

# Research Skills Analysis of Junior High School Students on Plant Propagation

Mely Yani<sup>1\*</sup>, Amprasto<sup>2</sup>, Rini Solihat<sup>2</sup>

<sup>1</sup> Science Education, Universitas Pendidikan Indonesia, Bandung, Indonesia.

<sup>2</sup> Biology Education, Universitas Pendidikan Indonesia, Bandung, Indonesia.

Received: May 8, 2023

Revised: July 12, 2023

Accepted: July 25, 2023

Published: July 31, 2023

Corresponding Author:

Mely Yani

[melyyani@student.upi.edu](mailto:melyyani@student.upi.edu)

DOI: [10.29303/jppipa.v9i7.3006](https://doi.org/10.29303/jppipa.v9i7.3006)

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**Abstract:** This was a descriptive study aims to analyze how the research skills of Junior High School Students, especially in plant propagation material. The research subjects consisted of 36 IX grade Junior High School students. The research skills measured consisted of five indicators, namely observing, questioning, planning, analyzing, and communicating. Data were obtained used a valid and reliable test instrument in the form of 17 essay questions. The data were recapitulated and analyzed by a simple statistical analysis. The results showed that students' average research skills score were in a low category. Most students have very low research skills. Questioning, analyzing, and communicating indicator were low. The highest average score was observing indicator in average category. The lowest average score was planning indicator in very low category. This showed that there is a need to increase the research skills of junior high school students by involving them regularly in the research process.

**Keywords:** Junior High School; Plant propagation; Research skills

## Introduction

Advancement of a country is determined by the development of science and technology. The development of science is dependent on existing human resources. In the 21st century, where science is advancing and technology is more sophisticated, human resources are needed to develop science and technology in accordance with the times. Without being equipped with a variety of 21st century skills such as problem solving, critical thinking, decision making, and others, human resources will not be able to compete with the global world. Conceptualizing the development of students' research skills and actualizing them is essential if the global community want to provide quality researchers to meet the challenges of the early, mid, and late 21st century (Willison & O'Regan, 2007).

Science education is a strategic and fundamental way to improve the quality of human resources. Through good science education, intelligent, competitive and good character human can be formed.

These good quality human resources that will be able to develop science and technology.

Research is the key to acquiring knowledge (Bjørkvold & Blikstad-Balas, 2018; Bjørkvold & Ryen, 2021; Clark, Judd, et al., 2021; Deale, 2020; Kim & Kim, 2021; Koomen et al., 2018; Labouta et al., 2018). Science is developed by researchers in the field through a research process. Through research, a series of logical and systematic ways are carried out to obtain the required data so that new knowledge is produced. Research skills are one of the things that a student must have in conducting research (Damayanti, et al., 2021). Research skills are very important to develop because they will be very useful for studying science, especially natural sciences.

Natural science as a science consists of products, processes and attitudes. As a product, natural science contains knowledge about natural phenomena. As a process, natural science consists of the scientific method used to obtain the knowledge itself. As an attitude, science must be able to develop positive attitudes in the student environment such as honesty, discipline,

## How to Cite:

Yani, M., Amprasto, & Solihat, R. (2023). Research Skills Analysis of Junior High School Students on Plant Propagation. *Jurnal Penelitian Pendidikan IPA*, 9(7), 5638-5644. <https://doi.org/10.29303/jppipa.v9i7.3006>

responsibility, and cooperation. Practicing research skills in learning science is in accordance with the nature of science as a product, process and attitude. Students do not only get knowledge from textbooks, but also from the research process they carry out so that students can feel what it's like to be a scientist. Apart from gaining knowledge, through a series of research processes many positive attitudes can be developed such as hard work and never giving up. This will make the learning process more meaningful for students. The existence of a research process facilitates students to generate knowledge through experiments based on scientific evidence thereby increasing students' understanding of the nature and epistemological functions of science (Bjørkvold & Blikstad-Balas, 2018; Bjørkvold & Ryen, 2021; Clark, Judd, et al., 2021; Clark, Lott, et al., 2021; Deale, 2020; Koomen et al., 2018; Labouta et al., 2018).

