EMTEKA: Jurnal Pendidikan Matematika
Volume 6, No. 1, 2025. 305-316
DOI: https://doi.org/10.24127/emteka.v6i1.7989

e-ISSN 2746-5594
p-ISSN 2746-5608

EFFECTIVENESS OF CYBERNETIC-BASED THINK TALK WRITE LEARNING MODEL ON STUDENTS' MATHEMATICS PROBLEM SOLVING ABILITY

Naumi Catur Aksoro[1*] Isna Farahsanti[2]

[1*.2]Universitas Veteran Bangun Nusantara, Sukoharjo, Indonesia
** Corresponding author. Jl. Letjend Sujono Humardani, 57521, Sukoharjo, Indonesia*

E-mail: naumicaturaksoro04@gmail.com [1*]
isnafarahsanti@gmail.com [2]

Received January 31, 2025; Received in revised form March, 07, 2025; Accepted March 23, 2025

ABSTRACT
This study was motivated by the limitations of conventional learning models in improving mathematics problem solving skills. The purpose of this experiment is to see the effectiveness of the cybernetic-based Think Talk Write learning model to help students solve mathematical problems. The method used is quantitative with pseudo-experiment research type. The sample was selected and there were two classes with the same ability to solve mathematical problems based on the analysis of initial scores. Data analysis through t-test with $\alpha = 0.05$. The test instrument was validated by both validators and was in the form of mathematical problem solving questions accompanied by a scoring rubric. The test results were subjected to t-test as an effectiveness test and it was determined that H_0 was rejected. This means that there is a difference in the average mathematical problem solving ability of students from the two sample classes. Based on the marginal mean, the class that applied the cybernetic-based Think Talk Write learning model was better than the class with conventional learning. The impact of this research makes students more active, able to think critically, and improve students' skills in utilising information systems to solve mathematical problems.
Keywords: cybernetic; math problem solving; think talk write

ABSTRAK
Penelitian ini dilatarbelakangi adanya keterbatasan model pembelajaran konvensional dalam meningkatkan kemampuan pemecahan masalah matematika. Tujuan eksperimen ini untuk melihat keefektifan model pembelajaran Think Talk Write berbasis sibernetik guna membantu siswa memecahkan masalah matematika. Metode yang digunakan yaitu kuantitatif dengan tipe penelitian eskperimen semu. Sampel dipilih dan terdapat dua kelas dengan kemampuan memecahkan masalah matematika yang sama berdasarkan analisis nilai awal. Analisis data melalui uji-t dengan $\alpha = 0{,}05$. Instrumen tes telah diakui validitasnya oleh kedua validator dan berupa soal memecahkan masalah matematika disertai rubrik penilaian. Hasil tes tersebut dilakukan uji-t sebagai uji efektivitas dan didapatkan penentuan bahwa H_0 ditolak. Hal itu bermakna terdapat perbedaan rata-rata kemampuan pemecahan masalah matematika siswa dari dua kelas sampel. Berdasarkan marginal rata-ratanya, kelas yang diterapkan model pembelajaran Think Talk Write berbasis sibernetik lebih baik daripada kelas dengan pembelajaran konvensional. Dampak dari penelitian ini menjadikan siswa lebih aktif, mampu berpikir kritis, dan meningkatkan keterampilan siswa dalam memanfaatkan system informasi untuk memecahkan permasalahan matematika.
***Kata kunci**: pemecahan masalah matematika; sibernetik; think talk write*

e-ISSN 2746-5594
p-ISSN 2746-5608

Introduction

Effective learning requires good interaction between teachers and students. Choosing the right learning technique with the appropriate learning media can make it easier for students to understand learning materials (Farahsanti, Pribadi, Ariyanti, & Gunawan, 2021). Difficulties in learning mathematics require educators to be creative in developing learning models (Hasiru, Badu, & Uno, 2021). Learning models are utilised as a reference to find the right tools by planning the learning process.

