

IMPLEMENTATION OF THE POGIL LEARNING MODEL INTEGRATED MIND MAP BASED ON ONLINE LEARNING TO IMPROVE COMMUNICATION AND COLLABORATION SKILLS OF AL MAARIF SINGOSARI ISLAMIC SMA STUDENTS

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Abstract—Communication and collaboration skills must be possessed in the 2013 curriculum learning to face the fierce job competition in the 21st Century. The results of observations and interviews of biology teachers at SMAI Al Maarif, students' communication and collaboration skills are still relatively low. This study aims to improve the communication and collaboration skills of Al Maarif Singosari Islamic High School students through the implementation of the POGIL learning model combined with online learning-based mind maps. This type of research is classroom action research. According to Kemmis and McTaggart, the CAR procedure consists of 4 stages, namely planning, implementing actions, observing, and reflecting, followed by the next spiral cycle. The research subjects were 35 students of class XI MIPA 3, totaling 35 people. The data in this study were oral communication and collaboration skills measured using observation sheets and written communication skills using students' worksheets. The results showed that implementing the POGIL learning model combined with online learning-based mindmaps could improve students' communication and collaboration skills. The highest increase in communication skills occurred in oral communication, which was 20,3%. Meanwhile, collaboration skills experienced the highest increase in the compromise indicator, which was 29.03%.

Keywords—*Collaboration; Communication; Mind map; Online Learning; POGIL*

I. INTRODUCTION

The rapid development of Information and Communication Technology in the 21st Century impacts the pace of global competition. In creating a generation that can compete, education must produce graduates who can face the challenges of the 21st Century. Educational Ministry of Indonesia Policy number 21 of 2016 explains that the Graduate Competency Standards in 2013 curriculum learning are based on 21st Century competencies, which contain soft skill competencies formulated by the Partnership of 21st Framework. Century Skills as "The 4C skills: Critical Thinking, Communication, Collaboration, and Creativity".

Communication and collaboration skills are two of the four competencies that must be developed in students. Permendikbud No. 20 of 2016 explains that the competency standards of education unit graduates in skills include having thinking and acting skills such as: productive, critical, creative, independent, collaborative, and communicative. Marzano in Hayat et al. (2019) explained that communication and collaboration are essential aspects of lifelong learning. A person can learn for his future life requires communication to express his ideas and collaborate with others. Students need to be able to communicate their thoughts clearly, both orally and in writing.

Indriwati et al. (2018) explained that basically everyone needs to express ideas, organize thoughts, and solve problems. In the implementation of biology learning, there must also be good communication between students and teachers. Students need communication to easily communicate or convey things related to the material being taught (Sendjaja, 2014). Supported by the statement, Choridah (2013) states that communication is a skill that needs to be improved because students can be actively involved in learning with communication.

Collaboration skills are also a key skill that 21st-century students must possess and are identified as important educational outcomes (Nahdi, 2019; Permendikbud, No. 20 tahun 2016; Keterampilan Abad 21). Students must be

trained to collaborate with their peers in the classroom to explore information, build meaning in learning, appreciate the strengths and talents of each person, and take on roles and adapt to them (Zubaidah, 2016). Collaboration can build students' empathy and care for others. Collaboration involves the active participation and positive dependence of students who have low and high abilities to solve academic problems and daily life problems. It can help students who have low abilities to be able to achieve predetermined learning goals and (Suyatno, 2009; Burns et al., 2014; Jones & Vall, 2014; OECD, 2015).

The initial observations on August 10-21 September 2020 at SMA ISLAM AL MAARIF SINGOSARI found that students' collaboration skills were still low. Interaction between students has occurred, but only discuss things outside the lesson. Student participation is less during group work. Some students talk to themselves, play, and also play with gadgets. The unclear division of tasks between group members, lack of respect among group members, and lack of sense of responsibility for the tasks assigned by the teacher make it difficult to achieve the learning objectives set by the teacher.

