JURNAL EDUKASI BIOLOGI
Volume 11 No 2, September, 2025, 162-171
ISSN: 2986-5484 E-ISSN: 2986-4828
DOI: 10.21831/edubio.v11i2.21594

COMPARISON OF THE COOPERATIVE LEARNING MODEL TYPE TGT AND NHT TO STUDENTS' COGNITIVE ABILITIES

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Abstract. This study aims to determine the differences in students' cognitive learning outcomes after applying the Team Game Tournament (TGT) and Number Head Together (NHT) cooperative learning models to the subject of coordination systems for class XI at SMA Negeri 1 Karangmojo. This quasi-experimental study used a pre-test-post-test non-equivalent control group design. Sampling was carried out using a purposive sampling technique. Data collection used pre-test and post-test questions in the form of multiple-choice exam questions. The instruments used in this study were validated modules, pre-test questions, and post-test questions, which were validated for content and construct by experts. The data analysis techniques employed were the Wilcoxon test and the Mann-Whitney U test, both using SPSS version 26.0, to compare effect size values. This study shows the following results: (1) There is an increase in students' cognitive abilities after the use of cooperative learning models, both TGT and NHT types. (2) There are differences in the results of increasing students' cognitive abilities after the application of cooperative learning models of TGT and NHT types. (3) The cooperative learning models of the TGT and NHT types based on the Effect Size value have a high influence on increasing students' cognitive abilities with a Cohen's NHT value of 2.838, which is greater than the Cohen's TGT value of 1.025. The results of this study are expected to be used by teachers as a basis for selecting a learning model, especially in biology education.
Keywords: Cognitive, Cooperative, Coordination system, NHT, TGT

Received: 03-06-2024 Revised: 05-09-2025 Accepted: 28-09-2025 Published: 30 -09-2025

INTRODUCTION

Several factors contribute to the achievement of classroom learning objectives. According to Sardiyanah (2018), classroom learning is influenced by both internal and external factors. One external factor contributing to the achievement of learning objectives comes from the educator (Zaliani et al., 2024). Educators must be innovative in their role as facilitators of learning, enabling effective learning and achieving educational objectives (Isnaini & Rahayu, 2023).

The achievement of learning objectives can be measured through the learning outcomes they achieve. All abilities students possess after experiencing learning experiences are considered learning outcomes (Amirono, 2016). Benjamin Bloom, in Bloom's Taxonomy revised by Anderson and Krathwohl (2001), states that learning outcomes can generally be categorised into three aspects: cognitive, psychomotor, and affective. According to Hamdayana (2016), cognitive aspects refer to behaviours that involve the work of the brain, also known as behaviours resulting from the thought process.

Cooperative learning models come in various forms, including Team Game Tournament (TGT) and Number Head Together (NHT). Students act as peer tutors in TGT. This learning model also incorporates game elements and is relatively easy to implement because students can actively participate regardless of their status (Hamdayama, 2016). The implementation of TGT has been shown to significantly improve students' cognitive learning outcomes in biology, as evidenced by the experimental class's cognitive assessment score (84.90), indicating a greater impact than the control class's score (82.35) (Zulfira, 2019).

The NHT model can be defined as a cooperative learning method that assigns numbers

to students. These numbers are then used to assess students based on the results of small group discussions (Hamdayama, 2016). Throughout the process, the NHT method also involves teamwork and active discussion among group members, ensuring that all group members can achieve the learning objectives. The implementation of NHT can improve students' cognitive abilities. The increase in the average learning outcomes of Class X students at Uswatun Hasanah Cempaka Putih Islamic Senior High School is evidence of this. The score obtained in the first cycle of the study was 56.66, with a completeness of the experimental class of 58%. Meanwhile, in the second cycle, the average score was 64.8, with a class completion rate of 75%. In the third cycle, the average score was 70.8, and the percentage of class achievement was 88%

