

Effectiveness of The Group Investigation Method on Problem-Solving Skills and Cooperation of Elementary School Students

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ABSTRACT

This study examines the influence and effectiveness of the Group Investigation method on elementary students' problem-solving ability and cooperation in Pancasila Education. It employed a quasi-experimental pretest-posttest control-group design, comparing an experimental class and a control class of fourth-grade students at Giriwungu State Elementary School. Data were collected using a reflective problem-solving test and a cooperation observation sheet, both of which were validated and tested for reliability prior to implementation. The data were analyzed using normality and homogeneity tests, normalized gain (N-gain), and Multivariate Analysis of Covariance (MANCOVA). The results revealed that the Group Investigation method had a significant simultaneous effect on students' problem-solving ability and cooperation, with a large effect size (partial $\eta^2 = .378$). Furthermore, the method explained 23.4% of the variance in problem-solving ability and 29.1% of the variance in cooperation after controlling for pretest scores. These findings provide empirical evidence that the Group Investigation method can simultaneously foster cognitive and social competencies through inquiry-based cooperative learning, highlighting its potential as an effective instructional approach for Pancasila Education in elementary schools.

Penelitian ini mengkaji pengaruh dan efektivitas metode Group Investigation terhadap kemampuan pemecahan masalah dan kerja sama peserta didik sekolah dasar dalam pembelajaran Pendidikan Pancasila. Penelitian ini menggunakan desain quasi-experimental pretest-posttest control-group dengan membandingkan kelas eksperimen dan kelas kontrol pada peserta didik kelas IV SD Negeri Giriwungu. Data dikumpulkan menggunakan tes reflektif kemampuan pemecahan masalah dan lembar observasi kerja sama yang telah diuji validitas dan reliabilitasnya sebelum digunakan. Data dianalisis menggunakan uji normalitas, homogenitas, normalized gain (N-gain), dan Multivariate Analysis of Covariance (MANCOVA). Hasil penelitian menunjukkan bahwa metode Group Investigation memberikan pengaruh simultan yang signifikan terhadap kemampuan pemecahan masalah dan kerja sama dengan ukuran efek yang besar (partial $\eta^2 = 0,378$). Selain itu, metode ini menjelaskan 23,4% variasi kemampuan pemecahan masalah dan 29,1% variasi kerja sama setelah mengontrol skor pretest. Temuan ini memberikan bukti empiris bahwa metode Group Investigation mampu mengembangkan kompetensi kognitif dan sosial secara simultan melalui pembelajaran kooperatif berbasis inkuiri, sehingga berpotensi menjadi pendekatan pembelajaran yang efektif dalam Pendidikan Pancasila di sekolah dasar.

Keywords: elementary school, group investigation, problem-solving skills, cooperation

Introduction

Education functions as a deliberate process through which knowledge, skills, and values are transmitted across generations to support both present and future life. In the Indonesian context, Law of the Republic of Indonesia No. 12 of 2024 stipulates that national education is directed toward producing meaningful and effective learning that strengthens faith, piety, and noble character while cultivating creativity, feeling, and initiative among learners as lifelong learners embodying Pancasila values (Permendikbudristek No. 12 Tahun 2024, 2024).

Achieving this ideal function of education depends heavily on the quality of teaching and learning processes. Whittaker (as cited in Djamarah) (2021) conceptualizes learning as a process through which behavior is shaped, refined, and reinforced through practice and experience, while Gagne and Briggs (1979) define instruction as a structured sequence of events deliberately arranged to bring about intended changes in learners' behavior or learning outcomes. These perspectives underscore that effective instruction requires purposefully designed learning experiences rather than incidental exposure to content.

