

## THE IMPLEMENTATION OF DISCOVERY LEARNING IN NATURAL SCIENCES MODULE TO IMPROVE SCIENTIFIC COMMUNICATION ABILITY OF JUNIOR HIGH SCHOOL

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### ABSTRACT

This research to determine the implementation of discovery learning science modules to improve scientific communication skills. Communicating is one of the 21st-century abilities that is needed and essential for today's generation. Communication is a way of presenting information to the public verbally or in writing. The process of delivering information requires expertise in speaking appropriately and using communicative language. This research method was quasi-experiment design with a pretest-posttest control group design. The sample was VII class as many as two classes in school A (high category) and school B (low category) in the Magetan Regency. The results showed that scientific communication skills in the experimental class of school A were 81.75% in the highly skilled category, while the control class was 71.84% in the skilled category. The control class of school B was 78.25% in the skilled category, and 63.84% in the control category was quite skilled. The results of scientific communication tests with n-gain were that the experimental class of school A was 0.79 high category, while the control class was 0.71 in the high category. Control class of the school B was 0.69 in the medium category, and the control class was 0.62 in the medium.

**KEYWORDS:** Discovery Learning, Module of Natural Science, Scientific Communication

### 1. INTRODUCTION

Communication is one of the skills that are the focus of discussion in partnership 21 (P21). 21st-century education refers to four competencies known as 4C, namely creativity, critical thinking, collaboration, and communication. Communication is needed for the world of work and industry. Communication skills play an essential role in life and professionalism. The world of corporate work requires people who have good communication and technical skills. Likewise, with education, communication skill is required. The effectiveness of receiving and delivering information determines a person's success factor (Rajendra Mahajan, 2015; Jeroen Kuntze, 2016). Communication is not just the ability to convey information. Communication is more than a set of speaking skills. Someone makes a statement driven by specific goals, personalization, and flexibility (Cees van der Vleuten, 2019). These competencies are learned and trained in a supportive environment so they can become more proficient and skilled.

Teaching by practicing communication is carried out from elementary to college level. Many methods are used to develop communication skills at school through writing reports, conversations, or learning electronically. The education and teaching process involves communication

competencies in disseminating knowledge. Competence is part of building knowledge as an educational product. The existence of this competency is assessed to modify the findings of new knowledge (Marina, 2010). The field of education emphasizes the importance of communication, primarily verbal, for students' success and professional future (Sherwyn P. Morrealea et al., 2017). Communication in learning science is specified as scientific communication. It is the delivery of the results of scientific knowledge from the results of research and studies to the intended group for various purposes (Samatowa, 2010). The results obtained through practical activities, field studies, interviews, or the results of studies from various sources are used as a major part in conveying new knowledge. There are two types of communication in the form of written communication and oral communication. Written communication is the delivery of knowledge through written activities that can be in the form of reports, journals, articles, drawings, schemes, graphics, or patterns. Meanwhile, oral communication can be in the form of delivering ideas, opinions, and research results directly to the recipient.

So far, science learning has not prioritized scientific communication orally or in writing. Science in schools is only limited to memorizing similarities and concepts obtained from books. The teacher has not trained direct experience in the form of 'hand-on' or 'mind-on.' Knowledge of concepts obtained by students is not conveyed to the public because the learning model applied does not develop abilities in building scientific knowledge and communication. The impact for students, if only the science learning routine by memorizing, makes the ability to understand does not become whole and tends to forget.

The application of verbal communication can be trained with group activities, exchange thoughts and ideas, and convey the results of discussions with presentations. Through group activities, students complete assignments or practicums. Then, oral communication occurs, which is scientific and based on facts. The activities take place not only during the practicum but also after the practicum, and students are trained to communicate in writing with the reporting of performance results. A learning model that can accommodate student activities in building knowledge is discovery learning. Discovery learning is part of the levels of inquiry initiated by Wenning. This learning model helps students to develop concepts based on experiences guided by the teacher (Wenning, 2005). There are five types of levels of inquiry, namely discovery learning, interactive demonstration, inquiry lessons, inquiry laboratories, real-world applications, and hypothetical inquiry (Wenning, 2005). The syntax of discovery learning in the form of observation, manipulation, generalization, verification, and application encourages students to be able to express opinions scientifically.

The discovery learning model is a learning model that directs students to form concepts or build knowledge from experience with teacher guidance. Discovery learning teaches students how to be an independent and thorough inquiry to gain new knowledge. Previous students have gained experience.

