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SCIENTIFIC ATTITUDE AND ITS EFFECT ON STUDENTS' PRODUCTIVITY

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ABSTRACT

There are seven indicators of scientific attitudes: curiosity, respect for data/facts, critical thinking, discovery and creativity, open-mindedness and cooperation, perseverance, and sensitivity to the environment. Scientific attitudes correlate with productivity. However, the relation between productivity and each scientific attitude indicator is unexplored. This study aims to determine the effect of scientific attitude indicators on undergraduate and postgraduate (master's and doctoral) students' productivity. The research method used was quantitative with a correlation approach. Data was collected using questionnaires distributed via Google Forms. The research respondents were randomly selected by distributing Google Forms in the WhatsApp group. The respondents of this study totaled 101 respondents consisting of 44 bachelor's students, 50 master's students, and 7 doctoral students. From the research results, the indicators of scientific attitude that correlate with bachelor students' productivity are respect for data/facts, critical thinking, as well as discovery and creativity. Meanwhile, indicators of scientific attitude that correlate with postgraduate students' productivity are curiosity, respect for data/facts, critical thinking, discovery and creativity, and perseverance. The overall scientific attitudes obtained a significance level of 0.050, indicating a significant correlation between the scientific attitude indicator and bachelor students' productivity. The significance level of the scientific attitude toward the productivity of postgraduate students is 0.003, so there is a significant correlation between scientific attitudes toward the productivity of postgraduate students. This study concludes that the effect of a scientific attitude on the productivity of postgraduate students is greater than that of undergraduate students. Hence, scientific attitudes influence students' productivity.

Keywords: scientific attitudes; students' productivity

INTRODUCTION

As academicians, students must have a scientific attitude and high productivity to continue to work and innovate. Students can develop skills and professionalism from their achievements, research, writing, and other relevant agendas in the academic field. In order to produce competent graduates, tertiary institutions must play a role in teaching, research, and community service so that students can develop knowledge and broaden their insight in the field of science and technology (Hutchison, 2016; Bodoh-Creed & Hickman, 2018; Andriani et al., 2020; González-Pérez & Ramírez-Montoya, 2022).

One form of character development in the 21st-century core skills is scientific attitudes (Laar et al., 2017; Afandi et al., 2019; Ilmi et al., 2020). Fundamentally, the scientific attitude is different from the attitude of knowledge, where the scientific attitude is owned by scientists to identify, research, and develop new knowledge (Dwianto et al., 2017; Fricker et al., 2019). The scientific attitude formed from the affective domain is related to learning motivation (Laar et al., 2017; Ismailov

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& Ono, 2021). A scientific attitude can be developed through scientific literacy activities (Auerbach & Schussler, 2017; Jufrida et al., 2019). In doing scientific work, students do critical, creative, and complex thinking (Syahrin et al., 2019). The aspects of scientific attitude include cooperation, curiosity, objectivity, openness, perseverance, tolerance, critical thinking, courage, honesty, humility, earnestness, intellectuality, and self-criticism (Astutik & Prahani, 2018; McIntyre, 2019; Parmiti et al., 2021).

A scientific attitude can be instilled through a series of scientific activities in a learning model syntax such as guided inquiry, problem-based learning (PBL) (Misbah et al., 2018; Sakliressy et al., 2021), or soft skills as a pedagogical implementation before entering the world of work (Jacobson-Lundeberg, 2016). The scientific attitude has three essential components: beliefs, feelings, and actions (Kumar, 2019). Students' scientific attitudes can be formed during scientific activities and learning. The assessment of students' scientific and affective attitudes is different, and the assessments carried out often tend to be only affective attitudes (Sakliressy et al., 2021). The lack of scientific attitude assessment reduces productivity in everyday life (Nugraha et al., 2020).

Scientific attitudes are essential for students as a framework for thinking and behaving in solving scientific problems. Students' scientific attitude is closely related to student productivity. A high scientific attitude will have implications for student productivity in producing scientific works such as books, articles, and others. The scientific attitude embedded in students will make them more productive, and it is hoped that there will be discoveries that can be useful in the advancement of the world (Ma, 2023).

The concepts of efficiency and productivity are two different things, but both have a relative correlation to achieving maximum productivity in an activity or goal (Aparicio et al., 2016; Havnaer et al., 2017). Productivity is always related to projects and results, whether in a product or scientific work (Benin, 2016; Jalinus et al., 2017; Schlombs, 2019). The productivity indicators include the ability to carry out tasks, improve the results, work enthusiasm, self-development, and the effort to improve quality and efficiency. Productivity is considered a long-term educational outcome and a global education reform (Fang et al., 2016; Hanushek & Ettema, 2017).

Cultivating organizational and scientific activities can impact students' attitudes, performance, behavior, and productivity from different backgrounds (Hamdani & Wibowo, 2017; Cherian et al., 2021). According to previous studies, productivity can be affected by age, so it requires a strategy that can encourage students' motivation and scientific work (Bakar, 2014; Möller & Shoshan, 2017). In addition, gender differences can also affect productivity, as seen from the number of scientific publications. However, if each individual can suppress the inhibiting factors for productivity, then there is no gap between men and women in the level of productivity at universities (Mairesse & Pezzoni, 2015; Upadhyaya & Vrinda, 2021). Obstacles that often occur are human resources, project habituation, strategy, and structural assignments related to scientific activities (Goldhaber & Startz, 2017; Szuflita-Żurawska et al., 2020).

Factors that can affect productivity are individual, social, psychological, and environmental factors. Other research shows that the self-efficacy and motivation of each individual with bachelor's, master's, and doctoral degrees have a vital role in driving their productivity (Kuo et al., 2017). One way for students to have high productivity is to involve them actively and productively in academics and non-academics (Gillies, 2019). Producing productive students requires collaboration between universities, faculties, and study programs. Facilities and infrastructure, learning designs, and learning experiences are provided evenly, not discriminatory, and inclusive (Murphy & Torre, 2014; Morales et al., 2017; Maniktala et al., 2022).

Previous researchers examine the students' attitudes toward a learning product (Aricia et al., 2019; Ismaili, 2021), science (Kurniawan et al., 2019), and the use of MOOCs (Al-Rahmi et al., 2021). They also investigate the influence of project-based learning and local culture on scientific attitudes and science process skills (Dwianto et al., 2017; Parmiti et al., 2021) and the formation of a scientific attitude from scientific work skills (Arinda et al., 2019). The results of this study are corroborated by the results of other studies, where students' scientific attitudes increase from 28.46% to 79.96% after treatment (Zulhelmi & Nur, 2017). Other research also shows that after carrying out scientific activities, students' scientific attitudes increase to 85.83% (Khusnani et al., 2022).