Elementary education represents a critical stage in children's development, as it establishes the foundation for both cognitive growth and character formation. During this period, students begin to develop the knowledge, values, and behaviors that influence their academic achievement and social interactions in later stages of life. Recognizing the importance of this developmental phase, the Indonesian Ministry of Education and Culture (Putri, 2011) identifies a set of core character values that should be cultivated in primary education, including religiosity, honesty, respect, discipline, democratic attitudes, peacefulness, and social and environmental responsibility. In the Indonesian education system, these values are integrated into the curriculum through the Pancasila Education subject. Rather than focusing solely on civic knowledge, the subject aims to foster students' character by promoting the competencies outlined in the Pancasila Student Profile, including faith and noble character, global diversity, independence, critical reasoning, creativity, and *gotong royong* (mutual cooperation) (Maulida & Oktavia, 2025). Among these dimensions, *gotong royong* is regarded as a core national value, reflecting learners' capacity to work voluntarily and collectively so that shared tasks become lighter and more effectively accomplished; this disposition is closely tied to the broader construct of cooperation. Given that elementary-age learners are in the concrete-operational stage of cognitive development, in which categorizing and making sense of their surroundings through active engagement is central to learning, group-based instructional approaches are particularly well suited to simultaneously nurture both cooperative attitudes and higher-order competencies such as problem-solving.

Within group-based learning, cooperation refers to a set of coordinated efforts through which learners work interdependently toward a shared goal rather than competing individually. Johnson, Johnson, and Smith (2017) identify five essential components that must be present for genuine cooperative learning to occur: positive interdependence, in which group members recognize that their success is linked to one another; promotive face-to-face interaction, through which members encourage and support each other's efforts; individual accountability, ensuring that each member is responsible for their own contribution to the group outcome; interpersonal and small-group skills, such as communication, trust-building, and conflict resolution; and group processing, in which members reflect on how well the group functioned and how collaboration can be improved. These five components distinguish authentic cooperative learning from merely seating learners together and expecting them to help one another (Johnson et al., 2017). Complementing this framework, Rusman (as cited in Polii & Polii) (2022) argues that cooperative learning provides students with meaningful opportunities to develop essential social skills, including sharing responsibility, respecting diverse perspectives, and working collaboratively toward common goals. These interpersonal competencies are often difficult to foster through individualized learning approaches alone.

Problem-solving ability, meanwhile, refers to learners' capacity to analyze a situation, identify viable alternatives, and apply an effective strategy to resolve a challenge. Polya's (1973) classic four-stage model remains the most widely used framework for describing this process:

(1) *understanding the problem*, in which the learner interprets relevant terms, statements, and symbols accurately; (2) *devising a plan*, in which the learner formulates an appropriate strategy; (3) *carrying out the plan*, in which the learner executes the chosen strategy systematically; and (4) *looking back*, in which the learner reviews and evaluates the solution obtained. This framework has been widely applied and validated in Indonesian classroom-based research, including studies on students' mathematical and social problem-solving performance (Anggraeni & Herdiman, 2018; Ansori & Herdiman, 2019). Although Polya's model was originally developed for mathematical problem solving, its four stages can be effectively applied to social and civic contexts, including those addressed in Pancasila Education. This is because the model represents a general cognitive process of understanding a problem, developing a plan, implementing the solution, and evaluating the results, rather than a procedure limited to mathematics. In cooperative learning settings, students are expected not only to progress through these cognitive stages individually but also to engage in them collectively by demonstrating the five essential elements of cooperative learning proposed by Johnson et al. (2017). This collaborative process involves building a shared understanding of the problem, jointly planning and implementing solutions, and reflecting on both the outcomes and the group's learning process.