In addition, in this digital era, teachers are also involved as facilitators by utilising the use of technology as learning media to expand student learning resources (Andi Sadriani, M. Ridwan Said Ahmad, & Ibrahim Arifin, 2023). Education quality can be improved by teachers being directly involved in the teaching and learning process (Pradja & Firmansyah, 2020). Education is an important learning process for the progress of the country, and science and technology are key to the future (Dewi, Wibawa, & Widiasih, 2023). A learning model is needed that can improve problem-solving abilities (Komariya, Farida & Vahlia, 2018). One of the learning models that can be utilised by teachers in helping the learning process is the cybernetic-based Think Talk Write learning model.

The Think Talk Write learning model can develop students' thinking with basic concepts through three stages: thinking, speaking, and writing. The learning is interactive, collaborative, and critical thinking in improving student understanding so it is necessary to apply the Think Talk Write learning model in mathematics. This learning model activity requires thoroughness through thinking (think), seen from the steps of reading a problem, followed by recording what has been read (write), the next stage speaks (talk) communication with words that students understand in order to be skilled in reflecting thoughts (Rizal, 2018). Based on this, this learning model can be implemented to help improve students' critical thinking skills. Problem consists of a series of steps used to achieve learning objectives, so that it can help students in solving the obstacles they face (Agustina & Vahlia, 2016).

Cybernetic-based Think Talk Write learning model is needed in mathematics learning because it is superior to conventional models in terms of interaction, feedback, and information processing. It is believed that the Think Talk Write learning model can facilitate students in learning mathematics (Riansyah & Sari, 2018). The Think Talk Write learning model has advantages including: 1) it can create a spirit of student learning independence in understanding a material, 2) students are given the opportunity to collaborate which allows interaction to improve communication and student activeness. 3) the results of the discussion are written by students in their own language so that it is easier to understand the learning outcomes. The weaknesses of this learning model include: 1) Requires more supervision because students will ask the teacher more often. 2) the discussion process will be dominated by smart students. 3) Because the system is a discussion, it will take longer time (Retnowati & Ekayanti, 2020). Seeing these advantages, there is nothing wrong with educators implementing Think Talk Write as a learning model.

Cybernetic learning theory is a theory that prioritises processes over outcomes that are examined in the form of information systems delivering messages

e-ISSN 2746-5594
p-ISSN 2746-5608

from teachers to students (Kalifah, Hidayah, & Yanti, 2022). Cybernetic learning takes place when students process information, monitor the information, and plan strategies related to the information obtained. The main aspect of this theory is the information system, which will determine the success of the learning process (Telaumbanua, Gulo, Lahagu, Gulo, & Gulo, 2022).

Cybernetic theory learning can be applied to achieve learning objectives by utilising technology as a digital-based learning medium (Wahyuna, Usmaidar, & Febriyanni, 2023). Amanda revealed that cybernetic theory has advantages and disadvantages, the advantages of cybernetic theory are: 1) More process-orientated ways of thinking. 2) Contains economic aspects in the presentation of knowledge 3) Learning competencies can be more complete 4) Learning activities are more directed towards the goals to be achieved. 5) Learning is transferred to the real life environment 6) Learning management is adjusted to the abilities of each individual. There are weaknesses in this theory because it only focuses on information systems and does not pay attention to the process of learning (Nur'alimah, 2022). The utilisation of technology in mathematics learning can accelerate learners' learning process and make it more efficient, and can develop their problem-solving skills (Saputra, Utami, & Purwanti, 2023). The way to find out how much students understand a problem is to give them a problem (Setiani, et.al., 2020).

The connection between Think Talk Write learning model and cybernetic theory lies in the process of student interaction and feedback that occurs in the learning process. Students will receive feedback that can help their understanding after the thinking and discussion process. Feedback is a staple in cybernetics that allows the learning system to adapt and evolve (Roisah, Kusrina, & Porwanto, 2023). Think Talk Write creates dynamic interactions that are in line with cybernetic theory where students are involved in processing information to obtain certain results. This learning model as an alternative makes the learning environment adaptive and responsive to students. That way it can be a reference to improve students' mathematical problem solving skills.

