific questionnaire referring to Lichtenstein et al. and Moore & Foy. Analysis of differences in scientific attitudes in each group of students was carried out using the Kruskal-Wallis test and continued with the Mann-Whitney test. Effect analysis was carried out using a linear regression test. The research results show that there are differences between student groups with differences in the number of practical courses that have been programmed. The results of the analysis also show that there is an effect of the number of practicum courses on the scientific attitudes of biology education students in South Kalimantan. The results of this study can be used as a consideration in curriculum development and the provision of infrastructure in the Biology Education Study Program.

Abstrak. *Kegiatan praktikum merupakan salah satu kegiatan yang dapat meningkatkan keterampilan proses sains dan berpengaruh terhadap sikap ilmiah. Sikap ilmiah penting untuk dimiliki mahasiswa Pendidikan biologi sebagai calon guru biologi. Penelitian ini bertujuan untuk menganalisis perbedaan sikap ilmiah antar kelompok mahasiswa dengan perbedaan pada jumlah mata kuliah berpraktikum yang telah diprogram, dan untuk menganalisis pengaruh jumlah mata kuliah berpraktikum yang telah ditempuh terhadap sikap ilmiah mahasiswa Pendidikan Biologi di Provinsi Kalimantan Selatan, Indonesia. Penelitian ini merupakan penelitian kuantitatif. Subjek penelitian merupakan mahasiswa Pendidikan Biologi di Kalimantan Selatan dari Universitas Lambung Mangkurat, UIN Antasari Banjarmasin, dan Universitas PGRI Kalimantan berjumlah 245 orang. Data dikumpulkan dengan menggunakan angket yang merujuk pada Lichtenstein et al. dan Moore & Foy. Analisis perbedaan sikap ilmiah pada masing-masing kelompok mahasiswa dilakukan dengan menggunakan uji Kruskal-Wallis dan dilanjutkan dengan uji Mann-Whitney. Analisis pengaruh dilakukan dengan uji regresi linear. Hasil penelitian menunjukkan terdapat perbedaan antar kelompok mahasiswa dengan perbedaan pada jumlah mata kuliah berpraktikum yang telah deprogram. Hasil analisis juga menunjukkan adanya pengaruh jumlah mata kuliah berpraktikum terhadap sikap ilmiah mahasiswa Pendidikan biologi di Kalimantan Selatan. Hasil penelitian ini dapat menjadi pertimbangan dalam pengembangan kurikulum dan pemenuhan sarana prasaran pada Program Studi Pendidikan Biologi.*

A. Introduction

A scientific attitude is a willingness to know and understand, question, search for data and its meaning, carry out verification, and consider consequences. A scientific attitude is a form of open mind and a desire to obtain knowledge that is accurate and has been verified so that it can solve problems with that knowledge (Osborne et al., 2003; Gokul Raj & Malliga, 2015). Attitude scientific too encouraging attitude someone to learn from something based on evidence empirical and changing corner look what has been studied. A scientific attitude is important for someone to have because it can support the process of scientific investigation to prove the truth of science. A scientific attitude is important to look for and consider evidence regarding the truth that someone believes. This evidence can strengthen or weaken confidence in the truth of that knowledge or belief. So, someone who has a scientific attitude can be open to these two things (Firdaus & Darmadi, 2017; McIntyre, 2014; Vácha & Rokos, 2017).

Attitude scientific is considered objective and important in learning science around the world. Science education must include the development of interests, values, attitudes, talents, and appreciation. Current developments in science and technology require students not only to have science knowledge but also to acquire a good attitude towards it and develop an interest in science. This is an important part of the scientific attitude in the world of education (Gokul Raj & Malliga, 2015). In higher education, a scientific attitude is important for PLO biology education study programs, especially in South Kalimantan, Indonesia. One of the PLOs is mastering educational research methods and techniques to solve problems in biology learning (Pendidikan Biologi ULM, 2020). so scientific attitudes must continue to be trained to support the achievement of the CPL (Fadli, 2019; Kiraz et al., 2017).