Despite the strategic role assigned to Pancasila Education in cultivating problem-solving ability and cooperative attitudes, classroom observations at Giriwungu State Elementary School reveal a persistent gap between this intended outcome and actual practice. Learners were found to be predominantly passive, tending to memorize information without applying it to novel situations; when presented with open-ended questions, most responded with brief, unelaborated answers rather than reasoned explanations. This pattern became more evident when students encountered authentic social situations, such as resolving disagreements during group work. Rather than expressing their opinions or engaging in collaborative negotiation, many tended to withdraw from the discussion or avoid the situation altogether. A contributing factor lies in instructional design: interviews with teachers at the research site indicated that lesson plans were typically adapted directly from internet sources or reused from previous years without modification to match learners' actual needs and abilities, and that Pancasila Education was often delivered through rote memorization. This is consistent with Joyce and Weil's (1980) view that an instructional model functions as a structured pattern guiding the planning and delivery of learning activities; without a deliberately chosen model, teachers lack a clear mechanism for fostering the higher-order competencies that Pancasila Education is meant to develop.

At the same time, a review of the literature on Group Investigation highlights important gaps in both context and research focus. Previous studies have shown that the model is effective in improving interpersonal skills (Ainiyah et al., 2022; Depin et al., 2023), enhancing elementary students' learning outcomes in social studies (Basirun & Tarto, 2022), and strengthening mathematical problem-solving skills while promoting positive student behavior (Siregar & Safitri, 2020). These findings build on the foundational work of Sharan and Sharan (1990), who established Group Investigation as a collaborative learning model rooted in the principles of cooperative learning. Despite this growing body of evidence, existing research has generally examined problem-solving and cooperation as separate learning outcomes or has focused on subjects such as mathematics and social studies. Comparatively little attention has been given to the application of Group Investigation in Pancasila Education, a subject specifically designed to foster both competencies simultaneously through the Pancasila

Student Profile. Moreover, to date Group Investigation has not been implemented or empirically tested at Giriwungu State Elementary School, leaving its effectiveness within this specific instructional context unknown. Taken together, these empirical, practical, and literature-based gaps point to the same underlying problem: the absence of a cooperative, inquiry-based instructional strategy capable of simultaneously developing elementary learners' problem-solving ability and cooperative attitudes within Pancasila Education. Therefore, the novelty of this study lies in addressing this exact problem through the specific integration of the Group Investigation model, a context that has not been widely explored in previous research. Beyond its contextual contribution, this study also contributes conceptually by examining the simultaneous development of cognitive and social competencies within a single instructional intervention. Rather than evaluating problem-solving ability and cooperation as separate outcomes, this study investigates how both competencies can be fostered concurrently through a structured inquiry-based cooperative learning process. This integrated perspective provides a more comprehensive understanding of the educational value of the Group Investigation method in elementary education.

Building on these gaps, this study addresses the question of whether the Group Investigation method significantly influences elementary school students' problem-solving ability and cooperation in Pancasila learning. To address this overarching question, the study adopts two complementary analytical perspectives. The first examines whether the method has a significant simultaneous effect on problem-solving ability and cooperative attitude, while the second investigates its effect on each competency individually. Accordingly, this study aims to determine the influence and effectiveness of the Group Investigation method on elementary school students' problem-solving ability and cooperation, both simultaneously and separately, within the context of Pancasila learning at Giriwungu State Elementary School. Using an experimental pretest-posttest control-group design, this study empirically examines the effectiveness of the Group Investigation model in Pancasila Education. By doing so, it aims to provide evidence-based guidance for educators regarding the extent to which a structured, inquiry-based cooperative learning approach can function as an effective alternative to conventional teacher-centered instruction. The findings are expected to demonstrate a meaningful effect of the method on students' capacity to solve social problems and work cooperatively, offering practical implications for the design of more participatory Pancasila learning at the elementary level.

Methods

This study employed an experimental design, defined by Gall, Gall, and Borg (2007) as an empirical approach in which the researcher manipulates one variable (e.g., a teaching technique) to determine its effect on another (e.g., learner behavior); when properly conducted, this design allows the researcher to infer a causal relationship between the two. Specifically, this study used a quasi-experimental pretest-posttest control-group design, adapted from the true experimental pretest-posttest control-group design described by Gall et al. (2003), which is well suited for evaluating an intervention by comparing an experimental and a control group. Because intact, pre-existing classes were assigned to the study conditions through purposive sampling rather than by randomly assigning individual students, the study employed a quasi-experimental design rather than a true experimental design. This methodological limitation is discussed further in the Discussion section. The experimental group received instruction using the Group Investigation method, whereas the control group was taught through conventional

direct instruction. Both groups completed a pretest before the intervention and a posttest after the intervention.

