

Improving Science Process Skills and Student Cooperation Skills Using the POGIL Model Assisted by Animated Media

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ABSTRAK

Berdasarkan tinjauan pustaka sebelumnya penerapan model POGIL (Process Oriented Guided Inquiry Learning) dalam pembelajaran sekolah dasar masih perlu diperkuat dengan penggunaan media animasi untuk mencapai tujuan pembelajaran yang optimal. Penelitian ini bertujuan untuk menganalisis keefektifan penggunaan model POGIL berbantuan media animasi dilihat dari perubahan tingkat keterampilan proses sains dan keterampilan kerja sama. Jenis penelitian ini adalah eksperimen semu dengan desain kelas Non Equivalent Control Group Design. Sampel yang digunakan sebanyak 58 siswa yang terdiri dari kelas VA sebanyak 29 siswa sebagai kelas eksperimen dan VB sebanyak 29 siswa sebagai kelas kontrol. Instrumen pengumpulan data pada penelitian ini adalah lembar soal essay, lembar observasi dan lembar angket. Metode analisis data yang digunakan adalah statistik inferensial dengan uji-t. Hasil penelitian ini yaitu penggunaan model POGIL berbantuan media animasi memiliki hasil yang sangat efektif terhadap keterampilan proses sains dan kemampuan kerjasama siswa sekolah dasar yang dilihat dari pencapaian dan peningkatan setiap indikator keterampilan proses sains yang tergolong pada kategori sangat tinggi. Kemampuan kerjasama siswa dalam kelompok mengalami peningkatan yang sangat signifikan dan menghasilkan nilai yang tergolong tinggi. Disimpulkan bahwa penggunaan Model POGIL memberikan pengaruh yang tinggi terhadap peningkatan keterampilan proses sains dan kerjasama siswa sekolah dasar.

ABSTRACT

Based on the previous literature review, applying the POGIL (Process Oriented Guided Inquiry Learning) model in elementary school learning still needs to be strengthened using animation media to achieve optimal learning goals. This research aims to analyze the effectiveness of using the POGIL model assisted by animation media regarding changes in science process and collaboration skills. This type of research is a quasi-experiment with a Non-Equivalent Control Group Design class design. The sample used was 58 students, consisting of 29 in the VA class as the experimental class and 29 in the VB class as the control class. The data collection instruments in this research were essay question sheets, observation sheets, and questionnaire sheets. The data analysis method used is inferential statistics with the t-test. The results of this research are that the use of the POGIL model assisted by animation media has very effective results on the science process skills and collaboration abilities of elementary school students as seen from the achievement and improvement of each indicator of science process skills which is classified in the very high category. Students' cooperative abilities in groups have increased significantly, resulting in relatively high scores. It was concluded that using the POGIL Model significantly improved elementary school students' science process skills and collaboration.

1. INTRODUCTION

Learning is a series of activities involving information and environment that are organized in a planned manner to facilitate student learning (Prahesti & Fauziah, 2021; Sukarini & Manuaba, 2021). The learning process is a process of activities in which there is interaction between teachers and students to achieve learning goals. In the learning process "the readiness of a teacher to recognize the characteristics of students in learning is the main capital for delivering learning materials and is an indicator of the

success of the implementation of learning (Andira et al., 2022; Marcelia et al., 2016).

Science is one of the core subjects in the Indonesian curriculum. Science has three components: scientific process, scientific product, and scientific attitude (Indarta & dkk, 2022; Yuliani et al., 2017). Thus it is expected to be seen in science learning so that students can experience learning as a whole, understand natural phenomena by imitating problem-solving activities, the scientific method and the way scientists try to discover new facts. Science as a process is a set of skills used by scientists to conduct scientific research. Science process skills (KPS) are basic abilities that are expected to be mastered by students in science learning (Eliyana, 2020; Nurjanah & Cahyana, 2021). The process skills approach has the aim that the activity and creativity of students in acquiring knowledge, skills, values and attitudes, as well as applying in everyday life and can develop their own facts and concepts, besides fostering and developing attitudes and values that are expected. Through the scientific process, students can determine the problems that surround them, observe, analyze, formulate hypotheses, conduct experiments, conclude and apply the necessary information.

