

Boosting Metacognition through STAD and NHT: A Study of Multiethnic Middle Schoolers in Ternate

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ARTICLE INFO

Keywords:

STAD;
NHT;
cooperative learning;
metacognitive skills;
multiethnic students

Article history:

Received 2025-06-14

Revised 2025-10-16

Accepted 2025-12-30

ABSTRACT

Metacognitive skills are essential for 21st-century learners, enabling students to plan, monitor, and evaluate their thinking processes. However, these skills remain underdeveloped among junior high school students in Ternate, particularly in multiethnic classroom settings. This study investigates the effectiveness of cooperative learning models—STAD, NHT, and a combined STAD–NHT model—in enhancing students' metacognitive skills across different ethnic groups. This quasi-experimental study employed a pretest–posttest nonequivalent control group design involving 76 multiethnic Grade VII students from four public junior high schools in Ternate City. Students were grouped into four treatment conditions: STAD, NHT, combined STAD–NHT, and conventional learning. Data on metacognitive skills were collected through an essay-based test aligned with Corebima's rubric and analyzed using ANCOVA with LSD post hoc tests to examine the effects of learning models, ethnicity, and their interaction. The combined STAD–NHT model produced significantly greater improvements in students' metacognitive skills compared to individual models and conventional learning. Ternate ethnic students showed higher metacognitive gains than their Makian and Tidore peers. A significant interaction between learning models and ethnicity was found, indicating that sociocultural factors influenced the effectiveness of cooperative learning. Findings suggest that combining STAD and NHT can support metacognitive development in multiethnic classrooms. However, cultural responsiveness in instructional design is critical. Further research is needed to explore how cultural norms shape collaborative learning and metacognitive growth.

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1. INTRODUCTION

Education serves as a vital foundation in developing a generation that is intelligent, critical, and adaptable to the evolving challenges of our times. A key component of 21st-century education is fostering higher-level thinking skills, particularly metacognitive skills (Danar et al., 2023). These skills

enable students to become aware of, control, and evaluate their thought processes during learning activities (Sapulete et al., 2024). Mastering metacognition is crucial, as it empowers students to become independent, reflective, and strategic learners capable of effectively solving problems (Suharto et al., 2022).

Recent findings from several junior high schools in Ternate City indicate that students' metacognitive skills remain relatively low (Ermin, 2021; Ermin, 2022). Additionally, past research has consistently shown that students' metacognitive abilities are lacking (Bahiyah, 2019; Nur' Azizah et al., 2021; Rahmawati et al., 2021). This is evident in students' suboptimal capabilities to plan, monitor, and evaluate their understanding and completion of study tasks (Amin & Sukestiyarno, 2015; Ansas et al., 2023). A contributing factor to this issue is the prevalent use of teacher-centered learning models, which often restrict student engagement in active thinking, discussion, and reflection.

In this context, cooperative learning models present a promising alternative. Approaches like Student Teams Achievement Division (STAD) and Numbered Heads Together (NHT) have proven effective in enhancing students' active participation in the learning process (Ilham Majid & Sari, 2024). The STAD model emphasizes teamwork with individual accountability culminating in group evaluations (Nina Rostiana, 2025). In contrast, NHT focuses on small group discussions with randomly assigned individual responsibilities to represent the group (Maman & Rajab, 2016). Both models create opportunities for students to hone their critical thinking and metacognitive skills through social interactions and reflections on their learning experiences.

Given the ethnic diversity present in Ternate City, adopting a collaborative learning approach is increasingly significant (Ermin & Marsaoly, 2021). A multiethnic learning environment necessitates strategies that promote inclusivity, cooperation, and mutual respect among students (Haerullah et al., 2017). The STAD and NHT models, which prioritize group collaboration and individual accountability in a supportive setting, can foster positive interactions among students from diverse backgrounds while simultaneously enhancing their metacognitive capabilities.

