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The Effectiveness of Guided Inquiry Learning Model Using TPS Approach of Science Process Skills and Conceptual Understanding

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ABSTRAK

Keterampilan proses sains dan pemahaman konseptual yang dimiliki siswa masih tergolong rendah. Siswa memerlukan model pembelajaran yang bisa mendukung peningkatan keterampilan siswa. Penelitian ini bertujuan untuk menganalisis peningkatan keterampilan proses sains dan pemahaman konsep siswa melalui model Guided Inquiry dengan pendekatan think pair share dan model Guided inquiry. Penelitian ini menggunakan jenis penelitian eksperimen semu (quasi experiment) dengan desain Pretest-Posttest Nonequivalent Control Group Design. Penentuan sampel menggunakan teknik random sampling. Sampel penelitian ini adalah siswa kelas V yang berjumlah 53 siswa. Instrumen yang digunakan berupa soal tes pemahaman konsep dan keterampilan proses sains pada tema Panas dan perpindahannya. Kemudian untuk analisis data digunakan uji n-gain, uji-t. Hasil penelitian menunjukkan bahwa model guided inquiry dengan pendekatan think pair share dapat meningkatkan pemahaman konsep dengan nilai rata-rata pretest 54,55 meningkat menjadi 85,19 dengan n-gain 0,66 dalam kategori sedang dan keterampilan proses sains memperoleh nilai rata-rata pretest 52,04 meningkat menjadi 82,59 dengan n-gain 0,63 dalam kategori sedang. Rata-rata kelas eksperimen lebih tinggi dibandingkan kelas kontrol. Hasil uji beda rata-rata pemahaman konsep dan keterampilan proses sains siswa mendapatkan hasil bahwa terdapat perbedaan yang signifikan keterampilan proses sains dan pemahaman konsep siswa kelas guided inquiry dengan pendekatan think pair share dan kelas guided inquiry. Keefektifan model pembelajaran ini ditandai dengan ketercapaian 3 indikator yaitu ketuntasan yang melebihi 75%, rata rata nilai keterampilan proses dan pemahaman konsep melebihi kelas kontrol dan nilai meningkat secara signifikan.

ABSTRACT

Science process skills and conceptual understanding of students are still relatively low. Students need a learning model that can support the improvement of student skills. The combination of Guided Inquiry and Think Pair Share can improve students' conceptual understanding and science process skills through every step taken. This study aims to analyze the improvement of science process skills and students' conceptual understanding through Guided Inquiry model with think pair share approach and Guided Inquiry model. This research used quasi-experimental research with Pretest-Posttest Nonequivalent Control Group Design. Determination of the sample used random sampling technique. The sample of this research was fifth graders totaling 53 students. The instrument used was a test of conceptual understanding and science process skills on the theme of heat and its displacement. The data was analyzed using n-gain test and t-test. The results showed that the average of the experimental class was higher than the control class. The results of the discrimination test results on the average of conceptual understanding and science process skills of students obtained that there are differences in science process skills and understanding of students' concepts in guided inquiry class and guide inquiry class with think pair share approach. The effectiveness of this learning model is indicated by the achievement of 3 indicators, that is completeness which exceeds 75%, the average value of process skills and conceptual understanding that exceeds the control class, and the score that increased significantly.

1. INTRODUCTION

Natural Science is a branch of science that studies objects and natural phenomena through a scientific investigation process so that the output or results of the investigation are scientific products such as facts, concepts, principles, laws, or theories (Kurniawan et al., 2019; Madu, 2020; Ndjangala et al., 2021). Science learning in elementary school can be mastered by students if students have the ability to understand science concepts (Leasa et al., 2021; Wahyu et al., 2020). Understanding this concept is needed by every student because science learning is composed of concepts. Understanding a student's

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concept is built through scientific investigation so that students find new phenomena or knowledge for themselves. In line with this previous study that state that students' acquisition of conceptual understanding is built by following various series of learning processes (Jailani & Almukarramah, 2020; Saepuzaman et al., 2019; Sukarelawan et al., 2019). Unsteady conceptual understanding can be characterized by not understanding the meaning of the knowledge content presented by the teacher, definitions, and reasons for the part of the interrelated knowledge presented by the teacher (Abrahams & Reiss, 2012; Chen & Liu, 2020; Dobber et al., 2017).

