

## Identification of Science Process Skills Making Tables and Graphs for High School Students on Biology Materials

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### ARTICLE INFO

#### *Keywords:*

Science Process Skills;  
Biological Material;  
Senior High School Student;  
Scientific communication

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#### *Article history:*

Received 2022-08-08

Revised 2022-09-12

Accepted 2023-08-18

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### ABSTRACT

Science process skills are a crucial instrument for learners to acquire competence through engaging in various learning activities. One facet of science process skills involves the utilisation of communication abilities, which may be effectively demonstrated through the creation of tables and graphs. Scientific communication encompasses both vocal and written forms of expression. Tables and graphs are commonly employed as effective instruments for delivering scientific knowledge or research findings communicatively. The objective of this study is to assess the proficiency of students in employing science process skills, specifically in the creation of tables and graphs, as well as to examine the potential correlation between these two skills. The employed research methodology is the descriptive correlational approach. Class XI science students from SMA in Bogor Regency in the 2021/2022 school year were included in this study. There were a total of 240 students across seven classes. Class XI Science 1 and XI Science 5 were used as samples in this research, with a total of 72 students. Cluster random sampling was used for the study's data collection. The study's findings indicate that students' Science Process Skills, specifically their ability to create tables and graphs, fall within the sufficient group. 2) The correlation between science process abilities and proficiency in creating tables and graphs falls within the poor category. 3) The proportion of the ability to create tables that accounts for the capacity to create graphs is 11%.

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## 1. INTRODUCTION

Science process skills are cognitive and psychomotor skills needed for problem-solving in order to construct new knowledge Akinbobola and Afolabi (2010). Science process skills are important for the learners, in order to gain knowledge through the scientific process through science process skills

through learning activities (Rauf, Rasul, Mansor, Othman, & Lyndn, 2013). Science process skills are mental and physical skills related to the basic abilities that students have, mastered and implemented in a scientific activity (Rustaman, 2007). Science process skills can be used for problem-solving skills in everyday life and allow students to be directly involved in experiences with science material when solving problems (Abungu, Okere, & Wachanga, 2014).

Previous studies have utilised qualitative descriptive methods to examine the science process skills of senior high school students in the field of biology. These investigations have yielded findings indicating that the most proficient skill among students is their ability to effectively communicate research data (Senisum, 2021). Another research using a descriptive exploratory method with the subject of college students shows the results in the form of basic science process skills are very low, and a more meaningful learning experience is needed to improve them (Syazali et al., 2021). Research on science process skills in junior high school was also carried out (Saleh, S.Y., 2020) with quantitative descriptive methods, and other research was carried out by (Sriyati et al., 2021) using the Research and Development method to develop local potential-based biology learning tools Dadijah for the development of science process skills. This study observes the relationship between the ability to make tables and the ability to make graphs naturally, which is part of the science process skills in students through correlational descriptive research methods that have not been used in other studies.

According to Firman (2000), scientific communication skills are the skills to convey ideas or findings to others. If students do not have good communication skills, it will produce students who are passive, uncommunicative and not good at writing scientific papers. Creating a table or graph is one method used to communicate data. The integrated science process skills include the process skills of making tables and graphs. A table is an arrangement of data in simple rows and columns or maybe in a more complex structure. Tables can be used in scientific communication of the results from the analysis of a study (Indonesia, 2019). At the same time, graphics are a form of visual communication where simple dots or strokes can communicate messages to others. The usage of visuals in the field of education has been shown to increase the effectiveness of teaching materials (Dewi et al., 2019). Skills including synthesising data, identifying correlations between variables, visualising the answer to a problem, generating predictions, and drawing conclusions are essential when employing graphs in the problem-solving process (Bunawan, Setiawan, Rusli, & Nahadi, 2013). Graphics can be used to portray authentic content, clarify ideas, establish connections between concepts, create conceptual frameworks, and summarise information.

Referring to the diagram of Rezba et al. (1995), it appears that one science process skill can relate to another science process skill. For example, to be able to classify or classify well, it is suggested that students can observe carefully. Therefore, looking at these linkages, this study discusses the identification of science process skills in making tables and graphs as well as the relationship between the two in biological material.

## 2. METHOD

The research method used in this study is descriptive correlational. The descriptive method is used to interpret the object of research without any treatment (Arikunto, 2009). In this design, the researcher does not manipulate the treatment, but directs to determine the nature of a situation at the time the research is conducted. The goal is to describe the variables or conditions that exist in a situation. The focus of the correlation research design is to measure the relationship between the Science Process Skills section of the table-making skills and the graph-making skills of the students.

