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ANALYSIS OF RESEARCH SKILLS FOR HIGH SCHOOL STUDENTS ON BIOLOGY LEARNING

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Abstract: Research skills are important for students because they can help identify problems, collect sources of information, channel resources for the quality and relevance of research and produce effective solutions to problem solving. This study was conducted in three different schools in the city and district of Cirebon. The three schools include SMA Negeri 1 Sumber, SMA Negeri 1 Ciwaringin and MAN 2 Kota Cirebon. The research method used is descriptive qualitative. The results of this study indicate that students' research skills in Cirebon need to be improved. It is recommended for SMA/MA Cirebon teachers to apply active and collaborative learning methods, such as project-based learning or laboratory experiments, with the aim of improving students' research skills. It is hoped that these steps will contribute to the development of students' critical and analytical thinking skills, and foster independence in research.
Keywords: Research skills, Laboratory, Critical thinking skills, Problem solving

1. INTRODUCTION

The shift in the educational paradigm that is currently happening is one of the characteristics of the era of globalization or also known as the era of openness. This is evidenced by the advancement of science and technology. The arrival of the 21st century has resulted in a fundamental change in the nature of learning (Hasibuan, 2019). Given this transition, there is a clear imperative to move away from a traditional, teacher-centered approach to learning to a more student-centered approach (Junedi, Mahuda, & Kusuma, 2020). In the 21st century, knowledge depends on knowledge and skills. Furthermore, the role of skills in 21st century learning is very important (Mardhiyah, 2021).

The National Education Association has defined the "4Cs" as 21st century skills, including critical thinking, communication, creativity, and collaboration. In the context of 21st century skill development, educators have a responsibility to inspire students to engage in the learning process. Therefore, effective communication between teachers and students is very important in the teaching and learning process. Student socialization is very important, because the period of students is a period of play (Septikasari, 2018).

The main competency that must be present in students in order to be involved during learning is communication skills. Communication skills are defined as students' ability to convey emotions and thoughts to others in a clear and effective way, both verbally and in writing (Nana & Pramono, 2019). Communication skills in the research process can be realized in the form of scientific papers in the form of reports. As defined by Bahdin (2005), a research report is a written document that provides an explanation of the methodology and findings of a research project (Mayasari, 2021). Basically, the process of researching is a relatively easy process. However, many students find it difficult to understand. This can be due to a lack of engagement with the subject matter and/or a tendency to doubt the veracity of the information obtained. Usually, students gain knowledge through classroom learning (Maknun, 2020).

The ability to conduct research is essential, as it allows individuals to identify problems, access information sources that can facilitate problem solving, evaluate resources in terms of research quality and relevance, and identify effective solutions to problems. Research plays a very important role in the advancement of science and technology. Through research, the quality of education and the achievement of competencies in any field can be measured. Furthermore, research offers many benefits in terms of problem solving, both in terms of product outcomes and process-based problem analysis. In the field of biology, research skills have a very important role. The acquisition of these skills can be facilitated through an experiential learning methodology. The application of the research skills approach has been shown to facilitate a change in students' perceptions regarding the importance of research, offering them hands-on experience (Maknun, 2020).

Most teachers lack a deep understanding of the scientific approach. Teachers only have student books as aids and rarely apply various learning methods, because each class is not equipped with LCDs. In addition, teachers do not use the surrounding environment for learning activities, which makes it difficult to explain relevant material. In addition, during learning activities, teachers do not follow the Learning Implementation Plan (RPP) properly, because they do not prepare their own lesson plans and only download them from the internet. The discrepancy between the lesson plan and the actual implementation of learning activities is further exacerbated by the teacher's ability to prepare the lesson plan, which greatly affects the effectiveness of the teaching and learning process (Pratiwi, 2017).