The role as a researcher also increases students' awareness regarding the importance of research skills for their future career (Bjørkvold & Blikstad-Balas, 2018; Bjørkvold & Ryen, 2021; Faller, 2018; Kim & Kim, 2021; Selwyn & Renaud-Assemat, 2020). Research skills are an important aspect of any career involving science, whether in academia, industry, education, or policy making (Symons et al, 2017). Research also can strengthens scientific knowledge (Clark, Smith et al., 2021; Kim & Kim, 2021; Koomen et al., 2018; Moon et al., 2018).

Developing research skills will be able to improve students in identifying and solving problems that are not only useful for learning at school but also in everyday life. This skills lead students to think critically and to solve problems (Sari et al., 2019). Research skills acquired through a series of research activities in helping students to critically examine a problem, generating and evaluating data, ideas, and hypotheses of relevant data, forming and testing, and succeeding in producing a conclusion (Sari et al., 2019).

Based on PISA and TIMSS scores, the science and technology abilities of Indonesian students are still relatively low, this is because students are used to receiving information from teachers so they are not used to using science process skills in exploring the information and knowledge learned (Mahfuziannor et al, 2016).

The descriptive study that aims to analyze how the research skills of Junior high school students is very important to do to describe a research skill in every indicator of junior high schools' students in Indonesia. That's because the result of the study can be used as a basic data to know a weakness of student's research skills and based on that data, we can find a way to improve students research skills.

Previous studies have found that there are very few teachers who develop research skills, especially in junior high school students. That practice of science education is not in line with the nature of science and scientific practice which is based on the idea of inquiry (Labouta et al., 2018).

Learning will be more meaningful if it is contextual and close to students' lives. Indonesia is an agricultural country where the majority of people work as farmers. Unfortunately, this is not supported by youth interest in agriculture. Even though this field has great potential to advance and improve the economy of the Indonesian people because the source of food consumed every day comes from here.

In secondary schools there is material related to the agricultural sector, namely the plant propagation system. Therefore, in this study the authors intend to analyze the research skills of junior high school students on plant propagation material.

## Method

This is descriptive research that aims to describe the actual condition (Creswell & John, 2014) of junior high school students' research skills without any intervention. This research was conducted in 36 IX grade junior high school students (18 male, 18 female). Data on students' research skills were obtained from a valid and reliable tests in the form of 17 essay questions. The test containing five indicators of students research skills, there are observing, questioning, planning, analyzing, and communicating.

Before being used to measure students' research skills, the questions were validated by four expert lecturers and then tested for readability, validity, and reliability and tested in the field. Based on the results of the instrument trials, it was found that the questions could be understood by students and, all questions were valid, and had very high reliability (88). This shows that the questions can be used to test students' research skills. Valid questions were then used to measure students' research skills. Processing of research data using microsoft excel to get a simple descriptive statistic. Scores on each indicator and overall are calculated using the following formula:

$$Score = \left( \frac{\text{obtained score}}{\text{total score}} \right) \times 100\% \quad (1)$$

In addition, total student scores and on each indicator are categorized and presented in a pie chart. The average research skills value for each indicator is presented in Table 1.

**Table 1.** Categories of Students' Research Skills (Hartono et al., 2022)

Value (%)	Research Skills Criteria
0-20	Very Low
21-40	Low
41-60	Average
61-80	High
81-100	Very High

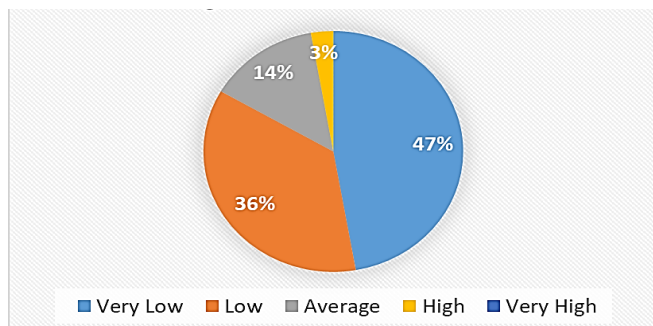
**Result and Discussion**

Research data on students' research skills are presented in Table 2.