The results of the initial observations also showed low communication skills. This is shown when students are allowed to ask and argue. Only about 1/3 of all students dare to have an opinion or ask questions. In addition, when appointed to have an opinion, students tend to read answers from books without understanding the meaning of the material. An interview with a Biology teacher at Al-Maarif Singosari Islamic High School on November 08, 2020, supports the results of initial observations about students' low communication and collaboration skills. Not all students actively discuss and contribute in groups. Collaboration occurs when students are in a group with friends they like only to achieve common goals. Several things that cause the low communication and collaboration skills of students are: 1) lack of variety of learning strategies, so students are less interested in following lessons, 2) students are less active in learning activities, 3) learning is more teacher-centered (Bahtiar, 2016)

The COVID-19 pandemic that has hit the world since 2020 has impacted all aspects of life, including education. The form of learning used as a solution by the government during the pandemic is online learning. On the other hand, online learning has become a world demand in the last few years and is needed in learning in the 4.0 industrial revolution era (Sadikin & Hamidah, 2020). *Online learning brings together teachers and students to carry out learning interactions with the help of the internet (Kuntarto, 2017)*. According to Sadikin & Hamidah (2020), online learning connects students with their learning resources (databases, experts/instructors, libraries) that are physically separated or far apart but can communicate, interact or collaborate either directly/synchronously or indirectly/asynchronously. Through online learning, students are not constrained by time and place. Students can take lessons from anywhere (Sadikin & Hamidah 2020).

One of the student-centered learning models that can improve students' communication and collaboration skills is POGIL (Process Oriented Guided Inquiry Learning). POGIL is a learning model that combines cooperative and guided inquiry activities. The POGIL learning model emphasizes a student-centered process to provide opportunities for students to be active and construct their understanding through discussion groups (Mulidiawati & Soeprodjo, 2014). POGIL learning can develop students' abilities in processing information, communication, teamwork, management, and self-assessment (Straumanis, 2010; Jasperson, 2013). According to Hanson (2006), the stages or phases of POGIL learning consist of orientation, exploration, concept discovery, application, and closing stages. The study by Rahman et al. (2018) showed that the POGIL model improved oral and written communication skills in the urinary sub-concept. Jasperson's (2013) research also shows that the POGIL model improves students' communication skills, science process skills, and concept mastery.

Mind maps are creative note-taking methods that make it easier for students to remember much information (Buzan, 2005). The integration of mind maps into the learning model can improve students' communication and collaboration skills. According to Kurniasari's research (2014), learning mind maps can improve communication skills. Students who carry out mind map presentations are easier to understand and remember concepts that have been conveyed to the audience as communicators, so students are not only glued to reading the text and at least make eye contact with other students even though students are in a stressful situation in front of the class (Milati & Rafaini, 2017).

Coogle™ software can facilitate creating collaborative mind maps in online groups so that it is expected to train students' collaboration skills. According to Sutton in Dewantara (2019), In addition to having advantages in terms of the appearance of making mind maps using Coogle™, it is also equipped with interactive capabilities from software that facilitates collaboration and discussion columns for making mind maps. In addition, the reason for integrating mind maps into the POGIL learning model is that it can support the role of the POGIL learning model to improve learning constructivism. In accordance with Miranti & Wilujeng (2018) opinion, which says that mind maps can support learning constructivism based on learning design.

Based on the description above, this study aims to improve student's communication and collaboration skills through the POGIL Model combined with an Online learning-based Mindmap at SMA Islam Al Ma'arif Singosari.

II. METHOD

This type of research is classroom action research (CAR), which consists of 2 cycles. Each cycle consists of 4 stages according to Kemmis and McTaggart, namely planning, implementing actions, observing, and reflecting, which is followed by the next spiral cycle. This research was conducted in class XI MIA 3 SMA Islam Almarif Singosari, Jl Masjid Number 28 Singosari, Malang, East Java, and lasted from November to May. The subjects of this study were students of XI MIA 3, which consisted of 35 students, 15 male students, and 20 female students. The data in this study were obtained from the observation sheet on the implementation of learning syntax, which the observer filled out, the observation sheet for oral communication skills and student collaboration guided by the indicators of assessment of oral communication and collaboration skills by Greenstein (2012) and the written communication data of students guided by the indicators of the assessment of written communication skills.

