

THE IMPLEMENTATION OF NUMBERED HEADS TOGETHER IN PRIMARY SCIENCE LEARNING: A QUALITATIVE CASE STUDY OF CLASSROOM PRACTICE AND DESCRIPTIVE LEARNING OUTCOMES

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Abstract

This study examines how the Numbered Heads Together (NHT) cooperative learning structure was implemented in Grade IV science instruction at SDN 1 Padelegan, Pamekasan, and describes the changes in classroom participation and learning scores observed after its implementation. The study used a qualitative case-study orientation supported by descriptive analysis of students' learning scores. Data were obtained through non-participant classroom observation, open-ended interviews with the Grade IV teacher and students, and document analysis. The classroom evidence indicates that NHT reorganized teacher-student interaction from predominantly teacher-led explanation toward structured peer discussion, individual accountability, and randomly selected student reporting. The implementation consisted of preparation, group formation, numbering, task distribution, collaborative discussion, random number calling, reporting, and joint reflection. The observation checklist recorded 9 of 10 specified implementation indicators as completed (90%). For the 23 student records available in the manuscript, the mean learning score increased from 60.65 under the earlier lecture-oriented instruction to 68.91 after NHT, an absolute increase of 8.26 points (13.62% relative to the earlier mean). Because the study did not use a control group, randomization, or a validated inferential outcome design, these score changes are interpreted descriptively rather than as causal evidence of NHT effectiveness. The findings suggest that NHT may provide a practical structure for increasing participation and shared responsibility in primary science classrooms, while also highlighting implementation constraints related to preparation time, student readiness, and anxiety when students are called to report.

Keywords: cooperative learning, Numbered Heads Together, primary science, classroom interaction, learning outcomes, qualitative case study

Abstrak

Penelitian ini mengkaji bagaimana struktur pembelajaran kooperatif Numbered Heads Together (NHT) diterapkan dalam pembelajaran ilmu pengetahuan alam kelas IV di SDN 1 Padelegan, Pamekasan, serta menggambarkan perubahan partisipasi di kelas dan nilai belajar yang diamati setelah penerapannya. Penelitian ini menggunakan pendekatan studi kasus kualitatif yang didukung oleh analisis deskriptif terhadap nilai belajar siswa. Data diperoleh melalui observasi kelas non-partisipan, wawancara terbuka dengan guru dan siswa Kelas IV, serta analisis dokumen. Bukti di kelas menunjukkan bahwa NHT mengubah interaksi guru-siswa dari penjelasan yang didominasi oleh guru menjadi

diskusi antarsiswa yang terstruktur, pertanggungjawaban individu, dan pelaporan oleh siswa yang dipilih secara acak. Penerapannya terdiri dari persiapan, pembentukan kelompok, penomoran, pembagian tugas, diskusi kolaboratif, pemanggilan nomor acak, pelaporan, dan refleksi bersama. Daftar periksa observasi mencatat 9 dari 10 indikator pelaksanaan yang ditentukan telah diselesaikan (90%). Untuk 23 catatan siswa yang tersedia dalam naskah ini, skor belajar rata-rata meningkat dari 60,65 pada pengajaran berorientasi ceramah sebelumnya menjadi 68,91 setelah penerapan NHT, dengan kenaikan absolut sebesar 8,26 poin (13,62% relatif terhadap rata-rata sebelumnya). Karena penelitian ini tidak menggunakan kelompok kontrol, pengacakan, atau desain hasil inferensial yang tervalidasi, perubahan skor ini diinterpretasikan secara deskriptif, bukan sebagai bukti kausal efektivitas NHT. Temuan ini menunjukkan bahwa NHT dapat memberikan struktur praktis untuk meningkatkan partisipasi dan tanggung jawab bersama di kelas sains sekolah dasar, sekaligus menyoroti kendala implementasi terkait waktu persiapan, kesiapan siswa, dan kecemasan saat siswa dipanggil untuk melaporkan.

Kata kunci: *pembelajaran kooperatif, Numbered Heads Together, sains tingkat dasar, interaksi di kelas, hasil belajar, studi kasus kualitatif*

INTRODUCTION

Primary science learning requires more than the transmission of factual information. Students are expected to engage with explanations, observations, questions, and peer interaction while developing the capacity to communicate their reasoning. Cooperative learning is relevant to this requirement because its structured forms create opportunities for students to explain ideas, negotiate answers, and assume individual responsibility within a group (Johnson & Johnson, 2009; Gillies, 2016). Meta-analytic evidence has reported positive effects of cooperative learning on achievement and attitudes, while also showing that outcomes vary across instructional and contextual conditions (Kyndt et al., 2013; Puzio & Colby, 2013; Springer et al., 1999). More recent syntheses likewise emphasize the importance of implementation quality, individual accountability, and interaction processes (Zhou & Colomer, 2024). These findings suggest that cooperative learning should be examined not only in terms of whether it works, but also in terms of how particular structures operate in particular classrooms.