## 2. MATERIAL AND METHODS

This research method was quasi-experiment design with a pretest-posttest control group design. The study population was all students of SMP A and SMP B in Magetan district. The sample of this research was students of VII class in SMP A and VII class in SMP B, each of which was an experimental class and a control class. It was 214 students.

Group	Pretest	Treatment	Posttest
Experiment	O <sub>1</sub>	X <sub>1</sub>	O <sub>2</sub>
Control	O <sub>3</sub>	X <sub>2</sub>	O <sub>4</sub>

Categorizing schools was by referring to the results of the national exam scores for the 2019/2020 school year. The research instrument was in the form of scientific communication observation sheets and scientific communication test questions. The observation sheet was for knowing students' scientific communication skills verbally and the test questions for knowing students' scientific communication skills in writing. There were three indicators of a scientific communication test: making tables, drawing, and explaining pictures and their meanings. The indicators of the observation and test sheets are as follows. Each indicator has a rating scale of 1-3.

**Table 1. Scientific Communication Indicators**

Indicators of Scientific Communication	Indicator of Achievement	Assessment Method
Listening and observing	a. Focus on delivery b. Submitting questions/statements	Non-test
Scientific writing	a. Discussion of the results of the investigation b. Accuracy of writing	
Delivering knowledge	a. The ability to convey material and appearance b. Language usage <ul style="list-style-type: none"> <li>• The language is easy to understand</li> <li>• Structured language</li> <li>• Right intonation</li> <li>• Clear articulation</li> <li>• Does not contain multiple meanings</li> </ul>	
Information statement	a. Make tables, draw, and explain pictures and their meanings	

There were two types of data analysis, namely for non-test scientific communication using the percentage of the number of abilities obtained by students. Whereas, the test of scientific

communication is examined by calculating the n-gain value, namely pretest minus the posttest value, then categorizing it into three criteria. Figure 1 shows the calculation method for non-test scientific communication.

$$P = \frac{\text{score average}}{\text{score maximum}} \times 100\%$$

**Table 2. Percentage of Non Test Communication**

Percentage (%)	Category
≥81	Highly Skilled
66-80	Skilled
46-65	Quite
≤45	Less

**Table 3. N-gain of Scientific Communication With Test**

Indeks	Category
0,7 < g < 1	High
0,3 ≤ g ≤ 0,7	Medium
0 ≤ g ≤ 0,3	Low

### 3. RESULTS

Research on the implementation of discovery learning modules to improve scientific communication used two schools that had different categories, namely high schools, and low schools, in order to find out the success of the modules in several schools. The discovery learning module has a syntax of discovery learning by integrating scientific communication indicators. The application of discovery learning modules directs students to explore newly acquired knowledge and experiences they have gained. Students conducted investigative activities to find out the truth and prove a concept.

The results of the analysis of the implementation of discovery learning models in the two schools are as follows.

**Table 4. The Result of Scientific Communication by Non Test**

Indicators of Scientific Communication	School A		School B	
	Experiment Class	Control Class	Experiment Class	Control Class
Listening and observing	77,99%	69,14%	77,47%	60,54%
Scientific writing	82,55%	72,26%	79,17%	64,58%
Delivering knowledge	84,72%	74,13%	78,12%	66,41%
Average	81,75%	71,84%	78,25%	63,84%
Category	Highly Skilled	Skilled	Skilled	Quite

**Table 5. The Result of Scientific Communication by Test**

N-gain Score	Indicators of Scientific Communication			
	Make table	Make a draw	Explain pictures and their meanings	
School A	Experiment Class	0,84	0,78	0,75
	Average	0,79 (High)		
	Control Class	0,77	0,68	0,69
	Average	0,71 (High)		
School B	Experiment Class	0,71	0,71	0,66
	Average	0,69 (Medium)		
	Control Class	0,55	0,64	0,68
	Average	0,62 (Medium)		

The effect of using modules to improve scientific communication can be seen based on the results obtained by students through observation or tests.

**4. DISCUSSION**

The main essence of discovery learning is an inquiry. An inquiry is generally described as the process of obtaining information from phenomena through the investigation of Shamsudin N M, Abdullah N & Yaamat N (2013). The learning step starts with (1) observing phenomena that occur around the environment; (2) manipulation, students conduct investigations; (3) generalization, students build the principles of the event; (4) verification, students make predictions from the results obtained and collect findings; (5) application, students make conclusions (Wenning, 2011). Student activities in each step lead to building knowledge. Activities carried out in groups can develop communication skills to facilitate the investigation.