The population of this study were all science students of class XI in the academic year 2021/2022 at SMA in Bogor Regency, which consisted of 7 classes with a total of 240 people. While the samples in this study were class XI Science 1 and XI Science 5, which consisted of 72 students. The research sampling technique was carried out using the Cluster Random Sampling technique. This technique is done by selecting a sample based on the group or cluster not the person (Sukardi, 2013). This study uses a test instrument in the form of multiple choice questions totalling 30 items that have been designed and tested for validity. The test instrument was used to measure the level of science process

skills of class XI students with indicators of science process skills, namely the ability to make tables and the ability to make graphs. In addition to using a test instrument, an interview instrument is also used which aims to determine the factors that affect the ability of students' science process skills.

### 3. FINDINGS AND DISCUSSION

The following is a summary of the results of the analysis of the ability to make tables and the ability to make graphs.

**Table 1.** Descriptive Statistics Score Ability Creating Tables and Graphs

KPS Indicator	Total Students	Maximum Score	Minimum Score	Average
Creating Table	72	100	26,67	60,65
Creating Graphics	72	86,67	20	63,8

The data obtained from the analysis shows that the average score of students' table-making abilities is 60.65, which is included in the sufficient category, with the highest total score of 100 while the lowest score of 26.67. The average value of the ability to make graphs is in the sufficient category with a value of 63.8, with the highest score of 86.67 and the lowest value of 20.

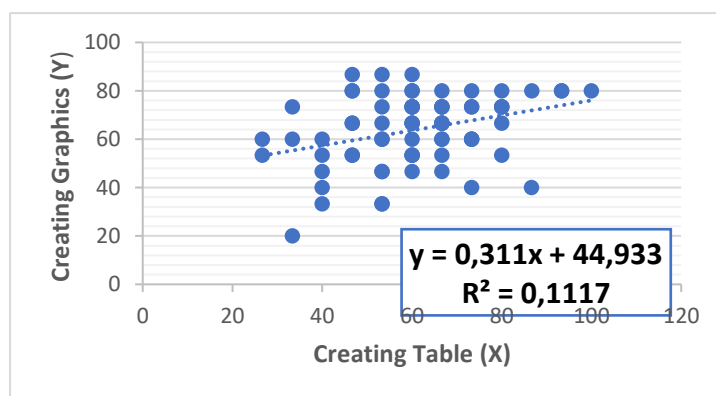
#### 3.1 The Data Research Using Regression Linearity

The results of the data analysis showed the value of A = 44.93 and the value of B = 0.31. To determine the regression equation, the formula  $y = a + bx$ , so that the regression equation obtained is  $y = 44.93 + 0.31x$ . The data from the linearity test analysis can be seen in Table 2.

**Tabel 2.** Results of Regression Linearity Test

Sv	JK	Db	RK	F <sub>hit</sub>	F <sub>tabel</sub>	Result
Tc	2908,1767	11	264,3797	1,48	2,58	F <sub>tc</sub> < F <sub>tabel</sub> , Linier Regression
Kk	2908,1767	59	178,005			

From the results of the linearity test analysis in Table 2. F<sub>count</sub> is 1.48 and F<sub>table</sub> is 2.58. This shows that F<sub>count</sub> 1.48 < F<sub>table</sub> 2.58, which means the relationship between the ability to make tables and the ability to make graphs has a linear regression. So the direction of the ability of science process skills in making tables with the ability to make graphs on the material of cells, plant tissues, animal tissues, locomotion systems and circulatory systems follow each other. Based on these findings, the direction of the regression linearity coefficient can be made as follows.



**Figure 1.** Direction of Regression Linearity Coefficient

Calculation of the correlation coefficient obtained the results with a value of  $r = 0.33$  with a significant level of  $\alpha = 0.05$  from  $N = 72$  students. These results indicate that there is a relationship between the ability to make tables (variable  $x$ ) and the ability to make graphs (variable  $y$ ). The results of the Hypothesis Test analysis on the ability to make tables and the ability to make graphs by obtaining a value of  $r_{count} = 0.33 > r_{table} = 0.227$ , shows that both variables have a significant correlation coefficient. At  $\alpha = 0.05$  with  $N = 72$  there is a rejection area of  $H_0$  and an acceptance area of  $H_a$ . When  $r = 0.33$ , then  $r^2 = 0.11$  or 11%. This means that the contribution to the ability to make tables on the achievement of students' scores on the ability to make graphs is 11%, the remaining 89%, which is influenced by other factors. This shows that the ability to make tables with the ability to make graphs shows that there is a relationship with having a low level of closeness to the coefficient criteria based on the findings using question instruments on cell material, plant tissue, animal tissue, locomotor systems, and circulation systems.