Numbered Heads Together (NHT) is a structured cooperative-learning technique in which students work in teams, each student receives a number, the teacher poses a question, group members discuss and prepare a shared answer, and the teacher then calls a number so that the corresponding student may report. The structure combines positive interdependence with individual accountability: group members need one another during preparation, but any individual may be required to demonstrate the group's understanding. This logic is consistent with the social-interdependence perspective on cooperative learning and with research emphasizing individual accountability and promotive interaction (Johnson & Johnson, 2009; Dziedzic Kristiansen et al., 2019; Zhou & Colomer, 2024).

Recent NHT-specific studies provide a useful empirical backdrop for the present case. Aditya et al. (2022) examined a problem-based NHT approach in elementary teaching, while Aulia and Lena (2023) reported NHT use in integrated thematic learning. Bayu et al. (2023) investigated NHT in elementary science using a post-test-only control-group

design, and Bella et al. (2024) examined collaboration and communication skills in a lesson-study context. More recent studies have examined NHT in science learning outcomes (Muafiah Nur et al., 2026), elementary learning outcomes (Ngada et al., 2026; Sari et al., 2025; Saptono, 2024), numeracy (Nurbaiti & Pratama, 2024), and mathematical concept understanding (Oktavia et al., 2024; Fatikasari et al., 2024; Apriani et al., 2023). These studies are methodologically heterogeneous; therefore, they are used here as contextual evidence rather than as direct proof of causality in the present qualitative case.

Recent primary-school research continues to examine NHT in relation to science and other learning outcomes. For example, a 2023 study reported the use of NHT in elementary science learning with a focus on science literacy and learning agility, while more recent studies have used quasi-experimental or classroom-action-research designs to examine learning outcomes. This literature indicates continued interest in NHT, but it also creates a need for context-sensitive accounts of classroom implementation, including the practical conditions that facilitate or constrain the model.

The present study originated from classroom observations at SDN 1 Padelegan in which teacher–student interaction was described as predominantly teacher-led, several students were passive, and some students appeared bored or inattentive. The original manuscript consequently proposed NHT as a more interactive instructional structure. However, the evidence available in the study is primarily qualitative, with descriptive pre/post learning scores rather than an experimental comparison. Accordingly, the present revision does not frame the study as a causal test of NHT. Instead, it asks how NHT was implemented and what observable changes accompanied implementation. The study addresses two questions: (1) How was NHT implemented in Grade IV science learning at SDN 1 Padelegan? and (2) What changes in classroom participation and descriptive learning scores were observed following implementation? This framing aligns the claims of the article with the evidence actually collected.

NHT is distinguished from unstructured group work by its explicit sequence and accountability mechanism. Students are not simply placed into groups; they are required to prepare collectively while remaining individually responsible for communicating the group’s answer. The structure therefore addresses a common problem in group learning in which only a small number of students participate actively. Its classroom value depends, however, on teacher preparation, clear task design, sufficient discussion time, and a classroom climate in which students can respond without excessive fear of error.

The broader cooperative-learning literature suggests that structured interaction can support achievement, attitudes, persistence, and higher-order learning, although effects are not uniform across contexts (Springer et al., 1999; Kyndt et al., 2013, 2013b; Zhou & Colomer, 2024). Research in school settings also indicates that peer acceptance and relationships can shape the quality and consequences of cooperative participation (Klang et al., 2021). For primary science, the relevance of NHT lies in the alignment between collaborative discussion and the need for students to articulate explanations. The contribution of the present study is therefore not to establish a universal effect of NHT,

but to document how the structure was enacted in one primary science classroom and how students' participation and recorded scores changed alongside that implementation.

METHOD

Research design and setting

The study is presented as a qualitative case study of classroom implementation, with descriptive learning-score data embedded in the case. The setting was Grade IV at SDN 1 Padelegan, Pamekasan, Indonesia. The participants described in the original manuscript included the school principal, the Grade IV teacher, and students. The researcher acted as a non-participant observer. The case-study orientation is appropriate for the revised research questions because the primary evidence concerns classroom processes, teacher explanations, student responses, implementation steps, and contextual constraints. The descriptive score comparison is treated as supplementary evidence and is not used to establish a causal treatment effect.