Another previous research is the effectiveness of authentic inquiry on increasing scientific attitudes (Widowati et al., 2017), the influence of 3D visual learning media on critical thinking skills and scientific attitudes (Astuti et al., 2020), and the improvement of creative thinking skills and scientific attitude with the inquiry learning model (Sandika & Fitrihidajati, 2018). Integrating teaching material with an inquiry learning model can improve critical thinking skills and scientific attitudes (Hastuti et al., 2018). In addition, IT-based learning media can also increase scientific attitudes and problem-solving (Saputri & Wilujeng, 2017).

Although many studies have explored scientific attitude and students' productivity, there is a lack of research on the correlation between each scientific attitude indicator and undergraduate and postgraduate students' productivity. Therefore, the novelty of this study is that it looks for the influence of each indicator of scientific attitudes on productivity in detail, with seven independent variables. The students' productivity is seen from the results of scientific products produced by students on both a national and international scale. Bachelor students already have good argumentation skills (Martini et al., 2021). However, their scientific attitudes towards scientific research depend on the facilities and the university's role, such as the phenomena in Peru and Spain (Morales et al., 2017; Hernández et al., 2021). Scientific attitudes can develop if students are active during the learning process and have high learning motivation (Sandika & Fitrihidajati, 2018), for example, observations, field research, projects, simulations, experiments, making products, and writing scientific papers.

Scientific attitude is the foundation of students' character before developing skills and professionalism to produce high productivity. However, not all students can master all scientific attitudes. These constraints certainly can affect motivation to carry out a scientific activity and produce a scientific product. Departing from the gap analysis, this study aims (1) to determine the effect of scientific attitudes on the productivity of undergraduate students, (2) to determine the effect of scientific attitudes on the productivity of postgraduate students, (3) to determine the aspects or indicators of scientific attitudes that affect productivity in undergraduate and postgraduate students.

METHODS

The research method used was quantitative with a correlation approach (Newby, 2014; Leavy, 2017), aiming to look at students' scientific attitudes and their effect on the productivity of undergraduate and postgraduate students in depth. Data were collected using questionnaires via Google Forms. The research was divided into several stages.

Firstly, the questionnaire was developed via Google Forms. The statements in the questionnaire were developed and adapted from indicators of scientific attitude and productivity of bachelor and master's students. Indicators of scientific attitudes include curiosity, prioritizing data or facts, critical thinking, discovery and creativity, open-mindedness and cooperation, and sensitivity to the surrounding environment. Meanwhile, student productivity indicators include completing assignments on time, producing book works, producing article works, producing proceedings work, producing IPR, producing products in physical goods, producing services, participating in competitions, and getting awards. The productivity instruments were developed from the Indonesian National Qualifications Framework (*Kerangka Kualifikasi Nasional Indonesia*/KKNI) (Peraturan Presiden Republik Indonesia, 2012). The questionnaire required respondents to answer the statement by choosing one answer. The scientific attitude questionnaire had four answer choices: strongly disagree, sometimes, often, and always. The statement on the productivity questionnaire had two answer options: Yes or No.

Secondly, the researchers tested the validity and reliability of the instrument. The instrument was validated empirically by five material experts. The validation results were analyzed using Confirmatory Factor Analysis (CFA), and the instrument's reliability was viewed using the SingleTrial Administration approach, resulting in internal consistency reliability estimated with Cronbach's alpha (α) coefficient formula with the help of SPSS. The instrument is reliable if the alpha coefficient is more than 0.70 (Taber, 2018; Ngulube, 2021). If the instrument is valid and reliable, it can be used as a data collection tool in the field (Zhou, 2022). Based on the results of the CFA analysis, KMO = 0.89 was obtained so that the instrument is valid. The reliability using Cronbach's alpha obtained a value of 0.93 (0.93> 0.70), so the instrument is reliable.

Then, the researchers distributed the questionnaire to the research participants through WhatsApp. This research was conducted in several undergraduate and postgraduate study programs at UIN Sunan Kalijaga and Universitas Negeri Yogyakarta. The total population used in the study was students from several undergraduate and postgraduate study programs at UIN Sunan Kalijaga and Universitas Negeri Yogyakarta. Respondents were randomly selected using a random sampling technique. This study's total number of samples was 101 respondents and included bachelor, master's, and doctoral students.

Furthermore, data analysis techniques were carried out after the data collection process in the field. Respondents' answers to the scientific attitude instrument were converted into quantitative values with the following guidelines: a score of 1 for "strongly disagree," 2 for "sometimes," 3 for "often," and 4 for "always." The results of these changes were analyzed using the Aiken formula or the V coefficient. Aiken is often used to measure convergence from 0 to complete consensus to 1 (Silver et al., 2020). To determine the effective contribution of each scientific attitude indicator to student productivity, it can be seen from the R square in the summary model that the amount of effective contribution is R square x 100%.

In the productivity instrument, if the respondents answered "no", they would get a score of 1; if they answered "yes", they would get a score of 2. The results of changing the qualitative to quantitative data were calculated using Cohen's Kappa percentage of agreements proposed by Grinnel (1988) by reducing the target number of agreements after changes by the number of per cent of approval, then divided by the total percentage of agreement that did not happen by chance (Besen-Cassino & Cassino, 2017; Mackey & Gass, 2022). To facilitate calculations, the researchers used SPSS software and obtained the result of 98. To provide an interpretation of the correlation coefficient, the researcher used the following guidelines (Sugiyono, 2015).

Table 1. Guidelines of Correlation Interpretation

No	Coefficient Interval	Correlation Range
1	0,00 – 0,199	Very Weak
2	0,20 – 0,399	Weak
3	0,40 – 0,599	Average
4	0,60 – 0,799	Strong
5	0,80 – 1,000	Very Strong

The results of the analysis of scientific attitude and its effect on students' productivity can be seen from each item of the scientific attitude indicator and its effect on students' productivity with the following hypothesis:
H0 = There is no correlation between scientific attitude and its effect on students' productivity
H1= There is a correlation between scientific attitude and its effect on student productivity
Criteria: Reject the null hypothesis (H0) if the p-value is significant (<0.05).