The study was conducted at SD Negeri Giriwungu, Imogiri District, Bantul Regency, Special Region of Yogyakarta, during the odd semester of the 2025/2026 academic year, during regular class hours so as not to disrupt other lessons. The population comprised all fourth-grade students at the school, drawn from two parallel classes; a purposive sampling technique was used to assign Class IV A as the experimental group (Group Investigation) and Class IV B as the control group (direct instruction), following Sugiyono's (2013) definition of population as a generalized area comprising objects or subjects with specific characteristics determined by the researcher for study and conclusion-drawing. Although the sample size in each group is relatively small (n equals 14 and n equals 13), this limitation reflects the real world conditions of intact classes at the school. To ensure the robustness of the statistical analysis with this sample size, rigorous assumption testing and a MANCOVA technique that controls for pretest scores were applied to minimize potential bias. Although the sample size was relatively small, the study reflects authentic classroom conditions in which intact classes were used as research groups. Such conditions are common in school-based educational research, where random assignment and larger samples are often impractical. Therefore, the findings should be interpreted as evidence of the effectiveness of the intervention within this instructional context, while acknowledging that broader generalization requires replication across larger and more diverse educational settings.

This study examined one independent variable, namely the Group Investigation method, and two dependent variables: students' social problem-solving ability and cooperative attitude in Pancasila learning. In line with Sudaryono (2019) and Suhirman et al., (2026), the independent variable was expected to influence changes in the two dependent variables. Data were collected using three techniques. First, classroom observations were conducted to document students' cooperative behavior during group activities in both the experimental and control classes. The observations were guided by an observation sheet based on the five essential elements of cooperative learning: positive interdependence, promotive interaction, individual accountability, interpersonal and small-group skills, and group processing. Second, semi-structured interviews with teachers were conducted to obtain contextual information about instructional practices and classroom conditions before the intervention. Third, students completed a reflective essay test consisting of ten items on Pancasila content, which was administered as both a pretest and a posttest to assess social problem-solving ability. The reflective format was informed by Dewey's (1933) conception of reflection as an active and deliberate process of thinking about experience to develop understanding and guide subsequent judgment.

The research instruments underwent both content and empirical validation to ensure their validity and reliability, in accordance with the criteria proposed by Azwar (2017). Content validity was established through expert judgment, in which the test instrument and teaching module were reviewed by two validators and revised based on their feedback, guided by Arikunto's (2013) conception of an observation/assessment sheet as a data-collection instrument used by the researcher through direct observation. Empirical validity was subsequently tested using SPSS 27, with an item considered valid if r -count exceeded r -table or its significance value was below 0.05. Instrument reliability was likewise tested using SPSS 27, with a Cronbach's Alpha value of ≥ 0.60 considered acceptable, consistent with the principle that a reliable instrument yields consistent, trustworthy data regardless of how often it is

administered (Arikunto, 2013). To improve the consistency of classroom observations, the observers discussed the assessment criteria prior to data collection and used a common scoring guide during classroom observations. This procedure was intended to minimize differences in scoring interpretation and enhance the consistency of observational data.

Prior to hypothesis testing, assumption tests were conducted, including normality testing (Kolmogorov–Smirnov or Shapiro–Wilk, with $p > 0.05$ indicating normal distribution) and homogeneity testing using Box's M test for multivariate homogeneity of variance–covariance matrices (with $p > 0.05$ indicating a homogeneous population). Normalized gain (N-gain) was then calculated to determine the magnitude of improvement in problem-solving ability and cooperation between pretest and posttest scores, categorized as high (> 0.70), moderate (0.30 – 0.70), or low (< 0.30). Finally, the research hypotheses were tested using Multivariate Analysis of Covariance (MANCOVA), which was used to examine mean differences between the experimental and control groups across the two dependent variables simultaneously, while controlling for the effect of the pretest scores as a covariate.