In the current era, students require many skills that can support the increasingly advanced era of globalization. One of the skills that is always applied in everyday life is science process skills. Science process skills or SPS are intellectual skills that must be learned and possessed by every student to be able to prove theories by looking for evidence and facts in the field to find acceptable answers (Chorunnisa et al., 2018; Laila Puspita, 2019; Leasa et al., 2020). Observations in the field and the results of interviews that have been carried out show that there is still a need for improvement in learning natural sciences. Teaching and learning activities that are carried out monotonously will cause students' ignorance about the process of the science concepts obtained (Bahadur & Boodun, 2013; Wulandari et al., 2019). Learning activities like this result in the process skills possessed by students being low. The designed learning should pay attention to the learning objectives, the characteristics of the material being taught, the student's abilities, and the learning resources available around the student's environment (Gideon & Rahmansyah, 2021; Nurtanto et al., 2021; Riananda, 2016). Students should be given the opportunity to explore understanding and develop thinking skills and scientific process skills including scientific investigation.

Guided Inquiry is one of the developments of the *inquiry model*. *Guided Inquiry* learning model emphasizes the process of independent knowledge discovery where students are the center of learning. Guided inquiry, teachers and students play an important role in the question and answer process (Fahrurrizal et al., 2019; Nurmayani et al., 2018; Srirahayu & Arty, 2018). This question and answer process will result in the condition of the class being active. One of the cooperative learning models that can be combined with other learning models is Think Pair Share. TPS (Think-Pair-Share) is one strategy that allows students to interact actively with their partners (Abidin, 2017; Kadek Yogi Parta, 2016; Mufarizuddin., 2018). The TPS model allows students with their partners to process information and develop communication skills so that passive students become more active. The TPS model can improve their thinking so that students can present the answers they find confidently. Students can exchange ideas in a discussion and share knowledge so that good communication occurs in the classroom (Agusdianita et al., 2020; Mufarizuddin., 2018).

Guided Inquiry with Think Pair Share approach is a combination of two learning models. This combination aims to maximize the learning process. Guided Inquiry is a learning model that requires students to acquire knowledge independently, while Think Pair Share is cooperative learning where students can learn in pairs so that the knowledge gained is more leverage than the students that have to study alone (Gunawan et al., 2019; Maknun, 2020; Seranica et al., 2018). The combination of Guided Inquiry and Think Pair Share can improve students' conceptual understanding and science process skills through every step taken. Students can communicate in formulating hypotheses, share, and find out which hypotheses will be used to be tested in the next step. In the end, students will find their own knowledge, improve science process skills and the conceptual understanding gained can be implemented in everyday life. Guided Inquiry based learning helps students develop individual responses and learner cognitive abilities, make reports systematically, problem solving, and process skills (Cartwright & Hallar, 2018; Kang, 2022; Payu et al., 2022). Guided Inquiry learning model can foster conceptual understanding, independence in learning, democratic spirit, and tolerance for differences of opinion.

Base on previous study state that *Think Pair Share* learning model is a learning model that can make students interact actively, process information, improve communication skills with peers, improve their thinking and also help them to participate effectively in the teaching and learning process in class through discussion (Cooper et al., 2021). Other study state that Guided inquiry is effective in measuring the achievement of understanding knowledge, increasing understanding of difficult concepts, and overcoming misconceptions of understanding knowledge (Rands et al., 2021; Tytler & Prain, 2022). Likewise previous study stated that Guided Inquiry based learning is a well-known strategy in Science, Technology, Engineering, and Mathematics (STEM) (Gupta et al., 2022; Payu et al., 2022).