Data sources and collection

Three sources of evidence were used: non-participant observation, open-ended interviews, and documents. Observation focused on the implementation of NHT during Grade IV science learning and recorded classroom activities and field notes. Interviews were conducted with the Grade IV teacher and students and focused on experiences with the NHT implementation. Documentary evidence included lesson-planning materials, records of classroom activity, and learning-score documentation.

Data analysis

Qualitative evidence was organized through data reduction, data display, and conclusion drawing/verification. The analysis focused on recurring patterns concerning instructional preparation, group formation, student interaction, reporting, participation, implementation barriers, and teacher responses to those barriers. The manuscript also reports source and technique triangulation. For the numerical records, the present revision recalculated the arithmetic means directly from the 23 student scores reported in the original tables. No inferential statistical test is presented because the original research design and measurement procedures do not establish the assumptions required for a causal effectiveness claim.

Trustworthiness

The original study reported prolonged attention to classroom observations, detailed description, and triangulation across sources and techniques. In a journal submission, the authors should additionally document the interview protocol, coding procedure, number of observation sessions, duration of fieldwork, and the procedure used to resolve discrepant interpretations. These details were not sufficiently reported in the source manuscript and should be supplied from the researchers' records before submission.

RESULT AND DISCUSSION

Initial classroom condition

The initial classroom observation described teacher–student interaction as relatively monotonous and teacher-led. Several students were reported to be passive, inattentive, or insufficiently motivated during science instruction. The problem identified by the researchers was therefore not only low recorded achievement but also limited student participation in the learning process.

Implementation of NHT

The observed implementation followed a recognizable NHT sequence. First, the teacher prepared learning materials and worksheets. Second, students were organized into groups of approximately three to five members. Third, each student received a number and groups were arranged to facilitate discussion. Fourth, the teacher distributed a task related to the science lesson. Fifth, students were given time to think and discuss their responses. Sixth, the teacher called numbers at random and the students with the selected number reported the group’s answer. Finally, the teacher and students jointly summarized the lesson. The implementation was embedded within ordinary classroom routines. The teacher opened the lesson with greeting, attendance, prayer, an ice-breaking activity, motivation, and explanation of the learning objectives. During the core activity, the teacher introduced the NHT procedure, distributed the task, facilitated group discussion, and selected students through random numbering. The lesson ended with joint summarization.

Implementation fidelity based on the observation checklist

IMPLEMENTATION DOMAIN	INDICATORS REPORTED	COMPLETED
APPRECIATION OPENING	/	Motivation; ice breaking; reward Reported as part of classroom opening
EXPLORATION	Use of approach/media; active participation; opportunities to participate	Reported as implemented
ELABORATION	Critical thinking/problem solving; opportunity to compete	Reported as implemented
CONCLUSION	Student and teacher jointly summarize	Reported as implemented

The original checklist recorded 9 of 10 indicators as completed, equivalent to 90%. Because the manuscript does not provide item-level coding rules or inter-observer reliability, this percentage should be interpreted as a descriptive implementation indicator rather than a validated fidelity score.

Implementation barriers

The teacher identified two recurring barriers. First, NHT required preparation of numbering materials, worksheets, and other learning resources. Second, some students were not adequately prepared and became nervous when a number was called. Classroom

observation was consistent with this account: some students appeared hesitant, embarrassed, or uncertain when required to present their group’s answer. Thus, individual accountability—one of the defining features of NHT—also created an immediate emotional and instructional demand for students who were unfamiliar with the structure.

Descriptive change in learning scores

The original manuscript contains two sets of scores for 23 student records. Recalculation shows that the earlier instruction scores sum to 1,395, producing a mean of 60.65, whereas the NHT-period scores sum to 1,585, producing a mean of 68.91. The difference is 8.26 points, corresponding to a 13.62% increase relative to the earlier mean.

CONDITION	N	TOTAL SCORE	MEAN
EARLIER LECTURE- ORIENTED INSTRUCTION	23	1395	60.65
NHT IMPLEMENTATION	23	1585	68.91

A critical correction is necessary: the original manuscript reported the NHT mean as 75, but the 23 individual scores reported in its Table 3 sum to 1,585; 1,585 divided by 23 equals 68.91. The revised article uses the mathematically consistent value. The data therefore support a descriptive increase from 60.65 to 68.91, not a mean of 75. Because the study lacks a control group and does not report a standardized validated achievement instrument, the observed score difference cannot by itself demonstrate that NHT caused the increase. The result is best understood as an outcome observed alongside IMPLEMENTATION.