Biology is essentially a branch of science that examines and studies living organisms, their environment, and the interactions between living organisms and their environment. Biology can be studied both textually and contextually. Contextual biology learning can encourage students to play a more active role and make the learning process more meaningful. This condition occurs because contextual learning is centred on student activity (Jayawardana et al., 2020). The coordination system, as a component of biology, encompasses a broad range of material, including the nervous system, hormonal system, and sensory systems. The coordination system also encompasses the relationship between a healthy lifestyle and disorders of the nervous system, hormones, and sensory organs in the human body. Learning the coordination system is important so students can understand the mechanisms by which hormones, nerves, and senses work in the body. This understanding is expected to foster students' sensitivity and ability to provide solutions to problems related to the coordination system.

Based on a survey of 105 eleventh-grade students at SMA Negeri 1 Karangmojo, a preferred learning activity at SMA Negeri 1 Karangmojo showed that 37.15% preferred learning through discussions and games in class, 31.43% preferred learning through practical activities, 22.85% preferred video-based learning, and 8.57% preferred learning by simply listening to the teacher. The survey results indicate a strong tendency for students to engage in active learning by increasing discussion and integrating learning through games. Therefore, opportunities for innovative learning models can be developed by narrowing down learning models that align with student interests.

Initial observations based on midterm exam documents at SMA Negeri 1 Karangmojo for the 2022/2023 academic year indicate that cognitive learning outcomes in biology in eleventh-grade students are considered unsatisfactory. This result is evidenced by the fact that out of 108 students, only one class achieved a class average score above the Minimum Completion Criteria (KKM), namely 75.11. The data indicate that the majority of students have not yet achieved their maximum cognitive abilities through classroom learning. As observed, conventional classroom learning models have also failed to engage students in an active manner. The process is not fully student-centred and often remains teacher-centred. Considering the demands of the independent learning curriculum and the less-than-optimal cognitive learning outcomes, it can be concluded that innovative learning models and methods are needed in the biology learning process for grade XI students at SMA Negeri 1 Karangmojo.

The fact that the implementation of the Number Heads Together (NHT) and Team Games Tournament (TGT) cooperative learning models successfully improved students' cognitive abilities should be considered for implementing these learning models in grade XI students at SMA Negeri 1 Karangmojo. However, further research on both methods is needed to determine the impact of implementing these two types of cooperative learning on improving students' cognitive abilities, particularly in the topic of coordination systems. Therefore, the author is interested in conducting quasi-experimental research to compare the application of two types of cooperative learning models in improving students' cognitive abilities, with the

title "Comparison of the Use of NHT and TGT Learning Models on Students' Cognitive Abilities".

METHOD

This type of research is a quasi-experimental study with a non-equivalent control group design. All samples in this study were subjected to both pre-tests and post-tests (Sugiyono, 2013). The study employed a pre-test-post-test design with its samples. The pre-test was conducted in the experimental and control classes at the beginning of the learning process. After that, the learning process will be carried out by providing treatment in the form of applying the TGT-type cooperative learning model in the experimental class and the NHT learning model in the control class. Improvement in cognitive domain learning outcomes was observed by comparing the results of the pre-test questions with those of the post-test questions after the treatment. The study was conducted from March to April 2023 at SMA Negeri 1 Karangmojo. The study population consisted of all grade XI students at SMA Negeri 1 Karangmojo. The research sample was selected using purposive sampling, specifically students in grade XI A as the experimental class and XI B as the control class. The data collection technique employed a test consisting of multiple-choice questions with five answer choices, designed to assess students' cognitive learning outcomes. Data processing involved descriptive analysis, including the Wilcoxon test, Mann-Whitney pre-test and post-test, and an Effect Size Test.

RESULTS AND DISCUSSION

Results

The average results of the pre-test and post-test scores in the classes with TGT and NHT treatments are presented in Table 1.

