Critical Thinking Assessment Profile of Biology Teacher Candidate Students of FTTE Tanjungpura University

Eka Adha Apriliani [1,*], Afandi [2], Anisyah Yuniarti [3]

Faculty of Teacher Training and Education, Universitas Tanjungpura, Indonesia
[1] ekaadhaapr@gmail.com; [2] afandi@fkip.untan.ac.id ; [3] anisyah.yuniarti@fkip.untan.a.id
* * Corresponding author: afandi@fkip.untan.ac.id

ABSTRACT

Critical thinking is a skill needed in 21st century education. This research was carried out using a quantitative descriptive method. Before collecting data, the test questions were tested first to determine their validity and reliability using tools such as Microsoft Exel 2016 software and Iteman Version 3.0. In this study, it can be seen that the Critical Thinking Assessment profile of prospective biology teacher from biology education students at FTEE UNTANis mostly included in the critical category with an average value of 70.40.

Keywords: Critical Thinking, Student, Teacher Candidate, Biology

Introduction

Critical thinking is a skill needed in 21st century education. This critical thinking skill ranks first in the list of skills needed today. This critical thinking skill is seen as a result of learning in higher education. According to Sternberg (1986) critical thinking is a mental process, a strategy used by individuals to solve problems and learn new concepts (Fajrianth et al., 2016). Critical thinking is very necessary for students as prospective teachers.

Critical thinking is an important term in the world of education. Educators will become interested in teaching thinking skills with a variety of methods rather than just delivering the material. According to John Dewey as the father of the modern critical thinking method, he labeled critical thinking as a reflective thinking which defines it as: active, persistent (continuous) consideration that examines about a form of knowledge that can be taken for granted and viewed from the point of view of the reasons that support it and the further conclusions that tend to be (Fisher, 2008).

The ability to think critically is an ability that is needed and necessary to deal with problems in someone's life. This critical thinking ability is often used by a person in making and taking decisions. This critical thinking ability is also used to evaluate and analyze the information obtained (Parera, 2019).

The ability to think critically is a very important basic skill for everyone. Critical thinking is an activity in analyzing ideas or thoughts in a particular direction. This critical thinking requires great effort in checking every answer or knowledge possessed with real evidence. An individual's critical thinking skills are very helpful in making the right decisions (Dewi et al., 2016).

Students must have the ability to think critically, meaning that students are able to understand a problem to get the right decision. The improvement of students' critical thinking skills in solving a problem is outlined in four components, i. e. understanding for the problems; understand the methods used in solving problems; understand what is known; and able to organize the steps performed (Setyaningsih, 2009).

The increase in critical thinking for students can make students able to filter everything that happens in their environment critically. In addition, it can make students search for information and find the best solution. (Arofah et al., 2019). This increase in critical thinking also increases high curiosity through questions, problem-solving methods (Avisca et al., 2018). Moreover, increasing critical thinking also allows students to analyze, evaluate, and conclude learning properly so that it can improve learning outcomes (Sari et al., 2020).

The problem that often arises in education is the weakening of students' ability to use critical thinking skills in solving problems. Critical thinking in biology learning has a huge role in improving learning processes and outcomes for the future. Critical thinking is an activity carried out to meet intellectual ability standards (Rahaman et al., 2018). This critical thinking requires self-correction, monitoring to assess the reasonableness of thinking, and reflexivity (Linda et al., 2011).

According to Syamsu (Setyawati et al., 2020) students in Indonesia are experiencing a decline in critical thinking due to the nature of students who are over relaxed and ignorant of what they are doing. Students also have low motivation to learn and having problems in teaching and learning process, where students are not given the opportunity to express their opinions.

This critical thinking ability can be identified by measuring critical thinking skills specifically. Critical thinking skills can be measured with a measurement tool which is often referred to as an instrument. (Parera, 2019). The level of critical thinking skills can be known from the score of a test given by the teacher. This value can be used as evaluation material in a learning process. Therefore, a test instrument is needed to measure learning outcomes so

that the assessment process can be conducted. One of the instruments used is a test instrument (Khayati et al., 2020).

In this study, critical thinking assessment was made based on Watson Glaser. The Watson Glaser Critical Thinking Appraisal (WGCTA) is an assessment tool used to measure a person's critical thinking ability. WGCTA is a test developed by Goodwin Watson and Edward Glaser in 1980 in America. The institution that publishes this test is Personnel Assessment (Danaryanti et al., 2017). This critical thinking test is a psychometric test used in the recruitment of graduates, professionals and managers. This test is the most common one used to test critical thinking skills as it is one of the primary evaluation tools for cognitive abilities.

