The Use of the Numbered Head Together (NHT) Cooperative Learning Model to Reduce Mathematics Anxiety in Grade XI Students at MAN Sumenep

Firyal Alya Nabiela; Ulfa Masamah

Universitas Islam Negeri Maulana Malik Ibrahim Malang, Indonesia

Abstract

This study aims to reduce mathematics anxiety among students of class XI-B at MAN Sumenep through the implementation of the cooperative learning model, Numbered Head Together (NHT). Mathematics anxiety is a psychological barrier that affects students' motivation, self-confidence, and academic performance. The research was conducted as a Classroom Action Research consisting of two cycles, each involving the stages of planning, action, observation, and reflection. The subjects were 35 students selected through total sampling based on observations and anxiety questionnaires conducted during the pre-cycle stage. Data were collected through observation, questionnaires, and documentation, and analyzed using descriptive quantitative methods. The results showed that the NHT model significantly reduced students' mathematics anxiety. In the pre-cycle, most students fell into the moderate to high anxiety categories. After two cycles of NHT implementation, the percentage of students with high anxiety decreased from 54.3% to 11.4%, while those with low anxiety increased from 11.4% to 54.3%. The learning process became more interactive, collaborative, and emotionally supportive. Students were more confident, actively participated in discussions, and were more engaged in learning activities. The study concludes that the NHT model is effective in creating a learning environment that supports the reduction of mathematics anxiety. Nevertheless, further efforts are needed to assist students who still exhibit high anxiety through individualized approaches. These findings imply that teachers should utilize instructional strategies that address not only cognitive learning outcomes but also students' psychological well-being.

Keywords: Classroom Action Research; Math Anxiety; Mathematical Learning; Numbered Heads Together

Introduction

Mathematics is one of the subjects that plays a crucial role in education. The logical, analytical, and systematic thinking skills developed through mathematics are essential in various fields of knowledge and everyday life (Artikasari & Saefudin, 2017). The mastery of mathematics is often used as an important indicator of educational success. Despite its importance, many students struggle to understand mathematical concepts and even exhibit negative attitudes toward the subject. One common phenomenon encountered in mathematics education is mathematics anxiety. This anxiety is defined as a feeling of fear,

The Use of the Numbered Head Together (NHT) Cooperative Learning Model to Reduce Mathematics Anxiety in Grade XI Students at MAN Sumenep

338

worry, or discomfort that arises when students are faced with mathematical tasks or exams. Mathematics anxiety often leads to a decline in academic achievement, hinders the development of mathematical thinking skills, and undermines students' interest in the subject (Amelia, 2011). This issue represents a serious educational and psychological concern due to its significant impact on students' emotional and academic development.

Based on preliminary observations conducted by the researcher in class XI-B at MAN Sumenep, it was found that most students expressed a dislike for mathematics. They reported feelings of fear and anxiety when dealing with math topics, with some stating that they found the subject difficult and boring. During the learning process, most students tended to be passive and reluctant to participate in class discussions or answer questions posed by the teacher. This reluctance was not solely due to a lack of understanding, but more so because of fear of making mistakes and low self-confidence. Such anxiety adversely affected the quality of the learning process and reduced their success in comprehending mathematical material. Students with mathematics anxiety tend to perform poorly and avoid situations involving mathematics, potentially worsening this cycle of discomfort (Pratiwi & Rusinani, 2020). This suggests that mathematics anxiety is not only an academic problem, but also a psychological one that requires serious attention from educators.

Numerous studies have sought effective strategies to reduce students' mathematics anxiety. One widely adopted approach is cooperative learning. Cooperative learning models have been proven to create a more enjoyable and supportive learning environment, encouraging students to work collaboratively in solving problems (Mardiana & Suharyanto, 2024). Among the various cooperative models, Numbered Head Together (NHT) has shown particular promise in reducing math anxiety. Developed by Spencer Kagan, the NHT model aims to enhance interaction among students in small groups and promote active participation from all members (Kagan & Kagan, 1994). In NHT, each student is randomly assigned a number, and the teacher poses a question for group discussion. Afterward, a random number is called to answer on behalf of the group. This structure motivates all students to engage with the material, since anyone could be called upon to respond. NHT fosters a collaborative and enjoyable classroom atmosphere while reducing the psychological pressure students often feel during math assessments. Group interaction also helps build self-confidence, which in turn can lessen math anxiety (Trisnani, 2022)