At the research site, students' level of understanding of mathematics problems varied. Some students struggled to understand and solve problems while others were able to identify problems more quickly. A variety of problem-solving strategies were found with most students still relying on conventional learning models without deeper understanding. Students who are interested in mathematics tend to be more active in finding solutions than students who find mathematics difficult and give up more easily.

Mathematics learning on mathematical problem solving skills includes understanding the problem, developing mathematical patterns, determining solutions and finding acceptable answers (Exacta, et. al.,, 2021). Tambunan said mathematical problem solving skills are useful for high school students in supporting the accuracy of the decision-making process, as a provision for students to be able to compete in various fields, where problem solving skills are one of the key skills needed (Khairani, Permana, Fauzan, & Musdi, 2024). Problem solving is regarded as the process of knowing combinations and solving problems with different steps (Astuningtyas, Wulandari, & Farahsanti, 2017). Thus, mathematical problem solving ability is closely related to students' skills in the process of interpreting a problem.

e-ISSN 2746-5594
p-ISSN 2746-5608

Based on research conducted by Hidayah & Arif (2022) it is said that the effectiveness of the Think Talk Write learning model is more valuable than conventional learning. Research by Cahyaningrum et al., (2020) it is concluded that the strategy of Think Talk Write learning is effective in students' mathematical problem solving ability. Research by Kalifah et al., (2022) it is concluded that cybernetic learning theory is effective in indicating information systems and making students independent and disciplined so that they can help solve problems.

Maths learning difficulties in students are influenced by various factors, both internal and external. Internal factors: low interest in learning and motivation, and a tendency to behave badly when learning mathematics. While external factors: teachers' teaching is less varied, the family environment is less motivating, and the average education of the community is relatively low (Ayu, Ardianti, & Wanabuliandari, 2021).

Based on the three relevant studies and the mathematics learning difficulties experienced by students, it is encouraged to conduct research to find out whether the cybernetic-based Think Talk Write learning model is more effective than conventional learning. The existence of this research is expected to be able to train and help improve students' ability to solve mathematical problems and manage and process information.

Research Methods

The research method is quantitative with the type of research Quasi Experiment. This experiment will compare students' ability to solve math problems before and after applying the Think Talk Write learning model based on cybernetic theory. The treatment imposed on research subjects is a quasi-experimental design. Research Stages can be seen in Figure 1.

Figure 1. Research Stages

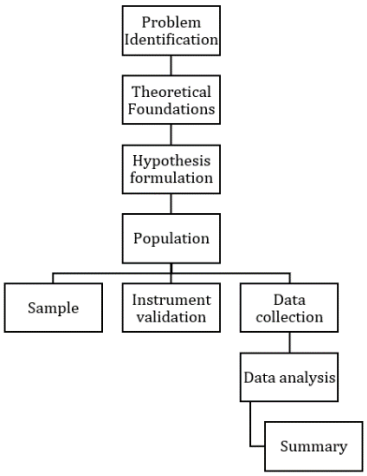

Figure 1 shows the stages of the research conducted. The population was Veteran High School Sukoharjo class X students. The sample was obtained through Cluster Random Sampling taken randomly from 7 classes, where each class numbered 40 students. The research was divided into two classes, namely the experimental class (Class X E2) which would be subjected to treatment and the control class (Class X E1) which applied conventional learning.

e-ISSN 2746-5594
p-ISSN 2746-5608

The instrument used to obtain data by giving tests. The test was conducted before and after the cybernetic-based Think Talk Write learning model treatment. The test was in the form of a description question that had been validated by two validators, namely a lecturer and a high school mathematics teacher. The test instrument was carried out a content validation process by checking the suitability of the questions based on the problem solving ability indicators in the test validation sheet.

The treatment plan stage is 1). First the two classes were given an initial test, the test carried out was a mid-semester summative assessment. 2). The next stage students in the experimental class applied the cybernetic-based Think Talk Write learning model 3). Then students are given a final test, in the form of a description question (essay) that has been validated in the experimental class. The purpose of the test is to compare the initial test with the final test that was previously obtained. According to Polya, in solving problems, you can use the stages of understanding the problem, making plans, carrying out plans, and reviewing (Masturoh, Syaiful, & Hasibuan, 2023). Test scoring indicators can be seen in Table 1.