Method

The method in this research is descriptive. In this study, researchers describe the results of research quantitatively. The population in this study were students of Biology Education, Faculty of Teacher Training and Education, Tanjungpura University batch 2016, 2017, 2018, 2019, 2020, 2021, with total number 466 students. The sampling technique in this research is random sampling. In this study, researcher calculated the sample size using the Slavin technique according to Sugiyono (2019). Slavin's formula in determining the sample is as follows:

$$n = N / (1 + N.e^2)$$

Information:
n = Number of samples required
N= Total population
e= Sampling error rate, usually 5%
Based on the calculation of the Slavin formula, the sample that will be used as respondents in this study is 215 students.

The data collection technique was done by giving test questions via google form. The test used in this study refers to the Watson Glaser Critical Thinking Appraisal (WGCTA). Before collecting data, the test questions were tested first to determine their validity and reliability using tools such as Microsoft Excel 2016 software and Iteman Version 3.0.

To determine the validity of the contents of the instrument, in this study validation was carried out by a validator (consisting of 5 lecturers of Biology Education FTTE UNTAN). The content validity analysis was carried out by calculating Aiken's V. Azwar (2012) stated that Aiken's V was used to calculate the content validity coefficient based on the expert's assessment of the item. Based on the validation results from the experts, it was found that the 40 test instrument questions that had been developed were declared valid, with the number of 0.90. The aspects assessed in this study can be seen in Table 1.

Table 1. Validation of Test Instruments

No	Aspect	Score	Category
1	Theory	0.88	Valid
2	Critical Thinking Appraisal	0.89	Valid
3	Grammar	0.90	Valid
4	Construct	0.93	Valid

After the content validity test, the instrument was then tested for test validity. Test validity using point-biseral correlation and Prop-Correct, which in this study was calculated using Iteman Version 3.0. This validity was carried out after the test questions were carried out on the 4th Semester Biology Education Students of Institute of Teacher Training and Education PGRI. The validity of this test can be seen reliability, point-biseral correlation and Prop. Correct. Reliability in this study was calculated using the Alpha formula. In this study, 3 tests were carried out and 2 item eliminations were conducted. The results of the test validity test

showed that of the 40 items tested, only 27 items were declared valid. The results of the reliability test show the number 0.510 and is in the moderate category, which means that the question can be used.

The difficulty level of the 27 items is in the range of 0.04-1.00 where 5 questions are in the difficult category, 12 questions are in the medium category, 10 questions are in the easy category. It can be seen in Table 2.

Table 2. Difficulty Level of Test Instruments

Question Number	Value Range	Category
1,6,8,20,27	0.04-0.027	Hard
2,3,4,5,10,12,15,16,17,21,22,24	0.31-0.61	Currently
7,9,11,13,14,18,19,23,25,26	0.77-1.00	Easy

The distinguishing power of this instrument is in the range of 0.42-0.17 where there are 9 items in the good category, 7 items in the accepted category, 3 items in the repaired category, and 8 items in the category. rejected. Can be seen in Table 3.

Table 3. Differential Power of Test Instruments

Question Number	Value Range	Category
5,6,10,12,15,17,19,21,26	0.42-0.83	Well
1,8,11,14,18,20,24	0.30-0.39	Received
4,16,22	0.253-0.272	Fixed
2,3,7,9,13,23,25,27	-9.00-0.17	Rejected

To analyze the overall critical thinking, this is done by calculating the score of each individual with the formula:

$$X= \frac{Correct\ Question}{Total\ Question} \times 100$$

Then, it is continued by determining the score criteria, which can be seen in Table 4:

Table 4. Criteria for Critical Thinking Score

No	Value Range	Criteria
1	81.25-100	VeryCritical
2	62.50-81.25	Critical
3	43.75-62.50	Not enoughCritical
4	25.00-43.75	Very lessCritical

(Setyowati et al., 2011)

The results of students' thinking abilities obtained are presented using the Siregar formula (2012) in (Danaryanti et al., 2017)

$$P = \frac{F}{N} \times 100$$

Information:
P = Percentage
F = Frequency in the searched percentage
N = Number of frequencies

To analyze critical thinking on each indicator, conducted by calculating the score of each individual for each indicator, then converted into a range of 0-100 and continued by determining the criteria in table 4.

In this study, the correlation test was used to determine the level of relationship between variables expressed by the correlation coefficient. (r). The correlation test in this study was carried out using SPSS 25.