This classroom action research starts from the pre-action stage. In the pre-action stage, a needs analysis was carried out through interviews with biology teachers and observations of learning in class XI MIA 3. The solution to overcome students' low communication and collaboration skills was the implementation of the POGIL learning model combined with online learning-based mindmaps on the Respiratory System material (cycle I) and Excretory System (cycle II). The stages in this research consist of (1) planning, (2) implementation, (3) observation, and (4) reflection.

Data analysis in this study was carried out qualitatively and quantitatively. Quantitative analysis was obtained from data from validation results, observation data on the implementation of learning, observations of oral communication and collaboration, and written communication data. Quantitative data analysis was carried out by calculating the data for each aspect and analyzing by dividing the number of descriptors in each aspect by the maximum scores. Then, the percentage of skills was calculated by dividing the classical score obtained by the maximum score. The criteria for implementing the syntax are successful if a minimum score of 80% is obtained (Sudjana, 2011). Oral and written communication skills are complete if they reach a minimum score of 80% (Sudjana, 2014). Meanwhile, collaboration skills are complete if they reach a minimum score of 75% (Arikunto 2009:44). Qualitative data analysis using data analysis model Miles and Huberman (1992:16).

III. RESULTS

Observation of the first cycle of action was carried out during the learning process with the assistance of 3 observers. The results of observations during learning show that the average classical mastery of students' oral communication skills has increased from cycle I to cycle II. In the first cycle, the classical mastery of students' oral communication skills was 71.78% and increased by 20.3% to 86.37% in the second cycle. Students' communication skills are trained at the presentation time, which is carried out after the concept application stage. Students conduct discussions to answer contextual questions contained in Students Worksheet by applying concepts that have been found in the previous stage. Students also presented the results of the Students Worksheet discussions, which were held face-to-face using Google meet. Students communicate the results of their discussions from the orientation stage to the conclusion. Students also present a mind map that has been made with their group. Other students responded, refuted, and gave suggestions to the group of presenters. Face-to-face presentations and discussions via Google meet can be seen in Figure 1.

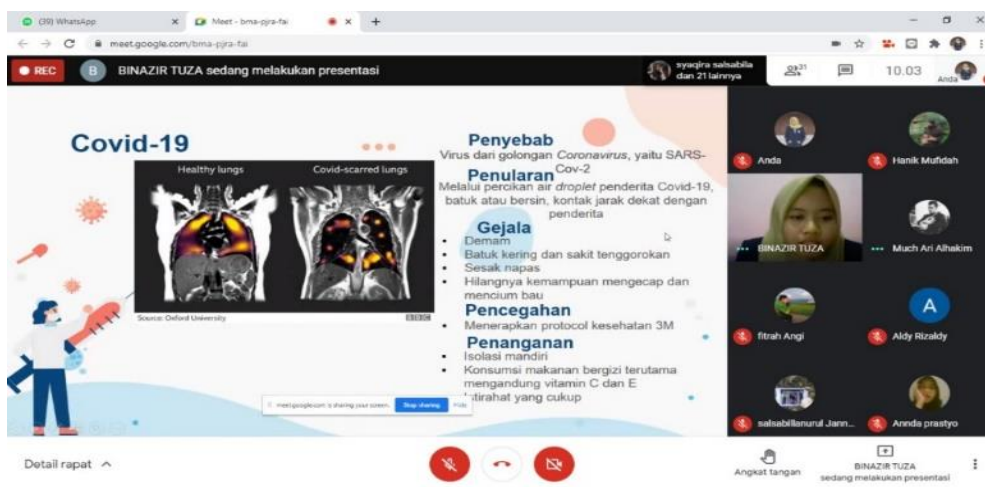
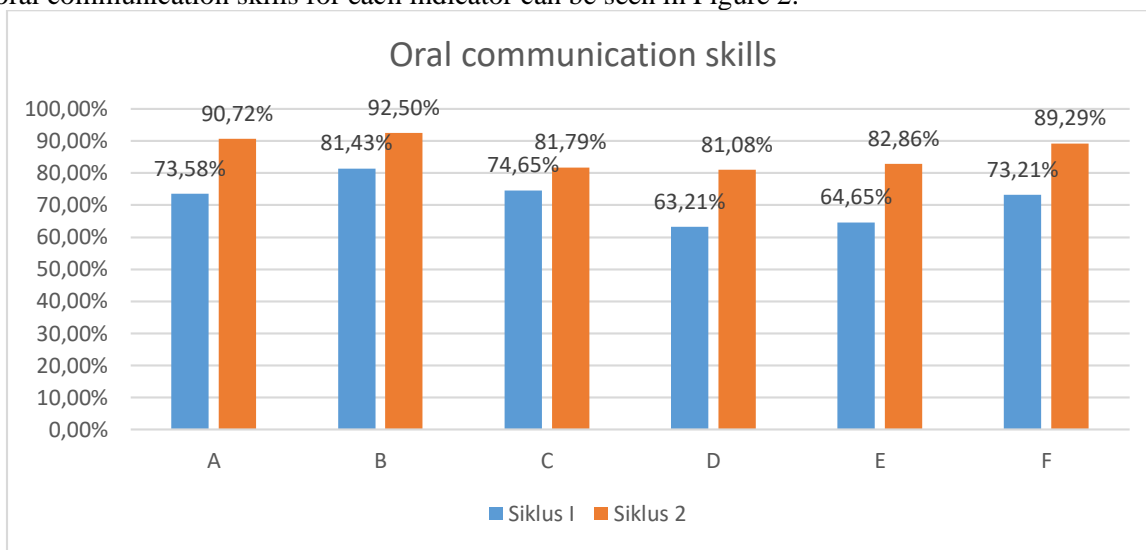