Table 1. Average pre-test and post-test results of students

Description	Control Class (NHT)		Experiment Class (TGT)	
	Pre-test	*Post-test*	*Pre-test*	*Post-test*
Number of samples	31	31	29	29
Average	45.48	70.32	45,00	55,00
Average percentage increase	54.62%		22.00%	

Table 1 shows that the NHT control class and the TGT experimental class obtained almost the same average pre-test score. The control class obtained an average pre-test score of 45.48, while the experimental class obtained an average pre-test score of 45. After undergoing the learning process with NHT-type cooperative learning in the control class and TGT-type cooperative learning in the experimental class, it is evident that both classes experienced an increase in average scores. The average post-test score of the NHT control class was 70.32, higher than the 55.00 obtained by the TGT experimental class. Seen from the percentage increase, the control class experienced a 54.62% increase in the class average, as presented in Figure 1, while the experimental class experienced a 22% increase in the class average, as presented in Figure 2.

Based on Figure 1, it can be seen that one student obtained the lowest score of 30, and another student obtained the highest score of 70. The results of the student scores in Figure 1 show that not all students in the control class have achieved the learning objective completion criteria (KKTP) of 78. The results of the pre-test for students in the experimental class are shown in Figure 2. In Figure 2, it can be seen that two students obtained the lowest score of 20, and three students obtained the highest score of 65. Therefore, it can be said that all students in the experimental class before the treatment were also unable to exceed the cognitive ability standards based on the predetermined KKTP.

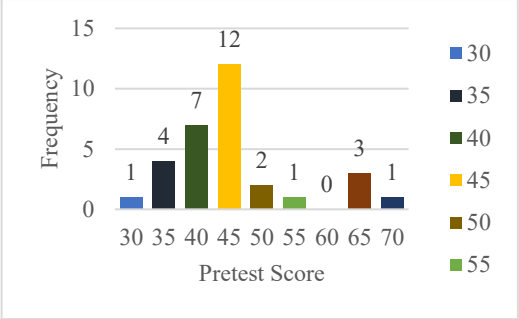

Figure 1. Distribution of pre-test scores for the control class

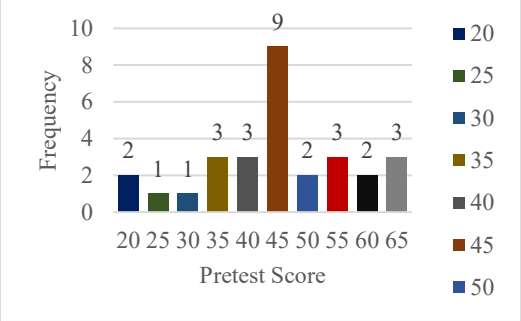

Figure 2. Distribution of pre-test scores for the experimental class

Figure 3 shows that there is one student with the lowest score of 30, and another student who obtained the highest score of 90. Based on the post-test results, it can be seen that 15 students achieved scores exceeding the KKTP standard score. This result suggests that the NHT treatment in the control class can have a positive impact on improving students' cognitive abilities. In the experimental class, using the TGT-type cooperative learning model, there is an increase and a change in the distribution of scores. The lowest score was achieved by one student, who scored 25, while the highest score was attained by three students, all of whom scored 95. Figure 4 shows that, compared to the specified KKTP standard score, the achievement of cognitive learning outcomes in the post-test of the experimental class increased, with 6 students exceeding the KKTP score. The results of the pre-test normality test are presented in Table 2.