Results and Discussion

Critical thinking is a skill needed in 21st century education. This critical thinking skill ranks first in the list of skills needed today. This critical thinking skill is seen as a result of learning in higher education. According to Sternberg (1986) critical thinking is a mental process, a strategy used by individuals to solve problems and learn new concepts (Fajrianth et al., 2016). Critical thinking is very necessary for students as prospective teachers (Suliono, 2017). In this study, critical thinking skills are described based on 5 indicators proposed by Watson Glaser, including: making conclusions, introducing assumptions, making deductions, making interpretations and analyzing argument evaluations.

Based on the results of the research data, it is known that of all students who were the sampled in this study, the categories that students got were mostly critical with an average score of 70.40.

Table 5. Percentage of Number of Students for Each Category of Critical Thinking

No	Category	Number of Students	Average	Standard Deviation	Percentage (%)
1	Very Critical	51	19.13	3.096	24%
2	Critical	111	19.12	3.081	52%
3	Less Critical	50	19.01	3.118	23%
4	Very Less Critical	3	19.02	3,199	1%

Interpretation of the average score of critical thinking skills can also be seen in the following figure.
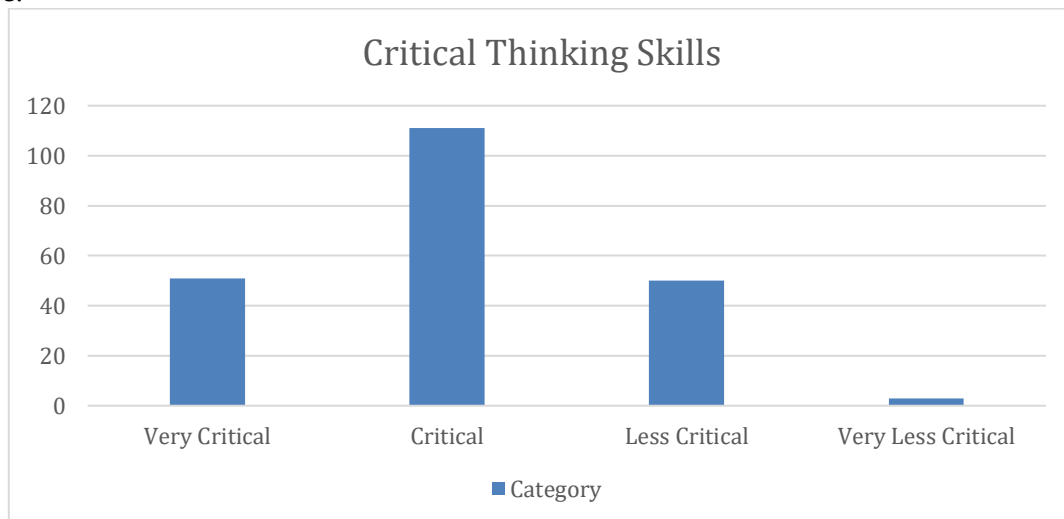

Figure 1. Bar chart of Critical Thinking Ability Test Results

Based on Table 5 and Figure 1, it can be seen that students' critical thinking skills are said to be very less critical at least when compared to other categories, as many as 3 students or 1%. Meanwhile, most students' critical thinking skills are located in the critical category, consisting of 111 students or 52%. There are 51 students who have the ability to think very critically for about 24%. Students who have the category of critical thinking skills in the less critical category are 50 people or 23%.

The average value for each indicator of critical thinking ability, such as: Making conclusions, Introducing assumptions, Making deductions, Making interpretations, and Analyzing argument evaluations is presented in Table 6 below.

Table 6. Descriptive Statistics of Students' Critical Thinking Based on Indicators

N o	Indicator	Number of Questions	Average	Standard Deviation	Score	Category
1	Making Conclusions	6	2.9907	1.2788	49,845	Less Critical
2	Making Assumptions	7	5.5023	1.1144	78.6047	Critical
3	Making Deductions	6	4.7674	1.0816	79.4574	Critical
4	Making Interpretations	4	3.32	0.89	82.907	Very Critical
5	Analyzing Argument Evaluation	4	2.433	0.745	60.814	Less Critical