The application of the science process skills approach has several advantages including: a) involving students directly with real world objects to facilitate students' understanding of the subject, b) training students to think more actively during learning, c) providing opportunities for students to learn to use the scientific method, d) can improve thinking skills and knowledge acquisition. (Alamsyah et al., 2018; Sumarti et al., 2018). Science learning activities through the science process skills approach must be carried out in collaboration, because cooperation is a form of social interaction carried out by a person or group of people to fulfill common interests or needs (Eliyana, 2020; Ilmiah et al., 2022). Collaboration is one way for students to be active in learning. The importance of students' ability to collaborate has become a paradigm in the world of education, where collaboration is one of the most important aspects.

The study on improving science process skills in elementary schools using the POGIL teaching model shows that learning can be maximally implemented with very good criteria, student creativity and cooperation increase gradually until more than 70% of students obtain very good creativity and cooperation criteria (Marcelia et al., 2016; Yulianti et al., 2016). The ability to cooperate using the POGIL model where the indicator for focusing on questions obtained an achievement of 81% and the achievement of the indicator answering questions about an explanation was 82% (Hartati et al., 2020; Suryani et al., 2019). The KPS between students taught with the SETS (*Science, Environment, Technology and Society*) approach is more effective than students taught with a conventional approach to influence the KPS of elementary school students (Maulida et al., 2020; Rini, 2017). Meanwhile, according to who applied the two-stay-two-guest strategy in the learning process stated that there was an increase in student cooperation activities in science subjects in class II SD Negeri 182/1 Hutan Lindung, furthermore the ability to cooperate in science lessons will have an impact on student knowledge (Marcelia et al., 2016; Sari & Kristin, 2020).

Seeing the positive effect of the POGIL model in science learning, this model can be an alternative to improve the quality of students. POGIL is a learning model that stands for Process Oriented Guided Inquiry Learning, based on constructivist principles that emphasize active learning from students through group interaction in solving problems. The learning steps of the POGIL model include: orientation, where the teacher provides general knowledge about the material to be learned; exploration, where students are given a series of tasks that lead to learning objectives, collect data and carry out experiments; concept formation, where the teacher directs and guides students in building concepts through key questions and connects the data obtained with the task; application, where students apply the concepts that have been found to solve the exercise questions given by the teacher; and closure, where the teacher provides reinforcement and guides students to reflect and evaluate their group performance (Abram et al., 2022; Malik et al., 2017). It is concluded that the POGIL learning model focuses on core concepts and processes, which are carried out collaboratively and encourage students to develop a deep understanding of the material being studied.

Based on previous literature review, it can be identified that the application of the POGIL (Process Oriented Guided Inquiry Learning) model in elementary school learning still needs to be strengthened by the use of animation media to achieve optimal learning objectives. Although previous research has recognized the potential of animation media in conveying messages that can inspire students' thoughts, feelings, attention, and willingness to learn, there are shortcomings in integrating this media effectively with the POGIL model. Conversely, other studies have shown that the approach of educating and advising children through animated videos has a satisfying impact on children's development (Annisya & Baadilla, 2022; Sinta et al., 2022) Animation media, as a form of multimedia technology, has a crucial role in the learning process (Bua, 2022; Ginting et al., 2017) The main function of animation media is not only limited to delivering visual information in the form of moving images, but also includes increasing student motivation and attractiveness during learning (Bua, 2022; Yuniarni et al., 2020). Therefore, animation

media can be considered as a form of learning media that not only presents technical elements, such as moving images, but is also able to create interesting learning experiences. The visual effects of moving objects in animated media can provide a positive boost to student interest and motivation to learn. Looking at the gaps identified above, this study aims to fill these gaps by applying the POGIL model which is strengthened by the integration of animation media. The main objective is to improve the science process skills and cooperation skills of primary school students through innovative and technology-based learning approaches. Thus, it is hoped that this research can make a positive contribution to the development of more effective and interesting learning methods in the context of basic education.