Many high school students do not have enough experience in conducting research independently. Students may find it difficult to formulate a research problem, find relevant sources

of information, or analyze data. High school students are often faced with a heavy learning load. They must take various subjects, do assignments, and prepare for exams. This can make it difficult for them to take the time and energy to do research. And not all schools have adequate facilities and resources to support student research activities. Limited access to libraries, laboratories, or the internet can be an obstacle in the research process (Devitasari, 2023)

Based on the problems that the researcher found, it was found that a problem that can be reviewed for further research is related to the analysis of research skills as one of the skills of the 21st century in Biology learning in several Senior High Schools (SMA) and Madrasah Aliyah (MA) in Cirebon, West Java. This research needs to be carried out because research skills are one of the most important abilities that 21st century students must have in order to effectively overcome global challenges, especially in the field of biology education. The purpose of this research is to ascertain how students are able to conduct scientific research, understand the research process, and develop critical and analytical thinking skills during the learning process. It is hoped that the findings of this study will provide a comprehensive understanding of the proficiency of students' research skills in Cirebon.

Knowledge related to how the level of research skills of high school/MA students in Cirebon in learning Biology, aspects of research skills that are most dominant and still need to be improved in high school/MA students in Cirebon, and how the effectiveness of Biology learning in improving research skills of high school/MA students in Cirebon is the main focus in this study. The findings of this study have the potential to contribute to the progress of theoretical studies in the field of biology education, especially those related to student research competence.

2. RESEARCH METHODS

The research was conducted in three different schools in Cirebon City and Regency, namely SMA Negeri 1 Sumber, SMA Negeri 1 Ciwaringin, and MAN 2 Cirebon City. The research was carried out in the odd semester period of the 2024/2025 school year, precisely from 15 to 26 October 2024. The research method used in this study is qualitative descriptive. The subjects of this study are students and educators at SMA Negeri 1 Sumber, SMA Negeri 1 Ciwaringin, and MAN 2 Cirebon City. Data were taken from 5 educators and 100 students including 2 Biology teachers and 35 students at SMA Negeri 1 Sumber, 1 Biology teacher and 35 students at SMA Negeri 1 Ciwaringin and 1 Biology teacher and 30 students at MAN 1 Cirebon City. The sampling technique in this study was through a closed questionnaire for students and interviews for educators.

3. RESULTS AND DISCUSSION.

A. Level of Research Skills for High School/MA Students in Cirebon

Critical thinking, creativity, communication, and cooperation are research skills. These skills are essential for achieving academic goals and solving everyday problems. Research skills will make students better prepared to face challenges in the international world. Biology learning in schools is usually teacher-centered and less varied. As a result, students are not involved in research. Many educators still use conventional methods, which take away enough research experience from students.

Most of the high school and secondary school students in Cirebon do not have good research skills. Formulating a research problem and analyzing data are two very difficult tasks for many students. To compile a research report, the most important skill is communication skills. The ability to think critically and analyze information must be improved. The main obstacles are the high learning load, lack of research experience, and limited facilities. Research resources such as libraries and laboratories are not available to many students. The students' ability to write research reports is shown in Figure 1. The ability of students to write the following research reports.

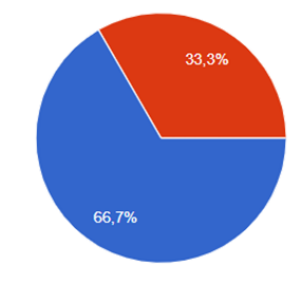

Figure 1. Students' Ability to Write Research Reports

This is in accordance with the results of a questionnaire given to high school/MA students in Cirebon regarding the writing of research reports. As many as 66.7% of students answered yes, and as many as 33.3% answered no. This shows that students are not yet fully able to write biological research reports systematically. Students often face the task of formulating research problems, seeking information, and analyzing the data they collect. Students are hesitant to apply critical thinking skills in this process due to a lack of understanding and practice.

In addition, many students have difficulty mastering the communication skills necessary to write reports and deliver research results. It is very important that the research report explains the methodology and results systematically and clearly. Unfortunately, many students do not have the

ability to produce reports that meet academic requirements. The results of research often do not reflect the potential and efforts that have been made. However, students' academic responsibility is also an obstacle.