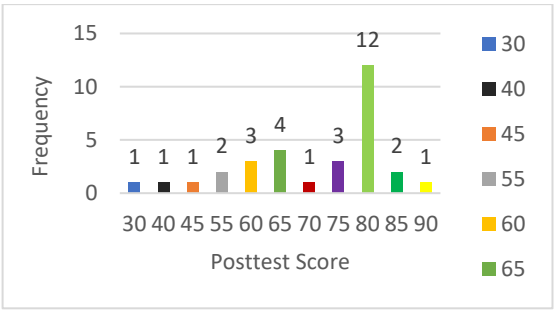

Figure 3. Distribution of post-test scores for the control class

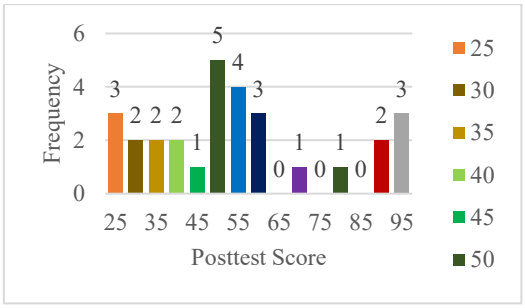

Figure 4. Distribution of post-test scores for the experimental class

Table 2. Pre-test normality test results

Test Type	Test Class	Significance Value	Conclusion of data distribution test results
Normality Test (Kolmogorov-Smirnov test)	Control	0.000	The pre-test data for the control class were not normally distributed.
	Experiment	0.072	The pre-test data for the experimental class were normally distributed.

In Table 2, the normality test above indicates that cognitive abilities in the control class were not normally distributed, whereas those in the experimental class were normally distributed. This result is indicated by the significance value of the normality test on the control class pre-test data being smaller than the significance level ($0.000 \leq 0.05$), so Ho is rejected. Meanwhile, in the experimental class pre-test data, the significance value of the normality test was greater than the significance level ($0.072 \geq 0.05$), so H0 is accepted and the data are normally distributed, as presented in Table 3.

The results of the homogeneity test (Table 3) for the data on students' cognitive abilities before treatment indicate a significance value greater than the significance level ($0.225 \geq 0.05$),

so Ho is accepted. Therefore, it can be concluded that the students' cognitive abilities before treatment are homogeneous, as presented in Table 4.

Table 3. Homogeneity pre-test result

Test Type	Significance Value	Conclusion of data distribution test results
Levene's Homogeneity Test	0.225	The pre-test data of the study are homogeneous

Table 1. Mann-Whitney pre-test result

Tested variables	Asymp. Sig. (2-tailed)
Pre-test scores	0.802

Based on the table, it can be seen that the significance value of the pre-test data for students' cognitive abilities is 0.802, which is greater than $\alpha = 0.05$, and therefore, H0 is accepted. This result indicates that there is no significant difference in students' initial cognitive abilities between the experimental class and the control class, as presented in Table 5.

Table 5 Post-test normality test results

Test Type	Test Class	Significance Value	Conclusion of data distribution test results
Normality Test (Kolmogorov-Smirnov test)	Control	0,000	The pre-test data for the control class were not normally distributed.
	Experiment	0.034	The pre-test data for the control class were not normally distributed.

The normality test table above shows that the cognitive ability data in the control and experimental classes are not normally distributed. This result is indicated by the significance value of the normality test on the control class post-test data being smaller than the significance level ($0.000 \leq 0.05$), which means that H0 is rejected. In the experimental class, the significance value of the normality test is 0.034, which is smaller than the significance level of 0.05. Therefore, it can be concluded that H0 is rejected, and the experimental class post-test data are not normally distributed, as presented in Table 6.

Table 2. Homogenitas posttest reuslt

Test Type	Significance Value	Conclusion of data distribution test results
Levene's Homogeneity Test	0,070	The pre-test data of the study are homogeneous

In the homogeneity test data (Table 6), it was found that the significance value of the post-test data was 0.070, which was greater than the significance level ($\alpha \geq 0.05$). When the significance value is greater than the significance level, it can be said that H0 is accepted, indicating that there is no significant difference between the cognitive abilities of students in the experimental class and those in the control class, as presented in Table 7.

Table 3. Mann Withney U Post-test results

Tested Variables	Asymp. Sig. (2-tailed)
Post-test Score	0.003

Based on Table 7, it can be seen that the significance value of the post-test data for students' cognitive abilities has a significance value of 0.003, so $\alpha \leq 0.05$ and Ho is rejected. This result indicates a significant difference in students' final cognitive abilities between the control class and the experimental class, as presented in Table 8.