2. METHOD

This study used a quasi-experimental research method with a Non Equivalent Control Group Design class design. The approach in this research is quantitative research, so it uses inferential statistical data analysis techniques.

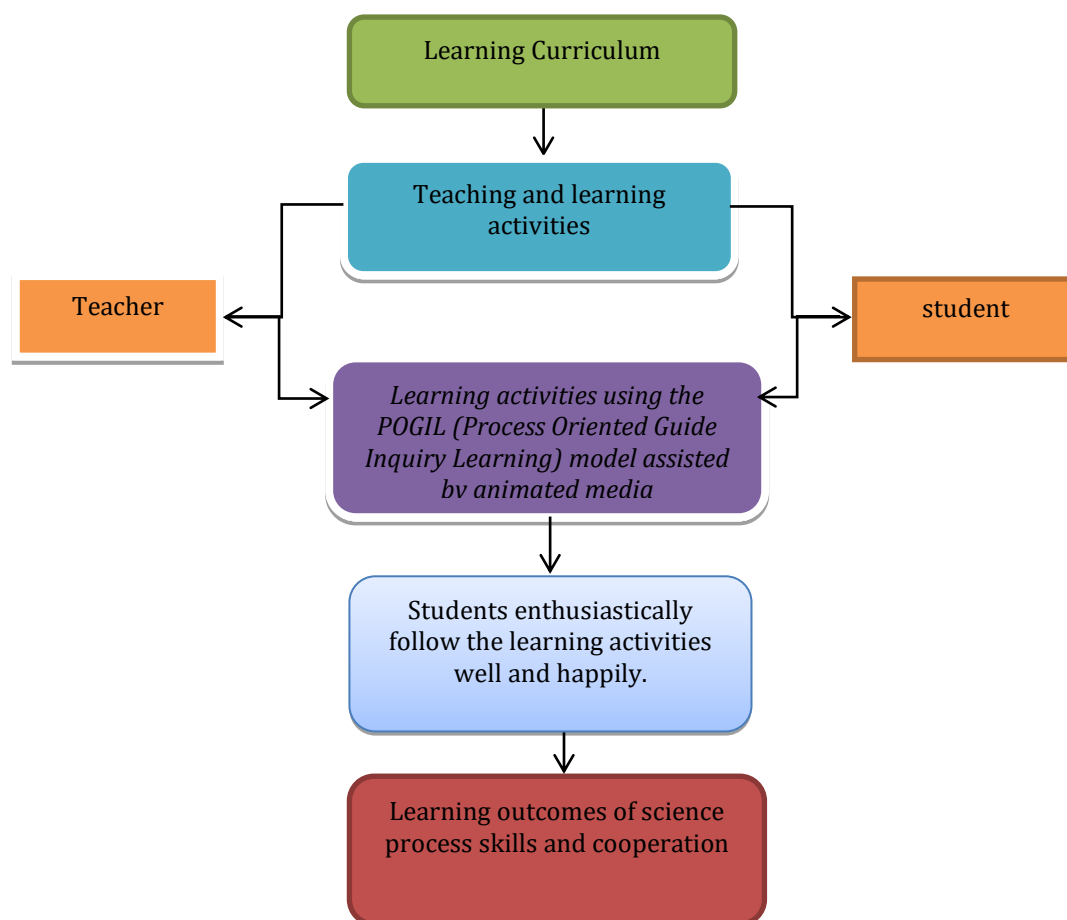


Figure 1. Research Paradigm

Figure 1, shows that the learning curriculum is a very important tool for the success of the educational process, meaning that without a good educational program it will be difficult to achieve the goals and objectives of education that are aspired to. Meanwhile, teaching and learning activities are efforts to provide motivation, guidance, and direction for students to carry out the learning process. The subjects in this study were all fifth grade elementary school students with a total of 58 students divided into two classes, namely VA and VB. The sampling technique was carried out by group random sampling where one experimental class and one control class were determined. Data collection was carried out with tests and non-tests, for process skills researchers used essay question sheet instruments and observation sheets. While for cooperation skills using a questionnaire instrument.