The results of interviews with teachers from various schools show that Cirebon High School/MA students have quite good research skills. However, there are some components that need to be improved. Students have different motivations and disciplines to influence these skills, some students have a strong understanding of research, while others still need guidance. The purpose of contextual learning, projects, and problems is to increase student participation. However, the measurement of research skills specifically has not been carried out, which suggests that a more thorough evaluation is needed.

Research skills include observation, hypothesis formulation, problem formulation, and result reporting. Knowing how to use laboratory equipment and understanding work procedures is still a problem. Teachers suggest models of inquiry and discovery and project-based learning and problem-solving to encourage students to conduct research. It is hoped that students can use collaborative presentation methods to develop students and report research results. To improve students' research abilities in the future, greater hands-on support and innovative teaching approaches are needed.

The results show that high school students in Cirebon are not ready to face the challenges that come with the digital and technological era. In addition, this study shows that many teachers do not understand the scientific approach thoroughly in teaching. Many people only learn from textbooks, without using various other learning media or the surrounding environment available.

B. Aspects of Research Skills that Need to Be Improved

The importance of research ability is not only limited to the academic world, but also to the professional environment. Today's companies are increasingly looking for graduates who have the ability to overcome challenges, demonstrate innovative thinking, and demonstrate independence in their work (Haryanti, 2024). Training for students to solve a particular problem instills their ability to generate the right information, analyze it, and realize the need to re-examine the results obtained (Cahyani, 2017).

Based on the data that has been obtained by the researcher, there are several aspects of student research skills that need to be improved. Several aspects of these research skills were obtained through the results of the dissemination of questionnaires and interviews with Biology teachers in each school. The first aspect of research skills is related to the presentation of graphs or diagrams. Where based on the questionnaire that has been filled out by students, as many as 50% of

students have not been able to make graphs or diagrams to present Biology research data. This indicates that further direction is needed so that students can make graphs from the results of the research that students conduct. The results of this ability are shown in Figure 2. The student's ability to present the following graph or diagram.

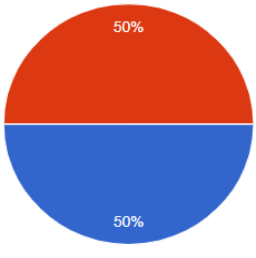

Figure 2. Students' Ability to Present Graphs or Diagrams

The use of graphs as a mathematical tool is a common practice, because the process of communicating through graphical representation requires mathematical skills such as visual perception, logical reasoning, plotting data, predicting line movements, and inferring relationships between variables (Tamyiz, 2020). The purpose of a graph is to accurately describe quantitative data, illustrate developments, or provide a concise and clear comparison between related objects or events. Unlike charts, graphs are based on mathematical principles and use comparative data (Pebrianti, 2019).

Second, students' speaking skills must be improved. In research, this ability is especially seen when students present the results of their research in front of others, both in the form of verbal and nonverbal communication, in the form of reports. Based on the data obtained, 57.1% of students agreed, 23.8% of students strongly agreed, and 19% of students disagreed. These findings suggest that students have the ability to articulate their research results coherently to peers and lecturers. However, some students still show an inability to think about the results of their research. This observation highlights the need to improve students' speaking skills shown in Figure 3. The students' ability to speak is as follows.

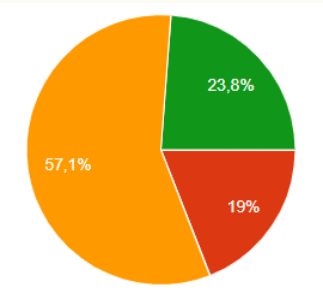

Figure 3. Students' Ability to Speak

Speaking is defined as a form of language that involves the use of articulation or words to convey meaning (Chadijah, 2023). According to Hurlock (Quoted from Irwansyah, 2021), the process of language acquisition can be conceptualized as a process that consists of three different but interrelated phases including pronunciation, vocabulary development, and sentence formation. The development of this language can be developed through the domestic environment and education. Based on this statement, speaking skills are very important for students to have so that there is no misperception of the results of the research they conduct. In addition, speaking skills will also help students in conveying their intentions and goals.