Based on Table 8, it is evident that in the control class using the Number Head Together (NHT) cooperative learning model, the asymptotic significance value (2-tailed) is 0.000, which is smaller than the significance level ($\alpha \leq 0.05$), so Ho is rejected. This result indicates a

significant difference between the post-test and pre-test results in the control class. In the experimental class with the Team Games Tournament (TGT) cooperative learning model, the Asymp. Significance value (2-tailed) is 0.014, which is smaller than the significance level ($\alpha \leq 0.05$), so Ho is rejected. This result indicates a significant difference between the post-test and pre-test results in the experimental class, as presented in Table 9.

Table 8. Wilcoxon Pre-test-Post-test test for the control class and experimental class

Non-Parametric Tests	Nilai Asymp. Sig. (2-tailed)
Wilcoxon Signed Ranks Test Pre-test-Post-test Control Class (NHT)	0.000
Wilcoxon Signed Ranks Test Pre-test-Post-test Experimental Class (TGT)	0.014

Table 9. Effect Size Test for NHT and TGT treatments

Class	Z-value	Cohens'd	Category
Experiment	-2,456	1,025	High
Control	-4,551	2,838	High

The Cohen's d value in the control class was 2.838, which, when compared to the Cohen's d value criteria scale, placed the control class in the high influence category (Cohen's d value > 1.00). Therefore, it can be said that the use of the NHT type of cooperative learning model is very effective in improving students' cognitive abilities. On the other hand, the experimental class had a Cohen's d value of 1.025, which falls in the high category (Cohen's d value > 1.00). Therefore, the use of the TGT type of cooperative learning model also had a significant influence on improving students' cognitive abilities.

Discussion

This research was conducted at SMA Negeri 1 Karangmojo, Gunungkidul, with two classes serving as samples: Class XI A as the control class and Class XI B as the experimental class. The sample was selected using a purposive sampling technique. The purpose of this study was to determine the comparative improvement in students' cognitive abilities after implementing the NHT and TGT cooperative learning models. Therefore, the success of this research is evident in the improvement of students' cognitive abilities. This statement is supported by the opinion of Destyana & Surjanti (2021), who stated that measuring learning outcomes can be used to assess students' competencies after they have gained learning experience.

The NHT and TGT research was conducted over four sessions. Each session consisted of three 30-minute lessons. The NHT cooperative learning was implemented in class XI A as the control class, with a sample size of 31 students. Prior to implementing the NHT learning model, a pre-test was conducted to determine students' initial knowledge of the coordination system material. In its implementation, NHT is conducted through four stages: numbering, asking questions, thinking together, and answering. Through its syntax, NHT promotes active learning activities. The numbering and random number generation require all students to be prepared and active in the teaching and learning process (Aminah et al., 2023).

The TGT cooperative learning model was implemented in grade XI B as an experimental class with a sample size of 29 students. Prior to TGT implementation, a pre-test was conducted to determine students' prior knowledge. TGT implementation involves five stages: class presentation, group division, games, class tournaments, and group awards (Hamdayana, 2016). Based on this syntax, the tournament activities in TGT foster students' mutual competence and critical thinking in problem-solving. Furthermore, group discussions prior to the tournaments help students understand the topic, resulting in increased student activity and learning outcomes (Putra et al., 2017). After implementing the cooperative learning model, both the NHT and TGT types, cognitive scores were obtained using post-test questions.

The data analysis used in this study was non-parametric because the distributions of data in the pre-test and post-test were not normally distributed and homogeneous. Pre-test data could not be processed using parametric analysis because neither dataset was normally distributed (Tyastirin & Hidayati, 2017). The post-test data showed that students' cognitive abilities were not normally distributed but homogeneous. Similar to the pre-test data, the post-test results were analysed using non-parametric analysis.

