The Implementation of Think Pair Share (TPS), Think Talk Write (TTW), and Problem Based Instruction (PBI) Learning Model on Students' Mathematics Learning Outcomes

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Abstract. This study aims to find out between TPS, TTW, or PBI learning models that provide the best learning outcomes. The research method used is quasi experimental. The data analysis technique used is the one-way variance analysis of equivalent cells. Based on the hypothetical test, it is obtained that $F_{\text{observed}} > F_{\text{critical}}$ (4.12 > 3.114) which means $H_0$ is rejected. It can be concluded that the students' mathematics learning outcomes based on the application of TPS, TTW, and PBI learning models are not the same. It can be seen from the average score of each model that is 72.60 for TPS, 78.45 for TTW, and 65.19 for PBI. It appears that the average score of the TTW model is the highest among the rest, and the average score of the TPS model is higher than the PBI model. It can be said that the TTW model provides better mathematics learning outcomes than the TPS and the PBI model and the TPS model provides better mathematics learning outcomes than the PBI model. In short, the TTW Learning model is the most effective to be used in learning the circle material.

1. Introduction

Education is a resource that deserves continuous attention in the context of improving the quality of education, especially in the mastery of science. Mathematics plays an important role in education both as a direct object (facts, concepts, principles) and indirect objects (critical attitude, logical, and perseverance). Due to the importance of mathematics, it becomes one of the mandatory subjects given in schools starting from the lowest level, namely elementary school to the tertiary level.

The learning process is composed of several components or elements that are interrelated with one another. The interaction between the teacher and students during the teaching and learning process plays an important role in achieving the desired goals. The possibility of teachers' failure in delivering materials is caused when the teaching and learning process, the teachers do not arouse the students' attention and activities in following the lessons, especially mathematics. Sometimes the teacher has difficulty making students understand the material so that mathematics learning outcomes are low. The results of observations of mathematics teaching at MTS (Islamic Junior High School) Nurul Falah Rego Padasuka-Petirdiscovered that there are several weaknesses of teaching, including the mathematics learning outcomes achieved by students that were still low and the mathematics learning interest still low because the students considered mathematics as a difficult subject and the learning
model was not varied so that it was possible for students to easily feel bored. The learning development needed now is innovative learning that can enhance students' creativity and provide a conducive atmosphere in the development of students' reasoning ability. Involving students actively in learning mathematics is very important because, in mathematics, many problems solving activities require active students. The students are the subjects who solve the problems and they are the ones who carry out the learning. Responding to the above reality which is also a challenge for the world of education, the learning paradigm must also be changed. From what was originally just "teaching a lot" to "encouraging students to learn", from what was originally problem-solving oriented to be creative mindsets oriented. Several learning models can be applied to make learning better. Some of them are Think Pair and Share, Think Talk Write, and Problem Based Instruction learning models.

Various studies on the Think Pair and Share, Think Talk Write, or Problem Based Instruction learning models have been carried out in previous studies [1-11] As well as research to improve students' learning outcomes [12-27]. However, no research investigates the TPS, TTW, or PBI learning model to see the effect on students' learning outcomes. Based on previous research, the researchers are interested in researching with renewal, that is, seeing the effect of the TPS [28], TTW [29] or PBI learning model on students' learning outcomes. So, this research aims to find out, among the three learning models, which learning model provides better mathematics learning outcomes on the circle material.

2. Research Methods
The research method employed in quantitative research. This type of research is quasi experimental [30] in three classes with different treatments. This study uses a factorial 3 × 1 research design, namely with three learning models and one dependent variable that is the learning outcomes of circle material. The instrument used in the study was a multiple-choice test with 25 questions with 4 answer choices that had previously met the validity and reliability requirements.

A data analysis technique was used to test the research's hypothesis of finding out the most effective learning model between TPS, TTW, and PBI. The average learning outcomes of the three models was calculated using one-way analysis of variance with the equivalent cell. Before the hypothetical test was carried out, the prerequisite tests analysis were carried out in the form of normality test and homogeneity test. The normality test was performed to determine whether the data obtained in the sample comes from normally distributed populations or not, in populations where the distribution is normal or close to the normal distribution. The formula used was the Lilliefors test. Then the homogeneity test was performed, i.e. the population variance is the same or not. If the two conditions are not met then the one-way Anova test cannot be carried out.