RESULTS AND DISCUSSION

This research shows that the development of students' scientific attitudes needs to be done. This study aims to analyze students' scientific attitudes at bachelor's, master's, and doctorate degrees and their effect on their productivity. The scientific attitude in this study consists of seven aspects/indicators. Therefore, each indicator was analyzed to determine the aspects/indicators of scientific attitudes that affect productivity in bachelor and master's students. The benefit is finding out the extent to which scientific attitudes correlate and affect the productivity of bachelor's and master's students so that they can represent what factors affect students' productivity. Scientific attitude or science is a collection of facts with a structured and directed procedure for asking or answering questions (Ostlund, 1992). Scientific attitude is the attitude shown by scientists when carrying out activities as a scientist (Sukaesih, 2011), so it can be understood that scientific attitude is an individual tendency to behave or act when solving a problem that is carried out systematically through scientific steps.

Students' productivity can be understood as their ability to manage research and development that is beneficial to society and science and to receive national and international recognition. This explanation is closely related to a scientific attitude or a person's point of view towards a pattern of thinking under the scientific method, so there is a tendency to accept or ignore the pattern of thinking under the scientific method.

Data on scientific attitude and its effect on students' productivity was collected using a questionnaire. The survey was conducted using a Google Form and was distributed to 101 bachelor's, master's, and doctoral students from various study programs, as presented in Table 2.

Table 2. Research Sample

No	Study Program	Bachelor	Master	Doctorate	Total
1	Islamic Elementary School Teaching	18	21	0	39
2	Educational Science, Mathematics Education Concentration	0	0	1	1
3	Islamic Teaching	0	5	2	7
4	General Education	0	0	2	2
5	Islamic Early Childhood Education	0	0	2	2
6	English Education	5	4	0	9
7	Intellectual Property Law	7	8	0	15
8	Sharia Economy	0	8	0	8
9	Education Management	0	1	0	1
10	Psychology	6	1	0	7
11	Physics Education	4	1	0	5
12	Art Education	4	1	0	5
Total Per Degree		44	50	7	101

Table 2 presents the total number of research samples from each study program. The total number of Islamic Elementary School Teaching students is 39, consisting of 18 bachelor's and 21 master's students. There is one doctoral student in the Education Science Study Program, concentrating on Mathematics Education. Seven Islamic Teaching students consist of five master's and two doctoral students. General Education and Islamic Early Childhood Education have two doctoral students each. Five bachelor's and four master's students came from the English Education study program. Fifteen Intellectual Property Law students consist of seven bachelor's and eight master's students. Sharia Economy is shown to have eight master's students, while Education Management only has one master's student. The psychology study program also has one master's student. However, they have six bachelor's students as well. Both Physics Education and Art Education have four bachelor's students and one master's student.

After the respondents completed the questionnaire, the researchers used correlation analysis to analyze the data. Correlation analysis can be defined as a statistical method to measure the closeness of the correlation between two variables. The word variable can be interpreted as a characteristic of the object under study (Astuti, 2017). This variable consists of independent and dependent variables. The magnitude of the correlation ranges from 0-1. If it is close to 1, the correlation between the two variables gets stronger, and if it is close to 0, the correlation between them gets weaker.

As for calculating the R table to see the correlation of scientific attitudes to the productivity of bachelor's students, it is obtained df = (N-2) = (44-2) = 42, where N is the number of samples, and 2 is two-way. The R table value is taken at df 42 with a significance level of 0.05 or 5%, equal to 0.2973. Whereas for the R table of scientific attitude correlation to the productivity of master's and doctoral students, it is obtained df = (N-2) = (57-2) = 55, with a significance level of 0.05 or 5%, equal to 0.2609. It is a matter of comparing the table values with the calculated results. If the calculated value is greater than the table value, it is said to have a significant correlation.

Table 3 presents the results of the analysis of scientific attitude and its effect on students' productivity. It can be seen from each item of the scientific attitude indicator and its effect on the productivity of bachelor's students as follows.

Table 3. The Correlation between Scientific Attitude Indicators and Productivity of Bachelor's Students

Correlations		
		Productivity
Curiosity	Pearson Correlation	.292
	Sig. (2-tailed)	.055
	N	44
Respecting Data/Fact	Pearson Correlation	.391**
	Sig. (2-tailed)	.009
	N	44
Critical Thinking	Pearson Correlation	.386**
	Sig. (2-tailed)	.010
	N	44
Discovery and Creativity	Pearson Correlation	.322**
	Sig. (2-tailed)	.033
	N	44
Open-mindedness and Cooperation	Pearson Correlation	.225
	Sig. (2-tailed)	.143
	N	44
Perseverance	Pearson Correlation	-.009
	Sig. (2-tailed)	.956
	N	44
Sensitivity to Surrounding Environment	Pearson Correlation	.165
	Sig. (2-tailed)	.284
	N	44
Scientific Attitude of Bachelor's Students	Pearson Correlation	.298**
	Sig. (2-tailed)	.050
	N	44

Respondents who filled out the questionnaire were bachelor's, master's, and doctoral students. Based on the KKNI level (Indonesian National Qualification Framework), students at the bachelor's, master's, and doctoral levels are at different levels, namely bachelor's students at level 6, master's students at level 8, and doctoral students at level 9. The difference in level is a consideration so that bachelor's student respondent data is distinguished from master's and doctoral student respondent data.

Figure 1. KKNI Level

Based on the data output in Table 3, the correlation coefficient of the scientific attitude indicator of curiosity on the productivity of bachelor's students is 0.292, indicating a weak correlation, while the significance level is 0.055 > 0.05. It can be concluded that there is no significant correlation between the scientific attitude indicator of curiosity and the productivity of bachelor's students.

The correlation coefficient of the scientific attitude indicator of respecting data/facts on the productivity of bachelor's students is 0.391, indicating a weak correlation, while the significance level is 0.009 > 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicator of respecting data/facts and the productivity of bachelor's students.

The correlation coefficient of the scientific attitude indicator of critical thinking on the productivity of bachelor's students is 0.386, indicating a weak correlation, while the significance level is 0.010 > 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicator of critical thinking and the productivity of bachelor's students.

Table 3 also shows the correlation coefficient of the scientific attitude indicator of discovery and creativity on the productivity of bachelor's students, which is 0.322, indicating a weak correlation, while the significance level is 0.033 > 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicator of discovery and creativity and the productivity of bachelor's students.