Previous research has demonstrated the effectiveness of cooperative learning, particularly the NHT model, in reducing mathematics anxiety. A study by Fitri & Fuadah (2020) found that NHT improved conceptual understanding in junior high students based on their learning interests. Another study by Adawiya (2022) revealed that NHT enhanced mathematics achievement among seventh-grade students. Additionally, Rahmawati et al., (2023) reported that NHT increased student engagement and learning outcomes in mathematics among fifth graders. While these studies confirm the benefits of NHT for understanding and engagement, few have specifically examined its impact on reducing mathematics anxiety at the senior secondary level (equivalent to Islamic senior high school/MA). Most existing research has focused on academic achievement rather than emotional barriers to learning.

In light of this gap, the present study aims to reduce mathematics anxiety among students in class XI-B at MAN Sumenep through the application of the NHT cooperative learning model. By implementing this approach, it is expected that students will feel more comfortable learning mathematics, participate more actively in discussions, and overcome their fear and anxiety about the subject. This research adopts a Classroom Action Research (CAR) framework, conducted over two cycles, with each cycle consisting of four stages: planning, action, observation, and reflection. The goal is to identify effective solutions for minimizing math anxiety and improving the quality of mathematics instruction in class XI-B at MAN Sumenep.

Methods

This study employed a Classroom Action Research (CAR) design aimed at reducing mathematics anxiety among students of class XI-B at MAN Sumenep through the implementation of the Numbered Head Together (NHT) cooperative learning model. The research design was based on the spiral model developed by Kemmis and McTaggart, consisting of four recurring stages in each cycle: planning, action, observation, and reflection (Dewayani et al., 2024). The research was carried out in two cycles, each comprising two classroom sessions. Prior to the intervention, a pre-cycle phase was conducted to assess the initial level of students' mathematics anxiety.

The research subjects consisted of all 35 students of class XI-B, selected through total sampling. This class was chosen based on initial observations that indicated signs of mathematics anxiety. The study was conducted during the even semester of the 2024/2025 academic year in the XI-B classroom.

According to Tsaqila et al., (2023), students' mathematics anxiety in this study was identified based on four key aspects:

Table 1. Aspects of Math Anxiety

Aspect	Characteristics
Cognitive	Negative thoughts when facing math problems, difficulty concentrating
Affective	Feelings of fear, nervousness, and lack of confidence while learning math
Psychomotor	Nervous behavior such as trembling, reluctance to answer or solve problems aloud
Somatic	Physical symptoms like a racing heart, stomach discomfort, pale face, cold hands

Students displaying a combination of these characteristics through observation and responses to the anxiety questionnaire were classified as experiencing math anxiety.

The classroom action was implemented in three stages: pre-cycle, Cycle I, and Cycle II, with the following structure:

Table 2. Stages of Classroom Action

Stage	Sessions	Main Activities
Pre-Cycle	1–2	Initial observation, administration of the math anxiety questionnaire, regular teaching
Cycle I	3–4	NHT implementation, observation, post-intervention questionnaire
Cycle II	5–6	Improved NHT implementation, observation, final anxiety questionnaire

The overall study spanned six meetings, with each session lasting 2×45 minutes. The procedures are detailed below:

Pre-Cycle

Initial observations were made during mathematics lessons in class XI-B. These focused on student behaviors indicative of anxiety, such as reluctance to answer, avoidance of participation, and visible nervousness. The researcher also administered a mathematics anxiety questionnaire adapted from the Mathematics Anxiety Rating Scale (MARS) by Richardson & Suinn (1972). At this stage, traditional teaching methods such as lectures and one-way questioning were still being used, serving as a baseline for comparison.

Cycle I

This cycle consisted of four components based on the CAR model: planning, implementation, observation, and reflection (Asmara, 2020). In the planning phase, the researcher prepared teaching modules using the NHT approach, student worksheets, and observation instruments to assess student activity and anxiety levels post-intervention.

During implementation, students were divided into heterogeneous groups and assigned random numbers. The teacher presented questions for discussion, and a randomly selected student would answer on behalf of the group. This model encouraged participation and shared responsibility. Cooperative learning theory supports the idea that group engagement can reduce individual pressure and enhance student confidence (Hendracipta, 2021). After the lesson, student activity was observed, and the anxiety questionnaire was re-administered.