Skills specifically a must-owned Pre-service Biology teacher according to PLO are one of them that is capable design and carrying out research that is relevant to learning problems according to the principles of scientific research. This is also a must-supported attitude to good science. A teacher must develop many attributes scientific, including curiosity, cooperation, receptiveness to new ideas, thinking critical, objectivity, honesty, and generosity (Mahulae et al., 2017; Stegniy & Kurbatova, 2013; Taşdemir & Kartal, 2013). There must be a program to improve scientific attitudes that are integrated into the learning process and curriculum of prospective teachers (Verdugo-Perona et al., 2016). A scientific attitude is important for prospective biology teachers to have because pre-service biology teachers will teach biology which must be accompanied by investigations for the concept proof process (Erdogan, 2016; Lederman et al., 2013; Mukagihana et al., 2021).

Students' scientific attitudes are an important part of the educational process which can be determined by the quality of learning, students' skills, teacher-student and student-student interactions, and the learning atmosphere. A scientific attitude is very important in solving problems that require evidence and structured procedures (Kuşdemir et al., 2013). Scientific attitude is important for prospective teacher students who will become educators including biology teachers. The results of the study Amintarti et al. (2018) showed that there are still aspects of the scientific attitude of biology education students in South Kalimantan that need to be improved. Meanwhile, based on the curriculum of the biology education study program, biology education students in South Kalimantan must carry out practical activities.

Investigation activities in biology courses have the potential to improve students' scientific attitudes (Brown et al., 2016; Henige, 2011; Woolcock et al., 2016). Laboratory activities in practical or experimental activities can improve students' scientific attitudes (Hadiati et al., 2019; Lee et al., 2011; Susanti et al., 2018; Yoon et al., 2015). Investigation activities in the laboratory can improve students' science process skills (Gunawan et al., 2019). The science process skills possessed by students are related to students' scientific attitudes (Irwanto et al., 2018; Juhji & Nuangchalerm, 2020). However, there has been no specific research report that reports the relationship between practical activities and scientific attitudes of Biology Education students in South Kalimantan. Therefore, it is necessary to conduct research related to the relationship between practical activities and scientific attitudes to analyze the influence of practical activities on scientific attitudes, especially among Biology Education students in South Kalimantan.

The results of research by Hadiati et al. (2019) and Susanti et al. (2018) show that practical activities or experiments in the laboratory can improve scientific attitudes. In line with that, according to experiential learning theory, learning experiences can influence the formation of attitudes. Practical learning experiences using investigations will shape scientific attitudes in students (Kolb, 2015). The effect of the number of practicum courses that have been programmed on scientific attitudes is important to research. Research on this has never been carried out specifically on biology education students, especially in South Kalimantan. This research aims to analyze differences in scientific attitudes between groups of students with differences in the number of eyes studying practicing what has been programmed and to analyze the effect of the number of eyes studying practicum that has been done taken to attitude scientific Biology Education student in South Kalimantan Province, Indonesia. The results of this analysis are important as a basis for consideration in developing the curriculum for Biology

Education study programs, especially in South Kalimantan, Indonesia. So, it is hoped that the Biology Education curriculum can support the formation of good scientific attitudes prospective biology teachers.

B. Material and method

This research is a quantitative comparative and regression research. This research was carried out at Lambung Mangkurat University, PGRI Kalimantan University, and Antasari State Islamic University Banjarmasin. The research subjects were Biology Education students at Lambung Mangkurat University, PGRI Kalimantan University, and Antasari State Islamic University Banjarmasin. The subjects of this research were biology education students at universities in South Kalimantan. The population in this study was 555 students from three universities in South Kalimantan with details and percentages in Table 1. The determination of the minimum sample is based on the Krejcie and Morgan sample table with a minimum sample size of 217. The sample in this study was enlarged from the minimum sample size to 245 students or 44% of the total population. 149 respondents came from Lambung Mangkurat University, 34 respondents came from PGRI Kalimantan University, and 61 respondents came from Antasari State Islamic University Banjarmasin. The sample is distributed proportionally to each class (year of entry) of students at the university.