Figure 1. Reinforcement of Material by Teachers about Abnormalities/Diseases in the Respiratory System

In the first cycle, the average classical mastery of students' oral communication skills was still good. In the first cycle, students are still less confident in expressing their opinions or questions. The teacher makes improvements in motivating so that students can be more confident in conveying their ideas/opinions in face-to-face discussion forums. This causes in cycle II almost all students actively ask questions, express opinions, refute, give suggestions, and add answers from other groups so that students' oral communication skills achieve good criteria.

An increase in the score of oral communication skills occurred in all indicators. The highest score increase was found in communicating clearly to achieve the goal, which was 28.16%. This fact interprets that after participating in the POGIL model learning combined with a Mind map based on online learning, students become trained to communicate their ideas clearly so that the audience can understand them. It is proven that in cycle II, almost all students actively communicate their critical questions so that discussions often take place beyond the allocation of learning time. These critical questions include "Why does the color of urine turn purple after eating dragon fruit? What drugs do people with diabetes mellitus inject into their stomachs after every meal? Can people who live with one kidney live a normal life like they have two kidneys in their body? Is the bad impact of cigarettes on smokers the same as cigarette factory workers? What is the effect of varying cigarette prices on their impact on the health of smokers?" and other critical questions.

The second highest score increase was found in the indicator using a communication strategy of 24.86%. This means that students have been able to communicate clearly, accurately, and reflectively in explaining the concept of material at the time of presentation and question and answer so that discussions can run smoothly. The improvement of student's oral communication skills for each indicator can be seen in Figure 2.



Notes:

- A: Oral communication
- B: Receptive communication: listening, reading, identifying
- C: Understand the purpose/purpose of communication
- D: Using communication strategies
- E: Communicate clearly to achieve a goal
- F: Presentation skills

Figure 2. Graph of the Improvement of Students' Oral Communication Skills for Each Indicator

Data on students' written communication skills were obtained from the student's written communication assessment sheet, which was filled out by the teacher based on the student's individual Students Worksheet answers. The assessment results of students' written communication skills showed an increase in the average classical mastery from cycle I to cycle II. In the first cycle, the classical mastery of students' written communication skills was 78.87%

with sufficient criteria and 14.23% to 89.90% with good criteria in the second cycle. The increase in the score of written communication skills was obtained from the improvement of learning in cycle II.