Research skills related to the process of information transfer by students are important (Figure 4. Students' ability to evaluate information). Based on the data obtained, 59.5% of students stated that they agreed, 19% strongly agreed, and 21.4% disagreed. This suggests that some students were unable to communicate the accuracy and relevance of the information found during the study, while others failed to investigate the accuracy and relevance of the information found.

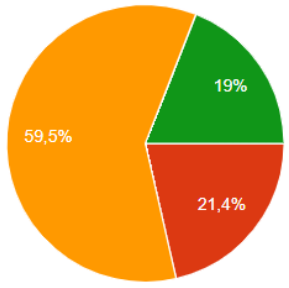

Figure 4. Students' Ability to Evaluate Information

The biggest challenge in the implementation of information literacy in educational institutions lies in the internal institutions themselves. These challenges include the lack of information literacy among school teachers and library staff, the lack of school policies for information literacy programs, and the lack of information literacy programs in school libraries. As a result, students are unable to search, trace, process and disseminate information effectively and efficiently (Kurnianingsih, 2017). This is supported by the results of joint interviews with Biology teachers, where literacy programs in schools are not maximized.

The aspect of counting is also something that needs to be improved in the next component of research skills. Based on the data obtained (Figure 5. students' ability to count), as many as 54.8% of students answered yes, 9.5% of students answered strongly agree and as many as 33.3% of students answered disagree. This shows that there are some students who are not able to know/perform simple statistical calculations to analyze research data. The process of counting is

certainly inseparable in the research process in learning Biology.

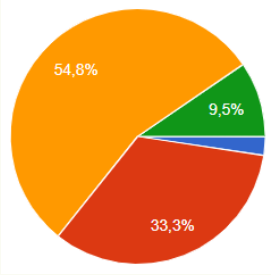

Figure 5. Students' Ability to Count

The ability to perform mathematical calculations is an inseparable part of the mathematics learning process and is a fundamental prerequisite for the development of mathematical competence. The acquisition of numeracy skills is the most important thing in the process of solving problems in the daily environment. The interaction of linguistic and mathematical numeracy skills plays an important role in the development of students' cognitive abilities. Through their linguistic abilities, students demonstrate a high level of sensitivity to their environment and use verbal communication to express their inner world (Napfiah, 2023).

The last aspect of research skills that needs to be improved is the ability of students to work independently. Data (Figure 6. The students' ability to work independently) collected showed that 45.2% of students agreed, 9.5% strongly agreed, 33.3% disagreed, and 11.9% strongly disagreed. This suggests that most students are able to conduct research independently, albeit sometimes with external support. However, it should be noted that a small percentage of students still rely on external support.

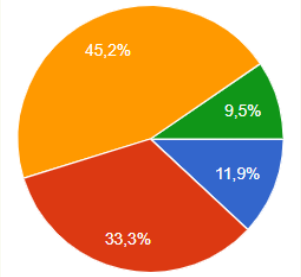

Figure 6. Students' Ability to Work Independently

In the modern education paradigm, learning independence plays a central role in achieving learning goals, where the focus is on the activeness of students in fulfilling their potential. This is based on the idea that students will be empowered to determine the various learning methods needed to achieve the desired learning outcomes, in accordance with their respective aspirations and needs

(Pratiwi, 2016). These findings are in line with the results of interviews with subject teachers where the most important indicator of research skills that students need to improve is how the student portrays himself as a researcher himself. Through independence from themselves, students are encouraged to formulate problem formulations, observe, formulate hypotheses, conduct research, prove hypotheses and make or report the results that have been prepared.

C. The Effectiveness of Biology Learning in Improving Research Skills

Biology learning is effective in improving research skills because it places students as active subjects in the learning process. Methods of inquiry, experimentation, project-based learning, as well as the use of technology and performance-based assessment help students develop scientific research skills. In the 21st century, it is clear that knowledge is not the only factor that contributes to effective learning. Skills development is also an important element in this context (Mardhiyah, 2021). To increase the effectiveness of biology learning in improving research skills, there are several things that need to be considered. First, teachers can use active and collaborative learning methods, such as project-based learning or laboratory experiments. This will help students to be more actively involved in the learning process and improve their research skills. At the same time, it develops students' science process skills. Science process skills (PPP) are an important foundation for developing research skills. By mastering PPP, students can conduct research systematically, think critically, solve problems scientifically, and build a deeper understanding of science concepts.