Based on the problems and previous research related to the TPS learning model and guided inquiry. It is important to consider combining Guided Inquiry implementation with a Think Pair Share approach. Because the research that analyzes the combination of these two learning models is still very limited. Therefore, researchers are interested in conducting research on the TPS learning model and guided inquiry. This study aims to analyze the improvement of science process skills and students'

conceptual understanding through the Guided Inquiry model with the think pair share approach and the Guided Inquiry model.

2. METHOD

This study used a quantitative research design with a quasi-experimental type of research. Quasi-experimental is a design that has a control group but cannot fully control external variables that affect the implementation of the experiment (Flannelly et al., 2018; Sugiono, 2015). The research design used was the Pretest-Posttest Nonequivalent Control Group Design. The population in this study were all fifth graders from six elementary schools in Jembrana district. Determination of the sample used random sampling technique. The sample of this research was the fifth graders from SD Negeri 1 Baler Bale Agung, totaling 27 students and 26 students of SD Negeri 3 Baler Bale Agung. The instrument used was a test of conceptual understanding and science process skills on the theme of heat and its transference. Data analysis used n-gain test, t test.

3. RESULT AND DISCUSSION

Result

Classical completeness test aims to test whether the proportion of students who achieve the KKM of 75 is 75%. Summary of classical completeness test on conceptual understanding is show in Table 1.

Table 1. Summary of Classical Completeness Test on Conceptual Understanding

Uji Z	Z_{table}	Zcount
Guided Inquiry Class	0.5199	-2.038
Guided inquiry with think pair share approach class	0.5199	0.777

Based on Table 1 related of standard normal tables, the Ztable results are 0.5199. Karen Zcount < Ztable or -2.038 <0.5199. It means that H0 is accepted. It can be concluded that the proportion of Guided Inquiry class students during learning that meet the minimum completeness criteria of 75 is less than 75%. Meanwhile, in the guided inquiry class with think pair share approach, the standard normal table list obtained Ztable results of 0.5199. Because Zcount > Ztable or 0.7777 > 0.5199, H0 is rejected. It can be concluded that the proportion of guided inquiry class students with think pair share approach during learning that meet the minimum completeness criteria of 75, is more than 75%. Classical completeness of conceptual understanding is show in Figure 1.

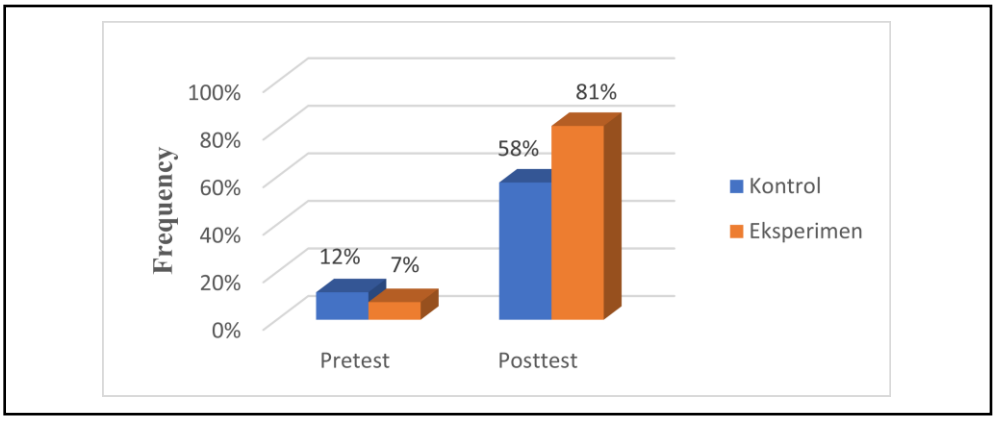

Figure 1. Classical Completeness of Conceptual Understanding

Table 2. N-Gain Calculation Results of Conceptual Understanding

Class	Pretest	Posttest	Gain Score	Criteria
Guided inquiry	52.69	77.31	0.50	Medium
Guided inquiry with think pair share approach	54.55	85.19	0.66	Medium

From the Table 2, it can be concluded that the increase in learning outcomes (N-gain) for conceptual understanding of the guided inquiry class belongs to the medium category, while the guided

inquiry class with the think pair share approach belongs to the medium category. Classical completeness of conceptual understanding is show in Figure 2.