The correlation coefficient of the scientific attitude indicator of open-mindedness and cooperation on the productivity of bachelor's students is 0.225, indicating a weak correlation, while the significance level is 0.143 > 0.05. It can be concluded that there is no significant correlation between the scientific attitude indicator of open-mindedness and cooperation and the productivity of bachelor's students.

The correlation coefficient of the scientific attitude indicator of perseverance on the productivity of bachelor's students is -0.009, indicating that it is not one-way, while the significance level is 0.956 > 0.05. It can be concluded that there is no significant correlation between the scientific attitude indicator of perseverance and the productivity of bachelor's students.

Table 3 also shows the correlation coefficient of the scientific attitude indicator of sensitivity to the surrounding environment on the productivity of bachelor's students, which is 0.165, indicating a very weak correlation, while the significance level is 0.284 > 0.05. It can be concluded that there is no significant correlation between the scientific attitude indicator of sensitivity to the surrounding environment and the productivity of bachelor's students.

The correlation coefficient of the overall scientific attitudes on the productivity of bachelor's students is 0.298, indicating a weak correlation, while the significance level is 0.050 > 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicators and the productivity of bachelor's students.

Table 4. The Correlation between Scientific Attitude Indicators and Productivity of Master's and Doctoral Students

Correlations		
		Productivity
Curiosity	Pearson Correlation	.347**
	Sig. (2-tailed)	.008
	N	57
Respecting Data/Fact	Pearson Correlation	.389**
	Sig. (2-tailed)	.003
	N	57
Critical Thinking	Pearson Correlation	.399**
	Sig. (2-tailed)	.002
	N	57
Discovery and Creativity	Pearson Correlation	.409**
	Sig. (2-tailed)	.002
	N	57

Correlations

		Productivity
Open-mindedness and Cooperation	Pearson Correlation	-.008
	Sig. (2-tailed)	.954
	N	57
Perseverance	Pearson Correlation	.320**
	Sig. (2-tailed)	.015
	N	57
Sensitivity to Surrounding Environment	Pearson Correlation	.247
	Sig. (2-tailed)	.064
	N	57
Scientific Attitude of Master's and Doctoral Students	Pearson Correlation	.387**
	Sig. (2-tailed)	.003
	N	57

Based on Table 4, the correlation coefficient of the scientific attitude indicator of curiosity on the productivity of master's and doctoral students is 0.347, indicating a weak correlation, while the significance level is 0.008 > 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicator of curiosity and the productivity of master's and doctoral students.

The correlation coefficient of the scientific attitude indicator of respecting data/fact on the productivity of master's and doctoral students is 0.389, indicating a weak correlation, while the significance level is 0.003 < 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicator of respecting data/facts and the productivity of master's and doctoral students.

The correlation coefficient of the scientific attitude indicator of critical thinking on the productivity of master's and doctoral students is 0.399, indicating a weak correlation, while the significance level is 0.002 < 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicator of critical thinking and the productivity of master's and doctoral students.

Table 3 also shows that the correlation coefficient of the scientific attitude indicator of discovery and creativity on the productivity of master's and doctoral students is 0.409, indicating a weak correlation, while the significance level is 0.002 < 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicator of discovery and creativity and the productivity of master's and doctoral students.

The correlation coefficient of the scientific attitude indicator of open-mindedness and cooperation on the productivity of master's and doctoral students is -0,008, indicating that it is not one-way, while the significance level is 0.954 > 0.05. It can be concluded that there is no significant correlation between the scientific attitude indicator of open-mindedness and cooperation and the productivity of master's and doctoral students.

The correlation coefficient of the scientific attitude indicator of perseverance on the productivity of master's and doctoral students is 0,320, indicating a weak correlation, while the significance level is 0.015 < 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicator of perseverance and the productivity of master's and doctoral students.

Table 3 also shows the correlation coefficient of the scientific attitude indicator of sensitivity to the surrounding environment on the productivity of master's and doctoral students, which is 0.247, indicating a weak correlation, while the significance level is 0.064 > 0.05. It can be concluded that there is no significant correlation between the scientific attitude indicator of sensitivity to the surrounding environment and the productivity of master's and doctoral students.

The correlation coefficient of the overall scientific attitude indicators on the productivity of master's and doctoral students is 0.387, indicating a weak correlation, while the significance level is 0.003 > 0.05. It can be concluded that there is a significant correlation between the scientific attitude indicators and the productivity of master's and doctoral students.

The data analysis results show that bachelor's students' curiosity is not correlated with their productivity. However, for master's and doctoral students, they are correlated. Curiosity is characterized by high interest and curiosity about every behavior in the natural world. Curiosity in students is an internal factor affecting the productivity process (Ameliah et al., 2016). Students are expected to be curious, like challenges, innovative, and creative in creating something they and others can be proud of.

Respecting data/facts is correlated with the productivity of bachelor's, master's, and doctoral students. It can be interpreted that respecting data/facts positively affects students' productivity. This process involves collecting and using data to test and develop ideas. Therefore, facts are needed to verify the idea. Students must always present data as it is and make decisions based on existing facts (Saputra et al., 2019). In other words, the results of an observation or experiment should not be affected by personal feelings but based on the facts obtained.

The scientific attitude indicator of critical thinking correlates with the productivity of bachelor's, master's, and doctoral students, so it can be interpreted that critical thinking affects students' productivity. Critical thinking is an organized effort that enables students to evaluate the evidence, assumptions, logic, and language that underlie other people's statements (Atika, 2016). Therefore, students must be accustomed to contemplating and reviewing activities through a contemplative process so that they will know whether they need to repeat the experiment or whether there are other alternatives to solve the problems they are facing. That way, students can develop their critical thinking.

The indicator of discovery and creativity correlates with the productivity of bachelor's, master's, and doctoral students. From this, it can be interpreted that discovery and creativity affect students' productivity. Students must develop their creativity to make it easier to solve problems or find new correct data quickly to support their productivity in the academic and non-academic fields (Arifin, 2018).

It is also known that the indicator of open-mindedness and cooperation does not correlate with the productivity of bachelor's, master's, and doctoral students. Therefore, it can be interpreted that open-mindedness and cooperation have no relationship with students' productivity. Low productivity is also affected by low open-mindedness and cooperation. The concept of productivity is closely related to efficiency and effectiveness. High effectiveness and efficiency will result in high productivity (Patimah, 2015). If the effectiveness and efficiency are low, it is assumed that there is a management error.