DISCUSSION

The case provides a process-level explanation for why NHT was experienced as a change in classroom interaction. The teacher moved from primarily explaining content toward organizing students into accountable peer groups, while the random-number procedure required students to prepare individually even though the answer was developed collectively. This structure is consistent with the defining features of NHT described in the cooperative-learning literature: students work together to formulate an answer, but each student remains potentially responsible for communicating it. (Johnson & Johnson, 2009; Dzemidzic Kristiansen et al., 2019; Bella et al., 2024)

The findings also indicate that implementation quality matters. The teacher’s preparation of worksheets, group composition, numbering, classroom positioning, and discussion time shaped the feasibility of the model. This is important because cooperative learning is not equivalent to simply placing students in groups. Prior meta-analytic evidence indicates that the outcomes of cooperative learning vary across age, academic domain, and cultural context. The present case adds contextual detail by showing how preparation

and student readiness affected the enactment of NHT in a Grade IV science classroom. (Abramczyk & Jurkowski, 2020; Gillies, 2016; Zhou & Colomer, 2024)

The student anxiety observed when numbers were called is particularly important. NHT's accountability mechanism can increase participation opportunities, but students who are not accustomed to public reporting may initially experience uncertainty or embarrassment. The teacher's role therefore extends beyond explaining the procedure: students need sufficient preparation time, clear expectations, supportive feedback, and repeated exposure to the structure. In this case, the teacher explicitly identified preparation and student readiness as areas requiring improvement. (Dzemidzic Kristiansen et al., 2019; Bella et al., 2024)

The descriptive score increase from 60.65 to 68.91 is compatible with the possibility that a more interactive learning structure supported better engagement and performance, but alternative explanations remain plausible. Students may have benefited from repeated exposure to the content, differences in task difficulty, teacher attention, familiarity with the assessment, or other classroom factors. The design does not permit these explanations to be separated. This limitation is not a weakness to conceal; it defines the appropriate level of inference. (Kyndt et al., 2013; Tenenbaum et al., 2020; Nur et al., 2026; Saptono, 2024)

The study's contribution is therefore primarily implementation-oriented. Rather than presenting NHT as universally effective, the evidence illustrates a plausible classroom mechanism: structured peer discussion can broaden participation when individual accountability is combined with collaborative preparation. For primary science teachers, the case suggests that NHT may be most useful when the teacher prepares tasks carefully, builds student confidence gradually, and protects sufficient time for discussion and reporting. (Abramczyk & Jurkowski, 2020; Bella et al., 2024; Bayu et al., 2023)

Implications

For practice, teachers considering NHT should prepare concise and curriculum-aligned tasks, establish groups and numbering before the lesson, provide adequate discussion time, and normalize mistakes as part of learning. Random calling should be accompanied by supportive feedback so that accountability does not become a source of avoidable anxiety. For research, future studies should use a stronger comparative design if the purpose is to estimate effectiveness. A pretest–posttest quasi-experimental design with a comparison group, a validated achievement measure, and documented implementation fidelity would permit stronger inference. Researchers may also examine whether NHT affects science literacy, participation, self-efficacy, or retention in addition to short-term achievement.

Limitations

Several limitations constrain interpretation. First, the study is based on a single classroom context and therefore cannot support statistical generalization. Second, the qualitative procedures are not reported with enough detail to permit full replication; the interview schedule, coding framework, number and duration of observations, and analytic audit trail

should be supplied. Third, the numerical outcome data are descriptive and do not establish a causal effect. Fourth, the original manuscript does not report an ethics approval or consent procedure. Fifth, the manuscript contains an arithmetic inconsistency in the reported NHT mean; this has been corrected using the individual scores supplied in the original table.

CONCLUSION

This case study shows how Numbered Heads Together was implemented in Grade IV science learning at SDN 1 Padelegan through group formation, numbering, collaborative task completion, random student selection, reporting, and joint summarization. The classroom evidence indicates a shift toward more structured peer interaction and individual accountability. The 23 reported student records show a descriptive increase in the mean score from 60.65 to 68.91, an 8.26-point or 13.62% relative increase. However, the available design does not justify a causal conclusion that NHT produced the increase. The principal value of the study lies in documenting the implementation process and the practical conditions teacher preparation, student readiness, time, and confidence that shape the use of NHT in primary science classrooms.

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