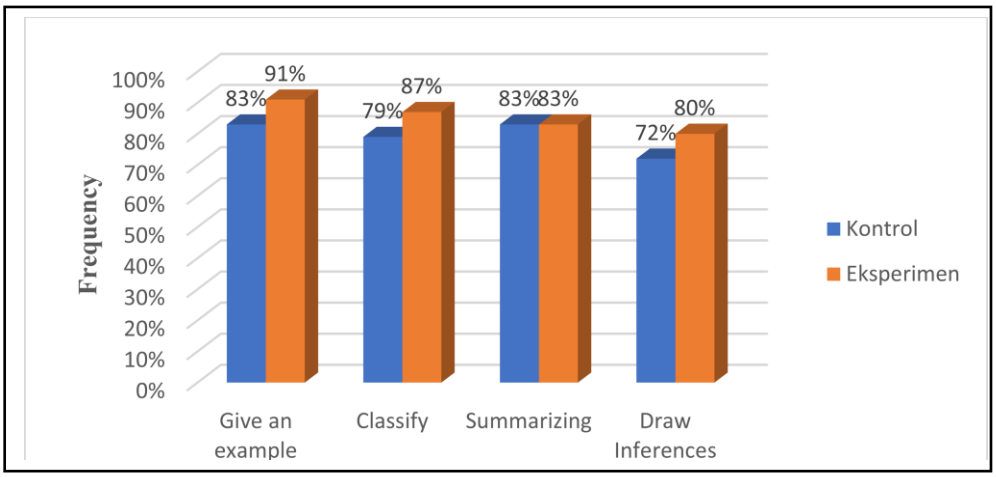

Figure 2. Classical Completeness of Conceptual Understanding

Based on Figure 2, it can be seen that the percentage of each indicator of conceptual understanding of the experimental class is higher than that of the control class. The percentages of each guided inquiry class indicator with the think pair share approach are as follows, for the exemplifying indicator, the percentage result is 91%, the clarifying indicator is 87%, the summarizing indicator is 83% and the inferring indicator is 80%. The overall percentage reach 85.25 which is in the good category. Summary of classical completeness of science process skills is show in Table 3.

Table 3. Summary of Classical Completeness of Science Process Skills

Z-test	Z_{table}	Z_{count}
Guided Inquiry	0.5199	-1.5851
guided inquiry with think pair share approach	0.5199	1.2222

Based on Table 3, show that the Ztable results are 0.5199. Because Zcount < Ztable or -1.5851 < 0.5199 then it is accepted H0. Meanwhile, in the guided inquiry class with the think pair share approach, the standard normal table list obtained Ztable results of 0.5199. Because Zcount > Ztable or 1.2222 > 0.5199, it is reject H0. It can be concluded that the proportion of students in the guided inquiry class with a think pair share approach during learning that meet the minimum completeness criteria of 75 is more than 75%. Classical completeness of science process skills is show in Figure 3.