The indicator of perseverance does not correlate with the productivity of bachelor's students but does correlate with the productivity of master's and doctoral students. Therefore, bachelor's students have a lower level of perseverance than master's and doctoral students. Following the productivity indicators for bachelor's, master's, and doctoral levels, bachelor's students are only required to make the right decisions based on information and data analysis and provide guidance in choosing various alternative solutions independently and in groups. Master's students must manage research and development that benefits society and science and receive national and international recognition. Doctoral students are required to manage, lead, and develop research and development that is beneficial to science and the benefit of humanity and to receive national and international recognition (Brata & Suriani, 2018).

From the results, it is also known that critical thinking is correlated with the productivity of bachelor's, master's, and doctoral students. Therefore, sensitivity to the surrounding environment has an effect on the productivity of bachelor's, master's, and doctoral students. The development of science and technology demands that learning patterns are not theoretical but applicable to any dynamics of change in society (Aristiyaningsih & Budiharti, 2015). The indicator of sensitivity to the surrounding environment also has an effect on students' productivity. The environment is one means that can support students' productivity because it has a very dominant contribution in developing abilities.

When viewed as a whole, it can be understood that scientific attitudes affect and correlate with the productivity of bachelor's, master's, and doctoral students. The scientific attitude around has a significant effect on students' productivity. In the academic world, students should develop skills and professionalism from achievement activities, research, writing, and other relevant scientific activities. The development of students' scientific attitudes can be carried out by lecturers using constructivist learning, potentially empowering scientific thinking skills such as inquiry learning. Inquiry learning comes from the word 'to inquire', which means to participate or be involved in asking questions, seeking information, and conducting investigations (Zulyetti, 2017).

In order to produce competent graduates, tertiary institutions must play a role in teaching, research, and community service so that students can develop knowledge and add insight into the field of science and technology (Andriani et al., 2020). In doing scientific work, students do critical, creative, and complex thinking, which refers to scientific attitudes (Syahrin et al., 2019). The aspects of scientific attitude include cooperation, curiosity, objectivity, openness, perseverance, tolerance, critical thinking, courage, and honesty.

After conducting a correlation test to see the correlation between scientific attitudes and the productivity of bachelor's, master's, and doctoral students, a regression test was carried out to see the magnitude of the effect of the scientific attitude indicator, which correlated with the productivity of bachelor's, master's, and doctoral students. The indicators of scientific attitude that correlate with bachelor's students' productivity are respecting data/facts, critical thinking, and discovery and creativity. Meanwhile, indicators of scientific attitude that correlate with master's and doctoral students' productivity are curiosity, respect for data/facts, critical thinking, discovery and creativity, and perseverance.

Following are the results of the scientific attitude indicator regression test that correlates with the productivity of bachelor's students.

Table 5. The Effect of Scientific Attitude Indicators on the Productivity of Bachelor's Students

Model Summary				
Indicator	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
Respecting Data/Facts	.391[a]	.153	.133	2.46229
Critical Thinking	.386[a]	.149	.128	2.46903
Discovery and Creativity	.322[a]	.104	.082	2.53336

Based on Table 5, the R Square value on the respecting data/facts indicator is 0.153. This value means that this indicator affects the productivity of bachelor's students by 15.3%. On the critical thinking indicator, the R Square value is 0.149, which means that this indicator affects the productivity of bachelor's students by 14.9%. Meanwhile, for the indicator of discovery and creativity, the R Square value is 0.104, which means that the inductor affects the productivity of bachelor's students by 10.4%. Technically, productivity is a mental attitude or behavior of always looking for improvements to what already exists (Annisa & Karjuniwati, 2021), a belief that one can do a better job today than yesterday and tomorrow better than today.

The following are the results of the scientific attitude indicator regression test that correlates with the productivity of master's and doctoral students.

Table 6. The Effect of Scientific Attitude Indicator on Productivity of Master's and Doctoral Students

Model Summary				
Indicator	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
Curiosity	.347[a]	.121	.105	3.40843
Respecting Data/Facts	.389[a]	.151	.136	3.34919
Critical Thinking	.399[a]	.159	.144	3.33350
Discovery and Creativity	.409[a]	.168	.152	3.31622
Perseverance	.320[a]	.102	.086	3.44418

Based on Table 6, the R Square value on the curiosity indicator is 0.121, which means that it affects the productivity of master's and doctoral students by 12.1%. On the respecting data/facts indicator, the R Square value is 0.151, which means it has a total effect of 15.1%. On the critical thinking indicator, the R Square value is 0.159, which means that this indicator affects the productivity of master's and doctoral students with a total of 15.9%. The discovery and creativity indicator has an R Squa re value of 0.168, which means this indicator affects the productivity of master's and doctoral students by 16.8%. As for the perseverance indicator, it can be seen that the

R Square value is 0.102, which means that this indicator affects the productivity of master's and doctoral students by 10.2%.

From the previous data, the scientific attitude indicator with the highest effect on bachelor's students' productivity is respecting data/facts, with a total effect of 15.3%. Meanwhile, for students with master's and doctoral degrees, the scientific attitude indicators that have the highest effect on their productivity are critical thinking, with a total effect of 15.9% and discovery and creativity, with 16.8%.

Respecting data/facts is one indicator that has a more dominant effect on bachelor's students' productivity than other indicators. For postgraduate (master's and doctoral) students, scientific attitude indicators that have a more dominant effect on productivity are critical thinking and discovery and creativity.

Several indicators of scientific attitudes that have an effect on the productivity of bachelor's, master's, and doctoral students are part of the productive behavior that students must have to develop themselves. Scientific independence can be achieved individually through planning, discovery, exploration, and seeking knowledge from integrated sources of information to obtain comprehensive scientific knowledge (Parmin et al., 2017). The intended positive and productive behavior is due to personal capacity. Individuals must have the ability, skills, and enthusiasm to adapt to the challenges of work and their environment (Subekti et al., 2021).

University students have a crucial role in producing research or scientific studies in education (Pardjono et al., 2017). Students are encouraged individually or in groups to actively seek, explore, and discover concepts (Parmin et al., 2016). The concept of productivity can basically be viewed from two perspectives: an individual's point of view and an organizational point of view (Yusup & Marzani, 2020). The study of individual productivity problems looks at various student activities. From an organizational point of view, the concept of productivity as a whole is another dimension of efforts to achieve the quality and quantity of an activity process concerning the discussion of economics.

