

Correlation between numerical interpretation and analysis abilities with critical analysis ability on biology education students

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Article Information	Abstract
<p>Keyword: Numerical interpretation; Numerical analysis; Critical analysis; Biology education students</p> <p>Kata Kunci: Interpretasi numerasi; Analisis numerasi; Analisis kritis; Mahasiswa pendidikan biologi</p>	<p>Numerical literacy and critical thinking skills are important 21st-century competencies for prospective biology teacher students in South Kalimantan. Some of these competencies include interpreting and analysis numeracy as well as critical analysis abilities. This study aims to analyze the correlation between Numerical interpretation and analysis ability with critical analysis ability of students' education biology. This study is quantitative correlational research. The sample of this research was 245 biology education students in South Kalimantan from Lambung Mangkurat University, UIN Antasari Banjarmasin, and STKIP PGRI Banjarmasin. Test instruments Numerical interpretation and analysis abilities refer to AACU, and critical analysis ability test instrument developed refer to Facione with the types of multiple choice questions and each variable totaling 6 (six) questions. Test instrument has been validated by empirical validation using a correlation test. The type of data collected is quantitative data from the scoring results of the three variables that are measured and analyzed using the Pearson Product Moment correlation test and multiple correlation tests with SPSS 26. Results of the study show a significant correlation between ability numerical interpretation ability with critical analysis ability, and other relationships also exist in numerical analysis ability with critical analysis ability in Biology Education Students.</p>
<p>History: Received : 30/01/2023 Accepted : 12/06/2023</p>	<p>Abstrak</p> <p>Literasi numerasi dan kemampuan berpikir kritis merupakan kompetensi abad 21 yang penting dimiliki oleh mahasiswa calon guru biologi di Kalimantan Selatan. Beberapa kompetensi tersebut diantaranya adalah kemampuan interpretasi dan analisis numerasi serta kemampuan analisis kritis. Penelitian ini bertujuan untuk menganalisis hubungan antara kemampuan interpretasi dan analisis numerasi dengan kemampuan analisis kritis mahasiswa pendidikan biologi di Kalimantan Selatan. Jenis penelitian ini adalah penelitian kuantitatif korelasional. Sampel penelitian ini yaitu mahasiswa Pendidikan Biologi di Kalimantan Selatan berjumlah 245 orang dari Universitas Lambung Mangkurat, UIN Antasari, dan STKIP PGRI Banjarmasin. Instrumen tes kemampuan interpretasi dan analisis numerasi merujuk pada AACU dan Instrumen tes kemampuan analisis kritis dikembangkan dengan merujuk pada Facione dengan jenis soal pilihan ganda dan masing-masing variabel berjumlah 6 (enam) soal. Instrumen tes divalidasi dengan validasi empiris menggunakan uji korelasi. Jenis data yang dikumpulkan merupakan data kuantitatif dari hasil penskoran ketiga variabel yang diukur dan dianalisis dengan menggunakan uji korelasi Pearson Product Moment dan uji korelasi berganda dengan SPSS 26. Hasil analisis menunjukkan adanya hubungan yang signifikan secara simultan antara Kemampuan Interpretasi dan Analisis Numerasi dengan Kemampuan Analisis Kritis Mahasiswa Pendidikan biologi di Kalimantan Selatan.</p>

A. Introduction

Numeracy literacy and critical thinking are competencies that students must possess as demands in life in 21st-century. Numeracy literacy is the ability to understand problems and solutions in a manner math and apply it in daily life. Numeracy literacy is important for retrieval decisions by quantitatively considering the data in detail. Numeracy literacy is not only based on the ability to make calculations but also on the ability to interpret mathematical data and analyze conditions from existing quantitative data (Association of American Colleges and Universities, 2009; Crauder et al., 2015). Students of biology education study programs who are prospective biology teachers need these abilities to help solve problems in life daily, especially those related to quantitative data. In addition, prospective teachers must also be able to evaluate learning processes and outcomes; this process is related to quantitative data. This follows the learning achievement for biology education graduates, namely mastering educational research methods and techniques to solve problems in learning biology (ULM Biology Education, 2020). Rafianti et al. (2018) explained that the ability to interpret and analyze quantitative data is an essential need for everyday people to solve quantitative problems in the fields of work and life. So this is important for students to have.