The increase in written communication skill scores occurred in all indicators. The increase in the highest written communication skill score was found in logical and orderly indicators with a percentage of 22.27%. The data can be interpreted that after going through the POGIL model learning combined with online learning-based Mind maps, students have developed ideas well by using many relevant and critical sources and arranging them logically in paragraphs when working on Students Worksheet. Students' written communication is also trained through the stage of making group mindmaps because there is discussion and interaction between students in the process. The classical mastery score of written communication was higher than oral communication in cycles I and II. This indicates that students tend to be more confident in communicating their ideas/opinions in written form than verbally. The improvement of student's written communication skills for each indicator can be seen in Figure 3.

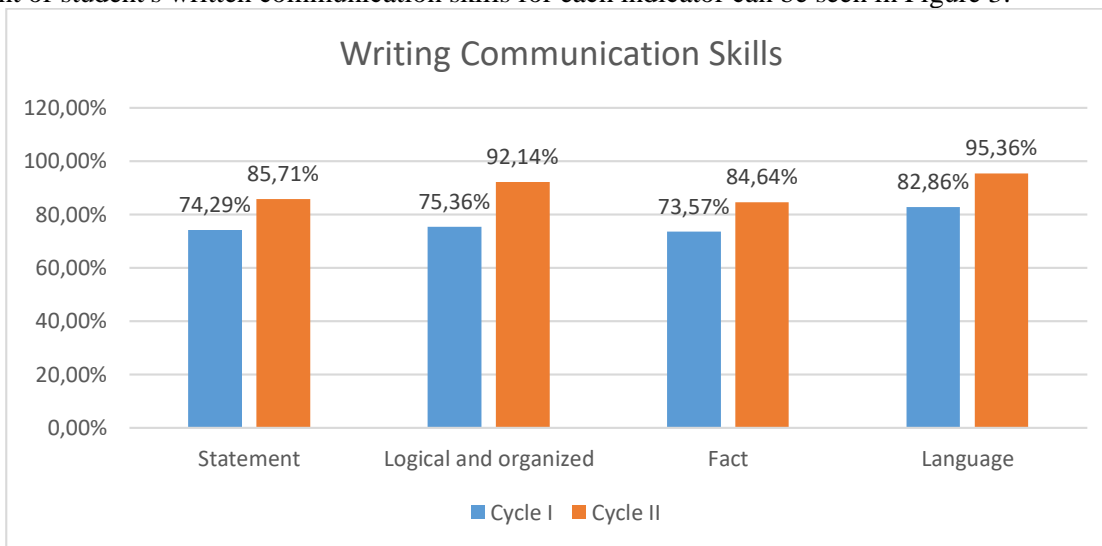


Figure 3. Graph of the Improvement of Students' Writing Communication Skills for Each Indicator

Data on student collaboration skills were obtained from observation sheets by observers filled out at the discussion stage and making mind maps. The results of observations during learning show that the average classical mastery of students' collaboration skills has increased from cycle I to cycle II. In the first cycle, students' classical mastery of collaboration skills was 71.6% in the good category and increased by 22.31% to 87.58%, with a good category in the second cycle. The increase in collaboration skills scores was obtained from the improvement of learning in cycle II. Improvements made by the teacher include motivating students to use time more efficiently and encouraging students who are less active to contribute to working on mind maps and discussing answers to HOTS questions. In addition, the teacher also overcomes students' difficulties in using Coggle™.

Students' collaboration skills are trained at the concept formation and application stages. At the concept formation stage, the teacher provides guided and conceptual questions to Students Worksheet. Students collaboratively answer questions in the form of mind maps using Coggle™ software. Students conduct discussions by using the comments column on Google Classroom and the comments column on Coggle™. Students explored the use of Coggle™ very well. Some groups used the comments column to discuss, greet each other and upload pictures to make the mind map more interesting. Meanwhile, at the application stage, students discuss in groups to solve contextual problems in Students Worksheet. The results of the collaboration in making mind maps by students are presented in Figure 4.