Based on Table 6, it can be seen that the indicators make conclusions that students are in the less critical category with a score of 49.845. The indicator makes assumptions in the critical category with a score of 78.6047. The indicator for making deductions is in the very critical category with a score of 79.4574. The indicator for making interpretation is in the very critical category with a score of 82.907. The indicator of analyzing the evaluation of arguments is in the less critical category with a score of 60.814.
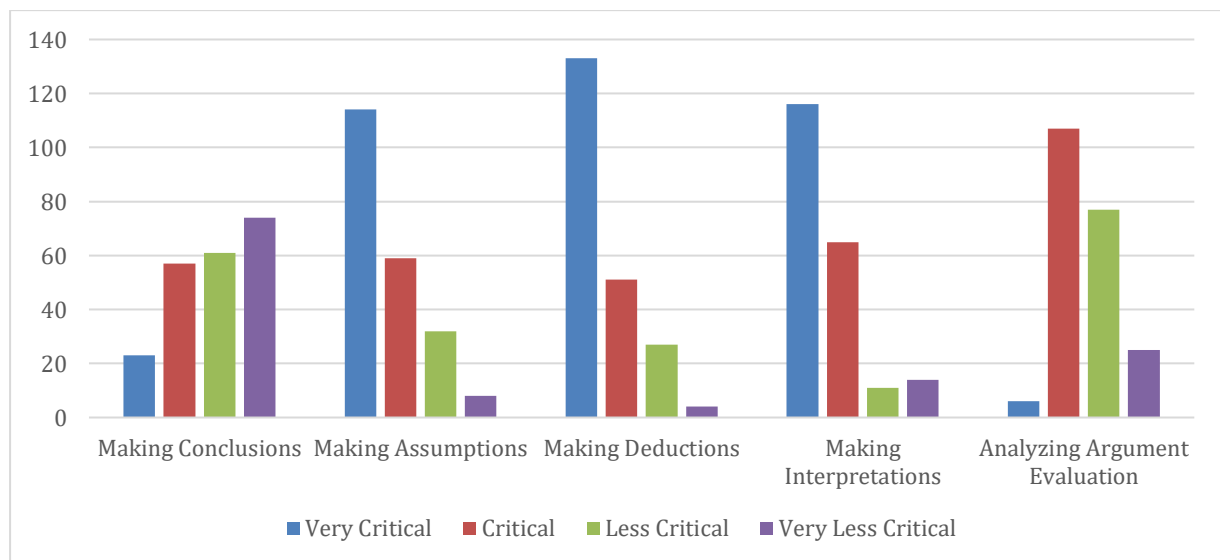

Figure 2. Number of Students for Each Indicator

The indicator with the lowest level of achievement (fifth) is the indicator making conclusions with a score of 49.845. In this indicator, the student's ability that will be measured is distinguishing the level of truth or error of a conclusion from the data given. It can be seen in Figure 2, that in the category of making conclusions as many as 23 people get the very critical category, 57 people get the critical category, 61 people get the less critical category, 74 people get the very less critical category.

The indicator with the third highest level of achievement is the indicator making assumptions with a score of 78.6047. In this indicator, the student's ability to be measured is

aware of the allegations from the information provided. It can be seen in Figure 2, that in the category of making assumptions as many as 114 people get the very critical category, 59 people get the critical category, 32 people get the less critical category, 8 people get the very less critical category.

The indicator with the second highest level of achievement is the indicator of making student deduction with a score of 79.4574. In this indicator, the student's ability to be measured is the ability to determine a certain conclusion following the information provided. It can be seen in Figure 2, that in the category of making deductions as many as 133 people get the very critical category, 51 people get the critical category, 27 people get the less critical category, 4 people get the very less critical category.

The indicator with the first highest level of achievement is the indicator for making student interpretations with a score of 82,907. In this indicator, the student's ability to be measured is measuring evidence or deciding whether generalizations or conclusions based on the data provided are correct. It can be seen in Figure 2, that in the category of making interpretations 116 people get the very critical category, 65 people get the critical category, 11 people get the less critical category, 14 people get the very less critical category.

The indicator with the fourth highest level of achievement is the indicator of analyzing argument evaluation with a score of 60.814. In this indicator, the student's ability to be measured is the ability to distinguish between strong and weak arguments. It can be seen in Figure 2, that in the category of analyzing the evaluation of arguments as many as 6 people get the very critical category, 107 people get the critical category, 77 people get the less critical category, 25 people get the very less critical category.

To find out the close relationship between critical thinking assessment and each indicator, it is necessary to do a correlation test using the SPSS 25 application.