Critical thinking is also important to note in prospective biology teachers. Critical thinking will support one of the learning outcomes formulations of the biology education study program, which states that prospective biology teachers must be able to solve problems in learning biology (ULM Biology Education, 2020). Critical thinking assesses an argument's truth and the ability to shape an argument related to appraisal truth (Epstein, 2006). Someone with critical thinking will tend to be wiser in making a decision or conclusion by problem-solving with consideration and proof of scientific and existing arguments (Fisher, 2011). Critical thinking is important to avoid reception information received spontaneously without further inspection of the information.

Critical thinking will assist in retrieving the right decision to achieve the desired purpose (Facione & Gittens, 2016). Critical thinking ability possessed by students will help the student to solve complex problems, which will help in the world of work (Anderson & Good, 2020). Prospective biology teachers must have critical thinking ability, so this capability can support making the related decision to results of evaluating and determining to follow the continuation of the learning process.

Learning outcomes for graduates of biology education in South Kalimantan among them that Biology Education graduates must have the ability to plan, design, implement and evaluate biology learning (ULM Biology Education, 2020). Hasanah et al. (2016) reported that only 32.4% of biology education students at the State University of Malang could meet the indicators of critical thinking ability. For the ability to analyze arguments, 41% of students who are respondents are still in the low category. Nuraeni et al. (2015) reported an initial measurement of the ability to interpret quantitative data on biology education students before treatment showing the low category with an average proportion of 64.71%.

The numeracy literacy ability can support this learning outcome for graduates in the evaluation process of learning and critical thinking ability in the planning and implementation process of learning. According to Facione & Gittens (2016), critical thinking ability has six indicators: interpretation, analysis, evaluation, inference, explanation, and self-regulation. Meanwhile, according to the Association of American Colleges and Universities (2009), numeracy literacy ability has six indicators: interpretation, representation, calculation, assumption, application, and communication. Both abilities have a number of the same indicator, that is interpretation and analysis. Although thus, there is a difference between them, where interpretation and analysis of numeracy literacy, more specifically numeration, is related to quantitative data. But both of them still have similarities in thought processes.

The correlation between interpretation ability, numerical analysis, and critical analysis is a partial indicator of literacy numeracy and critical thinking abilities essential to study. The conclusion about that correlation can be base for educators to plan appropriate learning processes so they can train many abilities at a time in a manner simultaneously in a single learning process. It will increase efficiency in the learning process. The results of Harianto et al. (2017); Nuraeni et al. (2015); Nuraeni & Rahmat (2019) show that ability to think mathematics can be trained through learning biology. The results of other studies Amin et al. (2020); Mcneal & Mierson (1999); Nguyen et al. (2017) show that learning biology can train critical thinking ability. Based on the results of the research, so important to know the correlation indicator numerical interpretation and analysis abilities with critical analysis ability to students, so it can be known potential to train capabilities the in a manner together in one learning process.

Research on the relationship between numeracy literacy and critical thinking has previously been reported by Asknes (2017). This research was not conducted on biology education students but on nursing students. In addition, this research also does not specifically examine the relationship between the ability to interpret quantitative data, quantitative data analysis, and critical analysis. Whereas in this article, the research aims to analyze the relationship between the ability of interpretation and numerical analysis with the critical thinking skills of biology education students in South Kalimantan. Studying the correlation between numeracy literacy and critical thinking skills for critical analysis in biology education students in South Kalimantan is important. The results of this study are expected to become the basis for decision-making in choosing a learning model that can train a number of abilities simultaneously in one learning process.

B. Material and Method

The type of research used is quantitative correlational research. This research was conducted at the Lambung Mangkurat University (ULM), High School of Teacher Training and Education (STKIP) PGRI Banjarmasin, and Islam State University (UIN) Antasari Banjarmasin. The research subjects were Biology Education students at Lambung Mangkurat University, STKIP PGRI Banjarmasin, and UIN Antasari Banjarmasin. The population of the subjects in this study amounted to 555 students from ULM, STKIP PGRI Banjarmasin, and UIN Antasari. The sample of this research was 245 students (44% of the total population), with details of 149 students originating from ULM, 34 students from STKIP PGRI Banjarmasin, and 61 from UIN Antasari Banjarmasin.