The data analysis technique uses the help of JASP software to interpret the results of data analysis or output from the value of the analytical requirements test to the independent t-test mean difference test

according to the equation using 2 tests, namely the t-test and regression test. The test disseminated to students consists of five indicators, positive dependence between students, individual responsibility, face-to-face interaction, interpersonal ability in groups, and group processing. Before testing the students, we conducted instrument validation. The aim was to assess the accuracy of the content of the questions, relevance to the objectives, and the rigor of the question construction. This validation process was carried out by two experts. The instrument used was a test. The test measures students' cooperation skills. The student cooperation ability instrument consists of five indicators (Djafar et al., 2023; Nugroho & Airlanda, 2020). The test disseminated to students consists of five indicators, positive dependence among students, individual responsibility, face-to-face interaction, interpersonal skills in groups, and group processing. Before testing students, we perform instrument validation. The purpose is to assess the accuracy of the content of the question, relevance to the purpose, and the accuracy of the construction of the question. This validation process is carried out by two experts. The instrument used is a test. The test measures students' cooperation ability. The student cooperation ability instrument consists of five indicators is shown in Table 1.

Table 1. Cooperation Ability Indicators

Aspect	Indicators
Positive dependence among students	a. Students feel happy with the discussion activities b. Students dare to express their opinions during group discussions
Individual responsibility	a. Students carry out tasks according to the division in the group b. Students are responsible for their individual tasks in the group
Face to face interaction	a. Students listen if a friend is expressing an opinion b. Students motivate each other to succeed together
Interpersonal skills in groups	a. Students communicate openly with anyone in the group b. Students accept and support each other's presence in the group
Group processing	a. Students maintain group cohesiveness b. Students keep the situation conducive during group discussion

(Yulia Vermana & Sylvia, 2019)

3. RESULT AND DISCUSSION

Result

The study used 2 classes as samples, namely class VA (Experiment class) and VB (Control class). The VA experimental class was treated with the POGIL (Process Oriented Guided Inquiry Learning) model assisted by animated media, while the Vb control class was treated with scientific learning. The achievement of science process skills of each class due to the treatment of each sample is shown in Figure 2.

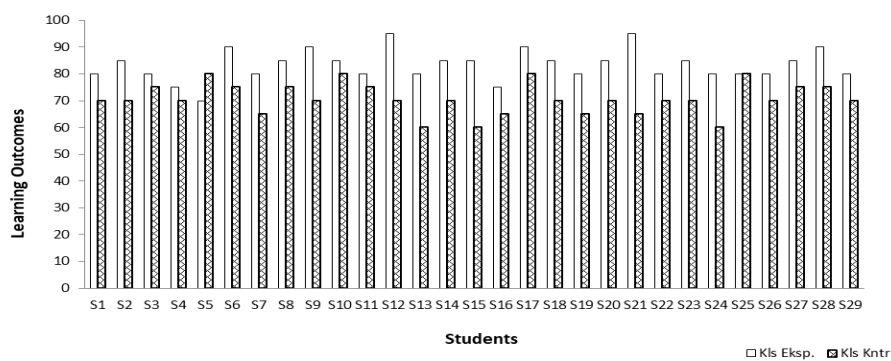


Figure 2. Learning Outcomes of Experimental and Control Classes

Based on Figure 2, it can be seen that after being treated using the POGIL (Process Oriented Guide Inquiry Learning) learning model assisted by animated media in class Va (Experimental Class), a description of the ability of science process skills of 29 students reached an average score of 83.28 with the highest score of 95 and the lowest score of 70, while in class Vb (Control Class) totaling 29 people obtained an average score of 70.69 with the highest score of 80 and the lowest score of 60. It can be observed that the application of the POGIL model assisted by animated media is more effective than the

control class using conventional learning with the 5M scientific approach (observing, questioning, trying, reasoning, and communicating).