The Mann-Whitney U test revealed no significant differences in students' cognitive abilities before treatment between the control and experimental classes. This result is indicated by the pre-test significance value of 0.802, which is greater than the significance level ($\alpha \geq 0.05$). Therefore, it can be concluded that the initial cognitive abilities of students in the control and experimental classes did not differ significantly before treatment.

On the other hand, analysis of cognitive assessment results using the Mann-Whitney U test in the control and experimental classes after treatment showed different results. The results showed that the post-test data significance value for students' cognitive abilities was 0.003 ($\alpha \leq 0.05$). Therefore, it can be concluded that there was a difference in cognitive ability improvement between the control and experimental classes after treatment.

Learning process is considered successful if students' knowledge levels increase compared to previous results (Saefi, et al., 2025). Based on the Wilcoxon test, the control class showed a significance value of 0.000, which is lower than the significance level ($\alpha \leq 0.05$), indicating a statistically significant difference in cognitive ability levels before and after the implementation of the NHT learning model. The use of the NHT cooperative learning model was proven to improve students' cognitive abilities in this study.

In the experimental class, the Wilcoxon test showed a significance level of 0.014, which is lower than the significance level ($\alpha \leq 0.05$). These results indicate that the experimental class also had a significant difference in cognitive ability levels before and after the implementation of the TGT cooperative learning model. The use of the TGT cooperative learning model in this study was also proven to improve students' cognitive abilities.

The extent of the learning model's influence on improving students' cognitive abilities can be further assessed using the Effect Size test. The results of the Effect Size test in the control and experimental classes in this experiment indicated that in the control class, the NHT cooperative learning model had a very high (significant) effect on improving learning outcomes in the cognitive domain. On the other hand, the application of TGT cooperative learning also demonstrated a high level of influence in improving students' cognitive abilities, as indicated by the Effect Size test. The NHT and TGT cooperative learning models used in this study successfully improved students' cognitive abilities. This improvement in cognitive abilities is one sign of a successful learning process. The cooperative learning model, both the NHT and TGT types, has a significant impact on improving students' cognitive abilities.

Classes in 11th grade at SMA Negeri 1 Karangmojo were randomly assigned and taught by the same teacher. Based on the previous explanation, the results of a pre-test showed that the control and experimental classes did not differ significantly, indicating that both classes started with nearly the same prior knowledge. Although both NHT and TGT are part of the cooperative learning model, they have several differences. NHT is designed primarily to influence interaction patterns among students. NHT cooperative learning prioritises collaboration among students in groups to achieve learning objectives and improve academic mastery (Palupi et al., 2023). TGT encourages activeness, independence, and responsibility in students through games and tournaments to improve learning outcomes (Putra et al., 2017). Therefore, the effects of TGT and NHT on improving cognitive abilities will also differ.

NHT shows a higher effect size than TGT. The significant impact of implementing this type of learning model is supported by the NHT syntax, which supports the learning process. Regulation of the Minister of Education, Culture, Research, and Technology of the

Republic of Indonesia Number 16 of 2022 concerning Process Standards in Early Childhood Education, Elementary Education, and Secondary Education, states that a good learning process is partly due to the creation of a motivating learning environment, providing creative space, and fostering independence for students.

In line with this, according to Slameto (Faizah, 2017), learning models and methods are among the external factors influencing the learning process and outcomes. The syntax of the NHT cooperative learning model can support the creation of a motivating learning environment, providing creative space, and fostering independence for students. Learning using the TGT cooperative learning model aligns with the demands of the independent curriculum, positioning students to actively participate in the learning process. In accordance with Regulation of the Minister of Education, Culture, Research, and Technology of the Republic of Indonesia Number 16 of 2022 concerning Process Standards in Early Childhood Education, Elementary Education, and Secondary Education, a good learning process is supported by the creation of a learning environment that motivates, challenges, and fosters student independence in understanding the subject matter. Similar to the characteristics of cooperative learning, which foster interaction patterns and tolerance among students, TGT also trains students to increase their motivation, active participation, and competitive spirit.