Research by Kusuma Busyairi (2023) explored the impact of the Reading Concept Mapping-Student Team Achievement Division (REMAP-STAD) model on students' metacognitive skills and cognitive learning outcomes, while Rahmat Muhdar (2023) examined ways to enhance metacognitive skills among multiethnic elementary students through the STAD model. Additionally, A. M. E. Pratiwi & Azizah (2022) investigated how the Numbered Heads Together cooperative learning model can improve metacognitive skills in the classroom.

However, there is a notable gap in studies specifically analyzing the effects of the STAD, NHT, and combined STAD-NHT models on students' metacognition within the context of ethnic diversity at junior high schools. By exploring the influence of these learning models, this research aims to contribute valuable insights toward developing more effective, adaptive, and inclusive educational strategies. Ultimately, this study aspires to enhance the quality of education by improving students' metacognitive skills in a multiethnic environment. Therefore, our goal is to investigate the impact of various learning models on the metacognitive skills of multiethnic students in Ternate City Junior High Schools.

2. METHODS

This study employed a quasi-experimental research design to investigate the impact of the Student Teams Achievement Division (STAD), Numbered Heads Together (NHT), and the combined STAD-NHT learning strategies on the metacognitive skills of multiethnic junior high school students in Ternate City. The research used a Pretest-Posttest Nonequivalent Control Group Design with a 4×1 factorial structure.

The unit of analysis was the individual student, with the class serving as the experimental unit for treatment assignment. The population included all Grade VII students from 13 multiethnic junior high schools in Ternate City during the 2024/2025 academic year. Sampling was carried out using random sampling at the class level, preceded by an equivalence test using a 30-item multiple-choice placement

test to ensure the similarity of initial academic ability across groups. Four schools with equivalent classes were selected: State Junior High School 2 (18 students); State Junior High School 3 (18 students); State Junior High School 7 (20 students); State Junior High School 13 (20 students), Resulting in a total of 76 students. The ethnic distribution consisted of 20 Ternate, 27 Makian, and 29 Tidore students. Each class was assigned one of the four learning conditions: STAD, NHT, combined STAD–NHT, and conventional learning (defined as teacher-centred instruction through lectures and individual exercises without structured group collaboration).

The metacognitive skills test instrument is in the form of open questions (essay form) in accordance with the test grid, the score for each item is determined by the metacognitive skills rubric covering planning, monitoring and evaluation which refers to Corebima (2009) with a scale of 0-7. Descriptive statistics (mean, standard deviation, minimum, maximum, and percentage gain) were used to summarise metacognition performance, which was also visualised in graphical form. Inferential analysis used Analysis of Covariance (ANCOVA) with pretest scores as covariates to control for initial differences among groups. ANCOVA assumptions—normality, homogeneity of variance, linearity, and homogeneity of regression slopes—were tested prior to analysis. Normality was tested using the Kolmogorov–Smirnov One-Sample Test, and homogeneity of variance was tested using Levene's Test of Equality of Error Variance. If the ANCOVA results indicated significant effects, Least Significant Difference (LSD) post hoc comparisons were conducted to identify which learning models differed significantly. All analyses were performed using SPSS version 23.0 for Windows at a significance level of 0.05.

Ethical clearance was obtained from the Faculty of Education, ISDIK Kie Raha Maluku Utara, and approved by the Ternate City Education Office. School principals authorised classroom participation, and all students were informed about the study's purpose and voluntarily assented to participate. The research posed minimal risk and was conducted within the regular learning process. Anonymity and confidentiality of student data were fully maintained.

3. FINDINGS AND DISCUSSION

Metacognition skills are also referred to as the concept of cognitive psychology which is oriented towards the active participation of individuals in a thought process including knowledge, tasks, and cognition. Students' metacognitive skills based on the learning model were measured using test questions, then the data were analyzed descriptively to determine the average pretest and posttest scores and differences in metacognitive skill scores of 76 students in the learning. The image of the analysis results can be seen in Figure 1.