Table 1. Test scoring indicators

Aspects	Indicator	Score
Understand the Problem	1. Record understanding and questioning appropriately and fully	4
	2. Notes understanding and questioning appropriately but less fully	3
	3. Notes understanding and questioning inaccurately	2
	4. No Recording understanding and questioning	1
Organise a plan	1. Write the mathematical steps needed to solve the problem correctly and fully	4
	2. Writes the mathematical steps needed to solve the problem correctly but less fully	3
	3. Writes the mathematical steps needed to solve the problem inaccurately	2
	4. Did not write the math steps needed to solve the problem	1
Implementing the plan	1. Able to solve problems precisely and fully	4
	2. Able to solve problems correctly but less fully	3
	3. Able to solve problems with less precision	2
	4. Unable to solve problems	1
Review	1. Recording answers precisely and fully	4
	2. Recording the answer correctly but not fully	3
	3. Recording the answer results is not correct	2
	4. Did not record answers	1

e-ISSN 2746-5594
p-ISSN 2746-5608

(Arifin & Aprisal, 2020).

The indicators in Table 1 are used as a reference to assess mathematical problem solving skills. The assessment is to help in identifying things that need to be improved in the problem solving process. After the test was carried out, the data were analyzed through the T test with a significance value (α = 0,05) to determine the difference in the average value of students before and after being treated with the cybernetic-based Think Talk Write learning model. Data analysis in the form of descriptive statistics, normality test, homogeneity test, and hypothesis testing.

Before analyzing the test results, a balance test was carried out using the t-test, provided that the normal distribution and homogeneity of variance were met. The normality test was assisted by SPSS software using the One Sample Kolmogorov Smirnov Test formula. Then Levene's test was used to find whether the homogeneity of variance was met.

The t-test steps taken to test effectiveness begin with formulating H_0: $\mu_1 = \mu_2$ (there is no difference in the average learning outcomes of the two sample classes taken). The results of the hypothesis test determine H_0 is rejected or is accepted by looking at the comparison of the level of significance. If $p < \alpha$ then H_0 is rejected, while if $p \geq \alpha$ then H_0 is accepted.

Results and Discussion

The data on students' initial grades in this study used mid-semester summative grades, while the final data on students' grades were obtained through tests given at the end of the treatment. The test instrument has been validated by two validators, namely teachers and lecturers. The validation results contained several words that caused assumptions and have been revised. So that the test used as an instrument has been declared valid and suitable for research use.

Based on the Cluster Random Sampling technique, a sample of two classes was obtained, namely class X E1 and X E2. Each class consists of 40 students. Class X E2 is the experimental class that will be applied cybernetic-based Think Talk Write learning model and class X E1 is the control class that is applied conventional learning model.

The initial values of the two classes before the experiment were descriptive statistics are stated in Table 2. The initial value data were tested for normality and homogeneity with the results presented in Tables 3 and 4 before the balance test through the t test was carried out. Descriptive statistics of initial scores can be seen in Table 2.

Table 2. Descriptive statistics of initial scores

Class	N	Mean	Standart Deviation
experimental class (X E2)	40	35,90	17,079
control class (X E1)	40	36,80	16,012

Judging from Table 2 shows that the average initial score of students from the experimental class is 35,90 and the average initial score of students from the control class is 36,80 . It is known that the average of Class X E1 is higher than Class X E2. Normality test of initial scores can be seen in Table 3.

EMTEKA: Jurnal Pendidikan Matematika
Volume 6, No. 1, 2025. 305-316
DOI: https://doi.org/10.24127/emteka.v6i1.7989
e-ISSN 2746-5594
p-ISSN 2746-5608

Table 3. Normality test of initial scores

Class	α	p (Sig.)	Determination	Results
experimental class (X E2)	0,05	0,096	H_0 is accepted	Normally Distributed
control class (X E1)	0,05	0,145	H_0 is accepted	Normally Distributed

Based on Table 3, the results show $p > \alpha$ decision H_0 is accepted. This means that the initial values of the two sample classes are normally distributed. Homogeneity test of initial score can be seen in Table 4.