TGT learning provides enjoyable learning because it is packaged in the form of games. Although packaged in the form of a game, learning with the TGT cooperative learning model is still implemented through a specific learning syntax. As part of the external factors that influence learning outcomes, syntax in TGT helps create a positive learning atmosphere. TGT, as previously explained, can also improve students' cognitive abilities. However, the results of the effect size test indicate that the implementation of TGT in grade XI biology, the subject of the coordination system, has a lower impact value than the implementation of NHT. This result occurs because TGT does not have a classical discussion stage, so group members' understanding is based solely on the teacher's initial explanation and small group discussions. Furthermore, peer tutoring activities in small groups can impact the length of group study time before games and tournaments, thus not optimally covering all the expected material (Putra & Suhartini, 2025). On the other hand, in NHT, discussion outcomes can develop alongside classical discussion activities during the response session of students whose numbers are indicated, allowing for the achievement of learning objectives and increased academic mastery (Azla, 2022).

CONCLUSION

Based on the results of the analysis and discussion, this study concludes that biology learning using the NHT and TGT cooperative learning models can improve the cognitive abilities of class XI students at SMA Negeri 1 Karangmojo in the subject of coordination systems. This result is indicated by the increase in the average value of the NHT class from 45.48 to 70.32 after treatment (an increase in the class average of 54.62%). At the same time, the TGT class experienced an increase in the average value from 45.00 to 55.00 after treatment (an increase in the class average of 22%). There is a significant difference in the increase in cognitive abilities of students at SMA Negeri 1 Karangmojo on the subject of coordination systems after the application of the NHT and TGT cooperative learning models. The application of the NHT and TGT cooperative learning models, based on the Effect Size test, has a significant influence on improving the cognitive abilities of students at SMA Negeri 1 Karangmojo in the subject of coordination systems.

REFERENCES

Aminah, S., Taqiyyah, F., Nakhlah, R. M., Puryati, L. K., & Ermawati, D. (2023). Pengaruh Model Pembelajaran Kooperatif Tipe NHT terhadap Kemampuan Pemecahan Masalah

Matematis di Sekolah Dasar. *Jurnal Basicedu*, *7*(4), 2040–2047. https://doi.org/10.31004/basicedu.v7i4.5831

Amirono, & Daryanto. (2016). *Evaluasi dan penilaian pembelajaran Kurikulum 2013*. Yogyakarta, Indonesia: Gava Media. https://www.gavamedia.net/produk-391-evaluasi-dan-penilaian-pembelajaran-kurikulum-2013.html

Anderson, L. W., & Krathwohl, D. R. (2001). A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives: Complete Edition. New York: Longman. https://api.semanticscholar.org/CorpusID:61966728

Azla, R. (2022). Kemampuan kognitif dan kreativitas melalui model pembelajaran Quantum Teaching dan model kooperatif learning tipe NHT pada siswa kelas X SMK Negeri 3 Kota Bengkulu. *Jurnal Economic Edu,* *2*(2), 1–12. https://doi.org/10.53682/jee.v2i2.2066

Destyana, V. A., & Surjanti, J. (2021). Efektivitas penggunaan Google Classroom dan motivasi belajar terhadap hasil belajar peserta didik pada mata pelajaran ekonomi. *Edukatif: Jurnal Ilmu Pendidikan, 3*(3), 1000–1009. https://doi.org/10.31004/edukatif.v3i3.507

Faizah, S. N. (2017). Hakikat belajar dan pembelajaran. *At-Thullab: Jurnal Pendidikan Guru Madrasah Ibtidaiyah, 1*(2), 46–54. https://doi.org/10.30736/atl.v1i2.17

Hamdayana, J. (2016). *Metodologi pengajaran*. Jakarta, Indonesia: Bumi Aksara.