**Table 2:** Students Research Skills Descriptive Statistics

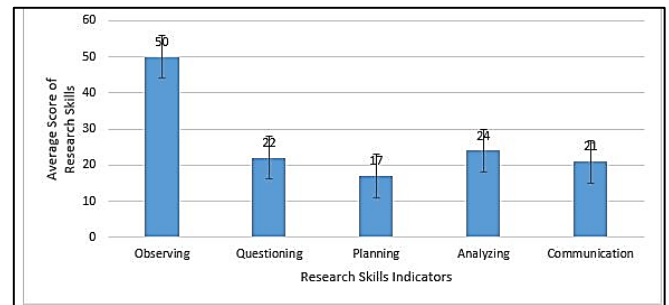
Descriptive Statistics	Value
Mean	24.72
Standard Error	2.74
Median	22.45
Mode	18.37
Standard Deviation	16.43
Largest(1)	71.43
Smallest(1)	2.04

Based on Table 2, the average value of junior high school students' research skills were 24.72, include to the low category. The student's highest score was 71.42, include to the high category and the lowest score was 2.04, include to the very low category. This shows that in general the research skills of junior high school students were low. This was because they were not used to doing research. Students are used to filling in questions which answers are in textbooks so they find it hard when required to fill out research skills essay questions. This was supported by the results of interviews conducted on several students. They explained that they felt difficult to fill in the research skills questions because they had never been taught before. Other students also explained that they did not understand the procedure for conducting research. This is in accordance with previous research which found that science skills process of students were low because 70% of science learning was carried out using lecture methods, 20% demonstration methods, around 10% using tools for learning media and rarely doing practicum (Rahmawati et al., 2016).



**Figure 1.** Student's Research Skills

Based on Figure 1 it can be seen that most students have very low (47%) and low (36%) research skills levels, 14% have average research skills, and only 1 person is high (3%). None of the student studied had very high research skills.



**Figure 2.** Students Research Skills Average Score

Research skills consist of five indicators, including observing, questioning, planning, analyzing, and communicating. Figure 2 shows that the highest score on the observing indicator with an average of 50 is included in the average category. The lowest score is found in the planning indicator with an average score of 17 include to the very low category. While the other three indicators, namely questioning, analyzing, and communication are in the low category. This result in line with other study which found that dominantly all the research subject have difficulties in every research stages, and respectively from the highest is conducting stage, reporting stage, and finally planning stage (Solihat et al., 2015).

These skills are low because teachers rarely invite students to do an experiment (Siswanto et al, 2016). Almost all student activities in the learning process are activities carried out because of orders from the teacher. Learning science in class still uses conventional and teacher-centered methods, such as lectures, so students can't practice research skills (Saleh et al., 2020; Siswanto et al, 2016; Rahmawati et al., 2016; Mahfuziannor et al. 2014; Setiawan et al., 2016; Mahfuziannor et al. 2014; Setiawan et al. al., 2016).

*Observing*

Observing is a student's skill in starting an investigation and clarifying the knowledge needed (Willison & O'Regan, 2007). At this stage students are expected to be able to find problems.

Most student's observing skills were in the low category (28%), the average and very high were the same, namely 22%, the high and very low were also the same as much as 14%. This shows that students' observing skills varied widely from very low to very high and were almost evenly distributed at each level.

Based on the results of interviewed conducted with several students, students have started to have good observing skills compared to other indicators because they identify problems quite often in various subjects. This trains their ability to observe problems so they don't have too much difficulty when asked to fill in questions related to identifying problems.

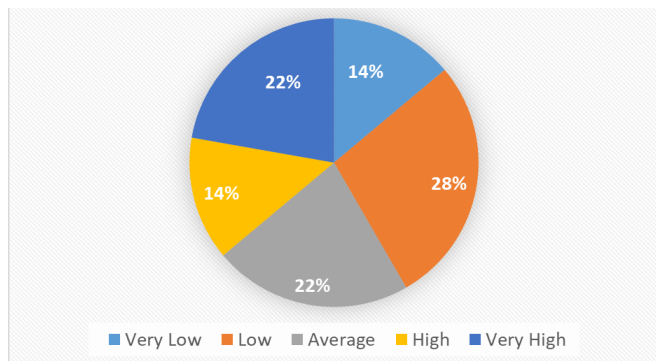


Figure 3. Student's Observing Skills

*Questioning*

Questioning is a student's skill in determining research questions to find the data needed (Willison & O'Regan, 2007). In addition, in this skill students also try to make hypothesis or temporary answers to research questions that have been made.