Data was collected using a questionnaire. Data on the number of practical courses and semesters taken were collected using a questionnaire. Student data is grouped based on the number of practical courses that have been programmed. There are five groups of students based on the number of practical courses that have been programmed, namely 0-5, 6-10, 11-15, 16-20, and 21-25 courses. Scientific attitude data was collected using a questionnaire referring to Lichtenstein et al. (2008) and Moore & Foy, (1997) indicators in Table 2.

Table 1 Spread research population and sample

No.	College	Number of biology education students	Percentage (%)
1	Universitas Lambung Mangkurat Banjarmasin	337	61
2	Universitas Islam Negeri Antasari Banjarmasin	140	25
3	Universitas PGRI Kalimantan	78	14
Total		**555**	**100**

Table 2 Indicators attitude scientific

Indicator	Statement item
Attitude to essence law and/ or scientific theory	The laws and/or theories of science are approximations of truth and are subject to change. Scientists are always interested in better explanations of things. Scientific ideas can be changed. Scientists believe that nothing is known to be true for sure. The laws and/or theories of science represent unchangeable truths discovered through science. When scientists have a good explanation, they do not try to make it better. Scientists discover laws which tell us exactly what is going on in nature. Scientific laws have been proven beyond all possible doubt.
Attitude to base explanation of scientific	Observation of natural phenomena and experimentation is the basis of scientific ex-planation. Science is limited in that it can only answer questions about natural phenomena and sometimes it is not able to do that. Scientists cannot always find the answers to their questions. Some questions cannot be answered by science. The senses are one of the most important tools a scientist has. The basis of scientific explanation is in authority. Science deals with all problems and it can provide correct answers to all questions. Anything we need to know can be found out through science. We can always get answers to our questions by asking a scientist. If a scientist cannot answer a question, another scientist can.
The attitude required for work in a way scientific	To operate in a scientific manner, one must display such traits as intellectual honesty, dependence upon objective observation of natural events, and willingness to alter one's position on the basis of sufficient evidence. Scientific questions are answered by observing things. Good scientists are willing to change their ideas. Scientists must report exactly what they observe. To operate in a scientific manner one needs to know what other scientists think; one needs to know all the scientific truths and to be able to take the side of other scientists. It is useless to listen to a new idea unless everybody agrees with it. If one scientist says an idea is true, all other scientists will believe it. Scientists should not criticize each other's work.

Indicator	Statement item
Attitude about the types of activities engendered in science	Science is an idea-generating activity. It is devoted to providing explanations of natural phenomena. Its value lies in its theoretical aspects. A scientist must have a good imagination to create new ideas. Ideas are the important result of science. Science tries to explain how things happen. Science is a technology-developing activity. It is devoted to serving mankind. Its value lies in its practical uses. Electronics are examples of the really valuable products of science. A major purpose of science is to produce new drugs and save lives. A major purpose of science is to help people live better.
Attitudes about progress in science	Progress in science requires public support in this age of science; therefore, the pub- lic should be made aware of the nature of science and what it attempts to do. The public can understand science and it ultimately benefits from scientific work. Most people can understand science. People must understand science because it affects their lives. Every citizen should understand science. Public understanding of science would contribute nothing to the advancement of science or to human welfare; therefore, the public has no need to understand the nature of science. They cannot understand it and it does not affect them. Only highly trained scientists can understand science. Most people are not able to understand science. Scientific work is useful only to scientists.
Attitude toward the work of scientists	Being a scientist or working in a job requiring scientific knowledge and thinking would be a very interesting and rewarding life's work. I would like to do scientific work. I would enjoy studying science. I would like to work with other scientists to solve scientific problems. I may not make great discoveries, but working in science would be fun. I would like to be a scientist. Working in a science laboratory would be fun. Being a scientist or working in a job requiring scientific knowledge and thinking would be dull and uninteresting; it is only for highly intelligent people who are willing to spend most of their time at work. I would not like to do scientific work. The search for scientific knowledge would be boring. Scientific work would be too hard for me. I do not want to be a scientist. Scientists do not have enough time for their families or for fun. Scientists have to study too much.