In the reflection phase, the researcher and teacher evaluated the process, identifying shortcomings such as uneven participation and suboptimal time management, and proposed improvements for the next cycle.

Cycle II

Improvements were implemented based on the first cycle's reflection. These included clearer discussion procedures, specific group roles (spokesperson, recorder, motivator), and stronger teacher facilitation during discussions. The teacher also provided positive reinforcement to build confidence. Observations and the final anxiety questionnaire assessed changes in behavior, emotional responses, and class engagement. The final reflection evaluated the success of the intervention. A significant reduction in anxiety and improved engagement indicated the effectiveness of the NHT model. This is supported by Vygotsky's theory, which emphasizes social interaction as a key factor in cognitive and emotional development (Amelia, 2011)

Instruments

The primary instrument was the mathematics anxiety questionnaire, structured around four psychological dimensions: somatic, cognitive, affective, and mathematical knowledge. This instrument measured students' anxiety levels before and after the NHT intervention.

Table 3. Questionnaire Outline

Aspect	Indicators
Somatic	Sweaty hands, racing heart during exams
Cognitive	Difficulty concentrating, fear of poor evaluation, forgetting formulas
Affective	Anxiety, lack of confidence, fear of math problems
Mathematical Knowledge	Low understanding, feeling incapable of competing

Scores ranged from 20 to 80. Lower scores indicated higher levels of anxiety.

Table 4. Categories of Anxiety Levels

Score Range	Interpretation
$60 \leq X < 80$	High Anxiety
$40 \leq X < 60$	Moderate Anxiety
$20 \leq X < 40$	Low Anxiety

The lower the score obtained by the students, the higher the level of math anxiety experienced

The Use of the Numbered Head Together (NHT) Cooperative Learning Model to Reduce Mathematics Anxiety in Grade XI Students at MAN Sumenep

341

Results and Discussion

Pre-Cycle

Figure 1. Observation

During the pre-cycle stage, initial data were gathered through classroom observation and the administration of the mathematics anxiety questionnaire to students in class XI-B at MAN Sumenep. Observations were participatory in nature, focusing on students' expressions, body language, and verbal responses during math lessons. The validated anxiety questionnaire provided insights into individual students' anxiety levels.

The results revealed that most students experienced moderate to high levels of mathematics anxiety. The distribution of anxiety levels is shown in the following table:

Table 5. Pre-Cycle Mathematics Anxiety Data

Anxiety Level	Number of Students	Percentage
High	19	54.3%
Moderate	12	34.3%
Low	4	11.4%
Total	35	100%

These findings indicate that 88.6% of students experienced moderate to high levels of anxiety. Observation data supported these results, showing that many students avoided asking questions, looked down when called upon, appeared nervous when solving problems at the board, and frequently expressed sentiments like "math is difficult" or "I'm afraid of being wrong." This high level of anxiety negatively impacted student engagement, with most students remaining passive and avoiding eye contact or participation. This supports the view of Putra & Yulanda (2022) that mathematics anxiety impairs cognitive functions such as concentration and problem-solving.

Cycle I

In Cycle I, the cooperative learning model Numbered Head Together (NHT) was introduced following the prescribed procedures: forming heterogeneous groups, assigning numbers, posing questions, group discussions, and randomly selecting a number to respond. After implementation, observations and a second round of the anxiety questionnaire were conducted.

Table 6. Cycle I Mathematics Anxiety Data

Anxiety Level	Number of Students	Percentage
High	10	28.6%
Moderate	18	51.4%
Low	7	20.0%
Total	**35**	**100%**

These results showed a decline in students with high anxiety from 54.3% to 28.6% and an increase in students with low anxiety from 11.4% to 20%. Although most students still exhibited moderate anxiety, the reduction in the high category suggests a positive impact of the NHT model.

Classroom observations noted behavioral changes: more students actively participated in group discussions, asked questions within their groups, and seemed better prepared when selected to answer. However, some students remained passive, overly reliant on peers, or felt pressured when chosen to speak.

The reflection from Cycle I identified several issues: unequal participation within groups, inefficient use of discussion time, and a need for more targeted support for students with high anxiety. These observations align with Kagan's (1994) assertion that the success of NHT relies heavily on group dynamics and the active involvement of all members (Mariyaningsih & Hidayati, 2018).

Cycle II

Based on Cycle I reflections, adjustments were made for Cycle II. These included more detailed instructions on group discussion mechanics, specific role assignments (e.g., spokesperson, recorder, encourager), and increased teacher facilitation during discussions. The teacher also used verbal encouragement to build student confidence.