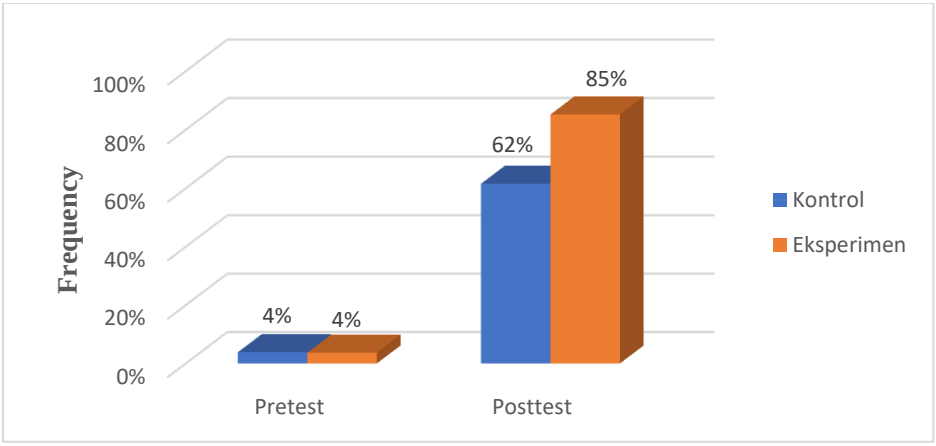

Figure 3. Classical Completeness of Science Process Skills

Table 4. N-Gain Calculation Results of Science Process Skills

Class	Pretest	Posttest	Gain Score	Criteria

Class	Pretest	Posttest	Gain Score	Criteria
Guided inquiry	36.35	75.38	0.58	Medium
Guided inquiry with *think pair share approach*	52.04	82.59	0.63	Medium

Based on the Table 4, it can be concluded that the increase in learning outcomes (N-gain) for the science process skills of the guided inquiry class belongs to the medium category, while the guided inquiry class with the think pair share approach belongs to the medium category. Improvement of science process skills based on n-gain criteria is show in Figure 4.

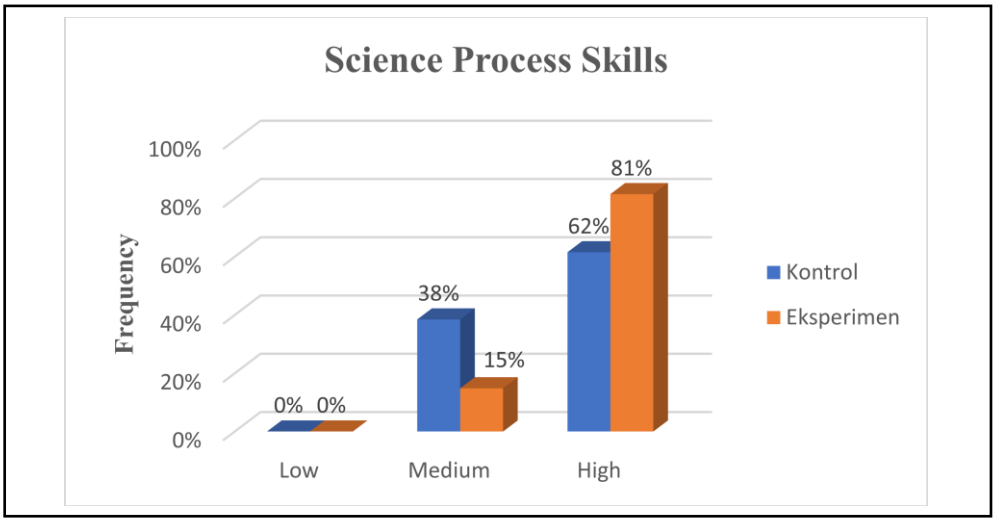

Figure 4. Improvement of Science Process Skills based on N-gain criteria

Table 5. Calculation Results of Average Discrimination Test in Conceptual Understanding and Science Process Skills

	Sig.(2-tailed) Score	Significance	Criteria
Conceptual Understanding	0.042	0.05	Significant
Science Process Skills	0.024	0.05	Significant

Base on Table 5, the results of the Independent sample T-test test output obtained with SPSS 23.0 assisted calculations are known that the resulting sig.(2-tailed) score is 0.042 <0.05, then Ho is rejected which means that there are differences in understanding the concepts of the guided inquiry class and guided inquiry class with the think pair share approach. Because there is an average difference, it can be seen in the group statistics table. In the table it is known that the average value of the guided inquiry class is 77.31 and the guided inquiry class with the think pair share approach is 85.19. The average guided inquiry class with think pair share approach is more than the guided inquiry class average. It can be concluded that there are differences in conceptual understanding of the guided inquiry class and the guided inquiry class with the think pair share approach.