The variable of this research, namely numerical interpretation ability, numerical analysis ability, and critical analysis ability in biology education students in South Kalimantan. Measurement of variable instruments using multiple choice test instruments with the number of questions for each variable is 6 (six). Test instruments Numerical interpretation and analysis abilities refer to Association of American Colleges and Universities (2009), and test instruments for critical analysis ability developed with reference to Facione & Gittenss (2016). Test instrument has to be measured its validity and reliability in a manner empirical on 100 respondents by measuring validity and Cronbach's alpha value to measure the instrument's reliability. Testing using SPSS 26 and obtained results score correlation coefficient

successively for the ability measurement test instrument numerical interpretation, numerical analysis, and critical analysis, namely 0.821, 0.876, and 0.909. As for the value of the r table, that is 0.195. It shows that the test instrument has been valid. Cornbach's alpha value measurement obtained the result is 0.949, and it can be concluded that the instrument is reliable.

The data in this research is in the form of quantitative data. Data were analyzed using the Pearson product-moment correlation test and multiple correlation tests to find out correlation in a manner simultaneous between Numerical interpretation and analysis ability with critical analysis ability. The analysis prerequisite test was carried out using the normality and homogeneity tests of the data. Based on the results of the normality and homogeneity tests show that the data are normally distributed and homogeneous, so the parametric test of product-moment correlation and multiple correlations can be continued. All data analysis was performed using the IBM SPSS Statistics 26 program. Correlation scheme between variables can be seen in Figure 1.

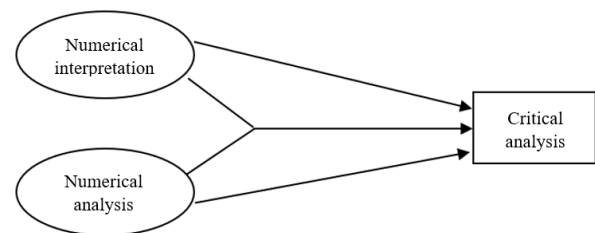


Figure 1 Correlation analysis scheme between variable

C. Results and Discussion

1. Average Interpretation Numeracy Ability, Numerical analysis Ability, and Critical Analysis Ability

Average score of numerical interpretation ability, numerical analysis ability, and critical analysis ability can be seen in Figure 2.

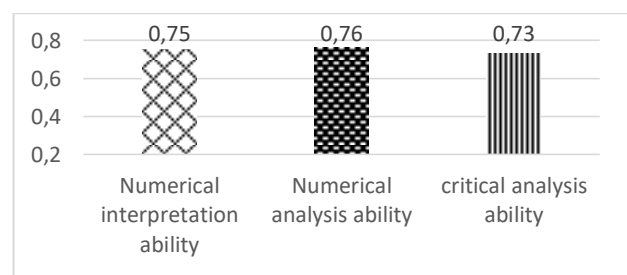


Figure 2
 Average numerical interpretation ability, numerical analysis ability, and critical analysis ability of biology education students in South Kalimantan

2. Correlation Between Numerical Interpretation Ability, Numerical Analysis Ability, and Critical Analysis Ability

The results of data analysis performed with the Pearson product-moment correlation test show exists correlation between numerical interpretation ability with critical analysis ability and other relationships also exist in numerical analysis ability with critical analysis ability. It is visible from the score of pearson correlation coefficient and value significance. Test results details using IBM SPSS Statistics 26 can be seen in Table 1.

Based on the Pearson correlation test results is known to score pearson correlation between ability interpretation numeracy with critical analysis skills is 0.919. This value is greater if

compared r-table value, which is 0.125. score significance results testing (0.000) also shows a smaller value than level significance, i.e., 0.05. So from the analysis results, there is a significant relationship between numerical interpretation ability and critical analysis ability in biology education students in South Kalimantan.

As for pearson correlation value between numerical interpretation ability with critical analysis ability is 0.924 with a level significance of 0.000. Pearson correlation value is greater compared r-table value. Apart from that, the value significance is also smaller than the significance of 0.05, so it can be concluded there is a significant correlation between numerical interpretation ability and critical analysis ability in biology education students in South Kalimantan.

Table 1 Pearson Correlation Coefficient Values and Values Significance based on Pearson Product-Moment Correlation Test Results

Variable		Analysis_Critical_Ability
Numerical_Interpretation_Ability	Pearson Correlation	0.919
	Sig. (2-tailde)	0.000
	N	245
Numerical_Analysis_Ability	Pearson Correlation	0.924
	Sig. (2-tailde)	0.000
	N	245

The analysis results show that the ability to interpret numeracy and analyze each is related to the ability to analyze students critically. The ability to synthesize information, including numerical information, influences one's analytical skills. The ability to analyze and interpret will affect the analysis ability in critical thinking. This is in line with the research results of Amin et al. (2020); Agusstiawan et al. (2021), which explain that analysing chart ability will help participants teach in interpreting. Further, Subali et al. (2015) stated that interpretation ability will influence understanding and analysing data ability. Anisa et al. (2017) explain interpreting chart's ability

related to their ability to solve the problem. The problem-solving process can support by analytical skills.