Correlations			
		Making Conclusions	*Critical Thinking* Assessment
Making Conclusions	Pearson Correlation	1	,568**
	Sig. (2-tailed)		,000
	N	215	215
All Indicators	Pearson Correlation	,568**	1
	Sig. (2-tailed)	,000	
	N	215	215

Figure 3. The Relationship Between Indicators Making Conclusions with Critical Thinking Assessment

Based on Figure 3, it can be seen that the significance of the relationship between indicators making conclusions and all indicators is 0.000. This means that the significance value is smaller than 0.05 (0.000 <0.05). Based on the proposed hypothesis, it can be concluded that H0 is rejected while H1 is accepted, which means that there is a positive relationship between the indicators of making conclusions and Critical Thinking Assessment. Indicators of making conclusions with Critical Thinking Assessment have a moderate level of relationship.

Correlations		
Making Assumptions Critical Thinking Assessment		
Making Assumptions Pearson Correlation	1	,660**
Sig. (2-tailed)		,000
N	215	215
All Indicators Pearson Correlation	,660**	1
Sig. (2-tailed) ,000		
N	215	215

Figure 4. The Relationship Between Indicators of Making Assumptions
and Critical Thinking Assessment

Based on Figure 4, it can be seen that the significance of the relationship between the indicators making assumptions and all indicators is 0.000. This means that the significance value is smaller than 0.05 (0.000 <0.05). Based on the proposed hypothesis, it can be concluded that H0 is rejected while H1 is accepted, which means that there is a positive relationship between the indicators making assumptions and Critical Thinking Assessment. Indicators making assumptions with Critical Thinking Assessment have a high degree of relationship.

Correlations			
		Making Deductions	*Critical Thinking* Assessment
Making Deductions	Pearson Correlation	1	,713**
	Sig. (2-tailed)		,000
	N	215	215
All Indicators	Pearson Correlation	,713**	1
	Sig. (2-tailed)	,000	
	N	215	215

Figure 5. The Relationship Between Indicators Making Deductions
with Critical Thinking Assessment

Based on Figure 5, it can be seen that the significance of the relationship between indicators making deductions and all indicators is 0.000. This means that the significance value is smaller than 0.05 (0.000 <0.05). Based on the proposed hypothesis, it can be concluded that H0 is rejected while H1 is accepted, which means that there is a positive relationship between indicators making deductions and Critical Thinking Assessment. The indicator of making deductions with Critical Thinking Assessment has a high degree of correlation.

Correlations			
		Making Interpretations	*Critical Thinking* Assessment
Making Interpretations	Pearson Correlation	1	,674**
	Sig. (2-tailed)		,000
	N	215	215
All Indicators	Pearson Correlation	,674**	1
	Sig. (2-tailed)	,000	
	N	215	215

Figure 6. The Relationship Between Indicators of Making Interpretations
with Critical Thinking Assessment

Based on Figure 6, it can be seen that the significance of the relationship between indicators making interpretations and all indicators is 0.000. This means that the significance value is smaller than 0.05 (0.000 <0.05). Based on the proposed hypothesis, it can be concluded that H0 is rejected while H1 is accepted, which means that there is a positive relationship between the indicators of making interpretations and Critical Thinking Assessment. Indicators of making interpretations with Critical Thinking Assessment have a high degree of correlation.

Correlations			
		Analyzing Argument Evaluation	*Critical Thinking* Assessment
Analyzing Argument Evaluation	Pearson Correlation	1	,379**
	Sig. (2-tailed)		,000
	N	215	215
All Indicators	Pearson Correlation	,379**	1
	Sig. (2-tailed)	,000	
	N	215	215

Figure 7. The Relationship Between Indicators of Analyzing Argument Evaluation
with Critical Thinking Assessment

Based on Figure 7, it can be seen that the significance of the relationship between the indicators analyzing the evaluation of the arguments with all indicators is 0.000. This means that the significance value is smaller than 0.05 (0.000 <0.05). Based on the proposed hypothesis, it can be concluded that H0 is rejected while H1 is accepted, which means that there is a positive relationship between the indicators of analyzing argument evaluation and Critical Thinking Assessment. The indicator of analyzing argument evaluation with Critical Thinking Assessment has a low level of relationship.

Conclusion

Based on the discussion, it can be concluded that the Critical Thinking Assessment profile of prospective Biology Education Students at FTTE UNTAN is mostly included in the critical category with an average score of 70.40. In each indicator, such as: y making conclusions into the less critical category with an average value of 49,845; make assumptions into the critical category with an average value of 78.605; make the deduction into the critical category with an average value of 79,457; make the interpretation into the very critical category with an average value of 82,907; analyzing the evaluation of the arguments into the less critical

category with an average value of 60.814. In this study, it can be concluded that there is a relationship between each indicator and Critical Thinking Assessment.

