

Effect of Numbered Heads Together Model with a Scientific Approach on Students' Critical Thinking in Biology

Pengaruh Model Numbered Heads Together (NHT) Terintegrasi Saintifik Terhadap Kemampuan Berpikir Kritis Pada Pembelajaran IPA-Biologi

Junauan Abdullah¹⁾, Bahtiar Bahtiar²⁾, Suparman Suparman^{3*)}

¹⁾ Master's Program in Biology Education, Graduate School, Universitas Khairun, Indonesia.

^{2, 3*)} Biology Education Study Program, Faculty of Teacher Training and Education, Universitas Khairun, Indonesia.

* Corresponding Email: suparman@unkhair.ac.id

Abstract	Article Information
<p>The Numbered Heads Together (NHT) model and the Scientific approach are two effective learning strategies to improve critical thinking skills and student engagement in the learning process. This study aims to examine the effect of integrating the NHT model based on the Scientific approach on students' critical thinking skills on the material of the plant reproductive system at SMP Nasional Banau, Ternate City. The research method used was a quasi-experimental design with a Pretest-Posttest Control Group Design. The experimental group implemented the NHT model integrated with the Scientific approach, while the control used the Scientific approach (5M) without NHT integration. The research instruments included a critical thinking ability test based on high cognitive levels (C3–C6) and an observation sheet for the implementation of learning. The results of the ANCOVA test showed that there was a significant effect of the learning model on improving students' critical thinking skills ($F = 9.598$; $sig. = 0.003$). R^2 of 0.667 indicated that 66.7% of the variation in the post-test critical thinking score could be explained by the learning model. These findings indicate that the integration of NHT and the Scientific approach is more effective than the pure Scientific approach in improving students' critical thinking skills, especially in understanding complex materials such as the plant reproductive system. Scientific collaborative learning encourages high-level thinking processes in biology learning.</p>	<p>Keywords: critical thinking; plant reproductive system; science learning-biology; scientific approach</p>
<p><i>Model Numbered Heads Together (NHT) dan pendekatan saintifik merupakan dua strategi pembelajaran yang efektif untuk meningkatkan keterampilan berpikir kritis dan keterlibatan siswa dalam proses pembelajaran. Penelitian ini bertujuan untuk mengkaji pengaruh integrasi model NHT berbasis pendekatan Saintifik terhadap kemampuan berpikir kritis siswa pada materi sistem reproduksi tumbuhan di SMP Nasional Banau, Kota Ternate. Metode penelitian yang digunakan adalah kuasi eksperimen dengan desain Pretest-Posttest Control Group Design. Kelompok eksperimen menggunakan model NHT terintegrasi pendekatan Saintifik dan kelompok kontrol menggunakan pendekatan Saintifik (5M) tanpa integrasi NHT. Instrumen penelitian mencakup tes kemampuan berpikir kritis berbasis level kognitif tinggi (C3–C6) dan lembar observasi pembelajaran. Hasil uji ANCOVA menunjukkan bahwa terdapat pengaruh signifikan dari model pembelajaran terhadap peningkatan kemampuan berpikir kritis siswa ($F = 9,598$; $sig. = 0,003$). R^2 sebesar 0,667 menunjukkan bahwa 66,7% variasi skor postes berpikir kritis dapat dijelaskan oleh model pembelajaran. Temuan ini mengindikasikan bahwa integrasi NHT dan pendekatan Saintifik lebih efektif dibandingkan pendekatan Saintifik murni dalam meningkatkan kemampuan berpikir kritis siswa, khususnya dalam memahami materi kompleks seperti sistem reproduksi tumbuhan. Pembelajaran kolaboratif yang berpola saintifik mendorong proses berpikir tingkat tinggi dalam pembelajaran biologi.</i></p>	<p>Kata kunci: berpikir kritis; pembelajaran ipa-biologi; pendekatan saintifik; sistem reproduksi tumbuhan</p> <p>History Received : 18/09/2025 Revised : 07/10/2025 Accepted : 15/10/2025 Published : 31/10/2025</p>

A. INTRODUCTION

The curriculum is one of the key components that makes a significant contribution to improving the quality of student learning outcomes. Periodic curriculum refinement, accompanied by effective curriculum management, serves as a strategic effort to achieve the goals of national education (Rahayu et al., 2023). SMP Nasional Banau in Ternate City, one of the schools located in South Ternate District, has implemented both the 2013 Curriculum and the Merdeka Curriculum. The implementation of the 2013 Curriculum serves as an important intervention in improving the quality of education through a scientific approach, involving students as active subjects and teachers as the main facilitators of the learning process (Nuraini et al., 2015).

