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IMPLEMENTATION OF TAI-TYPE COOPERATIVE LEARNING TO INCREASE STUDENTS' MATHEMATICAL REPRESENTATION BASED ON THE CONSTRUCTIVIST APPROACH

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ABSTRACT
This study aims to determine the average increase in the mathematical representation ability of students who are taught using Team Assisted Individualization (TAI) learning and conventional learning and to see the effectiveness of the TAI learning model with a constructivist approach. The subjects in this study were students of class VIII SMP Negeri 3 Samaturu in the even semester. Sampling was carried out using cluster random sampling technique as the experimental unit selected two research classes. Data analysis techniques using descriptive statistics and inferential statistics. Furthermore, the results of inferential statistics on hypothesis testing using the t-test. Based on the results and discussion in this study, several conclusions were obtained, namely: (1) students' mathematical representation abilities before being taught by the TAI model with a constructivism approach consisting of 19 students showed an average of 14.08, with a standard deviation of 5.78615; (2) students' mathematical representation abilities after being taught using TAI learning with a constructivism approach show an average value of 58.72, with a standard deviation of 7.332761; and (3) Learning mathematics through the TAI learning model is more effective than conventional learning.

Keywords: tai-type learning, mathematical representation, constructivism.

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INTRODUCTION

Learning mathematics as part of the educational process in schools plays a vital role in increasing students' potential. This is following the regulation of the minister of national education number 22 of 2006 concerning content standards that mathematics subjects need to be given to all students starting from elementary school to equip students with the ability to think logically, analytically, systematically, critically and creatively, as well as the ability to work together (Masuri, 2019). The development of science begins with human nature, which wants to know everything (Arifin, 2020). So far, in learning mathematics, students have never or rarely been allowed to present their representations (Djidu et al., 2021). Students tend to imitate the teacher's steps in solving problems. As a result, students' mathematical representation abilities still need to develop. In addition, the resources that can support the student learning process could be more extensive. So, global competition arises between various nations to obtain supporting sources to succeed in this learning (Jahring et al., 2022).

Referring to the National Council of Teachers of Mathematics states that five basic mathematical abilities are standard, namely problem-solving, reasoning and proof, communication, connections, and representation (HL et al., 2023). One of the abilities that students must possess is

the ability to represent. Representational ability is the ability of students to express their ideas in mathematical models to plan a problem-solving through mathematical representations; students can develop and deepen their understanding of mathematical concepts and help students communicate their thoughts. Based on this description, the ability to represent is an essential element in learning mathematics (Yusnani, 2016).

Based on the results of observations and interviews conducted at the school, it was found that most students' mathematical representation abilities were at a low level (Sejati et al., 2021). This is due to several factors, including the lack of students' ability to express ideas or ideas, the lack of student involvement in the teaching and learning process, and the use of the learning model used is not appropriate, the learning that teachers often apply is discussion, lecture, and question and answer. This resulted in students needing more motivation to obtain sources of information other than the teacher and students not accustomed to discovering mathematical concepts.

Recognizing the importance of mathematical representation abilities, teachers must seek learning by applying learning models that usually involve students fully in the learning process, encouraging students to be able to communicate the ideas they have (Ovan et al., 2023). By choosing the suitable learning model, existing learning can provide opportunities and encourage students to practice students mathematical abilities (Jahring et al., 2022).

Observing this, it is better to renew innovation and mindset toward learning goals of mathematics that are more varied with learning methods or models that can optimize students' abilities (Hariyati et al., 2013). An exciting and effective learning model or method is needed so students can participate in the learning process (Nasruddin et al., 2019).

The Team Assisted Individualization (TAI) type of cooperative learning model was initiated to design a particular teaching form that could solve problems that could make individual teaching methods ineffective. By having students work in cooperative learning teams and taking responsibility for managing and checking routines, helping each other with problems, and encouraging each other to progress, teachers can free themselves from giving one-on-one instruction to small groups—homogeneous students from heterogeneous teams (Hakim, 2023). As teachers, we dream of reviving the joy of learning.