CONCLUSION

Scientific attitude is one's point of view towards a pattern of thinking under the scientific method. Cultivating organizational and scientific activities can impact students' attitudes, performance, behavior, and productivity from different backgrounds. Based on the research results, the overall scientific attitudes show a significance level of 0.050, indicating a significant correlation between the scientific attitude indicators and the productivity of bachelor's students. The significance level of the scientific attitude on the productivity of master's and doctoral students is 0.003, so there is a significant correlation between scientific attitudes and the productivity of master's and doctoral students. Thus, scientific attitudes have an effect on students' productivity. The scientific attitude indicator that has the highest effect on the productivity of bachelor's students is respecting data/facts, with a total effect of 15.3%. Meanwhile, for master's and doctoral students, the scientific attitude indicators that have the highest effect on their productivity are critical thinking at 15.9% and discovery and creativity at 16.8%. It can be concluded that scientific attitudes have an effect on students' productivity.

REFERENCES

Afandi, A., Sajidan, S., Akhyar, M., & Suryani, N. (2019). Development frameworks of the Indonesian partnership 21st-century skills standards for prospective science teachers: A Delphi Study. *Jurnal Pendidikan IPA Indonesia*, *8*(1), 89-100.

Al-Rahmi, W. M., Yahaya, N., Alamri, M. M., Alyoussef, I. Y., Al-Rahmi, A. M., & Kamin, Y. B. (2021). Integrating innovation diffusion theory with technology acceptance model: Supporting students' attitude towards using a massive open online courses (MOOCs) systems. *Interactive Learning Environments*, *29*(8), 1380–1392.

Ameliah, I. H., & Munawaroh, M., & Muchyidin, A. (2016). The influence of curiosity and self-confidence of students. *EduMa*, *5*(1), 9-21.

Andriani, D., Purwana, D., & Susita, D. (2020). Analysis Of Factors That Effect Lecturer Productivity Producing International Scientific Article In Private University: Motivation As A Moderating Variable. *IJHCM: International Journal of Human Capital Management*, *4*(1).

Annisa, I. A., & Karjuniwati. (2021). Produktivitas Mahasiswa di Rumah Selama Masa Pandemi Covid-19 di Tangerang Ditinjau dari Jenis Kelamin. *Jurnal Riset Dan Pengabdian Masyarakat*, *1*(1), 111-121.

Aparicio, J., Lovell, C. A. K., & Pastor, J. T. (2016). *Advances in Efficiency and Productivity*. Springer.

Aricia, F., Yildirima, P., Caliklara, eyma, & Yilmazb, R. M. (2019). Research trends in the use of augmented reality in science education: Content and bibliometric mapping analysis. *Computers & Education*, *142*, 103647.

Arifin, M. B. U. B. (2018). *Buku ajar metodologi penelitian pendidikan*. Umsida Press.

Arinda, Y., Wilujeng, İ., & Kuswanto, H. (2019). The

Application Group Investigation (GI) Learning Model assisted Phet to Facilitate Student Scientific Work Skills. *International Journal of Educational Research Review*, *4*(2), 254-261.

Aristiyaningsih, L., & Budiharti, R. (2015). Peningkatan sikap peka terhadap lingkungan sekitar melalui project based learning. In *PROSIDING: Seminar Nasional Fisika dan Pendidikan Fisika* (Vol. 6, No. 4).

Astuti, C. C. (2017). Analisis Korelasi untuk Mengetahui Keeratan Hubungan antara Keaktifan Mahasiswa dengan Hasil Belajar Akhir. *JICTE (Journal of Information and Computer Technology Education)*, *1*(1), 1-7.

Astuti, T. N., Sugiyarto, K. H., & Ikhsan, J. (2020). Effect of 3D Visualization on Students' Critical Thinking Skills and Scientific Attitude in Chemistry. *International Journal of Instruction*, *13*(1), 151–164.

Astutik, S., & Prahani, B. K. (2018). The Practicality and Effectiveness of Collaborative Creativity Learning (CCL) Model by Using PhET Simulation to Increase Students' Scientific Creativity. *International Journal of Instruction*, *11*(4), 409–424.

Atika, N., & Amir MZ, Z.. (2016). Pengembangan LKS Berbasis Pendekatan RME Untuk Menumbuhkembangkan Kemampuan Berpikir Kritis Matematis Siswa. *Suska Journal of Mathematics Education*, *2*(2), 103-110.

Auerbach, A. J., & Schussler, E. E. (2017). Curriculum Alignment with Vision and Change Improves Student Scientific Literacy. *CBE—Life Sciences Education*, *16*(2), ar29.

Bakar, R. (2014). The Effect of Learning Motivation on Student's Productive Competencies in Vocational High School, West Sumatra. *International Journal of Asian Social Science*, *4*(6), 722-732.

Benin, S. (2016). Conclusions and implications for raising and sustaining high agricultural productivity in Africa. *Agricultural productivity in Africa: Trends, patterns, and determinants*, 335-347.

Besen-Cassino, Y., & Cassino, D. (2017). *Social Research Methods by Example: Applications in the Modern World*. Taylor & Francis.

Bodoh-Creed, A. L., & Hickman, B. R. (2018). College assignment as a large contest. *Journal of Economic Theory*, *175*, 88-126.

Brata, W., & Suriani, C. (2018). Analisis Pembelajaran Biologi dalam Pespektif Inkuiri pada Pembelajaran Menggunakan Kurikulum Kerangka Kualifikasi Nasional Indonesia (KKNI). *Jurnal Pendidikan Biologi*, *8*(1), 39-45.

Cherian, J., Gaikar, V., Paul, R., & Pech, R. (2021). Corporate culture and its impact on employees' attitude, performance, productivity, and behavior: An investigative analysis from selected organizations of the United Arab Emirates (UAE). *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 45.

Dwianto, A., Wilujeng, I., Prasetyo, Z. K., & Suryadarma, I. G. P. (2017). The Development of Science Domain Based Learning Tool Which is Integrated with Local Wisdom to Improve Science Process Skill and Scientific Attitude. *Jurnal Pendidikan IPA Indonesia*, *6*(1).

Fang, Z., Xu, X., Grant, L. W., Stronge, J. H., & Ward, T. J. (2016). National Culture, Creativity, and Productivity: What's the Relationship with Student Achievement? *Creativity Research Journal*, *28*(4), 395–406.

Fricker, M., Graham, P. J., Henderson, D., & Pedersen, N. J. L. L. (2019). *The Routledge Handbook of Social Epistemology*. Routledge.

Gillies, R. M. (2019). Promoting academically productive student dialogue during collaborative learning. *International Journal of Educational Research*, *97*, 200–209.