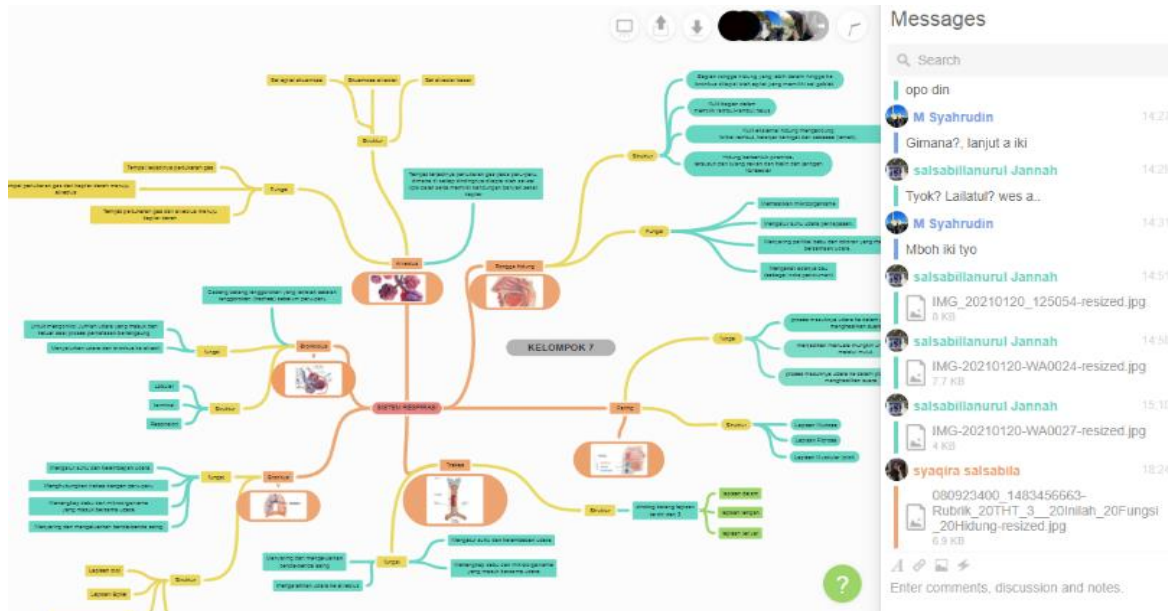


Figure 4. Mind Map of Student Collaboration Results Using Coggle™ Software

The mindmap above is the result of the collaboration of 5 people in one group. Students communicate and collaborate very well in compiling the mind map. Students divide tasks into sub-tasks for all group members. Based on observations in groups, each student is responsible for the material for 1 or 2 branches of the mindmap. On the other hand, some students also seem to divide the task to find pictures that match the material to perfect the presentation of the mind map. This is what causes the score of the joint responsibility indicator to increase by 20.19%. The division of tasks carried out in making mind maps makes students understand the role of their responsibilities in group work because each student contributes to completing the mind map task.

The increase in collaboration skills scores occurred in all indicators. The highest increase in collaboration skills scores was found in the compromise indicator of 29.03%. It is proven by students being able to complete group assignments well and on time. In addition, the truth of the concepts presented in the mind map is also an indicator that students can compromise with their group friends. This indicates that learning the POGIL model combined with Mind maps based on online learning can foster a positive attitude of dependence between students to compromise and complete their assignments entirely and on time. The improvement of students' collaboration skills for each indicator can be seen in Figure 5.