Based on the data in both classes and by using the Test of Normality (Shapiro-Wilk) it was found that $W (0.950) > p (0.180)$, this means that the data characteristics of both samples are normally distributed. On the other hand, the homogeneity test with the Levene test obtained a sig value > 0.05 so that the data has the same variance or homogeneous. Based on this analytical requirement test, the mean difference test between the two classes was carried out by t-test. In accordance with the results of independent t-test inferential statistical calculations between the experimental class and the control class showed that there was a significant difference between the two classes ($p < 0.001$). The results of the effect size test (Cohen'sd) also show a large effect size ($1.559 > 0.05$) which indicates that there is a difference between the learning process in the two classes. The t-test shows that the improvement of science process skills and cooperation skills using the POGIL model ($t = 8.397$ $p = 0.001 < 0.05$), while the Cohen'sd value (0.385) shows that of the two experimental and control classes, the more effective learning process using the POGIL model is the experimental class because the effect size is high.

Regression test is used to determine the direction and how much influence the independent variables X, Y1, and Y2 have on the dependent variable. Regression test between X and Y1, namely the value of the observation sheet (X) and the value of the questionnaire sheet (Y1) by applying the POGIL learning model, obtained an R value of 0.825, seen from the correlation level this value is classified as sufficient. While the R^2 value is 0.680%. This means that the effect of the relationship between the two variables is very significant on the application of the POGIL model in improving the science process skills and cooperation skills of elementary school students. Based on the ANOVA test results table, the value of Fhitung is obtained: 6.380 where $> F_{table} 3.94$ so it can be concluded that there is a significant influence between the observation variable (X) and the test variable (Y1) together on the science process skills and cooperation skills of students. Based on the results of the coefficients test, it can be seen that the value of T count is $55.149 > T_{table} 0.001$. and the significance value is $0.086 < 0.05$. Meanwhile, the unstandardized value of 0.526 means that the application of the POGIL model is 0.526 points to improve the results of science process skills and cooperation skills of elementary school students. This also proves hypothesis 1. If the calculated T value $< T_{table}$ and significant value < 0.05 then H_0 is rejected and H_1 is accepted. This means that there is a significant influence between the application of the POGIL model on the science process skills and cooperation skills of elementary school students.

The Regression Test of X between Y2 shown in the Model Summary shows the R-Square value of 0.847 or 84.7%, which means that the effect of the application of the POGIL model (X) on cooperation skills (Y1) is 84.7%. While the ANOVA test obtained an Fcount value of $16.649 > F_{table} 3.94$ which means that there is a significant influence between the observation variable (X) and the questionnaire variable (Y2) together on the science process skills and cooperation skills of students. Based on the results of the coefficients test, it can be seen that the value of T count is $47.436 > T_{table} 0.001$ and the significance value is $0.027 < 0.05$, and the unstandardized value of 0.716 means that the application of the POGIL model is 0.716 points to improve the results of science process skills and cooperation skills of elementary school students. This also proves that there is a significant influence between the application of the POGIL model on the science process skills and cooperation skills of elementary school students.

This observation was carried out during the practicum activity on magnetism. The ability of students' science process skills was assessed by 5 observers during the practicum activities is shown in Figure 3.