3. Results and Discussion
A new research instrument can be used to collect data if it meets the criteria of a good instrument which is valid and reliable. Based on the results of the validity test using biserial r points, 25 valid questions were obtained, namely those that met the criteria greater than r_{critical} or equal to 0.361. The biserial r point value was calculated then compared to the r_{critical} value. If the value of the biserial r point is greater than the value of the r_{critical} then the item is declared valid. The instrument reliability test with KR-20 resulted in r_{11} = 0.87 with a very high reliability category. After the valid questions were calculated for their reliability, reliable results with very high categories were obtained. The questions or learning outcomes instruments were used to retrieve data on the research sample.

Based on the results of data collection on student learning outcomes on the circle material, a data normality test was performed using the Lilliefors test. The mathematics test results of the classes that employed TPS, TTW and PBI learning models are listed in Table 1.
Table 1. The Summary of Data Normality Test

| Group       | $L_{\text{observed}}$ | $L_{\text{critical}}$ | $\alpha$ | N  | Description |
|-------------|-----------------------|------------------------|----------|----|-------------|
| Experimental I | 0.1380                | 0.161                  | 0.05     | 30 | Normal      |
| Experimental II | 0.1005               | 0.161                  | 0.05     | 30 | Normal      |
| Experimental III | 0.1485               |                        |          | 30 | Normal      |

Based on the results in Table 1, it can be seen that the data come from normally distributed populations because, in each experimental group, the results obtained are $L_{\text{observed}} < L_{\text{critical}}$ which data comes from populations that are normally distributed. The homogeneity test was performed using the Bartlet test with a significance level of 5%, based on the calculation results, the obtained data can be seen in Table 2.

Table 2. Summary of Homogeneity Test Results

| Group       | $\alpha$ | N    | $\chi^2$ | $\chi^2_{\text{observed}}$ | $\chi^2_{\text{critical}}$ | Description |
|-------------|----------|------|----------|-----------------------------|-----------------------------|-------------|
| Experimental I | 0.05     | 30   | 96.04    | 2.016                       | 5.991                       | The variance of the groups is equal |
| Experimental II |         | 30   | 118.24   | 2.016                       | 5.991                       |            |
| Experimental III |         | 30   | 129.36   | 2.016                       | 5.991                       |            |

Based on the results in Table 2, it was found that the variances of the three samples were homogeneous or equal because of $\chi^2_{\text{observed}} < \chi^2_{\text{critical}}$. The Value of $\chi^2_{\text{observed}}$ is 2.016 and the value of $\chi^2_{\text{critical}}$ is 5.991 at the significance level of 5%. The hypotheses test was done using all three average scores with the proposed hypothesis. From the calculation results, the $F_{\text{observed}}$ is 4.12 and the $F_{\text{critical}}$ is at the real level of $\alpha = 0.05$ and $dk = 63$ of 3.114. $H_0$ is rejected if $F_{\text{observed}}$ is greater than the $F_{\text{critical}}$. Based on the calculations, it was obtained that 4.12 > 3.114, thus, the null hypothesis is rejected. It means that not all learning models provide the same mathematics learning outcomes for the eighth grade of Mts. Nurul Falah Rego Padasuka especially on the circle material. Judging from the average student learning outcomes, the TTW model provides the best learning outcomes compared to TPS and PBI and the TPS model provides better learning outcomes than PBI.

TPS or Think-Pair-Share is a type of cooperative learning that is designed to meet the patterns of student interaction by making variations in the atmosphere of class discussion patterns with the assumption that all recitation and procedures used in TPS can give students more time to think, respond, and help one another. The teacher only gives a short presentation or the students read the assignment. Now the teacher wants students to consider more of what is explained and understood. As the name suggests, thinking begins when the teacher asks questions or issues related to the lesson for students to think about. The teacher allows them to think about the answer. Next is pairing. At this stage, the teacher asks the students to pair up and allow them to discuss it. It is hoped that this discussion can deepen the meaning of the answers they have thought inter-subjectively with their partners. The results of the inter-subjective discourse in each pair are then discussed with the whole class. In the Sharing stage, it is expected that questions and answers will rise which will encourage the construction of knowledge in an integrative manner. Students can find the structure of the knowledge they learn.[31] TPS is a cooperative learning model that gives students time to think and respond and help one another. This model introduces the idea of "thinking time or waiting time" which is a strong factor in increasing students' ability to respond to questions. This TPS cooperative learning model is relatively simpler because it does not take long to arrange to seat or classify students. This learning trains students to dare to think and respect the opinions of friends. The TPS's procedures explicitly give students time to think, answer, and help one another. Thus, students are expected to be able to cooperate, need each other, and depend on each other in small groups cooperatively. [32]