The scientific approach encourages students to construct their own knowledge through a series of scientific steps: observing, questioning, experimenting, reasoning, and communicating (Asmawati & Nurhayati, 2016; Harahap, 2018). In the context of biology learning, this approach is highly relevant as it trains students to discover concepts through experimentation (Karjo et al., 2019; Mayasari et al., 2019). Teachers serve as facilitators who create enjoyable and meaningful learning experiences, so this approach is expected to enhance students' conceptual understanding and critical thinking skills.

Previous studies have shown that the scientific approach can enhance students' critical thinking skills (Agustin, 2019; Mulyana, 2022), It also strengthens cognition and fosters problem-solving and decision-making skills (Yuniastuti, 2023). Selvia (Selvia et al., 2023) have also stated that this approach helps students achieve minimum competency scores across various subjects. Overall, the scientific approach trains students to think logically and systematically, forming the foundation for developing critical thinking skills. In addition, the scientific approach is flexible and can be integrated with other learning models, one of which is the Numbered Heads Together (NHT) model. The NHT model promotes group collaboration, enhances motivation, and fosters positive attitudes toward learning (Jampel et al., 2018)). This model can also improve students' social attitudes, such as cooperation and empathy (Suzerli et al., 2019), encourage active participation (Utami et al., 2023), and reduce apathy toward learning (Oktavia & Winanto, 2023).

Although the scientific approach and the NHT model have been widely studied separately, few studies have explicitly examined the integration of both within the context of science–biology learning to develop students' critical thinking and social skills, particularly in the eastern regions of Indonesia. Preliminary observations at SMP Nasional Banau Ternate revealed that: (1) teachers have not yet systematically assessed students' critical thinking skills; (2) cognitive assessment remains limited to conceptual understanding; (3) students' social attitudes are still low, especially in terms of responsibility and cooperation; (4) the topic of plant and animal reproductive systems is among the most challenging for students; and (5) teaching approaches remain predominantly conventional.

This study aims to examine the effect of the NHT model based on the scientific approach in enhancing students' critical thinking skills on the topic of the plant reproductive system. The findings of this research are expected to serve as a reference for developing science learning that is more active, contextual, and oriented toward strengthening character and 21st-century skills.

B. METHOD

The study was conducted with ninth-grade students of SMP Nasional Banau, Ternate City, from January to April 2025. The research employed a quasi-experimental method with a Pretest–Posttest Control Group design. The treatment was applied to the independent variable—science–biology learning using the Numbered Heads Together (NHT) model integrated with the scientific approach—to measure its effect on the dependent variable, namely students’ critical thinking skills. As a quasi-experimental study, control over the independent variable was not strictly applied; however, it still allowed for a structured analysis of cause-and-effect relationships.

Table 1. Pretest–Posttest Control Group Experimental Design

O1	MP1	O2
O3	MP2	O4

Notes:

MP1 : NHT Model integrated with the Scientific Approach

MP2 : NHT Model (Control)

O1, O3 ... O31 represent pretest scores of critical thinking skills

O2, O4 ... O32 represent posttest scores of concept mastery

The research instruments consisted of: (1) a Critical Thinking Skills Test, designed to assess students’ critical thinking abilities on the topic of *Plant Reproduction*. The test items were developed at higher-order cognitive levels, referring to Bloom’s Revised Taxonomy by Anderson & Krathwohl (2001) ((Oktaviana & Prihatin, 2018)), namely: *applying (C3)*, *analyzing (C4)*, *evaluating (C5)*, and *creating (C6)*. Critical thinking scores were assessed using a rubric modified from Finken and Ennis (1993) and further developed by Hidayati et al. (Hidayati et al., 2023). (2) A Learning Observation Sheet was used to assess the implementation of learning syntax according to the designed instructional model. The learning materials used in this study were developed by modifying and integrating the NHT model with the scientific approach, with the steps outlined in Table 2.