Analysis of differences in scientific attitudes in each student group was carried out using the Kruskal-Wallis test and followed by the Mann-Whitney test. Effect analysis was carried out with a regression test. This is because results testing Data normality as a prerequisite test using the Kolmogorov-Smirnov test shows that the data is not normally distributed. Another prerequisite test is the homogeneity test with the Levene test showing the second data variable homogeneous. Kolmogorov-Smirnov test, Levene test, Mann-Whitney test, Kruskal-Wallis test, and regression test carried out using SPSS 26.

C. Results and discussion

Analysis prerequisite test

In this research, analysis prerequisite tests were carried out by analyzing the norm and homogeneity of the data. The normality test was carried out using the Kolmogorov-Smirnov test. The results of the normality test are presented in Table 3.

Based on normality test results the significance of the entire data group is 0.000 smaller than level significance (0.05). This means the data is not normally distributed. Data homogeneity testing was carried out using the Liliefors test. The results of the data homogeneity test are presented in Table 4.

Table 3 Normality test results with the Kolmogorov-Smirnov test

Variable	Group sample number of practicum courses that have been programmed	Kolmogorov-Smirnov		
		Statistics	df	Sig.
Attitude Scientific	0-5	0.248	85	0.000
	6-10	0.314	75	0.000
	11-15	0.382	32	0.000
	16-20	0.321	19	0.000
	21-25	0.274	34	0.000

Table 4 Homogeneity test results with the Liliefors test

Levene statistics	df1	df2	Sig.
15,435	4	240	,000

The significance value of the Liliefors test results is 0.000, which is smaller than the significance level (0.05). The conclusion of the data homogeneity test results is based on the Liliefors test, namely that the data is not homogeneous. So, the test used for data analysis is a nonparametric test.

Differences in scientific attitudes between student groups based on the number of practical courses that have been programmed

Descriptive analysis by determining the average value of scientific attitude was carried out to see the average value of scientific attitude in each group of students. The average scientific attitude scores for each student group are presented in Table 5.

Table 5 Average scientific attitude scores for each student group

No.	Number of practical courses that have been programmed	Average scientific attitude score
1.	0-5	2.80
2.	6-10	2.95
3.	11-15	3.02
4.	16-20	3.10
5.	21-25	3.17

The test carried out to analyze differences in scientific attitudes between groups of students based on the number of practical courses that have been programmed is the Kruskal-Wallis test. The Kruskal-Wallis test was carried out to determine the significance of differences between groups. The results of the Kruskal-Wallis test are presented in Table 6.

Table 6 Test results for differences between groups using the Kruskal-Wallis test

Rank			Test statistics		
Group	N	Mean rank	Kruskal-Wallis	df	Asymp. sig.
0-5	85	44.56	219,463	4	0.000
6-10	75	123.11			
11-15	32	172.44			
16-20	19	208.47			
21-25	34	224.56			
Total	**245**				

The results of the Kruskal-Wallis test show mark significance namely 0.000 which is a smaller value than level significance 0.05. This shows There are significant differences between student groups based on the number of practicum courses that have been programmed. To know in a way specific differences between each group then the analysis continues with the Mann-Whitney test. The results of the analysis using the Mann-Whitney test are presented in Table 7.

Table 7 Mann-Whitney test results

Group		0-5	6-10	11-15	16-20	21-25
		Asymp. sig. (2-tailed)				
0-5						
6-10	Asymp.	0,000				
11-15	Sig.(2-	0,000	0,000			
16-20	tailed)	0,000	0,000	0,000		
21-25		0,000	0,000	0,000	0,000	

Based on the Mann-Whitney test in Tabel 7, it is known between each group of students there is a difference in value attitude scientific significance. This is concluded from the Asymp value. Sig. (2-tailed) which is smaller than 0.05.