The TAI is a group learning model with a guidance strategy between friends. In this lesson, students are given worksheets to work on in groups so that students can easily understand the concept of the material. Students are invited to study independently, trained to optimize their ability to absorb the scientific information they seek, explain their findings to other parties, solve problems, and use their representations. So through this learning model, the students' activeness, independence, and skills in expressing their ideas can be developed. In addition, this model is expected to improve students' mathematical representation abilities.

The aims of this study were 1) to find out how the pretest and posttest results of the students' mathematical representation abilities were taught by using the TAI cooperative learning model and conventional learning models; 2) to find out whether the average increase in students' mathematical representation abilities after being taught with the TAI type cooperative learning model with a constructivism approach and conventional learning models; and 3) to find out whether the students'

mathematical representation skills taught by the TAI type cooperative learning model with a constructivism approach are more effective than conventional learning models.

METHODS

This type of research is True Experiment research involving two classes, namely TAI learning with a constructivism approach given to experimental class students and conventional learning given to control class students. Experimental research is a method used to seek the effect of specific treatments on others under controlled conditions (Sugiyono, 2013). This research was conducted at Samaturu 3 Public Middle School in class VIII, even semester, in Liku Village, Samaturu District, Kolaka Regency. This study used two classes, namely the first class, taught by the TAI learning model with a constructivism approach, and the second class, which was taught by conventional learning. This study used pretest and posttest to measure students' initial and final abilities. The experimental design used a pretest-posttest control group design. According to Arikunto, the population is the entire research subject (Arikunto, 2002). Meanwhile, according to Sugiyono, the population is a generalization area consisting of objects/subjects with specific qualities and characteristics determined by researchers to be studied and then conclusions drawn (Sugiyono, 2013). The population in this study were all class VIII students at SMP Negeri 3 Samaturu, which consisted of 3 classes with 86 students. The sample in this study was selected using cluster random sampling. Sukardi states that random cluster sampling is a sample selected based on groups, regions, or subjects that naturally come together (Sukardi, 2021). At the same time, Bintari stated that cluster random sampling is sampling based on groups as members of the population. This study used simple cluster random sampling (Bintari et al., 2014).

RESULTS AND DISCUSSION

Descriptive Analysis

Descriptive analysis in this study consisted of an analysis of students' mathematical representation abilities, an analysis of teacher observation sheets, and an analysis of student activity observation sheets as well as an analysis of students' mathematical representation abilities.

Analysis of Students' Mathematical Representation Ability

Analysis of students' mathematical representation abilities is intended to provide an overview of the characteristics and differences in the average value of the Team Assisted Individualization cooperative learning model. (TAI) with the constructivism approach and the conventional learning model, which can be seen through the average or mean and standard deviation values in Table 1 below.

Table 1 . Descriptive Analysis of Students' Representational Ability

Statistics	Learning model					
	TAI			conventional		
	Pretest	Posttest	N-Gains	Pretest	Posttest	N-Gain
N	19	19	19	17	17	17
Average	14.08	58.72	0.525	15	55.52	0.478
Save. raw	5.78615	7.332761	0.07060	6.78923	7.20368	0.06694
Variance	33.47953	53.76938	0.005	46.09375	51.89306	0.004

Based on Table 1, we obtained an average increase in the ability of mathematical representation (KRM) of students taught with the TAI-type cooperative learning model of 0.525. In contrast, the average increase in KRM taught with a conventional learning model was 0.478; the interpretation of the N-gain value for both learnings was included in the medium category. So the average increase in students in TAI learning with a constructivist approach is higher than the average increase in students taught with conventional learning.

Analysis of Teacher Activity Observation Sheets

The teacher's observation sheet is used to see whether the teacher can carry out the learning process according to the existing syntax. The results of the observation sheet are presented in Table 2 and Figure 1 below:

Table 2. Results of Teacher Activity Observation Sheet

Observation of Teacher Activities	Meeting			
	1	2	3	4
Experiment Class	81.25%	86.67%	86.67%	93.33%
Control Class	80%	81.818%	90.909%	90.909%
Average Percentage of Experiment Class Teacher Activities	86.98%			
Average Percentage of Activity Control Class Teacher	85.909%			

From the results of the analysis in Table 2 above, it can be seen that the percentage of the average value of teacher activity in the learning process using the TAI learning model with a Constructivism approach in the experimental class is 86.98%. While the percentage of the average value of teacher activity in the learning process using conventional learning in the control class is 85.909%. The results of the analysis of the observation sheet can be seen in Figure 1 below:

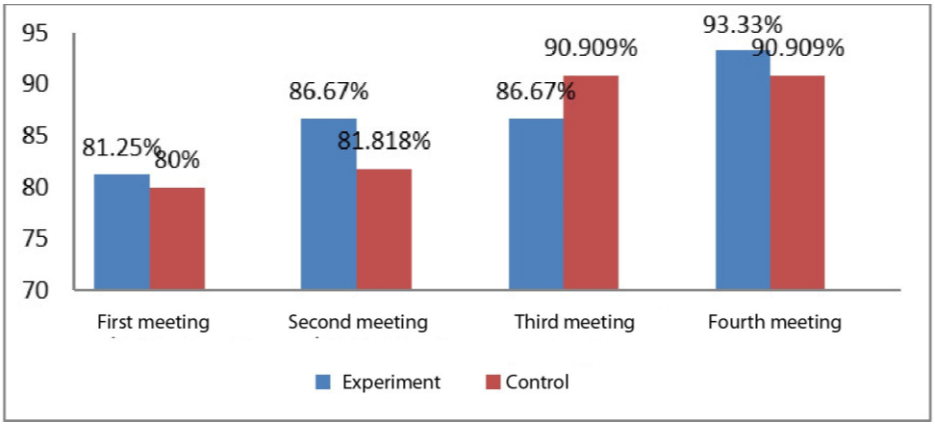

Figure 1. Results of Analysis of Teacher Activity Observation Sheets

Analysis of Student Activity Observation Sheets

Student activity observation sheets determine student activity during the learning process. The results of the observation sheet are presented in Table 3 and Figure 2 below:

Table 3. Results of Student Activity Observation Sheets

Observation Student Activities	Meeting			
	1	2	3	4
Experiment Class	76.67%	76.67%	80%	83.33%
Control Class	63.64%	75%	78.33%	83.64%
Average Percentage of Experiment Class Student Activities	79.18%			
Average Percentage of Activity Control Class Students	74.70%			

From the analysis results in Table 3 . above, it can be seen that the percentage of the average value of student activity in the learning process using the *TAI learning model* with a constructivism approach in the experimental class is 79.18%. While the percentage of the average value of student activity in the learning process using conventional learning in the control class is 74.70%. The results of the student observation sheet analysis can be seen in Figure 2 below:

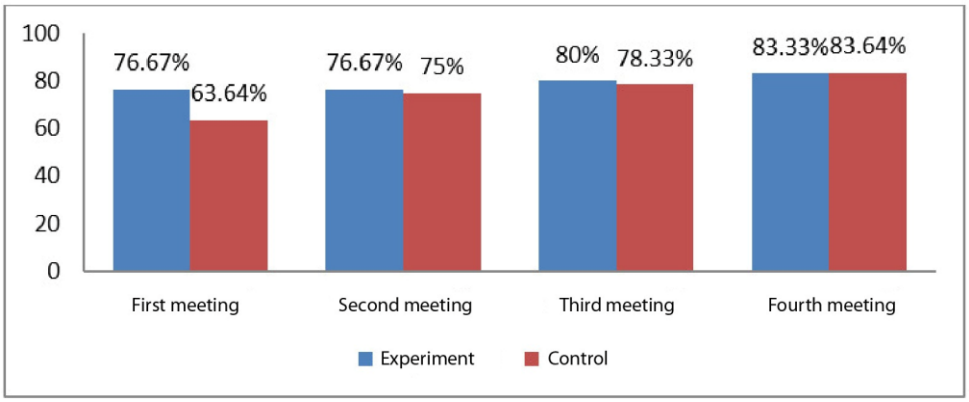

Figure 2 Results of Analysis of Student Activity Observation Sheets

Inferential Analysis

The difference in increase using independent sample t-test, with the following statistical hypotheses:

$H_0 : \mu_{g1} \leq \mu_{g2}$ lawan $H_1 : \mu_{g1} > \mu_{g2}$

The test criteria used are if the $t_{hit\ value} > t_{table,}$ then H_0 is rejected, and if the $t_{hit\ value} < t_{table,}$ then H_0 is accepted. The significance test is used to test the increase in students' mathematics learning outcomes taught by the *TAI cooperative learning model,* and the conventional learning model uses *the Independent Samples T-Test*, presented in Table 4.