Table 2. Learning Steps Integrating the NHT Model with the Scientific Approach (5C)

Introduction Activities	a) The teacher communicates the learning objectives.
	b) The teacher explains the learning process.
	c) The teacher conducts an apperception activity.
	d) The teacher provides motivation to the students.
Main Learning Activities (Consist of six phases)	1. Numbering – The teacher divides students into groups of 4–5 members and assigns each member a number from 1 to 5.
	2. Observing – Students observe, watch, read, listen, and pay attention to materials presented through a video.
	3. Questioning – The teacher poses questions to the students, which are provided in the Student Worksheet (LKPD).
	4. Experimenting (Data Collection) – Students identify the data needed to answer the questions, determine data sources (objects, documents, books, or experiments), and collect data according to the guidelines in the LKPD (Thinking Together).
	5. Associating – Students analyze the data, determine relationships or categories, and draw conclusions based on the results of data analysis.
	6. Communicating – The teacher calls on one student (based on their assigned number) from each group to present the conceptual findings orally.
Closing Activities	Summarizing and Evaluation

The experimental results were analyzed using descriptive qualitative statistics, including total scores, means, and percentages. Class equivalence was tested using ANOVA, while hypothesis testing was conducted using ANCOVA at a 5% significance level. Statistical analysis was performed with the aid of SPSS 22 for Windows, preceded by parametric assumption tests, namely homogeneity and normality tests.

C. RESULTS AND DISCUSSION

Results

This study implemented two instructional treatments: the Numbered Heads Together (NHT) model integrated with the Scientific Approach, and the Scientific Approach (5M) without the integration of NHT steps. During the pretest phase, the average score of students' critical thinking skills in the Scientific group was 36.93, with a score range of 24–54, while the NHT integrated with Scientific group had a slightly lower average score of 35.33, with a score range of 26–54.

Table 3. Description of Students' Critical Thinking Data

Treatment	N	Mean	Std. Deviation	Minimum	Maximum
Pretest – Critical Thinking					
Scientific (5M)	30	36.93	9.03	24	54
NHT + Scientific	30	35.33	9.55	26	54
Posttest – Critical Thinking					
Scientific (5M)	30	67.73	10.17	42	84
NHT + Scientific	30	71.07	9.77	48	90

The results of this study indicate a significant increase in posttest scores after the implementation of the learning treatments. The group of students taught using the NHT model integrated with the Scientific Approach achieved an average posttest score of 71.07, while the Scientific (5M) model group increased to 67.73. The maximum score of the NHT group reached 90, higher than that of the Scientific (5M) group. These findings suggest that the use of the collaborative NHT learning strategy combined with the scientific approach produced a more effective impact in enhancing students' critical thinking skills—both in understanding concepts and in critically analyzing the topic of plant reproduction. The learning process not only became more interactive but also emphasized inquiry, data processing, and scientific reasoning, which collectively fostered higher-order thinking skills. A visualization of the pretest and posttest score improvements in students' critical thinking skills under the NHT integrated with Scientific and Scientific (5M) learning models is presented in Figure 1.