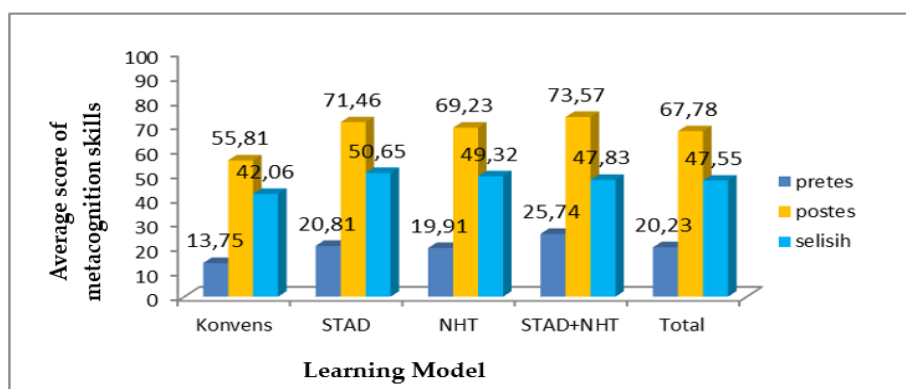


Figure 1. Average Pretest and Posttest Scores of Students' Metacognitive Skills in Each Learning Model

Students' metacognition skills based on ethnicity in each learning model were analyzed descriptively to determine the average pretest, posttest, and differences in learning scores. The results of the analysis of students' metacognition skills in each ethnicity in each learning model can be seen in detail. Figure 2 provides an overview of the metacognitive skills of 76 multiethnic students.

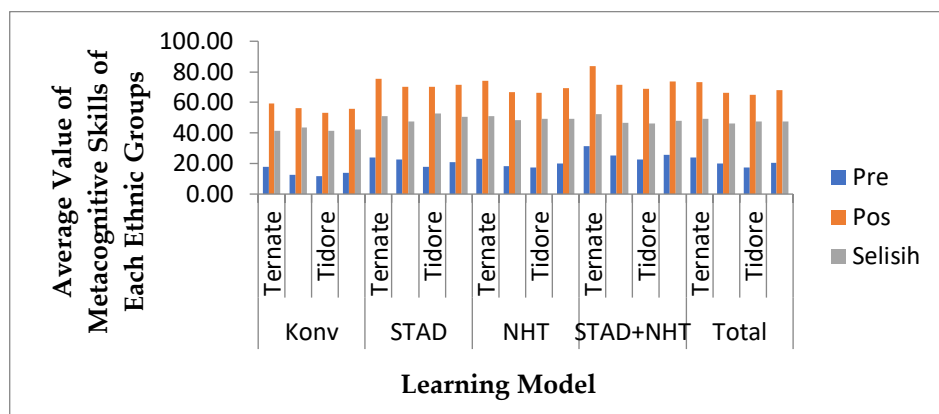


Figure 2. Average Pretest and Posttest Scores of Multiethnic Students' Metacognitive Skills in Each Learning Model

3.1 Results of the Research Hypothesis Test of Learning Models, Ethnicity, and the Interaction of Learning Models with Ethnicity on Students' Metacognition Skills

The results of the ANOVA test on learning models, ethnicity, and the interaction of learning with ethnicity on students' metacognition skills are aimed at. A summary of the results of the hypothesis test using ANOVA, the influence of the learning model, ethnicity, and the interaction of the learning model with ethnicity on metacognitive skills in 76 multi-ethnic students can be seen in Table 1.

3.2 Results of the Parametric Statistics Prerequisite Assumption Test

The results of the data normality test showed that the probability value (sig.) for the pretest metacognitive skills was 0.066. The probability value for the posttest metacognitive skills was 0.096. The probability values for metacognitive skills (pretest and posttest) were greater than the alpha value of 0.05. This indicates that all tested data groups were normally distributed and showed no deviations from normality.

Based on the results of the data homogeneity test, the probability value (sig.) for the pretest metacognitive skills was 0.746. The probability value (sig.) for the posttest metacognitive skills was 0.149. The analysis showed that the variance was greater than 0.05, thus concluding that there was no difference in variance between the data groups, thus the data was considered homogeneous.