Table 7. Cycle II Mathematics Anxiety Data

Anxiety Level	Number of Students	Percentage
High	4	11.4%
Moderate	12	34.3%
Low	19	54.3%
Total	**35**	**100%**

The final results showed a substantial decrease in students with high anxiety—from 28.6% to 11.4%—and an increase in those with low anxiety—from 20.0% to 54.3%. More than half the class had reached a low anxiety level after two NHT cycles. Observations noted a more dynamic and supportive learning environment: students were more confident in expressing ideas, asking questions, and answering aloud. Previously passive students began to engage actively, and their body language became more relaxed.

Figure 2. Implementation of the Numbered Heads Together (NHT) Cooperative Learning Model

Discussion

The significant reduction in math anxiety after two cycles of NHT demonstrates the model's effectiveness in fostering a psychologically safe learning environment. These results align with Susiyani et al., (2024)   who reported enhanced conceptual understanding through collaborative discussions using NHT. The model reduces fear of individual judgment by emphasizing group responsibility, with responses reflecting collective reasoning rather than individual performance. This supports Vygotsky's theory of cognitive development through social interaction (Sukini, 2019).

Increased student confidence was also a key factor. Group successes during the learning process offered positive reinforcement, boosting students' self-efficacy (SITI, 2021). Despite these successes, 11.4% of students remained in the high anxiety category, suggesting that NHT alone may not address deep-seated anxiety. Personal factors such as introversion, past negative experiences, or family pressure may require individual counseling or psychoeducation.

Another challenge was unequal group participation, where stronger students dominated and others passively followed. This calls for more structured role assignments and role rotation to ensure equitable involvement. The findings underscore the importance of NHT not just as a tool for improving academic outcomes but also for addressing psychological barriers in learning mathematics. Effective implementation requires teacher training in cooperative classroom management, time control, and reinforcement strategies.

Conclusion

This study demonstrates that the cooperative learning model Numbered Head Together (NHT) positively impacts the reduction of mathematics anxiety among students in class XI-B at MAN Sumenep. After two cycles of implementation, there was a significant shift in students' anxiety levels, with a notable reduction in high anxiety and an increase in low anxiety cases. This indicates that the NHT model effectively fosters a more comfortable learning environment, promotes active participation, and builds students' confidence in engaging with mathematical concepts.

The Use of the Numbered Head Together (NHT) Cooperative Learning Model to Reduce Mathematics Anxiety in Grade XI Students at MAN Sumenep

344

By emphasizing collaborative group work and shared responsibility, students felt safer expressing their thoughts, participating in discussions, and answering questions. NHT reduces the individual pressure associated with traditional assessments by focusing on collective responses rather than personal performance. This process helped establish a more enjoyable and humanistic learning experience, thereby minimizing emotional barriers that typically hinder mathematics learning.

However, the findings also suggest that not all students respond equally to this approach. A small proportion of students continued to exhibit high anxiety levels, likely due to deeper psychological factors. As a result, the NHT model should be complemented by additional support strategies—such as individualized mentoring or counseling—to ensure that all students benefit optimally.

The success of the NHT implementation is closely tied to thorough planning, consistent execution, and continuous evaluation by teachers in their role as learning facilitators. Therefore, it is recommended that teachers integrate cooperative strategies like NHT not only to enhance academic achievement but also to support students' psychological well-being in the mathematics classroom.

References

Adawiya, R. (2022). Penerapan Model Pembelajaran Kooperatif Tipe Numbered Head Together (NHT) Untuk Meningkatkan Hasil Belajar Matematika Kelas VII Siswa MTS Amalul Ikhlas T.A. 2019/2020. *LITERASI (Jurnal Ilmu Pendidikan)*, *13*(1), 78. https://doi.org/10.21927/literasi.2022.13(1).78-90.

Amelia, R. (2011). *Penerapan pendekatan matemateka realistik Indonesia (PMRI) dalam mengurangi kecemasan belajar matematika siswa*.

Artikasari, E. A., & Saefudin, A. A. (2017). Menumbuh Kembangkan Kemampuan Berpikir Kreatif Matematis Dengan Pendekatan Contextual Teaching And Learning: berpikir kreatif matematis, pendekatan contextual teaching and learning. *Jurnal Math Educator Nusantara: Wahana Publikasi Karya Tulis Ilmiah Di Bidang Pendidikan Matematika*, *3*(2), 73–82.