Table 4. Homogeneity test of initial score

Levene's Test	α	p (Sig.)	Determination	Results
0,009	0,05	**0,925**	Normally Distributed	Variance is declared homogeneous

In Table 4 there are results from the homogeneity test with the Levene test, $F\ count = 0{,}009 \in DK$ and $0{,}925 > 0{,}05$ means $p > \alpha$, then the determination H_0 is accepted. This means that the homogeneity of the variance of the two sample classes is fulfilled. So that in table 5 there are the results of the continued t-test to find out the initial data is balanced with a homogeneous hypothesis. Analysis of baseline scores with Independent sample t-test can be seen in Table 5.

Table 5. Analysis of baseline scores with Independent sample t-test

Result t	α	p (Sig.)	Determination	Results
0,480	0,05	**0,632**	H_0 is accepted	Balanced initial value

Judging from Table 5 that $t\ count = 0{,}480 \in$ DK and $0{,}632 > 0{,}05$ means $p > \alpha$, then the determination H_0 is accepted. This means that the mathematical problem solving ability of students from two classes is balanced or the same before treatment. That way the two classes can be used as experimental and control classes.

Furthermore, the effectiveness test uses student final score data obtained from the test after the experiment. Based on the test results, the descriptive statistics are shown in Table 6.

Table 6. Descriptive statistics of final grades

Class	N	Mean	Standart Deviation
experimental class (X E2)	40	78,70	9,603
control class (X E1)	40	56,65	13,515

Table 6 shows that the higher average of the experimental class is 78,70 than the control class whose average is only 56,65 . Furthermore, to determine the effectiveness of the cybernetic-based Think Talk Write learning model, a comparison test of the means of the two classes is needed.

e-ISSN 2746-5594
p-ISSN 2746-5608

The implementation of the t-test is the same as the balance test on the initial score. The data were analyzed with the normality test in Table 7 then in Table 8 the homogeneity test results are shown.

Table 7. Normality test of final grades

Class	α	p (Sig.)	Determination	Results
experimental class (X E2)	0,05	0,92	H_0 is accepted	Normally Distributed
control class (X E1)	0,05	0,79	H_0 is accepted	Normally Distributed

Viewing the normality test in Table 7 shows the results $p > \alpha$ obtained the decision H_0 is accepted. Data on the final score of students' mathematical problem solving ability from both classes are normally distributed. Homogeneity test of final score are shown in Table 8.

Table 8. Homogeneity test of final score

Levene's Test	α	p (Sig.)	Determination	Results
3,498	0,05	**0,065**	H_0 is accepted	Variance is declared homogeneous

The results of Levene's test for homogeneity test in Table 8, F count $=$ $3{,}498 \in DK$ and $0{,}065 > 0{,}05$ means $p > \alpha$, then the determination H_0 is accepted. This means that the homogeneity of the variance of the two sample classes is fulfilled. So it can continue the t-test to determine the effectiveness with a homogeneous hypothesis with the results shown in Table 9.

Table 9. Analysis of final scores with Independent sample t-test

Result t	α	p (Sig.)	Determination	Results
−8,412	0,05	0,000	H_0 is rejected	The mathematical problem solving ability of students in both classes is different

Table 9 shows $t\ count = -8{,}412 \notin$ DK and $0{,}000 < 0{,}05$ means $p < \alpha$, then H_0 is rejected. So, the average final score of students of both classes is different. The results of the marginal average of Table 6 show that the average final score of students in class X E2 (experimental class) is better than the average final score of class X E1 (control class). Thus, the implementation of cybernetic-based Think Talk Write learning model is more effective to improve students' ability to solve math problems than conventional learning.