Goldhaber, D., & Startz, R. (2017). On the Distribution of Worker Productivity: The Case of Teacher Effectiveness and Student Achievement. *Statistics and Public Policy*, *4*(1), 1–12.

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st Century Skills Frameworks: Systematic Review. *Sustainability*, *14*(3).

Grinnell, R.M. Jr. (1988). *Social Work Research and Evaluation. (3rd Ed.)* Itasca, Illinois: FE Peacock Publisher, Inc.

Hamdani, D., & Wibowo, F. C. (2017). The Effect of Organizational Culture and Job Satisfaction to Principals Productivity in Senior High School in Province of Jakarta. *Advanced Science Letters*, *23*(11), 10943–10946.

Hanushek, E. A., & Ettema, E. (2017). Defining Productivity in Education: Issues and Illustrations. *The American Economist*, *62*(2), 165–183.

Hastuti, P. W., Nurohman, S., & Setianingsih, W. (2018). The Development of Science Worksheet Based on Inquiry Science Issues to Improve Critical Thinking and Scientific Attitude. *Journal of Physics: Conference Series*, *1097*(1), 012004.

Havnaer, A. G., Chen, A. J., & Greenberg, P. B. (2017). Scholarly concentration programs and medical student research productivity: A systematic review. *Perspectives on Medical Education*, *6*(4), 216–226.

Hernández, R. M., Saavedra-López, M. A., Calle-Ramirez, X. M., & Rodríguez-Fuentes, A. (2021). Index of Undergraduate Students' Attitude towards Scientific Research: A Study in Peru and Spain. *Jurnal Pendidikan IPA Indonesia*, *10*(3), 416-427.

Hutchison, M. (2016). The Empathy Project: Using a Project-Based Learning Assignment to Increase First-Year College Students' Comfort with Interdisciplinarity. *Interdisciplinary Journal of Problem-Based Learning*, *10*(1).

Ilmi, A. M., Sukarmin, & Sunarno, W. (2020). Development of TPACK-based physics learning media to improve HOTS and scientific attitude. *Journal of Physics: Conference Series*, *1440*(1), 012049.

Ismaili, Y. (2021). Evaluation of students' attitude toward distance learning during the pandemic (Covid-19): A case study of ELTE University. *On the Horizon*, *29*(1), 17–30.

Ismailov, M., & Ono, Y. (2021). Assignment Design and its Effects on Japanese College Freshmen's Motivation in L2 Emergency Online Courses: A Qualitative Study. *The Asia-Pacific Education Researcher*, *30*(3), 263–278.

Jacobson-Lundeberg, V. (2016). Pedagogical Implementation of 21st Century Skills. *Educational Leadership and Administration: Teaching and Program Development*, *27*, 82–100.

Jalinus, N., Nabawi, R. A., & Mardin, A. (2017). The Seven Steps of Project Based Learning Model to Enhance Productive Competences of Vocational Students. *Proceedings of the International Conference on Technology and Vocational Teachers (ICTVT 2017)*, 251–256.

Jufrida, Basuki, F. R., Kurniawan, W., Pangestu, M. D., & Fitaloka, O. (2019). Scientific Literacy and Science Learning Achievement at Junior High School. *International Journal of Evaluation and Research in Education*, *8*(4), 630–636.

Jufrida, J., Basuki, F. R., Kurniawan, W., Pangestu, M. D., & Fitaloka, O. (2019). Scientific Literacy and Science Learning Achievement at Junior High School. *International Journal of Evaluation and Research in Education*, *8*(4), 630-636.

Jufrida, J., Kurniawan, W., Astalini, A., Darmaji, Kurniawan, D. A., & Maya, W. A. (2019). Students' attitude and motivation in mathematical physics. *International Journal of Evaluation and Research in Education (IJERE)*, *8*(3), 401-408.

Khusnani, A., Sya'bania, N., Jufriansah, A., Donuata, P. B., & Ahdiany, D. (2022). Utilization of Diamond Software as a Measuring Tool for Student Scientific Attitude. *Jurnal Pendidikan Fisika Dan Teknologi*, *8*(1), 76-81.

Kumar, S. (2019). *Scientific Attitude*. Uttkarsh Prakashan.

Kuo, P. B., Woo, H., & Bang, N. M. (2017). Advisory Relationship as a Moderator Between Research Self-Efficacy, Motivation, and Productivity Among Counselor Education Doctoral Students. *Counselor Education and Supervision*, *56*(2), 130–144.

Kurniawan, D. A., Astalini, Darmaji, & Melsayanti, R. (2019). Students' Attitude towards Natural Sciences. *International Journal of Evaluation and Research in Education*, *8*(3), 455–460.

Laar, E. V., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, *72*, 577–588.

Leavy, P. (2017). *Research Design Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches* (2nd ed.). The Guilford Press.

Ma, Y. (2023). The Effect of Inquiry-Based Practices on Scientific Literacy: The Mediating Role of Science Attitudes. *International Journal of Science and Mathematics Education*, *21*(7), 2045–2066.

Mackey, A., & Gass, S. M. (2022). *Second Language Research: Methodology and Design* (Third Edition). Routledge.

Mairesse, J., & Pezzoni, M. (2015). Does Gender Affect Scientific Productivity? A Critical Review of the Empirical Evidence and a Panel Data Econometric Analysis for French Physicists. *Revue économique*, *66*(1), 65–113.

Maniktala, M., Chi, M., & Barnes, T. (2022). Enhancing a student productivity model for adaptive problem-solving assistance. *User Modeling and User-Adapted Interaction*, *33*(1), 159-188.

Martini, M., Widodo, W., Qosyim, A., Mahdiannur, M. A., & Jatmiko, B. (2021). Improving Undergraduate Science Education Students' Argumentation Skills through Debates on Socioscientific Issues. *Jurnal Pendidikan IPA Indonesia*, *10*(3), 428-438.

McIntyre, L. (2019). *The Scientific Attitude: Defending Science from Denial, Fraud, and Pseudoscience*. The MIT Press.

Misbah, M., Dewantara, D., Hasan, S. M., & Annur, S. (2018). The Development Of Student Worksheet By Using Guided Inquiry Learning Model To Train Student's Scientific Attitude. *Unnes Science Education Journal*, *7*(1).

Möller, R., & Shoshan, M. (2017). Medical students' research productivity and career preferences; a 2-year prospective follow-up study. *BMC Medical Education*, *17*(1), 51.