Asmara, B. (2020). Meningkatkan kemampuan motorik halus melalui kegiatan menggunting pada anak usia dini di kelompok A tk khadijah surabaya. *Pedagogi: Jurnal Anak Usia Dini Dan Pendidikan Anak Usia Dini*, *6*(1), 11–23.

Dewayani, R. D., Nurwahyunani, A., & Priyanta, E. (2024). Peningkatan Motivasi dan Hasil Belajar Kognitif Kelas X melalui Model Problem Based Learning. *Jurnal Pendidikan Guru Profesional*, *2*(1), 55–62.

Fitri, I., & Fuadah, N. H. (2020). Pengaruh Penerapan Model Pembelajaran Kooperatif Tipe Numbered Heads Together (NHT) Terhadap Kemampuan Pemahaman Konsep Matematis Berdasarkan Minat Belajar Siswa Sekolah Menengah Pertama (SMP). *JURING (Journal for Research in Mathematics Learning)*, *3*(4), 393. https://doi.org/10.24014/juring.v3i4.10634.

Hendracipta, N. (2021). *Model Model Pembelajaran SD*. Multikreasi Press.

Kagan, S., & Kagan, S. (1994). *Cooperative learning*. Kagan San Clemente, CA.

Mardiana, S., & Suharyanto, S. (2024). Upaya Meningkatkan Keaktifan Siswa melalui Model Pembelajaran Kooperatif Tipe Number Head Together (NHT) pada Mata Pelajaran IPAS Sekolah Dasar. *Ainara Journal (Jurnal Penelitian Dan PKM Bidang Ilmu Pendidikan)*, *5*(2), 177–184.

Mariyaningsih, N., & Hidayati, M. (2018). *Bukan Kelas Biasa: Teori dan Praktik Berbagai Model dan Metode Pembelajaran menerapkan inovasi pembelajaran di kelas-kelas inspiratif*. CV Kekata Group.

Pratiwi, K., & Rusinani, D. (2020). *Buku ajar psikologi perkembangan dalam siklus hidup wanita*. Deepublish.

Putra, A., & Yulanda, Y. (2022). Kecemasan matematika siswa dan pengaruhnya: systematic literature review. *Didaktika: Jurnal Kependidikan*, *15*(1), 1–14.

Rahmawati, A. N., Siti Poerwanti, J. I., & Sularmi, S. (2023). Penerapan model pembelajaran kooperatif Numbered Head Together (NHT) untuk meningkatkan keaktifan dan hasil belajar matematika materi satuan kecepatan. *Jurnal Pendidikan Dasar*, *10*(2). https://doi.org/10.20961/jpd.v10i2.65703.

SITI, N. U. R. A. (2021). *Pelaksanaan Konseling Kelompok Melalui Teknik Penguatan Positif Dalam Meningkatkan Motivasi Belajar Daring Pada Peserta Didik Kelas Viii Di Mts N 2 Bandar Lampung Tahun Pelajaran 2020/2021*. UIN Raden Intan Lampung.

Sukini, M. P. (2019). *Panduan Pembelajaran Apresiasi Puisi Berbasis Inkuiri*. Penerbit K-Media.

Susiyani, R., Murtiyasa, B., & Setyaningsih, N. (2024). Peningkatan Pemahaman Konsep Matematika Materi Statistika Melalui Model Pembelajaran Kooperatif (NHT) Di Sdn Sampangan. *Jurnal Pendidikan: Kajian Dan Implementasi*, *6*(2).

Trisnani, N. (2022). Pembelajaran Matematika Sekolah Dasar: Antara Kepercayaan Vs Realita. *AR-RIAYAH: Jurnal Pendidikan Dasar*, *6*(1), 49–68.

Tsaqila, S., Astriani, L., Dasar, G. S., Pendidikan, F. I., & Jakarta, U. M. (2023). Analisis Math Anxiety dalam Pembelajaran Matematika pada Materi Bangun Datar Kelas 5 Siswa Sekolah Dasar. *Prosiding Seminar Nasional Penelitian LPPM UMJ*, 2.

Copyrights

The Use of the Numbered Head Together (NHT) Cooperative Learning Model to Reduce Mathematics Anxiety in Grade XI Students at MAN Sumenep

346