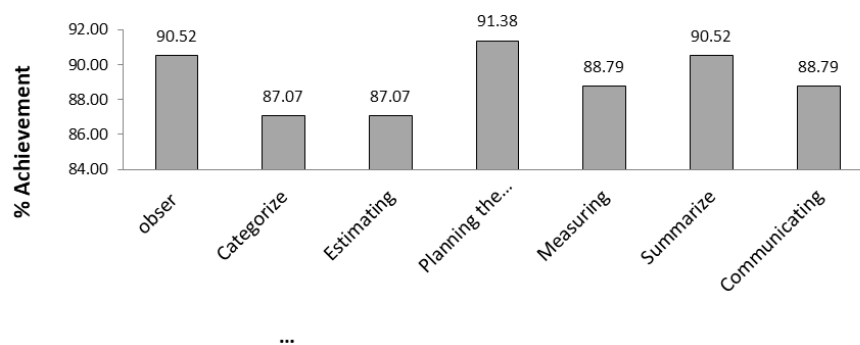


Figure 3. Achievement of Science Process Skills of Fifth Grade Students

Based on Figure 3, it can be seen that students' science process skills have different achievements and categories in each indicator. The first skill in the diagram above is observing skills getting a score of 90.52% with a very high category, the second indicator is classifying getting a result of 87.07% with a high category, the third skill is estimating getting a result of 87.07% with a high category, the fourth skill indicator is planning an experiment getting a result of 91.38% with a very high category, the fifth skill indicator is measuring getting a result of 88.79% with a high category, the sixth skill is concluding getting a result of 90.52% with a very high category, and the seventh skill is communicating getting a result of 88.79% with a high category. The achievement of cooperation between elementary school students in these four aspects is shown in Figure 4.

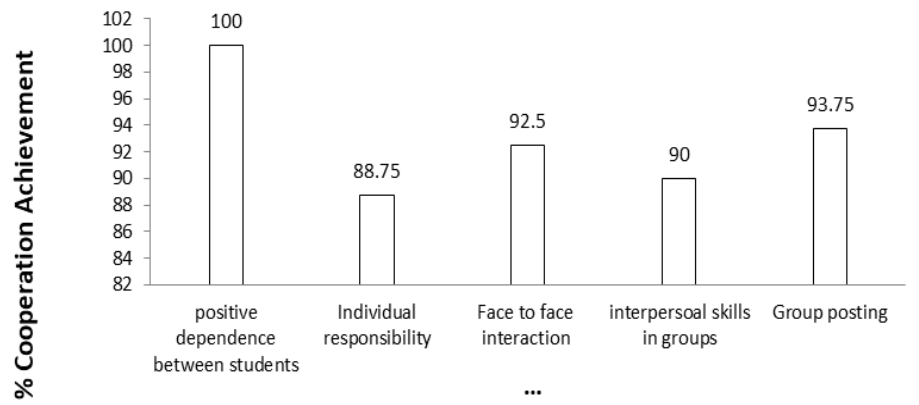


Figure 4. Results of Student Cooperation Profile

Figure 4 shows that the achievement of elementary school students' cooperation in the first aspect, namely positive dependence between students, has a result of 100% in the very high category. The second aspect, namely individual student responsibility, gets a result of 88.75% with a high achievement category. The third aspect of face-to-face interaction of students gets the results of the achievement indicator 92.5% with a very high category. The fourth aspect is interpersonal skills in groups getting a score of 90% with a very high category. The fifth aspect, namely student group posting, gets a result of 93.75% with a very high category.