3. Correlation Simultaneously Between Numerical Interpretation Ability and Numerical Analysis Ability with Critical Analysis Ability

Testing correlation simultaneously between numerical interpretation ability and numerical analysis ability with critical analysis ability used multiple correlation tests using the IBM SPSS Statistics 26 program. The test results can be seen in Table 2.

Table 2 Correlation Test Results Simultaneously between Numerical Interpretation Ability and Numerical Analysis Ability with Critical Analysis Ability

R	R Square	Adjusted R Square	std. Error of the Estimate	Change Statistics				
				R Square Change	FChang	df1	df2	Sig. FChange
0.946	0.896	0.895	0.39589	0.896	1038,478	2	242	0.000

a. Predictors: (Constant), Numerical_Analytic_Ability, Numeral_Interpretation_Ability

Test of Correlation simultaneously results show a significant correlation between numerical interpretation and numerical analysis abilities with critical analysis ability on students. A smaller

significance value from level a significance of 0.000 and an r-value of 0.946 indicates a strong correlation between the variable of numerical interpretation ability and numerical analysis ability

with critical analysis ability. These results indicate a correlation between indicators of numeracy literacy ability and indicators of critical thinking skills, in line with the results of Asknes' research (2017) on students, including those showing a relationship between the two abilities. The results of Noor & Ranti (2019) show a relationship between critical thinking ability and mathematical communication skills. Arsyad et al. (2019); Antika et al. (2020); Zaini & Arsyad (2021) explain that critical thinking skills are related to a person's interpersonal abilities, including analysis and interpretation abilities.

The ability to read numerical data (interpretation) can improve critical thinking skills. (Abdullah & Suhartini, 2017). This is because the process of critical thinking must go through a process of interpretation (Facione & Gittens, 2016). Critical thinking skills are related to the ability to analyze and synthesize both information and assumptions. Good analytical skills will form critical thinking skills. The ability to think critically as a directed process will help mental activities such as analyzing and solving problems to conducting scientific research (Cindiati et al., 2021; Fisher, 2011).

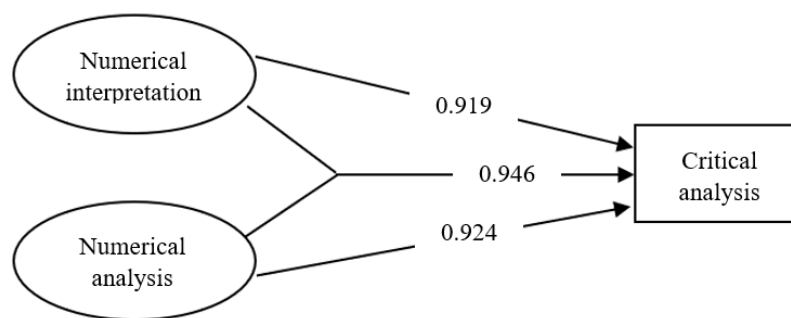


Figure 3
Coefficient correlation value between variables

The correlation shown from the results of the analysis in this study is expected capable Becomes base consideration in planning activity learning. So that several indicators of ability can be applied at the same time in learning, expect more details on existing research results, which will be taken into consideration and can help power educators to design learning that can train quantitative literacy ability and critical thinking ability in learning. The effort to the enhancement of literacy quantitative ability, and critical thinking ability is important to train ability in the learning process, including learning biology (Agnafia, 2019).

The correlation between variables in full can be seen in Figure 3. In the schematic in Figure 3, seen score of correlation coefficient is seen so that there is a good correlation between each variable, as well as multiple correlations measured in a manner simultaneous.

D. Conclusion

Results of the study show a significant correlation between ability numerical interpretation ability with critical analysis ability, and other relationships also exist in numerical analysis ability with critical analysis ability in Biology Education Students in South Kalimantan. Test results in a manner simultaneous Among ability interpretation

numeracy and numeracy analysis with critical analysis skills show significant correlation simultaneously. The results of this research are expected to be used as material for consideration in planning the learning process so that one lesson can train several abilities simultaneously and with the support of appropriate learning tools, learning media, and learning resources. This can support graduates to have 21st-century life skills.

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