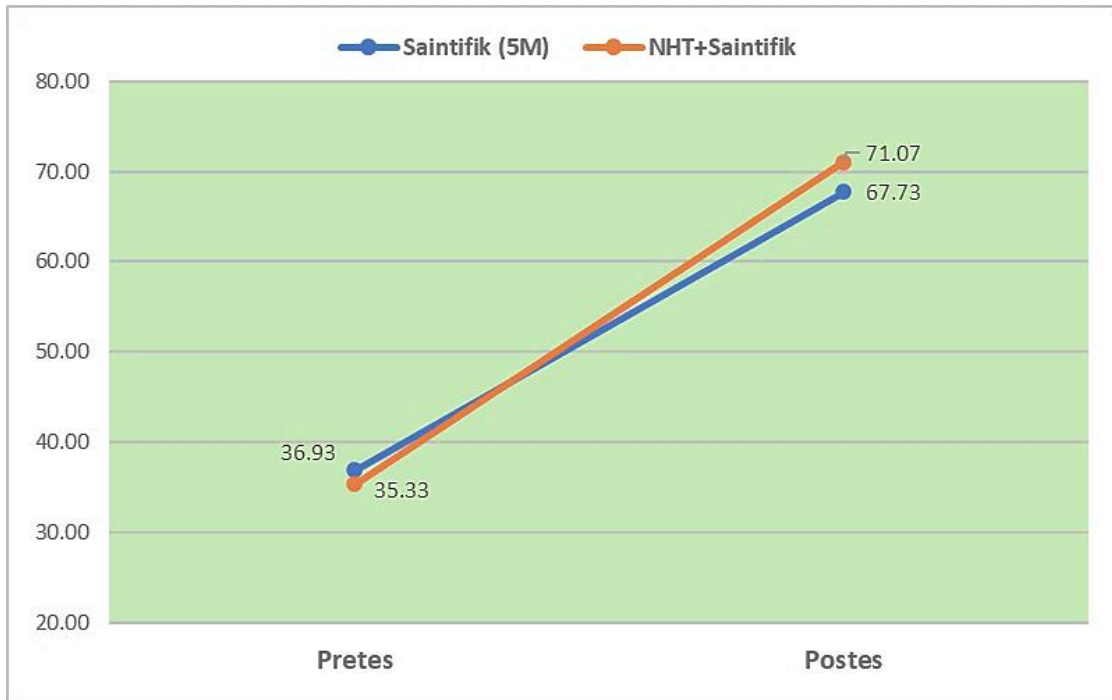


Figure 1. Pretest and Posttest Scores of Students' Critical Thinking Skills in the NHT Integrated with Scientific and Scientific (5M) Learning Models

The results of the ANCOVA analysis presented in Table 3 show a significant effect of the learning model on students' critical thinking skills, with an F-value of 9.598 and a significance level of 0.003. Since the significance value of $0.003 < 0.005$, it can be concluded that, after controlling for the influence of the initial (pretest) scores, the learning model contributed significantly to the improvement of students' critical thinking skills. The results of the Analysis of Covariance (ANCOVA) indicate that the NHT model integrated with the Scientific Approach had a significant effect on enhancing students' critical thinking skills in the topic of the Plant Reproductive System, while controlling for the influence of pretest scores.

Table 4. Results of the ANCOVA Test on the Effect of the NHT Model Integrated with the Scientific Approach on Students' Critical Thinking Skills

Tests of Between-Subjects Effects						
Dependent Variable: Posttest Critical Thinking						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	3956.540 ^a	2	1978.270	57.127	.000	
Intercept	5197.878	1	5197.878	150.101	.000	
Pretes_BKritis	3789.873	1	3789.873	109.442	.000	
Model_Belajar	332.355	1	332.355	9.598	.003	
Error	1973.860	57	34.629			
Total	294912.000	60				
Corrected Total	5930.400	59				

R Squared = .667 (Adjusted R Squared = .655)

The R^2 value of 0.667 indicates that 66.7% of the variation in posttest critical thinking scores can be explained by the model used in this study. This means that the NHT model integrated with the Scientific Approach is demonstrably more effective in enhancing students' critical thinking skills compared to the Scientific (5M) approach alone. This finding reinforces the argument that learning models emphasizing social interaction and group responsibility, such as NHT, strongly support the achievement of higher cognitive learning outcomes—particularly in complex topics such as fertilization, pollination, and reproduction processes in plants.

Discussion

The findings of this study demonstrate that the Numbered Heads Together (NHT) learning model integrated with the Scientific Approach has a significant effect on improving students' critical thinking skills in the topic of the plant reproductive system. This is evidenced by the results of the Analysis of Covariance (ANCOVA), which yielded a significance value of 0.003 ($p < 0.05$) and an F-value of 9.598. These results indicate that the NHT integrated with the Scientific Approach effectively encourages students to be more active, think deeply, and engage directly in the biology learning process particularly in conceptual topics that require systematic understanding, such as the plant reproductive system.