Experimental classes that are subjected to the cybernetic-based Think Talk Write learning model tend to be more active during learning. Students who are subjected to experimental treatment are also able to think critically so that they are more thorough in solving math problems. That is what causes the experimental class to have higher student scores than the students in the control class.

The application of the cybernetic-based Think Talk Write learning model is a strategy to invite students to be more active in thinking, speaking and writing by

e-ISSN 2746-5594
p-ISSN 2746-5608

interacting with friends and utilizing technology in learning. In this learning, students are given time to understand math problems individually first, then discuss with groups that have been determined randomly. During the discussion process students are given the freedom to access information sources with the help of problem solving applications. Students write the results of the discussion individually which will then be assessed based on indicators of problem solving ability. This learning also allows the process of feedback to students either directly or online discussion. Based on this process, it is found that students are more motivated to think critically. Students are also more independent and creative and immediately correct mistakes in solving math problems.

The results obtained are in accordance with the opinion of Harahap & Hasibuan (2023) that the Think Talk Write learning model overcomes students' learning difficulties in mathematics. Factors that influence the effectiveness of the Think Talk Write learning model are in accordance with the opinion of Januamita & Febriani (2024) student learning activities are more improved by this learning approach. The opinion of Salim & Maryanti (2017) states that cybernetic learning theory is effectively applied in learning mathematics with the help of software can improve students' mathematical critical thinking skills. Supported by the opinion of Nur'alimah (2022) concluded that the implementation of cybernetic theory hones information technology skills and the results of the mathematical abilities of teachers and students. It is hoped that it can be an alternative to learning by implementing a cybernetic-based Think Talk Write learning model to facilitate students in solving math problems.

Conclusion and Suggestion

Looking at the results and discussion, it can be concluded that the cybernetic-based Think Talk Write learning model is more effective in improving students' mathematical problem solving skills than conventional learning.

Based on the results of this study, some suggestions are made for the development of future researchers to expand the research by involving various levels of education and other subjects. In addition, it is recommended that the experiment be conducted in a broader context with a diverse sample so that the results are more representative.

Reference

Agustina, R. & Vahlia, I. (2016). Pengembangan Bahan Ajar Berbasis Masalah Pada Mata Kuliah Matematika Ekonomi Program Studi Pendidikan Matematika. Jurnal Aksioma, 5(2), 152-158. https://doi.org/10.24127/ajpm.v5i2.668

Andi Sadriani, M. Ridwan Said Ahmad, & Ibrahim Arifin. (2023). Peran Guru Dalam Perkembangan Teknologi Pendidikan di Era Digital. *Seminar Nasional Dies Natalis 62*, *1*, 32–37. https://doi.org/10.59562/semnasdies.v1i1.431

Arifin, S., & Aprisal, A. (2020). Penerapan Model Pembelajaran Kooperatif Tipe Pair Checks Terhadap Kemampuan Pemecahan Masalah Matematika. *Jurnal Pendidikan Matematika*, *11*(1), 89-98. https://doi.org/10.36709/jpm.v11i1.9974

Astuningtyas, E. L., Wulandari, A. A., & Farahsanti, I. (2017). Etnomatematika Dan Pemecahan Masalah Kombinatorik. *Jurnal Math Educator Nusantara*, *3*(2), 111-

e-ISSN 2746-5594
p-ISSN 2746-5608

118. https://doi.org/10.29407/jmen.v3i2.907

Ayu, S., Ardianti, S. D., & Wanabuliandari, S. (2021). Analisis Faktor Penyebab Kesulitan Belajar Matematika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(3), 1611-1622. https://doi.org/10.24127/ajpm.v10i3.3824

Cahyaningrum, I., Husna, A., & Gusmania, Y. (2020). Efektivitas Strategi Think Talk Write terhadap Kemampuan Pemecahan Masalah Matematis Siswa. *Edumatika: Jurnal Riset Pendidikan Matematika*, *3*(1), 23-32. https://doi.org/10.32939/ejrpm.v3i1.405