3.3 Results of Hypothesis Testing of Learning Models, Ethnicity, and the Interaction of Learning Models with Ethnicity on Students' Metacognitive Skills

To examine the influence of learning models, ethnicity, and the interaction between learning models and ethnicity on students' metacognitive skills, an Analysis of Covariance (ANCOVA) was conducted. This statistical approach allows for the control of potential covariates while assessing the main and interaction effects of the independent variables. The analysis provides insight into whether different instructional strategies and students' ethnic backgrounds significantly impact their ability to regulate and monitor their own learning processes. The results of the hypothesis testing are summarized in Table 1.

Table 1. Summary of the Results of the ANCOVA Test on the Influence of Learning Models, Ethnicity, and Interaction of Learning Strategies on Student Metacognition Skills

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	4774.620 ^a	12	397.885	43.164	.000
Intercept	1584.670	1	1584.670	171.911	.000
XK Metakognisi Strategi	53.212	1	53.212	5.773	.019
Etnis	537.743	3	179.248	19.445	.000
Etnis	132.716	2	66.358	7.199	.002
Strategi * Etnis	189.056	6	31.509	3.418	.006
Error	580.733	63	9.218		
Total	354572.827	76			
Corrected Total	5355.353	75			

The results of the ANCOVA indicated that the learning model had a significant effect on students' metacognitive skills, as evidenced by an F-value of 19.445 and a significance level of 0.000. Since the p-value was less than the α threshold of 0.05, the null hypothesis (H_0) was rejected, supporting the research hypothesis that the learning model significantly influences the metacognitive skills of multiethnic students. Furthermore, the analysis also revealed a significant effect of ethnicity on students' metacognitive skills, with an F-value of 7.199 and a significance level of 0.002. Again, the p-value being below 0.05 led to the rejection of the null hypothesis, indicating that students' ethnic backgrounds have a significant influence on their metacognitive abilities. Additionally, the interaction between the learning model and ethnicity was found to be significant, with a p-value of 0.006, leading to the rejection of the null hypothesis for interaction effects. This finding suggests that the effectiveness of learning models in enhancing metacognitive skills varies across ethnic groups. Table 2 presents the results of post hoc testing to further examine the effects of different learning models on the metacognitive skills of 76 multiethnic students.

Table 2. Summary of the Results of the Advanced Test of the Influence of Learning Models on Students Metacognition Skills

Strategy	XKMeta	YKMeta	Difference	KMetaCor	LSD Notation
STAD+NHT	25.74	73.57	47.82	71.49	a
STAD	20.81	71.46	50.64	71.20	a
NHT	19.91	69.23	49.32	69.18	a
Konv	13.75	55.81	42.06	59.32	b

Based on Table 2, it can be seen that the average corrected value of metacognition skills in conventional learning is 59.327 and the highest in the STAD model combined with NHT, which is 71.491. The results of the follow-up test showed that the students' metacognition skills in the STAD combined learning model group combined with NHT were not significantly different from the STAD and NHT models, however, it was 20.50% higher when compared to conventional learning.

The results of further testing of the influence of ethnicity on metacognitive skills of 76 multiethnic students can be seen in Table 3.

Table 3. Summary of the Results of the Advanced Test of the Influence of Ethnicity on Students' Metacognition Skills.

Ethnic	XKMeta	YKMeta	Difference	KMetaCor	LSD Notation
Ternate	23.96	73.12	49.16	71.06	a
Makian	20.05	66.36	46.30	66.21	b
Tidore	17.36	64.85	47.49	66.12	b

The follow-up test results in Table 3 show that the metacognition skills of the Ternate ethnic group are significantly higher at 7.32% than the Makian ethnic group and considerably higher at 7.47% than the Tidore ethnic group. Thus, it can be said that the metacognition skills of the Ternate ethnic are higher than those of the Makian and Tidore ethnicities.