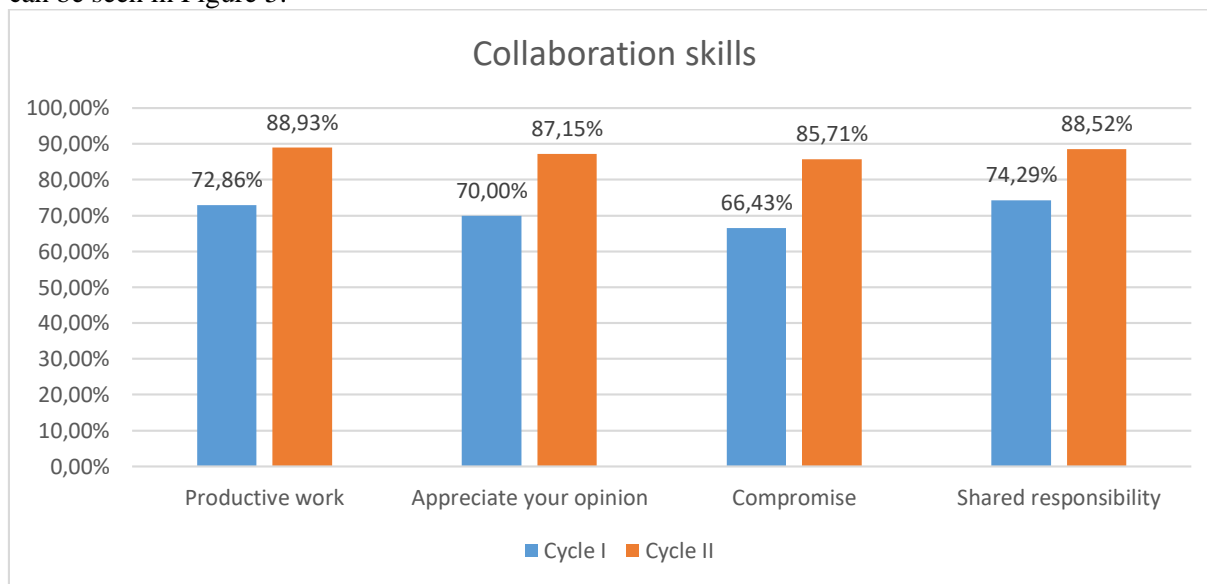


Figure 5. Graph of Student Collaboration Skills Improvement for Each Indicator

IV. DISCUSSION

The POGIL learning model combined with online learning-based mind maps affects students' oral and written communication skills. In general, the student's oral communication skills score increased by 20.3% from the first cycle of 71.78% to 86.37% in the second cycle. Students' oral communication skills are seen in the exploration and concept formation, and application stages. At the exploration stage, students discuss practical activities. At the end of the concept formation and application stages, a presentation of the practicum results, Students Worksheet questions, and mindmaps for each group was made. This activity causes students to interact with each other and trains students' communication skills. Each student in the group expresses their opinion about the practicum results from the video presented by the teacher via the Youtube link. According to Rahman et al. (2018), at the explore stage, students can take an active role in experimental/practical activities so that students have the opportunity to practice their communication skills. Supported by research by Fujiarti & Mastur (2014), at the exploration stage using the POGIL model, cognitive elaboration occurs, where students have the opportunity to express opinions and rebuttals related to the experimental results to increase students' thinking power and active role in learning.

The highest oral communication skill score was found in the indicator of communicating clearly, which was 28.16%. This happens because students are trained to express their opinions on presentation activities that are carried out after the concept formation and application stages. In this presentation activity, each group presented the results of the Students Worksheet and a mind map made in collaboration. Other groups were given the opportunity to discuss and respond to the presenter group by asking questions, expressing their group's opinions, and giving objections to the presenter group. According to research Indriwati et al. (2018) which states that the discussion stage facilitates students to ask questions and explore information related to their friends' findings. It is clarified by the statement of Ginanjar et al. (2015) which states that rebuttals are different arguments.

Presentation and discussion activities in the POGIL learning model also improve students' oral communication skills on indicators using communication strategies, which are 24.86%. This means that the POGIL learning model makes students skilled in communicating the results of their Students Worksheet clearly, accurately, and reflectively according to the criteria of an effective communication strategy. According to Locker & Kienzleir (2008), the criteria for effective communication include clear, complete, and accurate information in the message. In addition, oral communication indicators also increased by 23.30% through discussion activities. This indicates that the active participation of students in the learning process through joint discussions, asking questions, opinions, refuting, and discussing can improve students' oral communication. This is in line with the opinion of Awang & Daud (2015), which states that students' oral communication skills can be improved through discussion activities because students can express their opinions/ideas through discussion. Oral communication skills are also honed through mind map presentations in the learning process, following the research results by Marcelina (2014), which states that oral communication skills increase through mind-mapping. Students who carry out mind map presentations will more easily understand and remember concepts presented to their friends as communicators. Students are glued to reading texts and at least make eye contact with other students even though they are tense in front of the class (Milati & Rafaini, 2017).