Isnaini, A. N., & Rahayu, T. (2023). Pengaruh pembelajaran biologi berbasis socio scientific issues (SSI) terhadap literasi kesehatan siswa. *Jurnal Edukasi Biologi, 9*(2), 112–127. http://dx.doi.org/10.21831/edubio.v9i2.19233

Jayawardana, H. B. A., Sugiarti, R., & Gita, D. (2020). Inovasi pembelajaran biologi di era revolusi industri 4.0. *Prosiding Seminar Nasional Biologi, 6*(1), 40–46. https://api.semanticscholar.org/CorpusID:225213580

Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia. (2022). *Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia Nomor 16 Tahun 2022 tentang Standar Proses pada Pendidikan Anak Usia Dini, Jenjang Pendidikan Dasar, dan Jenjang Pendidikan Menengah*. Jakarta, Indonesia: Kemendikbudristek. https://peraturan.bpk.go.id/Home/Details/224238/permendikbudriset-no-16-tahun-2022

Palupi, D. I., Rahmani, E., Yusnita, E., Gustina, H., Pertiwi, H., & Priyanti, N. (2023). Mengenal model kooperatif Numbered Head Together (NHT) untuk pembelajaran anak usia dini. *Edukasia: Jurnal Pendidikan dan Pembelajaran, 4*(1), 21–28. https://doi.org/10.62775/edukasia.v4i1.89

Putra, P. H. I. G. P. N., Ariawan, U. K., & Arsa, S. I. P. (2017). Penerapan model pembelajaran kooperatif tipe Team Game Tournament untuk meningkatkan hasil belajar perakitan komputer. *Jurnal Pendidikan Teknik Elektro Undiksha, 6*(3), 49–58. https://ejournal.undiksha.ac.id/index.php/JJPTE/article/view/20854

Putra, D. T. A., & Suhartini, S. (2025). Pengembangan Media Pembelajaran Environbytiktok dengan Sosio-Scientific Issues Alih Fungsi Hutan Ibu Kota Nusantara Untuk Mendukung Literasi Lingkungan Siswa SMA. *Jurnal Edukasi Biologi*, 11(1), 27–41. https://doi.org/10.21831/edubio.v11i1.22558

Saefi, M., Suwono, H., Fachrunnisa, R., Adi, W. C., Susilo, H., & Sudrajat, A. K. (2025). Raising Information Literacy of Biology Pre-service Teachers: Study on Three Problem Solving Methods. *Australian Journal of Teacher Education, 50*(2). https://doi.org/10.14221/1835-517X.6442

Sardiyanah. (2018). Faktor yang mempengaruhi belajar. *Al-Qalam: Jurnal Kajian Islam & Pendidikan, 10*(2), 145–154. https://doi.org/10.47435/al-qalam.v10i1.263

Sugiyono. (2013). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D*. Bandung, Indonesia: Alfabeta. https://perpustakaan.binadarma.ac.id/opac/detail-opac?id=8

Tyastirin, E., & Hidayati, I. (2017). Efektivitas penggunaan model pembelajaran berbasis proyek untuk meningkatkan hasil belajar siswa. *European Journal of Social Psychology, 47*(3), 365–372. https://doi.org/10.1002/ejsp.2256

Zaliani, I., Nur Aliza, N., Sihotang, R., Suryanda, A., & Rini, D. S. (2024). Evaluasi strategi pengajaran dalam pembelajaran biologi di SMA. *Jurnal Edukasi Biologi, 10*(1), 49–56. https://doi.org/10.21831/edubio.v10i1.19650

Zulfira, V., Anggereini, E., & Sadikin, A. (2019). Pengaruh penerapan model pembelajaran kooperatif tipe Teams Games Tournament (TGT) terhadap hasil belajar biologi pada materi keanekaragaman hayati di SMA Negeri 1 Batang Hari. *Biodik: Jurnal Ilmiah Pendidikan Biologi, 5*(3), 273–285. https://doi.org/10.22437/bio.v5i3.8418