The integration of the Scientific Approach within the NHT model strengthens the development of critical thinking skills, as students are guided through scientific stages such as observing, questioning, reasoning, experimenting, and communicating. Meanwhile, the discussion component of the NHT model requires students to take responsibility for group outcomes, thereby promoting idea elaboration and deeper understanding.

The increase in the average post-test score in the NHT group (71.07) compared to the pure Scientific group (67.73) reinforces the claim that a learning intervention emphasizing collaboration and scientific activity can significantly enhance the quality of students' critical thinking. A scientific approach embedded within collaborative learning has been shown to contribute positively to the development of higher-order thinking skills (Wijaya et al., 2024).

The main advantage of the NHT model integrated with the Scientific Approach lies in its cooperative and participatory nature. Unlike the pure Scientific (5M) model, which tends to focus on individual activities and can sometimes be one-directional, the NHT model enhanced with structured group discussions provides ample opportunities for students to exchange ideas, discuss observational findings, and clarify their understanding through group interactions. This process stimulates the use of critical and analytical reasoning skills. Moreover, NHT fosters a social environment where students are required to verify and justify their opinions before their peers, thereby reinforcing conceptual mastery and critical thinking (Sabrina & Arif, 2023).

The application of the NHT model within the Scientific Approach not only improves conceptual understanding but also promotes active student engagement in scientific discourse, which serves as a crucial foundation for developing critical thinking skills. This model is effective because it encourages students to comprehend, reinterpret, and communicate information to other group members while collectively taking responsibility for their group's understanding. Therefore, the combination of scientific inquiry and collaborative group structure in the NHT model has proven to create a learning environment that fosters deep reflection, problem-solving, and logical argumentation among students when studying the plant reproductive system.

The Numbered Heads Together (NHT) model, when combined with the Scientific Approach, establishes a robust framework for collaborative learning. Beyond merely following the scientific steps observing, questioning, reasoning, experimenting, and communicating this

model requires students to explain concepts to one another and to take responsibility for their collective understanding. Such mechanisms stimulate metacognitive activity and argumentation, both of which constitute the core of critical thinking (García-Carmona, 2023).

Recent analyses have further supported the effectiveness of NHT. Solichah et al. (Solichah et al., 2022) reported a high effect size of 0.863, indicating that NHT exerts a significant influence on improving students' critical thinking skills compared to conventional instructional methods. This finding aligns with the study by Husniyyah et al. (Husniyyah et al., 2023), which demonstrated an enhancement of scientific literacy through the implementation of NHT based on a Growth Mindset.

In the context of plant reproduction particularly for complex or abstract concepts NHT facilitates scientific dialogue among students rather than emphasizing individual observation as in the traditional Scientific (5M) model. Group discussions encourage students to probe assumptions, formulate hypotheses, and critically evaluate peers' opinions (Suparman & Husen, 2015). This interactive process creates a learning environment that is far more conducive to developing critical thinking than isolated, less socialized activities typical of the pure Scientific (5M) approach.

D. CONCLUSION

The implementation of the Numbered Heads Together (NHT) model integrated with the Scientific Approach had a significant effect on students' critical thinking skills in the topic of Plant Reproduction Systems. This finding is supported by the results of the Analysis of Covariance (ANCOVA), which showed a significance value of 0.003 ($p < 0.05$).

Future research is recommended to expand the scope of this study to different educational levels and subject areas. In addition, further studies should also examine the influence of this integrated learning model on students' character development, motivation, and scientific literacy.

E. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the management of SMP Nasional Banau, including the foundation, teachers, and students, for their willingness to assist in the implementation of this study and the collection of research data.