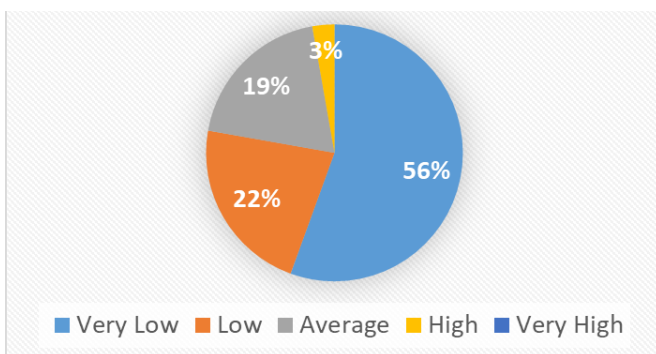


Figure 4. Student's Questioning Skills

Most of the students had very low (56%) and low (22%) questioning skills, and only one (3%) person had high questioning skills. This shows that students have not been able to make the right research questions. Most of the students did not use interrogative sentences, the questions were less specific to the data needed, and could not be tested through research. This is consistent with the results of previous research showed that students' ability to formulate problems (6.125 out of a maximum score of 100), determine the problem hypothesis (4.75 out of a maximum score of 100) is still low (Sudibyo et al., 2018).

Even though they may have carried out practical activities several times, they are not required to

determine research questions and hypothesis by themselves, but have been provided by the teacher in worksheets. This shows the importance of conducting authentic research because it can provide opportunities for students to create their own research questions according to their interests thereby increasing students' ability to create research questions that are specific and can be investigated (Bjørkvold & Blikstad-Balas, 2018; Erumit et al. al., 2019; Koomen et al., 2018).

*Planning*

Planning is a student's skill in planning research methods to obtain data (Willison & O'Regan, 2007). In this section students determine research variables, tools, materials, and also work steps for conducting research.

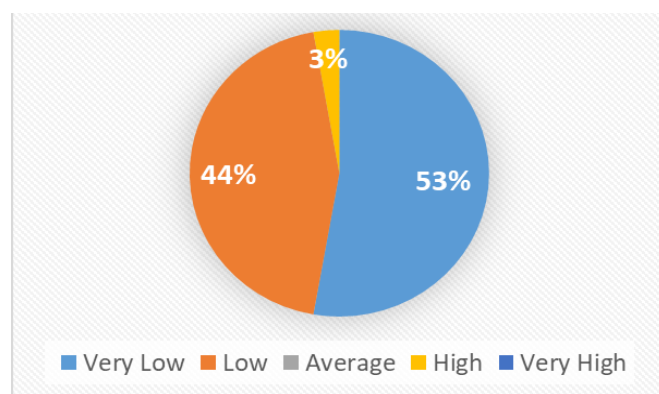


Figure 5. Student's Planning Skills

Most students have very low (53%) and low (44%) planning skills. Only one person has high planning skills (3%). This shows that students do not understand how the procedure is in conducting research. Students have not been able to distinguish between independent and dependent variables. Students also have not been able to determine the tools and materials completely. The work steps that have been made are sufficiently systematic but not specific enough to answer the research questions. This is consistent with previous research which found that the ability to identify variables (5.125 out of a maximum score of 100) is still very low (Sudibyo et al., 2018).

Planning skills in students were very low because they are not use to do a research. Even though they may have carried out practical activities several times, they are not required to determine variables, tools and materials and work steps by themselves, but have been provided by the teacher in worksheets. Based on interviewed conducted to several students they said that "I don't understand what variable and hypothesis is", they said that they rarely doing a research, and they never told by the teacher about how to do a research. It means that students need to do a research regularly in their class to learn how to planning and doing a research.

By doing a research regularly, they will learn to choose a variable, tools, materials and work steps to do a research. It will get them a good experience to improve their planning skills.

*Analyzing*

Analyzing is a student's skill in analyzing and synthesizing the new knowledge they get (Willison & O'Regan, 2007). Analyzing is a very important skill not only in learning sciences but also in daily lives. This skills also will be very useful in their future career. There are many jobs in daily lives that needed this skill to be done. With this skill, we will have better problem solving and critical thinking skills. Unfortunately in school such as in a science education this skills are rarely develop to student. It make students have a low analyzing skills. Analyzing skills of students show in Figure 6.