Think-Talk-Write (TTW) was first introduced by Huinker and Laughlin and was built through the activities of thinking, speaking, and writing. TTW is a learning strategy that is expected to cultivate the ability of students' mathematical understanding and communication. The cooperative learning
model is done through the activity of thinking, talk or discuss, exchange opinions (talk), and write down the results of the discussion (write) for learning and competencies that are expected to be achieved.[33] It can be concluded that TTW is a model of cooperative learning that starts from the flow of thought (think) through reading, speaking (talk) through discussion activities, exchanging opinions and presentations and writing (write) the results of the discussion. TTW can be applied to heterogeneous groups of 3-5 students. In the group, students are asked to read, take small notes, explain, listen, and share ideas with friends then express them with friends and end by expressing their ideas through writing.

Problem Based Instruction (PBI) is problem-based learning and project-based that belongs to collaborative learning. Problem Based Instruction (PBI) or Problem Based Learning (PBL) can only develop if an effective classroom situation is developed. PBI is a learning process that is the starting point of learning based on problems in real life and from this problem, the students are stimulated to study the problems based on prior knowledge and experience so that new knowledge and experiences will form. In acquiring information and developing an understanding of topics, students learn how to construct a problem's frameworks, organize and investigate the problems, collect and analyze the data, compile the facts, and construct the arguments about problem-solving by working individually or collaboratively. Based on the theories, it can be concluded that the PBI model is a classroom management model based on constructivism approach that can be used to design problem-based learning experiences for students. Students conduct exploration, assessment, interpretation, and synthesize the information to produce various forms of learning outcomes.

4. Conclusions and Suggestions
Based on the results of research and discussion, it can be concluded that the results of students' mathematics learning outcomes using TPS, TTW and PBI learning models are not the same. This is seen from the average scores on each model that is 72.60 for TPS, 78.45 for TTW, and 65.19 for PBI. The average score of the TTW model is the highest among the three and the average score of the TPS model is higher than the PBI model. So it can be said that the TTW model provides better mathematics learning outcomes compared to the TPS and PBI learning models and the TPS learning model provides better mathematics learning outcomes than PBI on circle material. So that the TTW Learning model is the most effective to be used in circle material.

Based on the conclusions of this study, several suggestions can be made. The teachers can use the TTW model in teaching the circle material and further researchers to examine the effect of the TTW learning model on other subjects to improve mathematics learning outcomes.

References
[1] E. Subekti and T. Sentono 2016, “Effektivitas Metode Pembelajaran Think-Talk-Write Terhadap Hasil Belajar Mata Pelajaran Teknik Bubut Siswa Kelas XI SMK Muhammadiyah 3 Yogyakarta,” *J. Taman Vokasi*, 4 2 pp. 278–292
[2] A. D. Angriani, Bernard, R. Nur, and Nurjawarih 2016, “Meningkatkan Kemampuan Pemecahan Masalah Melalui Pembelajaran Kooperatif Think-Talk-Write Pada Peserta Didik Kelas VIII MTs N Model Makassar.” *Mapan J. Mat. Dan Pembelajaran.*, 4 1 pp. 11–28
[3] I. Rodliyah 2017, “Keefektifan Pembelajaran Kooperatif Tipe Think Talk Write (Ttw) Pada Materi Bangun Ruang Kelas VIII MTs/ SMP,” *Erud. J. Educ. Innov.*, 3 2 pp. 13–24
[4] H. Afthina, Mardiyana, and I. Pramudya 2017, “The Comparison of Think Talk Write and Think Pair Share Model with Realistic Mathematics Education Approach Viewed from Mathematical-Logical Intelligence,” *Int. J. Sci. Appl. Sci. Conf. Ser.*, 2 1 pp. 181–189, 2017.
[5] M. M. L. Siahaan and E. E. Napitupulu 2018 “The Difference of Students’ Mathematical Communication Ability Taught by Cooperative Learning Model Think Talk Write Type and Numbered Head Together Type,” *Sch. J. Pendidik. dan Kebud.*, 8 3 pp. 231–242
[6] Y. Arnidha 2016, “Peningkatan Kemampuan Representasi Matematis Melalui Model Pembelajaran Kooperatif Think Pair Share,” *J. e-DuMath*, 2 1 pp. 128–137, 2016.
[7] S. Zahara 2014, “Peningkatan Kemampuan Penalaran Logis dan Komunikasi Matematis Melalui Model Pembelajaran Kooperatif Tipe Think Pair Share (TPS) di SMP Negeri 24 Medan,” J. Pendidik. Mat. Parad., 7 3