Data on written communication skills showed an increase of 14.23% from cycle I to cycle II. This is because each syntax of the POGIL model facilitates written communication skills through the Students Worksheet. Students Worksheet is used to develop written communication skills because all stages of the POGIL syntax have been integrated into the Students Worksheet, making it easier for teachers to assess student's written communication skills. All stages of learning in the POGIL model combined with online learning-based mind maps impact improving students' written communication skills. Starting from the POGIL syntax in the orientation stage, students are skilled in making and writing problem formulations based on the phenomena presented by the teacher. According to research by Indriwati et al. (2018), the problem orientation stage in the guided inquiry learning model displays phenomena that support students in formulating problems. At the exploration stage, students write down the practicum results on the Students Worksheet in the form of a description. The concept formation stage involves communication between students to create a group mind map using Coggle™. Meanwhile, at the application stage, students are directed to solve contextual problems associated with indicators of written communication skills in it. According to research results by Rahman et al. (2018), students' written communication skills are honed at the exploration and concept application stages because at that stage, students write down their observations and work on HOTS questions.

Data on written communication skills improved on all indicators. The most significant increase was in the logically ordered indicator of 22.27%. This means that students have developed ideas well and organized them logically into paragraphs when working on problems on the Students Worksheet. The integration of group mind maps at the concept

formation stage supports students' written communication skills according to the research results (Kurniasari, 2014), which states that mind mapping learning can improve student communication. In addition, the mind map on the POGIL learning model can also support the role of the POGIL learning model to improve learning constructivism. According to Miranti & Wilujeng (2018), mind mapping can support constructivism based on learning designs that make it easier for students to understand various relationships in the material being studied. Through the POGIL model combined with online learning-based mindmaps, students can construct their own knowledge and experience in studying biological materials, especially the Respiratory System and Excretion System concepts.

The POGIL learning model combined with online learning-based mindmaps is also able to improve students' collaboration skills. In the first cycle, the student's collaboration skill score was 71.6% and increased by 22.31% to 87.58% in the second cycle. This is because the POGIL learning model uses a cooperative approach and is designed with group learning. Through group learning, students' collaboration skills can be improved. Nahdi (2019) states that by carrying out learning and grouping students into groups, they will learn together to appreciate different points of view and knowledge, participate in discussions through brainstorming, listening, and support each other. Supported by Zubaidah's (2016) statement, collaboration skills can be trained through peer tutoring in groups. Students' collaboration skills are trained at the concept formation and application stages.

Students discuss solving conceptual problems at the concept formation stage and collaboratively present them in a group mind map using Coggle™. In making mind maps, students interact, exchange opinions, and equate perceptions to find a concept. In line with the opinion of Nurhayati et al. (2019) regarding the advantages of working in groups, namely students can interact with other students, exchange opinions and compare their work with other members to obtain solutions to problems through discussion. While at the application stage, students are required to solve contextual problems in the form of HOTS questions on the Students Worksheet to work together in group discussions to solve them. According to Zubaidah (2016), collaboration skills can be trained and developed by providing challenging problems in life, thus spurring group discussions to solve problems. In line with opinion Nurhayati, dkk. (2019) states that learning activities carried out in groups aim to foster cooperation between students in solving a problem.

The highest increase in collaboration skills scores was found in the compromise indicator of 29.03%. This indicates that through learning the POGIL model combined with Mind maps based on online learning, students can compromise with their group members to solve problems on the Students Worksheet and realize their respective obligations/duties to achieve common goals. According to Van Leeuwen (2015), through collaboration or group work to complete tasks, students are challenged to share ideas, express their thoughts, and engage in discussions.

V. CONCLUSION

Implementing the POGIL learning model combined with online learning-based mindmaps can improve students' communication and collaboration skills. The highest increase in communication skills occurred in oral communication skills, which was 20.3%. Meanwhile, collaboration skills experienced the highest increase in the compromise indicator, which was 29.03%. Suggestions for further research are better in managing and managing time allocation so that the learning process runs more effectively and efficiently. In addition, other researchers can also implement the POGIL learning model combined with online learning-based mindmaps to develop other 21st century skills such as critical thinking and problem-solving. Coggle™ can also be used to develop students' creativity through making group mind maps.

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