### 3.2 Discussion

The ability to make tables has an average of 60.65, while the ability to make graphs is 63.8, as shown in Table 1. Both abilities are included in the sufficient category. The ability to make tables and the ability to make graphs are included in the type of science process skills to communicate research data. Communicating in science process skills is an activity to convey ideas, including observations to other parties in several forms. One of the forms of delivery is by displaying pictures and graphics. In the study (Senisum, 2021) of the eight science process skills tested, the highest score was communication skills, which was 73.9% in the sufficient category. One of the assumptions why this skill has the highest value than other skills is that this skill is not only developed in learning biology but also in other subjects (Abungu et al., 2014). Another assumption is that pictures or graphics are more interesting to look at and understand than text narratives without pictures or graphics. This study provides the same results as previous studies that the indicator of science process skills on the ability to communicate research data results is higher than other indicators of 66.9% with sufficient category, which means that respondents prefer communication because this ability is carried out and experienced regularly directly so as to provide meaningful learning (Safahi, Pusporini, & Akbar, 2020).

Based on the interview with biology teachers, it was found that teachers only knew the meaning of science process skills and only knew a few indicators. So, in the learning activities, the teacher has not applied science process skills. However, the teacher always uses the lecture and discussion method during the learning activities. According to (Senisum, 2021), communicating through discussion is a bridge between science and the art of language, because the content of delivery is also related to the art of conveying the content. Discussion is the same as conveying an argument or can be called arguing. The importance of argumentation in science education has been highlighted in recent years (Nurlaelah, Widodo, Redjeki, & Rahman, 2020). Argumentation is an important part of science. In the science learning practice, argumentation is the main activity that underlies students in learning through the process of thinking, acting, and communicating (Nurlaelah et al., 2020).

The research data shows that many students still have difficulty working on item number 28, which measures the science process skills of making graphs. Judging from the number of respondents who worked on the questions, only a few were able to answer correctly, namely, as many as 32 students out of a total of 72 students or 44.44%. The items above train students to determine the scale range of the graph on each of the axes. For this reason, students must first read the table and identify the variables to be included in the graph. Reading the table is included in the type of science process skills communication. According to (Khairunnisa, Ita, & Istiqamah, 2019) communication is divided into two, namely written and verbal communication. Lack of communication skills can have a fatal impact on everyday life and especially in the learning process at school. Because students are required to be able to communicate the results of discussions, observations, write scientific papers, write practicum reports, presentations, make tables and others. According to (Khairunnisa et al., 2019) communication in science is communicating data by communicators to communicants. If students do not have good

communication skills, it will produce students who are passive and uncommunicative and are not good at writing scientific papers.

Based on the interviews, the students admitted that they had difficulty working on the science process skills of making graphs, because students had difficulties in understanding the questions and determining the point for the placement of each variable. Students find it difficult to determine the point on each variable contained in the graph line because the distance between each number is adjacent. This also happened in research (Nurlaelah, 2020), where it was found that almost more than half of the students from the sample studied were still having difficulty understanding pictures and charts. In a further part, students admitted that they found it difficult when entering data into tables, because too many variables were used. Creating and reading tables is sometimes considered easy. Creating and reading tables can train the thinking skills of readers, develop memory and the ability to identify part by part.

Based on the findings of the investigation, it can be posited that a correlation exists between the proficiency in constructing tables and the proficiency in constructing graphs. This aligns with the findings of Mustain (2015), who emphasised the utilisation of visual aids such as graphs, data tables, symbols, maps, and diagrams to convey information effectively, organise data, depict relationship patterns, and communicate scientific knowledge. Numerous scientists employ diverse forms of visual aids, such as slideshows, graphs, and tables, to effectively convey concepts, interpret significance, elucidate phenomena, make projections, and facilitate scientific communication (Kozma, Chin, Russell, & Marx, 2000; Mustain, 2015).

#### 4. CONCLUSION

The research findings and discussions have led to the following conclusions: 1) The Science Process Skills of making tables and graphs are classified as sufficient. 2) The correlation between science process skills, specifically the ability to make tables and graphs, is categorised as low. 3) The ability to make tables accounts for 11% of the ability to make graphs. The scope of this study was restricted to high school students enrolled in one of the educational institutions in Bogor. To enhance the scope of the study, it is advisable to carry out research in additional domains, utilising a more extensive sample size.

**Acknowledgements:** The author would like to thank the Research and Development Institute of The University of Muhammadiyah Prof. Dr. Hamka (Lemlitbang UHAMKA) for the funding provided with a research contract number: 337/ F.03.07/ 2022 dated March 2, 2022.

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