[8] M. M. Huda, H. Susilo, and C. Sa’dijah 2017, “Penerapan Pembelajaran Reciprocal Teaching Dipadu Think Pair Share Untuk Meningkatkan Keterampilan Berpikir Kritis Dan Hasil Belajar Siswa,” J. Pendidik., 2 20, pp. 1356–1368

[9] S. Mukhoyaroh and S. Jazil 2013, “Pengaruh Model Pembelajaran Kooperatif Tipe TPS (Think Pair Share) Terhadap Pemahaman Siswa Pada Mata Pelajaran Fiqih Kelas VII MTS Al-Irsyadiyah Dermolembang Sarirejo Lamongan,” J. Pendidik. Agama Islam, 1 1, pp. 23–44

[10] T. Muah 2016, “Penggunaan Model Pembelajaran Problem Based Instruction (PBI) Untuk Meningkatkan Keaktifan Dan Hasil Belajar Matematika Siswa Kelas 9b Semester Gasal Tahun Pelajaran 2014/2015 SMP Negeri 2 Tuntang Semarang,” Sch. J. Pendidik. Dan Kebud., 6 1, pp. 41–53

[11] Suhita 2019, “Analisis Kemampuan Berpikir Kritis Matematis: Dampak Model Pembelajaran Problem Based Instruction,” Desimal J. Mat., 2 2, pp. 189–195

[12] R. N. K. Rambe 2018, “Penerapan Strategi Index Card Match Untuk Meningkatkan Hasil Belajar Siswa Pada Mata Pelajaran Bahasa Indonesia,” J. Tarb., 25 1, pp. 93–124

[13] D. Septiono and B. P. Darminto 2014, “Perbandingan Pembelajaran Matematika Dengan Hypnoteaching Dan Eksppositori Terhadap Hasil Belajar Pada Materi Limit Fungsi,” Ekuivalen, 12 2, pp. 214–219

[14] Wahyudi and M. C. Siswanti 2015, “Pengaruh Pendekatan Saintifik Melalui Model Discovery Learning Dengan Permainan Terhadap Hasil Belajar Matematika Siswa Kelas 5 SD,” Scholaria, 5 3, pp. 23–36

[15] M. Sasono, F. Huriawati, and A. C. Yusro 2017, “Pendekatan Konstruktivistik Dengan Metode Five E ( 5e ) Stages Learning Cycle Untuk Meningkatkan Hasil Belajar Dan Keterampilan Proses Sains,” 1 1, pp. 45–55

[16] D. Murni and S. Romlah Noer Hodijah 2016, “Penerapan Blended Learning Berbasis Scaffolding Untuk Meningkatkan Kemampuan Berpikir Logis Dan Hasil Belajar Mahasiswa Pada Mata Kuliah Biologi Umum,” Biodidaktika, 11 1, pp. 45–51

[17] H. Yulianti, S. An’nur, and M. Wati 2014, “Meningkatkan Hasil Belajar Siswa Pada Materi Ajar Listrik Statis Dengan Pendekatan Problem Posing,” Berk. Ilm. Pendidik. Fis., 2 3, pp. 244–252

[18] Prihartini and N. Mediatati 2103, “Perbedaan Pengaruh Metode Pembelajaran Kooperatif Tipe TSTS ( Two Stay Two Stray) Dan Metode Ceramah Terhadap Hasil Belajar,” Satya Widya, 29 2, pp. 127–133