The test results showed that there were differences in each group. The average calculation shows that the highest scientific attitude score is in the group of students with a total of 21-25 programmed courses. The lowest average scientific attitude score was in the group of students with a total of 0-5 programmed practical courses. This shows that the greater the number of courses programmed, the higher the average student's scientific attitude.

The effect of the number of programmed courses on the scientific attitudes of biology education students

Analysis of the Influence of the Number of Programmed Courses on the Scientific Attitudes of Biology Education Students in South Kalimantan Province, Indonesia was carried out using a regression test. Regression test results are presented in Table 8.

Table 8 Regression test results of programmed courses on scientific attitudes

Model	t	Sig.	R	R square
(Constant)	325.425	0.000	0.873	0.762
Number of practicum courses have been programmed	27.927	0.000		

Dependent variable: Scientific attitude
Predictors: (Constant), Number of practicum courses have been programmed

Regression tests are known to mark a smaller significance of 0.05 this means there is an effect of the number of practicum courses that have been programmed towards attitude scientific student education biology in the Indonesian province of South Kalimantan. The calculated t value also shows the influence of the independent variable on the dependent variable. This can be concluded from the calculated t value (27.927) which is greater than the t table value (1.97). The R Square value is 0.762. This means that the number of courses that have been

programmed is predicted to contribute 76.2% to the scientific attitude of biology education students in South Kalimantan, Indonesia.

The form of learning activities can influence student activities and skills. Practical activities are a form of learning that can improve students' science process skills (Darmaji et al., 2019a; Darmaji et al., 2019b; Juniar et al., 2020). Activities using laboratory facilities can improve students' science process skills (Adlim et al., 2020; Irwanto et al., 2019).

Science process skills relate closely to student scientific attitude. Science process skills are formed in the activity process practicum and can form attitude science in students (Dwianto et al., 2017; Irwanto, 2022; Kustijono et al., 2018). In line with that, Wiwin & Kustijono (2018) explain that activities observing, classifying, inferring, predicting, and communicating which constitute part of science process skills and training in activities practicum can support an attitude of curiosity, responsibility, and thinking open which is part from attitude scientific.

The higher the number of practicum activities, the greater the opportunity to improve scientific attitudes in Biology Education students in South Kalimantan, Indonesia. Practical activities in the form of direct observation of natural phenomena can improve attitudes toward the nature of laws or theories in science (Susanti et al., 2018). The investigation can also improve attitudes towards the basis of scientific explanations. Practical activities in the laboratory can train students to work scientifically and attitudes about the types of activities that arise in science. Practical activities in the laboratory will also support attitudes towards the work of scientists (Hadiati et al., 2019). The higher the number of practicum activities, the greater the opportunity to improve the scientific attitude of Biology Education students in South Kalimantan, Indonesia. Therefore, universities should pay attention to learning facilities and infrastructure that support practicum activities, such as laboratories, so that they comply with national higher education standards to support these practicum activities (Regulation of the Minister of Education and Culture Number 03 of 2020 concerning National Higher Education Standards). This is so that prospective biology teachers get used to thinking and working scientifically in the investigation process (Amintarti et al., 2018). So it is hoped that the biology learning that will be taught will be more contextual and understanding will not be limited to abstract concepts (Bartlett et al., 2023; Harman et al., 2016).

D. Conclusion

The research results show that there are differences between student groups with differences in the number of practicum courses that have been programmed. The results of the analysis also show that there is an influence of the number of practical courses on the scientific attitudes of biology education students in South Kalimantan Province, Indonesia. The results of this study can be a consideration for universities, especially Biology Education study programs, in developing curricula and improving supporting facilities and infrastructure for practical activities. So that practical activities can support the formation of scientific attitudes in prospective biology teacher students.

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