Result

Prior to the intervention, this study was conducted at SD Negeri Giriwungu, Imogiri District, Bantul Regency, in October–November 2025, following the mid-semester examination period so as not to disrupt other learning activities. The classroom teacher acted as both facilitator and observer during instruction, while the researcher served as an independent observer. The experimental class (4A, $n = 14$) received instruction using the Group Investigation method, and the control class (4B, $n = 13$) received direct instruction, both on Pancasila Education content concerning attitudes and behaviors reflecting Pancasila values. Interviews conducted with the classroom teacher prior to treatment confirmed that students exhibited low cooperative attitudes and problem-solving ability alongside limited sustained attention during lessons, corroborating the gap identified in the Introduction. To minimize confounding bias, several controls were applied: the same teacher facilitated both classes, treatment timing (morning sessions) was identical across groups, the instructional material had not been previously taught to either class, and both classes operated within the same school environment.

1. Assumption Tests

Before hypothesis testing, the collected data were examined for normality and homogeneity using SPSS 27, following standard assumption-testing procedures for parametric multivariate analysis (Sudaryono, 2019). The normality assumption was assessed using the Kolmogorov–Smirnov test. The test produced significance values of 0.200 for the posttest problem-solving residuals and 0.192 for the posttest cooperation residuals. As both values were greater than 0.05, the residuals met the assumption of normality (Table 1). Although the sample size is relatively small (N is less than 50), the Kolmogorov Smirnov test results demonstrated a convincing probability ($p > 0.05$), indicating that the assumption of a normal distribution is adequately met to proceed with parametric analysis.

Box's M test of equality of covariance matrices yielded $M = 3.963$, $F(3,140813.213) = 1.206$, $p = 0.306$ (Table 2); since this value exceeds 0.05, the null hypothesis is accepted, indicating that the data originate from a population with homogeneous variance–covariance matrices. With both assumptions satisfied, the data were deemed appropriate for MANCOVA. Descriptive inspection of the pretest scores indicated that the experimental group entered the study with higher baseline performance than the control group, particularly for problem-solving

ability. Therefore, subsequent analyses relied primarily on MANCOVA, which statistically adjusted for these initial differences by treating the pretest scores as covariates.

Table 1. Normality Test Results (Kolmogorov-Smirnov)

Variable	Statistic	df	Sig.
Posttest Problem-Solving Residual	0.103	27	0.200
Posttest Cooperation Residual	0.139	27	0.192

Table 2. Homogeneity Test Results (Box's M)

Box's M	F	df1	df2	Sig.
3.963	1.206	3	140813.213	0.306

2. Improvement in Problem-Solving Ability and Cooperation (N-Gain)

To examine the magnitude of improvement between pretest and posttest scores, normalized gain (N-Gain) was calculated following Hake's (1998) formula, which expresses the actual gain achieved as a proportion of the maximum possible gain and classifies the result as high ($g \geq 0.70$), medium ($0.30 \leq g < 0.70$), or low ($g < 0.30$). Because the experimental and control groups differed in their initial performance levels, the N-Gain values should be interpreted descriptively rather than as the primary indicator of treatment effectiveness. The adjusted MANCOVA results provide a more appropriate estimate of the intervention effect because they account for baseline differences between the two groups. Problem-solving ability was assessed across four indicators: understanding the problem, planning, execution, and reflection. The control class showed an increase in the total score from 130.8 on the pretest to 197.4 on the posttest, yielding an N-Gain of 0.247. The experimental class also improved, with the total score increasing from 197.6 to 245.2 and an N-Gain of 0.235. According to Hake's (1998) classification, both N-Gain values fall within the low category. Notably, the experimental class started with a substantially higher pretest score than the control class, averaging 49.4 compared with 32.7 (out of 100) across the four problem-solving indicators. This higher baseline left less opportunity for improvement between the pretest and posttest, which may have contributed to the relatively lower N-Gain observed in the experimental class. To account for these initial differences, the subsequent MANCOVA analysis controlled for pretest scores when examining the treatment effect (Table 3; Figure 1).