Table 4. Results of the Analysis of the Significance Test of Differences in Students' Mathematical Representation Ability in Both Learning

	n	$\bar{x}$	s^2	s_{tab}	t_{count}	t_{table}	Conclusion
Experiment	19	0.525	0.00498	0.069	2039	1.6918	H_0 is rejected
Control	17	0.478	0.00448				

Based on the table above, it is found that the value of $t_{count} = 2.039 > t_{table} = 1.6918$, then H_0 is rejected, and H_1 is accepted. By accepting H_1, it can be concluded that the increase in the mathematical representation abilities of students who use the TAI learning model with a

constructivist approach is higher than the increase in the mathematical representation abilities of students who use conventional learning in class VIII students of SMP Negeri 3 Samaturu.

From the results of the research that has been described previously, the discussion in this study includes 1) Students' mathematical representation abilities; 2) the teacher's ability to manage to learn; 3) student activity in the learning process, and 4) The effectiveness of the learning model. The discussion is described as follows:

Students' Mathematical Representation Ability

From the results of the study, it was found that the increase in students' mathematical representation abilities (N-gain) who were taught using the TAI type cooperative learning model with a constructivism approach consisting of 19 students obtained an average value (mean) of 0.525, with a variance of 0.005 and a standard deviation 0.07060. While improving students' mathematical representation abilities (N-gain) taught using conventional learning consisting of 17 students obtained an average value (mean) of 0.478, with a variance of 0.004 and a standard deviation of 0.06694.

The results of testing the hypothesis using a single t-test at a significance level of $\alpha = 0.05$ obtained a sig. (0.000) < $\alpha = 0.05$ means H_0 is rejected, and H_1 is accepted. This means that there is an increase in students' mathematical representation abilities after being taught using the TAI learning model and conventional learning. While the results of testing the hypothesis using the t-test at a significance level of $\alpha = 0.05$ obtained a value of t_{count} (2.03985) > t_{table} (1.6918). Because $t_{count} > t_{table}$, then testing the hypothesis with the t-test shows that H_0 is rejected, increasing the mathematical representation abilities of students who use the TAI-type cooperative learning model with a constructivism approach is more effective than increasing the mathematical representation abilities of students who use conventional learning.

Teacher Ability to Manage Learning

The teacher's ability to manage learning both in the experimental and control classes was generally carried out well; this is in accordance with the observer's observations during 4 (four) consecutive meetings. The average percentage of teacher activity in the learning process in the experimental class was 86.98%. Meanwhile, the average percentage of teacher activity in the learning process in the control class was 85.909%. The average percentage of teacher activity in the learning process shows that teacher activity in the learning process in both the experimental class and the control class is included in the very active category.

Student Activities in Following the Learning Process

Observer results on student activities in the learning process, both in the experimental and control classes, show that all aspects observed are generally carried out well. The average value of the percentage of student activity in the learning process in the experimental class was 79.18%. At the same time, the average value of the percentage of student activity in the control class was 74.70%. From the average value of the percentage of student activity in the learning process in the experimental class, it is included in the very active category. In contrast, the control class is included in the active category.

Learning Effectiveness

The effectiveness of learning in this study can be concluded that the achievement of learning effectively both in the TAI cooperative learning model and conventional learning models is adequate for applying cube and block learning materials for class VIII junior high school students. However, after further analysis by comparing the average value of the increase in mathematical representation ability (N- gain), it shows that the average increase in the mathematical representation ability of students who are taught with the TAI-type cooperative learning model with a constructivism approach higher than the average increase in the ability of students' mathematical representations taught using conventional learning models. This means that improving students' mathematical representation abilities by applying the TAI-type cooperative learning model with a constructivist approach is more effective than conventional learning models.

CONCLUSION

Based on the results of data analysis and discussion that has been carried out, the results of this study can be concluded that the average ability of students' mathematical representations before being taught using the TAI learning model with a constructivist approach is still meager, equal to 14.08. while the average pretest results of students taught using conventional mathematics is 15.00. Meanwhile, the average mathematical representation ability of students after being taught using the TAI learning model with a constructivism approach is better than the average mathematical representation ability of the previous students, which was equal to 58.72. Meanwhile, the average posttest results of students taught using conventional learning were better than the average results of students' pretest mathematics, which was 55.2.