F. REFERENCES

- Agustin, N. (2019). Pendekatan Saintifik Terhadap Keterampilan Berpikir Kritis Siswa Subtema Keberagaman MakhluK Hidup Di Lingkunganku Kelas IV Sekolah Dasar. *Child Education Journal*, 1(1), 36–43. <https://journal2.unusa.ac.id/index.php/CEJ/article/view/912/832>
- Asmawati, E., & Nurhayati, L. (2016). Penerapan Pendekatan Saintifik untuk Meningkatkan Keterampilan Proses Siswa pada Konsep Siklus Air. *Jurnal Pedagogik Pendidikan Dasar*, 4, 73–86. <https://ejournal.upi.edu/index.php/jppd/article/view/21296/10539>
- García-Carmona, A. (2023). Scientific Thinking and Critical Thinking in Science Education : Two Distinct but Symbiotically Related Intellectual Processes. *Science and Education*. <https://doi.org/10.1007/s11191-023-00460-5>

- Harahap, D. G. S. (2018). Peningkatan Hasil Belajar Siswa Pada Konsep Interaksi Makhluk Hidup Dengan Lingkungan Melalui Pendekatan Sainifik Kurikulum 2013 (Penelitian Tindakan Kelas di SMA Swasta Kampus Padangsidimpuan). *Jurnal ESTUPRO*, 3(3), 62–69. <https://jurnal.ugn.ac.id/index.php/ESTUPRO/article/view/276>
- Hidayati, H., Arsih, F., Alberida, H., & Rahmatika, H. (2023). Pengembangan Instrumen Soal Uraian Terintegrasi Keterampilan Berpikir Kritis Pada Materi Sistem Ekskresi Untuk SMA. *Ruang-Ruang Kelas: Jurnal Pendidikan Biologi*, 3(1), 2023. <http://rrkjurnal.ppj.unp.ac.id/index.php/RRKJURNAL>
- Husniyyah, A. A., Erman, E., Purnomo, T., & Budiyanto, M. (2023). Scientific Literacy Improvement Using Socio-Scientific Issues Learning. *IJORER: International Journal of Recent Educational Research*, 4(4), 447–456. <https://doi.org/10.46245/ijorer.v4i4.303>
- Jampel, I. N., Fahrurrozi, Artawan, G., Widiana, I. W., Parmiti, D. P., & Hellman, J. (2018). Studying natural science in elementary school using nos-oriented cooperative learning model with the NHT type. *Jurnal Pendidikan IPA Indonesia*, 7(2), 138–146. <https://doi.org/10.15294/jpii.v7i2.9863>
- Karjo, K., Ashadi, A., & Sugiyarto, S. (2019). Penerapan Pendekatan Sainifik dalam Pembelajaran Biologi Menggunakan Model GI dan STAD Ditinjau Dari Kemampuan Berpikir Deduktif Dan Motivasi Berprestasi. *INKUIRI: Jurnal Pendidikan IPA*, 8(2), 162. <https://doi.org/10.20961/inkuiri.v8i2.37755>
- Mayasari, D. D., Wardianti, Y., & Febrianti, Y. (2019). Pengaruh Pendekatan Sainifik terhadap Motivasi dan Hasil Belajar Biologi Siswa. *BIOEDUSAINS: Jurnal Pendidikan Biologi Dan Sains*, 2(2), 93–103. <https://doi.org/10.31539/bioedusains.v2i2.861>
- Mulyana, E. (2022). Pengaruh Pendekatan Sainifik terhadap Kemampuan Berpikir Kritis Peserta Didik pada Pembelajaran Ilmu Pengetahuan Sosial. *Jurnal Pendidikan IPS*, 12(1), 24–29. <https://doi.org/10.37630/jpi.v12i1.554>
- Nuraini, H. I. M., Saddhono, K., & Ulya, C. (2015). Implementasi Kurikulum 2013 pada Pembelajaran Menulis Teks Eksposisi (Studi Kasus di Kelas X SMK Negeri 1 Karanganyar). *BASASTRA Jurnal Penelitian Bahasa, Sastra Indonesia Dan Pengajarannya*, 3(3), 1–17. <https://media.neliti.com/media/publications/54730-ID-implementasi-kurikulum-2013-pada-pembela.pdf>
- Oktavia, W., & Winanto, A. (2023). Penerapan Model Pembelajaran Kooperatif Tipe Numbered Heads Together (NHT) untuk Meningkatkan Sikap Gotong Royong Kelas 3A DI SD Negeri Ledok 02 Salatiga. *Didaktik: Jurnal Ilmiah PGSD STKIP Subang*, 2574–2585. <https://journal.stkipsubang.ac.id/index.php/didaktik/article/view/1833>
- Oktaviana, D., & Prihatin, I. (2018). Analisis Hasil Belajar Siswa Pada Materi Perbandingan Berdasarkan Ranah Kognitif Revisi Taksonomi Bloom. *Jurnal Ilmiah Matematika Dan Pendidikan Matematika*, 8(2). https://jurnal.unipasby.ac.id/buana_matematika/article/view/1732
- Rahayu, M. S., Hasan, I., Asmendri, A., & Sari, M. (2023). Relavansi Kurikulum dan Pembelajaran Dalam Pendidikan. *DE JOURNAL (Dharmas Education Journal)*, 4(1), 108–118. http://ejournal.undhari.ac.id/index.php/de_journal
- Sabrina, N., & Arif, K. (2023). The Effect of Numbered Head Together (NHT) Cooperative Learning Model on Students Learning Outcomes on Human Respiratory System Materials. *Universe*, 4(1), 26–31. <http://universe.ppj.unp.ac.id/index.php/universe/article/view/341/87>
- Selvia, A., Al' Ayubi, S., & Irawati, T. N. (2023). Meningkatkan Hasil Belajar melalui Model Pembelajaran Sainifik Kelas VII MTs Darul Mukhlashin Materi Garis dan Sudut. *GAUSS: Jurnal Pendidikan Matematika*, 6(2), 1–16. <https://doi.org/10.30656/gauss.v6i2.7740>