Dewi, N. K. T. Y., Wibawa, K. A., & Widiasih, W. (2023). Pengaruh Penggunaan Teknologi Sebagai Moderasi Antara Minat Belajar Dan Literasi Numerasi Terhadap Kemampuan Pemecahan Masalah Matematika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(3), 3457-3469. https://doi.org/10.24127/ajpm.v12i3.7388

Exacta, A. P., Hadiprasetyo, K., Afghohani, A., & Astutiningtyas, E. L. (2021). Analisis Kemampuan Problem Solving Mahasiswa Pada Mata Kuliah Analisis Kompleks Ditinjau Dari Kemampuan Awal. *JEID: Journal of Educational Integration and Development*, *1*(2), 80-87.https://doi.org/https://doi.org/10.55868/jeid.v1i2.86

Farahsanti, I., Pribadi, A. J., Ariyanti, R., & Gunawan, G. (2021). Penggunaan Video Pembelajaran Matematika untuk Meningkatkan Prestasi Belajar pada Pembelajaran Online Berbasis Lesson Study. *Edudikara: Jurnal Pendidikan Dan Pembelajaran*, *6*(1), 45–52. https://doi.org/10.32585/edudikara.v6i1.230

Harahap, A. Y. A., & Hasibuan, A. M. (2023). Penerapan Metode Pembelajaran Think Talk Write terhadap Hasil Belajar Matematika. *Journal on Teacher Education*, *4*(3), 629–635. https://doi.org/10.31004/jote.v4i3.12862

Hasiru, D., Badu, S. Q., & Uno, H. B. (2021). Media-Media Pembelajaran Efektif dalam Membantu Pembelajaran Matematika Jarak Jauh. *Jambura Journal of Mathematics Education*, *2*(2), 59–69. https://doi.org/10.34312/jmathedu.v2i2.10587

Hidayah, U. N. K., & Arif, S. (2022). Efektivitas Model Pembelajaran Think Talk Write (TTW) Berbantuan Web Liveworksheet Terhadap Kemampuan Menyelesaikan Masalah. *Jurnal Tadris IPA Indonesia*, *2*(3), 242–251. https://doi.org/10.21154/jtii.v2i3.940

Januamita, M., & Febriani, E. A. (2024). Upaya Peningkatan Aktivitas Belajar Siswa dengan Menggunakan Model Kooperatif Tipe Think Talk Write (TTW) Berbantuan Media Teka Teki Silang (TTS) dalam Pembelajaran Sosiologi di Kelas X Fase E SMAN 1 Hiliran Gumanti. *Naradidik: Journal of Education and Pedagogy*, *3*(4), 419–427. https://doi.org/10.24036/nara.v3i4.266

Kalifah, D. R. N., Hidayah, N., & Yanti, Y. (2022). Implikasi Teori Belajar Sibernetik Terhadap Pembelajaran Daring Dengan Menggunakan Google Classroom. *ELSE (Elementary School Education Journal) : Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar*, *6*(2), 500-512. https://doi.org/10.30651/else.v6i2.13725

Khairani, D., Permana, D., Fauzan, A., & Musdi, E. (2024). Pengembangan Perangkat Pembelajaran Berbasis Discovery Learning Berbantuan Geogebra Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *13*(2), 379-393. https://doi.org/10.24127/ajpm.v13i2.8468

e-ISSN 2746-5594
p-ISSN 2746-5608

Komariya, K., Farida, N., & Vahlia, I. (2018). Pengaruh Model Pembelajaran FSLC Terhadap Kemampuan Pemecahan Masalah Matematika Ditinjau Dari Motivasi Belajar Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *7*(1), 96-102. https://doi.org/10.24127/ajpm.v7i1.1355

Masturoh, T., Syaiful, S., & Hasibuan, M. H. E. (2023). Pengaruh Model Search Solve Create Share Terhadap Kemampuan Pemecahan Masalah Matematis Ditinjau Dari Motivasi Belajar. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(1), 183-190. https://doi.org/10.24127/ajpm.v12i1.5295