Discussion

Based on past research with the title The Effect of Process Oriented Guided Inquiry Learning Model on Science Process Skills and Cognitive Abilities of Students in Physics Subjects with the results studied that the POGIL model can improve process skills, thinking skills, problem solving skills, and improve students' cognitive abilities. POGIL consists of five stages, namely: 1) orientation, 2) exploration, 3) concept formation, 4) application and 5) closing. Orientation, at this stage students are directed to focus on one specific topic, also facilitates students to make observations as an initial activity for exploration. As a result of the activities at the exploration stage, concepts are formed, introduced to students or students prove concepts that have been discovered by experts (Rustam Ramdani & Sedijani, 2017; Widyaningrum et al., 2016). Meanwhile studied The Effect of Process Oriented Guided Inquiry Learning Model (Pogil) on Understanding Science Concepts, Science Process Skills and Cooperation Skills of Smp Negeri 3 Pringgabaya East Lombok students with the results showed that (1) There is an effect of the POGIL learning model on understanding science concepts, (2) There is an effect of the POGIL learning model on science process skills, (3) There is an effect of the POGIL learning model on critical thinking skills, and (4) There is a simultaneous effect of the application of the POGIL learning model on understanding science concepts, science process skills, and critical thinking skills.. with the title Application of Process Oriented Guided Inquiry Learning (Pogil) to Improve Students' Science Process Skills with the results studied that the science process skills of students have increased (Marcelia et al., 2016; Rustam Ramdani & Sedijani, 2017).

The shortcomings experienced during learning by using this POGIL learning model are time problems that cannot be allocated properly, student order during learning, student passivity, and student willingness to look for additional references. While the advantages according to Similar research POGIL Learning model can improve the teacher's ability to manage learning in an inquiry manner, so that it is

easily understood by the teacher. So that teachers and students can carry out the learning process easily and well (A. Kurniati et al., 2019; Malik et al., 2017). Based on the results of the study, the application of learning using the POGIL (Process Oriented Guide Inquiry Learning) model assisted by animated media can be seen effective compared to the application of scientific learning models. The use of the POGIL model assisted by animated media shows significance in improving students' science process skills and cooperation skills. This increase can be seen from the results of the science process skills test and student cooperation ability questionnaire in the experimental group. This is because the POGIL learning model is a teaching approach that combines guided inquiry and collaborative learning where students are involved in the learning process. (Abram et al., 2022; Malik et al., 2017).

The purpose of the POGIL learning model in this study is to help students understand the concepts and principles in a topic by discovering and applying their own knowledge. This can be explained by several factors. First, the POGIL model places students as active agents in their own learning so that they can build a deeper understanding of the science concepts being studied. In addition, by working in small groups students can discuss and help each other to solve problems and design experiments. Secondly, the use of animated media in learning can help students understand difficult science concepts more easily and clarify their understanding of the topic being studied. Animated media can make learning more interesting and interactive, so it can increase students' motivation and interest in learning. Third, in small groups, students can learn to cooperate, communicate, and respect the opinions of others. These abilities are very important in the world of work and daily life so that they can help students in facing future challenges (N. Kurniati et al., 2021; Marcelia et al., 2016).

The first skill that can be analyzed in the aspect of science process skills is observation skills. Observation skills are tested through students' skills in making magnets. The assessment indicator is to use the various senses possessed to obtain data according to the phenomenon/event/or experiment performed. The achievement of students' skills in observing is 90.52% with a very good category. This is because this skill is the most basic and is often experienced by students at all times so that students can easily do it, besides this skill is often refined with productive tasks and questions given during learning. Through this method the teacher can see directly the activity of observing during learning, looking for facts using the senses, namely hearing, sight, and touch (Abram et al., 2022; Widyaningrum et al., 2016).

The second skill is grouping skills. Students' grouping skills are seen from the grouping of tools and materials as well as subject matter in the experiment appropriately and clearly. The first assessment indicator in this skill is that students classify the tools, materials, and subject matter in the experiment precisely and clearly. The second assessment indicator is that students classify the tools, materials, and subject matter in the experiment appropriately and less clearly. The third indicator is classifying the tools, materials, and subject matter in the experiment less precisely and less clearly. The fourth assessment indicator is classifying the tools, materials, and subject matter in the experiment inappropriately. The achievement assessment obtained by students in classifying skills is 87.07% with a good ability category. Based on these results, students are still easy to answer because this skill is still a basic and familiar category for students. Classification indicators include describing observations obtained separately, determining differences and similarities, determining characteristics, comparing, finding the core in grouping, combining results from observations (Eliyana, 2020; N. Kurniati et al., 2021).