- Solichah, H., Jailani, J., & Handayani, M. T. (2022). Pembelajaran Tipe NHT untuk Mendukung Keterampilan Communication, Collaboration, Critical Thinking, dan Problem Solving. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(2), 1381. <https://doi.org/10.24127/ajpm.v11i2.4783>
- Suparman, S., & Husen, D. N. (2015). Peningkatan Kemampuan Berpikir Kreatif Siswa Melalui Penerapan Model Problem Based Learning. *Bioedukasi*, 3(2), 2301–4678. <https://ejournal.unkhair.ac.id/index.php/bioedu/article/view/109>
- Suzerli, T. F., Alberida, H., & Yogica, R. (2019). Pengaruh Model Pembelajaran Kooperatif Tipe Numbered Head Together (NHT) terhadap Kompetensi Sikap Sosial Peserta Didik Kelas VII SMPN 1 Padang. *Bioeducation Journal*, 3(1), 17–26. <http://bioeducation.ppj.unp.ac.id/index.php/bioedu/article/view/97>
- Utami, A. W., Balqis, I. A. S., Widodo, S. T., Wahyuni, N. I., & Rohmah, K. (2023). Pengaruh Model Pembelajaran Kooperatif Tipe NHT dengan Berbantuan Media Pembelajaran Papan Pintar Pancasila untuk Meningkatkan Keaktifan Peserta Didik Kelas I SDN Podorejo 02. *Didaktik: Jurnal Ilmiah PGSD FKIP Universitas Mandiri*, 09(05), 1310–1319. <https://journal.stkipsubang.ac.id/index.php/didaktik/article/view/2084>
- Wijaya, R. H., Anshori, M., & Risnawati, R. (2024). Strategi Pendekatan Sainstifik Learning dalam Meningkatkan Keterampilan Berpikir Kritis Peserta Didik Kelas VI Pada Mata Pelajaran Al-Qur'an Hadits di Madrasah Ibtidaiyah (MI) As Sidiqiyah Kecamatan Siak. *Jurnal Pendidikan Rokania*, 9(1), 1–17. <https://doi.org/10.37728/jpr.v9i1.1020>
- Yuniastuti, N. (2023). Improving Critical Thinking Ability and Biology Learning Outcomes in Senior High School with the Science Technology and Society Approach with the Assistance of E-LKPD. *Jurnal Edukasi Biologi*, 9(2), 98–111. <https://doi.org/10.21831/edubio.v9i2.18741>