Nur'alimah, E. O. (2022). Implementasi Teori Sibernetik pada Pembelajaran Jarak Jauh Masa Pandemi COVID-19. *Jurnal Syntax Imperatif : Jurnal Ilmu Sosial Dan Pendidikan*, *3*(1), 36-46. https://doi.org/10.36418/syntax-imperatif.v3i1.146

Pradja, B. P., & Firmansyah, M. A. (2020). Penerapan Model Pembelajaran Reciprocal Teaching dalam Pembelajaran Matematika untuk Meningkatkan Aktivitas dan Hasil Belajar Siswa. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika*, *2*(2), 159–166. https://doi.org/10.26877/imajiner.v2i2.5829

Retnowati, P., & Ekayanti, A. (2020). Think Talk Write Sebagai Upaya Meningkatkan Komunikasi Matematis Siswa. *SIGMA*, *6*(1), 17-25. https://doi.org/10.36513/sigma.v6i2.863

Riansyah, F., & Sari, A. (2018). Pengaruh Penerapan Pembelajaran Kooperatif Tipe Think Talk Write (TTW) Terhadap Kemampuan Pemecahan Masalah Matematika Ditinjau dari Kemampuan Awal Matematika. *JURING (Journal for Research in Mathematics Learning)*, *1*(2), 119-126. https://doi.org/10.24014/juring.v1i2.5426

Rizal, M. S. (2018). Pengaruh Model Pembelajaran Kooperatif Tipe Think Talk Write (TTW) Terhadap Keaktifan Belajar Siswa Dalam Pembelajaran Matematika Kelas IV SDM 020 KUOK. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *2*(1), 105–117. https://doi.org/10.31004/cendekia.v2i1.37

Roisah, R., Kusrina, T., & Porwanto, B. E. (2023). Model Pembelajaran Kooperatif Tipe Think Talk Write (TTW) dapat Meningkatkan Kemampuan Berfikir Kritis dan Prestasi Belajar pada Mata Pelajaran IPS. *Journal of Education Research*, *4*(3), 1481–1487. https://doi.org/10.37985/jer.v4i3.355

Salim, S., & Maryanti, E. (2017). Pengembangan Perangkat Pembelajaran Matematika Melalui Teori Pembelajaran Sibernetik Berbantuan Software Derive. *Jurnal Riset Pendidikan Matematika*, *4*(2), 229-238. https://doi.org/10.21831/jrpm.v4i2.16068

Saputra, H., Utami, L. F., & Purwanti, R. D. (2023). Era Baru Pembelajaran Matematika: Menyongsong Society 5.0. *Indiktika : Jurnal Inovasi Pendidikan Matematika*, *5*(2), 146–157. https://doi.org/10.31851/indiktika.v5i2.11155

Setiani, L. I. N., Vahlia, I., Farida, N., & Suryadinata, N. (2020). Analisis kesalahan siswa dalam menyelesaikan masalah trigonometri berdasarkan teori Newman ditinjau dari gaya kognitif siswa. *Jurnal Pendidikan Matematika Universitas Lampung*, *8*(2), 89-99. https://doi.org/10.23960/mtk/v8i2.pp89-99

Telaumbanua, A., Gulo, D., Lahagu, L. A., Gulo, C. K., & Gulo, E. K. K. (2022). Pengaruh Penerapan Teori Belajar Sibernetik Terhadap Kemampuan Mahasiswa Mengelola Pembelajaran Berbasis Digital. *Jurnal Teologi Dan Pendidikan Kristen*, *1*(2), 60–69. https://doi.org/10.56854/pak.v1i2.105

Wahyuna, R., Usmaidar, & Febriyanni, R. (2023). Analisis Teori Sibernetik Pada Era

e-ISSN 2746-5594
p-ISSN 2746-5608

Pembelajaran 5.0 Dalam Perkembangan Hasil Belajar Siswa Di Kelas VII MTsN 1 Langkat. *Journal Ability : Journal of Education and Social Analysis*, *4*(2), 34–40. https://doi.org/https://doi.org/10.51178/jesa.v4i2.1192