The results of the Independent sample T-test test output obtained with SPSS 23.0 assisted calculations are known that the resulting sig.(2-tailed) score is 0.024 < 0.05, then H0 is rejected, which means that there are differences in science process skills in the guided inquiry class and the guided inquiry class with think pair share approach. Because there is an average difference, it can be seen in the group statistics table. In the table it is known that the average value of the control class is 75.38 and the experimental class is 82.59. The average of the experimental class is more than the average of the control class. It can be concluded that there are differences in the science process skills of the control class and the experimental class.

Table 6. Percentage of Science Process Skills Per Indicator

KPS Indicator	Average Percentage	Category
Observing	77%	Good
Asking questions	75%	Good

KPS Indicator	Average Percentage	Category
Formulating Hypotheses	84%	Exellent
Communicating	75%	Good
Overall average	78%	**Good**

Base on Table 6, the data obtained from the observation results show the highest indicator lies in the indicator of formulating hypotheses in the excellent category with an average percentage of 84% and the lowest observation result is the indicator asking questions with an average percentage of 75%. Based on the table above, the average overall observation of science process skills is 78% in the good category

Discussion

Based on the results of the study, the proportion of students in the guided inquiry class using the think pair share approach during learning who met the minimum completeness criteria was 75, more than 75%. So this means increasing knowledge of students using guided inquiry combined with a think pair share approach (Gupta et al., 2022; Williams, U. J., & Dries, 2022). Then the conceptual understanding of the guided inquiry class is included in the medium category, while the guided inquiry class with the think pair share approach is included in the medium category, the percentage of each indicator of the experimental class's conceptual understanding is higher than the control class. The overall percentage reached 85.25 which was included in the good category. This means that the experimental class, which applies the guided inquiry class with the think pair share approach, learns better than the control class which does not apply the guided inquiry and think pair share approach (Goeltz & Cuevas, 2021; Stender et al., 2018).

The learning outcomes (N-gain) of the science process skills of the guided inquiry class are in the medium category, while the guided inquiry class with the think pair share approach is in the medium category. The results of this study found that the use of inquiry learning and guided inquiry learning had a significant effect on student learning outcomes. Moreover, the average guided inquiry class with the think pair share approach is more than the average guided inquiry class. It can be concluded that there are differences in the conceptual understanding of the guided inquiry class and the guided inquiry class using the think pair share approach (Al Mamun et al., 2022; Gunawan et al., 2019; Pursitasari et al., 2020). The average of the experimental class is greater than the average of the control class. It can be concluded that there are differences in science process skills in the control class and the experimental class.

It is in line with previous study with aims to understand the implementation of PBL combined with TPS in enhancing students' scientific literacy (Wicaksono & Susilo, 2019). The results show that students' scientific literacy skill is increased from 50% in cycle 1 into 79% in cycle 2. Students' communication skill is also increased from 54% in cycle 1 into 70% in cycle 2. Results from observers show that PBL combined with TPS enhances student' learning activities and communication skills in class. It can be concluded that the implementation of PBL combined with TPS enhances students' scientific literacy. Other previos study is determine the effectiveness of the model in improving the understanding of the concept study (Ulya et al., 2013). The study result showed the student learning outcomes average of experimental class by learning model guided inquiry think pair share-based students has reached individual minimum completeness criteria and classical minimum completeness criteria. The implication of this research is to provide insight about how effective the guided inquiry learning model using the TPS approach in science process skills and conceptual understanding for students. This research is useful for teachers as a reference and choice in implementing a learning model that is in accordance with student needs and learning objectives. However, this research still has limitations. One of the limitations of this research lies in its scope which only involves fifth grade students. It is hoped that future research will further deepen the scope of research by considering other factors related to the application of the guided inquiry learning model using the TPS approach.

4. CONCLUSION

Based on the results of the research and discussion that has been described, it can be concluded that the Guided inquiry model with think pair share is more successful or effective if it is compared with the Guided inquiry model approach can improve students' conceptual understanding and improve students' science process skills

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