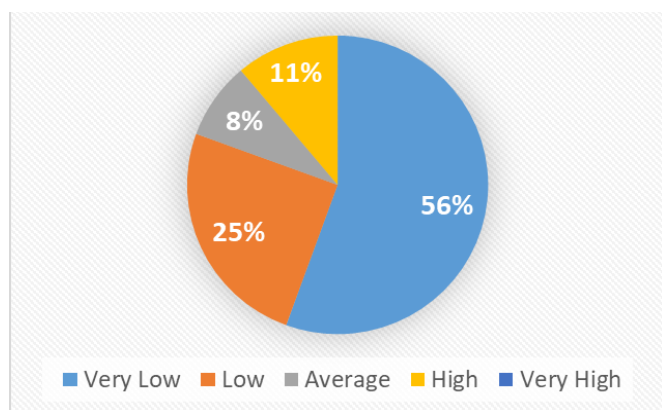


Figure 6. Student's Student's Analyzing Skills

Most students' analyzing skills are in the very low and low categories. However, there are also 11% of students who have high analyzing skills. Students' low analyzing skills occur because students have not been able to connect between the independent and dependent variables. This is consistent with previous research which found that the skills in interpreting student problem data are still low (26.50 out of a maximum score of 100) (Sudibyo et al., 2018). Teachers should improve student's analyzing skills with doing a research project with them. Doing a research make students can learn how to do data analyzing so it can improve their skill.

*Communication*

Communication is a student's skill in communicating research results and also the process used to get them with an awareness of problems in their environment (Willison & O'Regan, 2007). The ability to communicate includes the ability of students to change the form of data into appropriate tables and graphs, as well as being able to communicate research results that

are supported by arguments. Most of the students' communication skills were in the very low and low categories. Based on the results of the interviewed, they had been taught how to make tables and graphs, but they did not know for sure how to make the right tables and graphs.

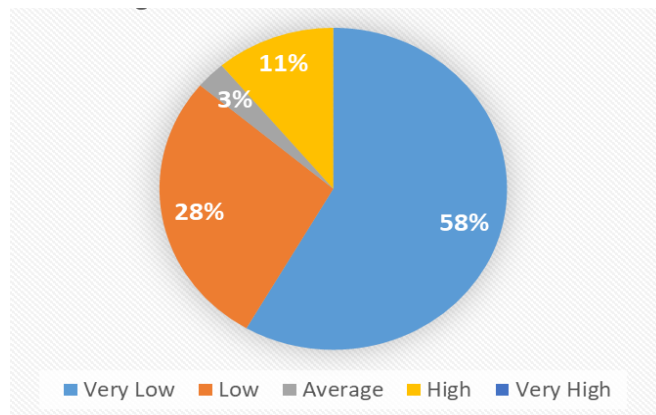


Figure 7. Student's Communication Skills

This is in line with previous research which stated that students communication skills (7.710 out of a maximum score of 100) are still very low (Sudibyo et al., 2018). This can be assisted by providing a text mentor such as scientific report, because students will be accustomed to reading scientific writing and this can help students understand how to write scientific writing (Faller, 2018; Moon et al., 2018; Oliveira, 2021).

**Conclusion**

The average score of junior high school students' research skills is 24,72, include to the low category. The student's highest score was 71.42, include to high category and the lowest score was 2.04, include to the very low category. This shows that in general the research skills of junior high school students are still low. Most students have very low (47%), and low (36%) research skill levels, 14% have average research skills, and only 1 person has high (3%) research skills. The highest score on the observing indicator with an average of 50 is include to the average category. The lowest score is found in the planning indicator with an average score of 17 include to the very low category. While the other three indicators, namely questioning, analyzing, and communication are in the low category. The highest percentage level on the 4 indicators namely questioning, planning, analyzing, and communication is in the very low category and none of the students have very high skills. This showed that there is a need to increase the research skills of junior high school students by involving them regularly in the research process.

### Acknowledgments

Thank you for all those who have participated and helped author finished this article until it published.

### Author Contribution

Mely Yani: writing original draft, result, discussions; Amprasto: supervision, validation, analysis, proofreading; Rini Solihat: validation, methodology, supervision, conclusion and review.

### Funding

This study did not receive any external financial support.

### Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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