[19] F. Kristin and D. Rahayu 2016, “Pengaruh Penerapan Model Pembelajaran Discovery Learning Terhadap Hasil IPS Siswa Kelas 4 SD,” Scholaria, 6 1, pp. 84–92

[20] A. S. Pritakananthi 2017, “Pengembangan Media Pembelajaran Menggunakan iSpring untuk Meningkatkan Hasil Belajar Mata Pelajaran Bahasa Inggris Kelas VIII SMP Negeri 37 Semarang,” Universitas Negeri Semarang

[21] B. Utami, B. Hastuti, S. Yatimah, S. Padmini, and F. Arroyan 2013, “Penerapan Siklus Belajar 5E Disertai LKS Untuk Peningkatan Kualitas Proses dan Hasil Belajar Kimia,” Cakrawala Pendidik., 32 2, pp. 315–325

[22] I. M. W. Jagantara, M. S. Prof. Dr. Putu Budi Adnyana, and S. S. Dr. Ni Luh Putu Manik Widiyanti 2014, “Pengaruh Model Pembelajaran Berbasis Proyek (Project Based Learning) Terhadap Hasil Belajar Biologi Ditinjau Dari Gaya Belajar Siswa SMA,” J. Pendidik. dan Pembelajaran IPA Indonesia., 4 1

[23] Y. L. Ningsih and Jayanti 2016, “Hasil Belajar Mahasiswa Melalui Penerapan Model Blended Learning Pada Mata Kuliah Persamaan Diferensial,” J. Pendidik. RAFA, 2 1, pp. 1–11

[24] M. Surur and R. N. U. Urfi 2017, “Penerapan Model PBL Menggunakan Index Card Match
Untuk Meningkatkan Aktivitas Dan Hasil Belajar Siswa Kelas X,” *J. Pendidik. Edutaa*, 42, pp. 11–18

[25] Z. Mustofa, H. Susilo, and M. H. I. Al Muhdhar 2016, “Penerapan Model Pembelajaran Problem Based Learning Melalui Pendekatan Kontekstual Berbasis Lesson Study Untuk Meningkatkan Kemampuan Memecahkan Masalah Dan Hasil Belajar Kognitif Siswa SMA,” *J. Pendidik. Teor. Penelitian, dan Pengemb.*, 15, pp. 885–889

[26] R. L. Agustina 2015, “Upaya Meningkatkan Hasil Belajar IPA Siswa Kelas IV Menggunakan Model STAD Dan NHT,” *J. EST*, 13, pp. 31–38

[27] R. Hamdi, M. A. Jamal, and S. Annur 2014, “Meningkatkan Hasil Belajar Fisika dengan Menerapkan Model Pembelajaran Kooperatif Tipe Two Stay Two Stray,” *Berk. Ilm. Pendidik. Fis.*, 23, pp. 265–273

[28] T. Pangkali, I. L. S. Sinon, and S. W. Widyaningsih 2016, “Penerapan Model Kooperatif Tipe TPS Terhadap Hasil Belajar Kognitif dan AKtivitas Peserta Didik Pada Materi Gelombang Mekanik Kelas XI IPA SMA Negeri 1 Kabupaten Sorong,” *J. Ilm. Pendidik. Fis. Al-BiRuNi*, vol. 52, pp. 173–181

[29] Irwandani, “Pengaruh Penerapan Strategi Pembelajaran Think Talk Write (TTW) Terhadap Prestasi Belajar Fisika Peserta Didik Kelas VIII MTS,” *J. Ilm. Pendidik. Fis. Al-Biruni*, pp. 51–61

[30] A. and U. Thahir, andi. Saregar 2019, “Efektivitas STEM-Berdasarkan Perbedaan Gender : Dampak Fisika Konsep Pemahaman,” European Journal of Educational Research, September

[31] A. Suprijono 2013, *Cooperative Learning*. Yogyakarta: Pustaka Pelajar

[32] A. Shoimin 2014, *68 Model Pembelajaran Inovatif Dalam Kurikulum 2013*. Yogyakarta: Arruz Media

[33] L. Iru and L. S. A. Ode 2012, *Analisis Penerapan Pendekatan, Metode, Strategi, dan Model Model Pembelajaran*. Yogyakarta: Multi Presindo