Morales, D. X., Grineski, S. E., & Collins, T. W. (2017). Increasing Research Productivity in Undergraduate Research Experiences: Exploring Predictors of Collaborative Faculty–Student Publications. *CBE—Life Sciences Education*, *16*(3), ar42.

Murphy, J., & Torre, D. (2014). *Creating Productive Cultures in Schools: For Students, Teachers, and Parents*. Corwin Press.

Newby, P. (2014). *Research Methods for Education, second edition* (Second Edition). Routledge.

Ngulube, P. (2021). *Handbook of Research on Mixed Methods Research in Information Science*. IGI Global.

Nugraha, I., Putri, N. K., & Sholihin, H. (2020). An Analysis of the Relationship between Students' Scientific Attitude and Students' Learning Style in Junior High School. *Journal of Science Learning*, *3*(3), 185-195.

Ostlund, K. L. (1992). *Science Process Skills Assessing Hand-On Student Performance*. Addison-Wesley Publishing Company.

Pardjono, P., Nuchron, N., Surono, S., & Ramdani, S. D. (2017). Analisis faktor-faktor penghambat produktivitas publikasi karya ilmiah mahasiswa Pps UNY pada jurnal internasional terindeks. *Jurnal Dinamika Vokasional Teknik Mesin*, *2*(2), 139-147.

Parmin, P., Sajidan, S., Ashadi, A., Sutikno, S., & Fibriana, F. (2017). Science integrated learning model to enhance the scientific work independence of student teacher in indigenous knowledge transformation. *Jurnal Pendidikan IPA Indonesia*, *6*(2), 365-372.

Parmin, P., Sajidan, S., Ashadi, A., Sutikno, S., & Maretta, Y. (2016). Preparing Prospective Teachers in Integrating Science and Local Wisdom through Practicing Open Inquiry. *Journal of Turkish Science Education*, *13*(2).

Parmiti, D. P., Rediani, N. N., Antara, I. G. W. S., & Jayadiningrat, M. G. (2021). The Effectiveness of Local Culture-Integrated Science Learning through Project-Based Assessment on Scientific Attitudes and Science Process Skills of Elementary School Students. *Jurnal Pendidikan IPA Indonesia*, *10*(3), 439-446.

Patimah, S. (2015). Pengaruh Rekrutmen dan Seleksi Terhadap Kinerja Kepala Madrasah Ibtidaiyah Negeri (MIN) Sekota Bandar Lampung. *Jurnal Ilmiah Peuradeun*, *3*(1), 165-190.

Peraturan Presiden Republik Indonesia Nomor 8 Tahun 2012 tentang Kerangka Kualifikasi Nasional Indonesia. (2012). https://peraturan.bpk.go.id/Home/Details/41251/perpres-no-8-tahun-2012

Sakliressy, M. T., Sunarno, W., & Nurosyid, F. (2021). Students' Scientific Attitude in Learning Physics Using Problem-Based Learning Model with Experimental and Project Methods. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, *10*(1), 59–70.

Sandika, B., & Fitrihidajati, H. (2018). Improving creative thinking skills and scientific attitude through inquiry-based learning in basic biology lecture toward students of biology education. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *4*(1), 23–28.

Saputra, T. B. R. E., Nur, M., & Purnomo, T. (2019). Pengembangan pembelajaran inkuiri berbantuan PhET untuk melatihkan keterampilan proses sains siswa. *JSEP (Journal of Science Education and Practice)*, *1*(1), 20-31.

Saputri, A. A., & Wilujeng, I. (2017). Developing Physics E-Scaffolding Teaching Media to Increase the Eleventh-Grade Students' Problem-Solving Ability and Scientific Attitude. *International Journal of Environmental and Science Education*, *12*(4), 729–745.

Schlombs, C. (2019). *Productivity Machines: German Appropriations of American Technology from Mass Production to Computer Automation*. MIT Press.

Silver, N. C., Badenes-Ribera, L., & Pedroli, E. (2020). *Scale Development and Score Validation*. Frontiers Media SA.

Subekti, N. P., Kammawati, A., Yusida, E., & Prastiwi, L. F. (2021). Perubahan Produktivitas Mahasiswa Selama Pandemi Covid-19. *Jambura Economic Education Journal*, *3*(1), 45–51.

Sugiyono. (2015). *Metode Penelitian Kuantitatif, Kualitatif dan R & D* (2nd ed.). Alfabeta.

Sukaesih, S. (2011). Analisis sikap ilmiah dan tanggapan mahasiswa terhadap penerapan model pembelajaran berbasis praktikum. *Jurnal Penelitian Pendidikan*, *28*(1).

Syahrin, A., Dawud, D., Suwignyo, H., & Priyatni, E. T. (2019). Creative Thinking Patterns In Student's Scientific Works. *Eurasian Journal of Educational Research*, *19*(81), 21-36.

Szuflita-Żurawska, M., Basińska, B., & Leja, K. (2020). *Barriers to and Facilitators of Scientific Productivity: A Case Study from Polish Technical University*. Politechnika Gdanska.

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*(6), 1273–1296.

Upadhyaya, P. & Vrinda. (2021). Impact of technostress on academic productivity of university students. *Education and Information Technologies*, *26*(2), 1647–1664.

Widowati, A., Nurohman, S., & Anjarsari, P. (2017). Developing Science Learning Material with Authentic Inquiry Learning Approach to Improve Problem-Solving and Scientific Attitude. *Jurnal Pendidikan IPA Indonesia*, *6*(1).

Yusup, M., & Marzani. (2020). Analisis Produktivitas Mahasiswa Institut Agama Islam (IAI) Nusantara Batanghari Melalui Pembelajaran Online. *Produ : Prokurasi Edukasi Jurnal Manajemen Pendidikan Islam*, *2*(1).

Zhou, Y. (2022). *Cognitive Requirement of Accounting Tasks: A Task Analysis in Chinese Vocational School Textbooks*. Wbv Publikation.

Zulhelmi, Z., & Nur, M. (2017). The Internalization Effort of Student Scientific Attitude through Inductive Teaching Method in Basic Physics Practical Course, Biology Study Program—PMIPA FKIP UR. *Journal of Educational Sciences*, *1*(1), 56-68.

Zulyetti, D. (2017). Sikap Ilmiah Dan Motivasi Belajar Mahasiswa Dalampraktikum Biologi Umum Dengan Pendekatan Inkuiri Terbimbing Di Stkip Abdi Pendidikan Payakumbuh. *Saintifik@*, *1*(2), 6.