References

Arofah, L., & Nawantara, R. D. (2019). Pentingnya Critical Thinking Bagi Siswa dalam Menghadapi Society 5.0. . *"Penguatan Pendidikan & Kebudayaan untuk Menyongsong Society 5.0"*, 538-54. http://repository.unpkediri.ac.id/id/eprint/3615

Avisca, K. C., Mawardi, & Astuti, S. (2018). Peningkatan Critical Thinking dan Collaborative Skill Matematika Melalui Model Group Investigation Berbantuan Magic Ball. *Naturalistic: Jurnal Kajian Penelitan Pendidikan dan Pembelajaran,* 2(2), 129-138. https://doi.org/10.26740/jp.v3n2.p97-103

Azwar, S. (2012). *Reliabilitas dan Validitas.* Yogyakarta: Penerbit Pustaka Belajar.

Danaryanti, A., & Lestari, A. T. (2017). Analisis Kemampuan Berpikir Kritis dalam Matematika Mengacu pada Watson Glase Critical Thinking Appraisal pada 2016/2017. *EDU-MAT Jurnal Pendidikan Matematika, 5*(2), 116-115. http://dx.doi.org/10.20527/edumat.v5i2.4631

Dewi, N. D., & Prasetyo, Z. K. (2016). Pengembangan Instrumen Penilaian IPA untuk Memetakan Critical Thinking dan Practical Skill Peserta Didik SMP. *Jurnal Inovasi Pendidikan IPA, 2*(2), 213-222. http://dx.doi.org/10.21831/jipi.v2i2.11963

Fajrianth, H., & Septarini, B. G. (2016). Pengembangan Tes Berpikir Kritis Dengan Pendekatan Item Response Theory. *Jurnal Penelitian dan Evaluasi Pendidikan, 20*(1), 43-55. https://doi.org/10.21831/pep.v20i1.6304

Fisher, A. (2008). *Berpikir Kritis.* Jakarta: Erlangga.

Khayati, D. N., & Raharjo. (2020). Pengembangan Instrumen Tes Berbasis Literasi Sains untuk Memetakan Critical Thinking dan Practical Skills Siswa pada Materi Sistem Peredaran Darah Kelas XI SMA. *BIOEDU, 9*(3), 433-442. https://doi.org/10.26740/bioedu.v9n3.p433-442

Linda, S., B., H. & Niu, L. (2011). Teaching Critical Thinking Skills In Higher Education: A Review Of The Literature. *Journal of College Teaching & Learning,, 8*(2), 25-41. http://dx.doi.org/10.19030/tlc.v8i2.3554

Parera, C. G. (2019). Uji Reliabilitas Instrumen Kemampuan Berpikir Kriitis SCTT (Surabaya Critical Thinking Test). *alyptra: Jurnal Ilmiah Mahasiswa Universitas Surabaya, 8*(1), 421-430. https://journal.ubaya.ac.id/index.php/jimus/article/view/3668

Rahaman, A., Wahyuni, I., & Aat, N. (2018). Profil Kemampuan Berpikir Kritis Dan Kemampuan Metakognitif Siswa Berdasarkan Jenis Kelamin. *Jurnal Pendidikan Biologi, 10*(1), 28-43. http://dx.doi.org/10.17977/um052v10i1p28-43

Sari, N. J., Awanita, I. M., & Irawan, I. K. A. (2020). Pola Porgram Berpikir Kritis (Critical Thinking) Dalam Ruang Belajar Mengajar Era Abad 21 (Studi Pada Pasraman Kota Tanggerang). *Jurnal Pasupati, 7*(1), 59-71. http://dx.doi.org/10.37428/pspt.v7i1.208

Setyaningsih, N. (2009). Peningkatan Kemampuan Berpikir Kritis Dan Kreatif Mahasiswa Dalam Pemecahan Masalah Pengantar Dasar Matematika Melalui Pendekatan Pembelajaran Berbasis Konstruktivitas. *Varia Pendidikan, 21*(1), 12-23. http://hdl.handle.net/11617/705

Setyawati, D. U., Ayu, F. B., & Chairun, N. I. (2020). Profil Kemampuan Berpikir Kritis Mahasiswa dalam Menyelesaikan Soal Pemecahan Masalah Matematika Ditinjau dari Jenis Kelamin. *Jurnal Didaktik Matematika*, 90- 104. https://doi.org/10.24815/jdm.v7i1.15709