Table 4 shows the results of further testing of the effect of the interaction between learning models and ethnicity on the metacognitive skills of 72 students.

Table 4. Summary of the Results of the Advanced Test on the Influence of Learning Model and Ethnicity Interaction on Students' Metacognitive Skills

Strategy	Ethnic	XKMeta	YKMeta	Difference	KMetaCor	LSD Notation
STAD+NHT	Ternate	31.29	83.53	52.24	77.84	a
STAD	Ternate	24.08	75.23	51.15	73.25	a b
NHT	Ternate	23.03	74.05	51.02	72.61	b
STAD	Tidore	17.69	70.29	52.60	71.60	b c
STAD+NHT	Makian	25.08	71.51	46.43	69.01	c
STAD	Makian	22.79	70.07	47.28	68.75	c
NHT	Tidore	17.18	66.33	49.15	67.90	c
STAD+NHT	Tidore	22.54	68.80	46.26	67.61	c
NHT	Makian	18.37	66.08	47.71	67.04	c
Konv	Ternate	17.82	59.31	41.49	60.55	d
Konv	Makian	12.58	56.12	43.53	60.05	d
Konv	Tidore	11.85	53.06	41.20	57.37	d

Based on the summary of the LSD test results of the interaction between the model and ethnicity in Table 4, it can be explained that the average corrected score of students' metacognition skills in the combination of the STAD model combined with the Ternate ethnic NHT is significantly higher by 12.78% than the combination of the STAD model combined with the Makian ethnic NHT; and a fundamental difference of 15.12% higher than the combination of STAD combined with the Tidore ethnic NHT. The average corrected score of students' metacognition skills in the Ternate ethnic STAD model was significantly higher than the Tidore ethnic STAD, and there was a significant difference of 6.54% from the STAD of the Makian ethnicity. The average corrected score of students' metacognition skills on the Ternate ethnic NHT strategy was significantly higher by 6.93% than the ethnic Tidore NHT, and the difference is considerably higher by 8.30% than the NHT of the Makian ethnicity. The average corrected score of students' metacognition skills in conventional learning of the Ternate ethnic group is not significantly different from the Makian ethnicity. It is not substantially different from the Tidore ethnicity. Thus, it can be seen that the STAD learning model combined with NHT is superior in improving the metacognition skills of Ternate ethnic students when compared to the Makian and Tidore ethnicities.

Discussion

The Influence of Learning Models on Metacognitive Skills

The findings indicate that the STAD learning model effectively improved students' metacognitive skills, particularly in the aspects of planning and monitoring understanding. In the STAD framework, students collaborate in heterogeneous teams to complete structured assignments, which encourages them to discuss, evaluate, and refine their thinking processes (Khairunnisa & Aziz, 2019). Cooperative learning emphasizes positive interdependence among students, individual responsibility within group roles, and rewards based on team achievement. STAD provides a structure that allows each student to actively participate in discussions, check their teammates' understanding, and reflect on their problem-solving strategies. Group interactions facilitate the exchange of learning strategies among multiethnic students, enhancing their awareness of how they learn (Setiyaningsih & Sujarwo, 2023). However, the self-regulation component of metacognition was less developed, as the STAD structure emphasises group achievement over individual reflection.

The NHT model also significantly contributed to improving metacognitive skills, especially in monitoring and evaluation. NHT requires students to actively discuss, prepare responses, and take responsibility for presenting their group's answers (I. Pratiwi, 2019). This promotes critical thinking about both content and process, thereby fostering metacognitive monitoring (Kinasih et al., 2023). The model's rotational structure also promotes interaction across ethnic groups, which supports reflective thinking. Nonetheless, time constraints during discussions may have limited students' opportunity to engage deeply in the planning phase of metacognitive activity.