The third skill is estimation skill. In this study, the skill of estimating students while conducting experiments to make magnets. The first assessment indicator is that students make a temporary estimate or guess before doing the experiment correctly and precisely. The second assessment indicator is students make estimates or conjectures before conducting experiments correctly and less precisely. The third assessment indicator is students making estimates or temporary guesses before conducting experiments with less correct and less precise. The fourth assessment indicator is that students make estimates or temporary guesses before conducting experiments incorrectly and incorrectly (Malik et al., 2017; Yuliani et al., 2017).

The fourth skill to be analyzed is the assessment indicator of planning an experiment. The first assessment indicator is that students determine the tools/source materials used to determine the objects measured, observed, and recorded and determine the working steps of the experiment appropriately. The second assessment indicator is that students determine the tools / source materials used to determine the objects measured, observed, and recorded and determine the working steps of the experiment inaccurately. The third assessment indicator is that students determine the source tools/materials used to determine the objects measured, observed, and recorded as well as determine the working steps of the experiment inappropriately. The fourth assessment indicator is that students do not determine the tools / source materials used to determine the objects measured, observed, and do not record and do not determine the experimental work steps (Abram et al., 2022; Yuliani et al., 2017).

The fifth skill is measuring skills. The first assessment indicator is that students use tools/materials, know the reasons why using tools/materials, know how to use tools/materials in accordance with the steps of the experiment appropriately. The second assessment indicator is students use tools / materials, know the reasons why using tools / materials, know how to use tools / materials in accordance with the steps of the experiment less precisely. The third assessment indicator is that students use tools / materials, know the reasons why using tools / materials, know how to use tools / materials in accordance with the steps of the experiment inappropriately. The fourth assessment indicator is students do not use tools / materials, know the reasons why using tools / materials, know how to use tools / materials in accordance with the steps of the experiment.

The sixth skill analyzed in students' science process skills is communicating. In this skill, the assessment indicators that are realized are first students convey the results of the discussion clearly, precisely, and effectively. The second assessment indicator is that students convey the results of the discussion clearly, precisely, and less effectively. The third assessment indicator is that students convey the results of the discussion clearly, less precisely, and less effectively. The fourth assessment indicator is that students convey the results of the discussion in an unclear, less precise, and less effective manner. On the other hand, the achievement in the first aspect of cooperation ability is that students feel with discussion activities. The second achievement indicator is that students dare to express their opinions. The third indicator is helping each other complete the task. The fourth achievement indicator is that students join in discussions to solve problems. The second ability aspect is individual responsibility. In student cooperation skills, the indicators seen are first the students carry out tasks according to the division in the group. The second indicator is that students are responsible for the duties of each individual in the group. The third indicator is that students carry out group discussions well. The fourth indicator is that students can condition themselves (not noisy) in the group.

The fifth ability aspect is group processing. In this aspect of ability, the indicators seen are first students maintain cohesiveness in the group. The second achievement indicator is that students keep the situation conducive during group discussions. The third indicator is that students contribute to helping other friends who are having difficulty. The fourth achievement indicator seen is that students are able to summarize the results of the discussion. The problem faced when conducting research is the difficulty of monitoring the ongoing discussion, because it is difficult to distinguish whether the lesson being discussed or another, there are also students who pay less attention to the teacher who is explaining the topic. When the teacher invited students to discuss together, only a few responded seriously, so the results were not optimal.

4. CONCLUSION

Based on the results in the analysis of research data, it can be concluded that the use of the POGIL learning model assisted by animated media applied in the experimental class has a more effective impact on the student learning process, where the science process skills and cooperation skills of students are categorized as high, more effective and have a high effect. The relationship between the two variables is very significant, where there is a significant influence between the application of the POGIL model on the science process skills and cooperation skills of elementary school students. So the application of the POGIL (Process Oriented Guide Inquiry Learning) model assisted by animated media is proven effective in improving the science process skills and cooperation skills of elementary school students.

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