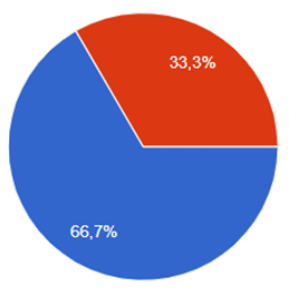

Figure 7. Students' Ability to Collect Data

This is in accordance with the results of the questionnaire (Figure 7. students' ability to collect data) that as many as 66.7% of students have collected data systematically and accurately. Meanwhile, as many as 33.3% of students have never collected data systematically and accurately. This Science Process (KPS) skill is important for students to be able to conduct research systematically because KPS provides the foundation and framework needed to carry out structured and directed research. Therefore, the development of PPP must be the main focus in science learning, especially biology.

In biology learning, research skills have a very important role and can be developed through practicum activities. According to Garg et al (2018), a research skills-based approach provides students with hands-on and real experiences, which can ultimately change their view of things that are considered important. Through research activities, students are invited to actively find out, analyze, and draw conclusions from the natural phenomena they observe. These skills not only train students to think critically and systematically, but also foster a high curiosity about the world around them.

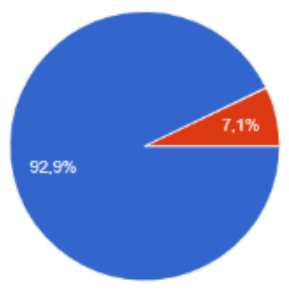

Figure 8. Students' Ability to Draw Conclusions

The results of data collection through student questionnaires stated that as many as 92.9% of students were able to draw conclusions from the observation results. Meanwhile, as many as 7.1% of students have not been able to draw conclusions from the observation results. Activities such as observing, asking, trying, thinking logically, communicating, and creating are part of the learning process. In addition, the development of research skills is one of the main goals in education. Current research is considered one of the important elements in learning in the educational environment, especially in the field of Biology which is a core of science and scientific learning (Putriani & Hudaidah, 2021).

Through experiments, practicums, and research projects, students are trained to design, implement, and analyze research results. This learning develops analytical skills, critical and logical thinking, and scientific communication. Thus, students are prepared to face challenges in the fields of science, technology, and health. Therefore, it is important to implement effective learning strategies such as project-based learning, discussion, and the use of technology.

The research skills approach produces direct student experience, so that it can change students' views on various important things (Bortnik et al., 2017). Research skills are not only essential for success in science but also for facing challenges in an increasingly complex world. In the learning process, a teacher must be able to help students develop research skills. The competence of qualified teachers or educators is very important in improving the quality of a country's human

resources. Therefore, it is natural that an educator needs to have superior capabilities. However, the reality in the field shows that there are still many teachers who do not have adequate competence. Especially in designing learning and conducting research (Nurlaelah et al., 2021).

4. CONCLUSIONS AND SUGGESTIONS

CONCLUSION

Based on the results and discussions that have been obtained, it can be concluded that biology learning has proven to be effective in improving students' research skills through active and collaborative learning, such as project-based learning or laboratory experiments. However, there are also aspects that need to be improved, including graphic presentation, speaking skills, information evaluation, numeracy skills, and independence in research. Therefore, intensive training for teachers is urgently needed to integrate information literacy in learning, as well as improve research support facilities to optimize the development of students' research skills comprehensively.

SUGGESTION

Based on the conclusion above, high school/MA teachers in Cirebon are advised to implement active and collaborative learning such as project-based learning or experiments to improve students' research skills. Intensive training for teachers on scientific methodology and information literacy integration is also important. In addition, research support facilities such as laboratories and access to teaching materials need to be improved. These steps are expected to develop students' critical thinking, analytical skills, and independence in research.

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