Scientific communication was in the form of oral consisting of listening and observing and delivering knowledge while in writing was scientific writing and information statement (Levy, 2008). Submitting scientific communication verbally means expressing ideas, thoughts, and results. Effectiveness in delivering materials to students in the class can be influenced by one's understanding of the depth of the material, mastery of the class, and courage in speaking. Communication takes place effectively is determined by the situation and social relations between communicators and communicants as well as extensive and meaningful experiences (Suryadi, 2010). The discovery learning model provides opportunities for students to maximize their five senses in conducting investigations and searching for information from relevant sources. This process of acquiring knowledge requires communication skills because it collects as much information as possible and conveys it to others. The delivery of knowledge will be successful if a communication relationship is established between the teacher and students and among fellow students (Marfuah, 2017). Discovery learning also helps students develop thoughts or ideas in solving problems, so

students easily understand knowledge, easily remember, and be in long-term memory, so that it impacts on learning outcomes (Suryadi, 2010). Investigations in science use a scientific approach that is observing, questioning, experimenting, associating, and communicating. This process trains students to think scientifically and rationally so students will develop attitudes, knowledge, and skills that are in line with the nature of science.

The role of the school and teacher environment can change the way students think and communicate. The teacher's contribution to inviting students to speak or write is implemented in the learning process, and students are trained to be brave and not afraid of being wrong. A comfortable classroom atmosphere supported by modules has a positive impact on the willingness to learn and interact. Aflatin and Martaniah (1998) state that individual confidence is trained by social interaction, independent thinking, and not afraid to do wrong. Freedom of students in expressing everything that is thought in the learning process by way of discussion. Activities such as question and answer, questions that fit the purpose, and construct new knowledge can be a way for students to be brave and confident (Purwasih, 2015). The implementation of learning that prioritizes scientific communication can increase the role of students so that learning becomes interactive and reflective has confidence, understands goals and values, and is involved in evaluating and reflecting (Ann Harris & Zhong Hua, 2018).

The difference between school A (high category) and school B (low category) had the result that school A was better in oral and written scientific communication. The ability to deliver, which was good, directed, and focused on the intended discussion, makes it easy for the recipient and the response. It indicates that the communication was built successfully. Students in school A had a great curiosity, were easy to think openly, and had good reasoning abilities, so the process of giving and receiving information became easier. As for school B, many students still needed training in expressing opinions and writing appropriately. Ineffective communication can be caused by several factors, namely the influence of social status, language used, the vastness of ways of thinking, cultural differences, disruption of the physical environment, inappropriate delivery media, and no response from the recipient (Wisman, 2017).

Each student has innovative potential and creativity. This potential is a tool for improving students' intellectual and social abilities. Students who can provide many ideas and opinions can direct a group to be able to follow or support, and it is crucial to direct the scientific communication skills to be more meaningful. The ability to speak well, precisely, and effectively is the key to success in the 21st century, because the world of work requires people who are competent in managing a project, convincing colleagues, or looking for consumers. If effective communication can be realized, the productivity, level of trust, and employee satisfaction are higher. The relationship between superiors and subordinates becomes more professional, enthusiasm, optimism, and presents ideas and solutions in dealing with problems (Ardiansyah, 2016). Job satisfaction can be influenced by leadership communication (Kumari, 2011).

Ongoing training to develop student scientific communication needs to be a particular concern, especially for students who are still at the elementary and secondary levels. Teachers must be able to convey effective communication to make positive relationships with students and make learning more memorable (Gursimsek, Vural, Demirsoz, 2008). The urgency of scientific communication can bring change for individuals to be able to face future challenges, prepare creative individuals in presenting ideas, and primarily compete in the world of work.

## 5. CONCLUSION

The results scientific communication skills using natural science module discovery learning in the experimental class of school A were 81.75% in the highly skilled category, while the control class was 71.84% in the skilled category. The control class of school B was 78.25% in the skilled category, and 63.84% in the control category was quite skilled. The results of scientific communication tests with n-gain were that the experimental class of school A was 0.79 high category, while the control class was 0.71 in the high category. Control class of the school B was 0.69 in the medium category, and the control class was 0.62 in the medium. Science learning through discovery learning module encourages students to develop scientific communication skills.

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