Combining STAD and NHT resulted in greater gains in metacognitive skills than either model alone. This combination integrates the structured collaboration of STAD with the rotational accountability and participation features of NHT. Together, they strengthen all three metacognitive components: *Planning*, as students jointly determine learning strategies and distribute group roles; *Monitoring*, as they continually assess their comprehension and progress during peer discussion, and; *Evaluation*, as they reflect on both group outcomes and individual contributions. This synergistic structure fosters an inclusive and reflective learning environment, which is particularly valuable in multiethnic classrooms. Interaction among culturally diverse peers encourages students to articulate their reasoning, compare strategies, and develop greater awareness of their cognitive processes.

Metacognitive Skills in Three Ethnic Groups

The analysis also revealed that students from the Ternate ethnic group demonstrated significantly higher metacognitive skills than their Makian and Tidore peers. These differences may reflect cultural communication patterns and social interaction norms that shape students' participation styles (Heyes et al., 2020; Hasyim, 2019; Putri, 2023). Ternate students tended to engage more openly in discussions and express ideas with confidence, supporting more effective monitoring and evaluation of their learning strategies. In contrast, Makian and Tidore students appeared to participate more cautiously in group tasks, which may have constrained opportunities for active reflection and feedback exchange. While such patterns suggest that cultural influences are at play in classroom interaction, further study is needed to confirm causal links.

The Influence of Interaction between Learning Models and Ethnicity on Metacognitive Skills

The significant interaction between learning models and ethnicity suggests that the success of cooperative learning strategies, such as STAD and NHT, depends partly on the alignment between instructional structures and students' sociocultural communication styles. The finding that Ternate ethnic students acquired higher metacognitive skills indicates that the STAD-NHT combination facilitates an optimal collaborative learning environment for this group, perhaps because they quickly

adapt to cooperative interaction norms that emphasize openness, exploratory discussion, and mutual assistance. The STAD+NHT model offers a flexible approach that balances collective accountability with individual reflection—key elements for cultivating metacognitive growth in multicultural learning environments. Ethnic Ternate students tend to demonstrate openness in group communication, initiative in expressing ideas, and a tendency to be reflective about their learning process. This aligns with Ternate cultural values, which are relatively egalitarian in social interaction and encourage active participation in discussion forums.

These findings also carry several implications for educational practice. First, teacher training programs in multicultural contexts should emphasise strategies for fostering metacognitive dialogue, reflective questioning, and equitable participation among students from diverse cultural backgrounds. Teachers need to be trained not only in implementing cooperative models such as STAD and NHT but also in scaffolding metacognitive reflection during and after group work. Second, for instructional design, schools serving multiethnic populations can integrate STAD+NHT-based cooperative structures to promote inclusive engagement and higher-order thinking. Providing structured reflection sheets or guided questioning can help students from various cultural backgrounds practice planning, monitoring, and evaluating their learning.

This study was limited to junior high schools in Ternate City, which may restrict the generalizability of the results to other regions with different sociocultural contexts. Possible confounding variables, such as teacher facilitation style and prior student achievement, might also have influenced outcomes. In addition, while the metacognition instrument was expert-validated, potential cultural bias in interpreting metacognitive indicators across ethnic groups cannot be ruled out. Future research should involve a broader and more diverse sample, include longitudinal measures of metacognitive development, and explore qualitative insights to understand better how cultural interaction patterns mediate cooperative learning outcomes.

4. CONCLUSION

This study found that the implementation of the STAD learning model combined with the NHT technique was more effective in enhancing the metacognitive skills of students from the Ternate ethnic group compared to those from the Makian and Tidore ethnic groups. This result highlights the significant role of students' socio-cultural backgrounds in shaping the effectiveness of cooperative learning strategies. However, the study is limited by its quantitative design, which may not fully capture the underlying cultural dynamics influencing metacognitive development. Therefore, future research is encouraged to adopt exploratory and qualitative methodologies to investigate the cultural mechanisms that mediate students' metacognitive processes within cooperative learning settings. Additionally, further studies should explore alternative learning models that intentionally incorporate multicultural pedagogical principles to better support diverse student populations.

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