REFERENCES

Arifin, Z. (2020). Metodologi Penelitian Pendidikan. *Jurnal Al-Hikmah*, *1*(1).

Arikunto, S. (2002). Proses Penelitian Suatu Pendekatan Praktik. *Jakarta: PT Rineka Cipta*.

Bintari, N. P., Dantes, N., & Sulastri, M. (2014). Korelasi Konsep Diri Dan Sikap Religiusitas Terhadap Kecenderungan Perilaku Menyimpang Dikalangan Siswa Pada Kelas XI SMA Negeri 4 Singaraja Tahun Ajaran 2013/2014. *Jurnal Ilmiah Bimbingan Konseling Undiksha*, *2*(1). https://doi.org/10.23887/jibk.v2i1.3747

Djidu, H., Mashuri, S., Nasruddin, N., Sejati, A. E., Rasmuin, R., & La Arua, A. (2021). Online Learning In The Post-Covid-19 Pandemic Era: Is Our Higher Education Ready For It? *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, *5*(2), 139–151. https://doi.org/10.36312/esaintika.v5i2.479

Hakim, A. R. (2023). *Konsep Landasan Dasar Pendidikan Karakter Di Indonesia*. *06*(01), 2361–2373.

Hariyati, E., Mardiyana, M., & Usodo, B. (2013). Efektivitas Model Pembelajaran Kooperatif Tipe Team Assisted Individualization (TAI) Dan Problem Based Learning (PBL) Pada Prestasi Belajar Matematika Ditinjau Dari Multiple Intelligences Siswa SMP Kabupaten Lampung Timur Tahun Pelajaran 2012/2013. *Jurnal Pembelajaran Matematika*, *1*(7).

HL, N. I., Nasruddin, N., Sejati, A. E., & Sugiarto, A. (2023). We are developing Teaching Material Of Research Methodology And Learning With a 4D Model In Facilitating Learning During The

Covid-19 Pandemic To Improve Critical Thinking Skills. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, *9*(2). https://doi.org/10.33394/jk.v9i2.7110

Jahring, J., Marniati, M., Nasruddin, N., Armin, A., Lukman, L., Aprisal, A., Purnomo, I. K. D. I., Rahman, R., Hastuti, P., & Indrawaty, I. (2022). Implementasi Teori Konstruktivisme Dalam Pembelajaran Matematika Di Rumah Untuk Anak Usia Dini Pasca Pandemi Covid-19. *Jurnal Pengabdian Masyarakat-PIMAS*, *1*(4), 104–109.

Madhuri, S. (2019). *Media Pembelajaran Matematika*. Deepublish.

Nasruddin, N., Mashuri, S., & Jahring, J. (2019). Implementation Of Team-Assisted Individualization Instructional Strategies Supported By Geogebra Software To Improve Mathematical Problem-Solving Ability. *Jurnal Pendidikan Progresif*, *9*(1), 16–21.

Ovan, O., Tasni, N., & Saputra, A. (2023). The Analysis Of Algebraic Problem Solving Ability On Students Of Package B Equivalency. *Journal Of Mathematics And Applied Statistics*, *1*(1), 1–8.

Sejati, A. E., Syarifuddin, S., Nasruddin, N., Miftachurohmah, N., & Hariyanto, E. (2021). The Effectiveness Of Guided Inquiry Learning Model With Edmodo Assisted To Facilitate Critical Thinking Skills. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *9*(2), 204–219. https://doi.org/10.33394/j-ps.v9i2.4260

Sugiyono, D. (2013). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif Dan R&D*.

Sukardi, H. M. (2021). *Metodologi Penelitian Pendidikan: Kompetensi Dan Praktiknya (Edisi Revisi)*. Bumi Aksara.

Yusnani, H. (2016). *Penerapan Model Discovery Learning Terhadap Kemampuan Representasi Matematis Dan Self Efficacy Siswa (Studi Pada Siswa Kelas VIII Semester Genap SMP Negeri 13 Bandar Lampung Tahun Pelajaran 2015/2016)*.