Table 3. Pretest-Posttest Scores and N-Gain for Problem-Solving Ability

Indicator	Max Score	Control Pretest	Control Posttest	Experiment Pretest	Experiment Posttest
Understanding the Problem	100	39.7	51.3	54.8	71.4
Planning	100	35.9	48.7	45.2	60.7
Execution	100	30.8	53.8	54.8	61.9
Reflection	100	24.4	46.6	42.9	51.2
Total	400	130.8	197.4	197.6	245.2
N-Gain (category)			0.247 (low)		0.235 (low)

Table 4. Pretest-Posttest Scores and N-Gain for Cooperation

Indicator	Control Max	Control Pretest	Control Posttest	Experiment Max	Experiment Pretest	Experiment Posttest
Positive Interdependence	156	115	120	168	124	153
Interaction	156	116	120	168	130	153
Responsibility	156	111	116	168	116	149
Group Skills	156	121	124	168	115	150
Group Processing	104	78	86	112	82	106

Total	728	541	566	784	567	711
N-Gain (category)			0.13 (low)			0.66 (medium)

Cooperative attitude was assessed across five indicators: positive interdependence, promotive interaction, individual responsibility, interpersonal and group skills, and group processing. The control class showed a modest increase in the total score from 541 on the pretest to 566 on the posttest, resulting in an N-Gain of 0.13, which falls within Hake's (1998) low category. In contrast, the experimental class improved from 567 to 711, yielding an N-Gain of 0.66, which is classified as a medium gain. These findings indicate a substantially greater relative improvement in cooperative attitude among students in the experimental class than among those in the control class (Table 4; Figure 2).

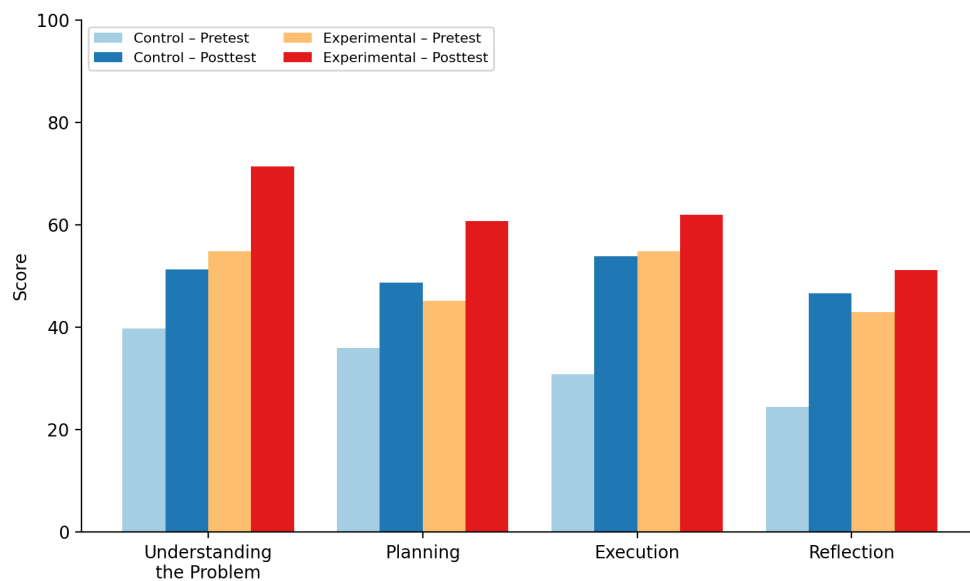


Figure 1. Pretest-posttest comparison of problem-solving ability by indicator, control versus experimental group.

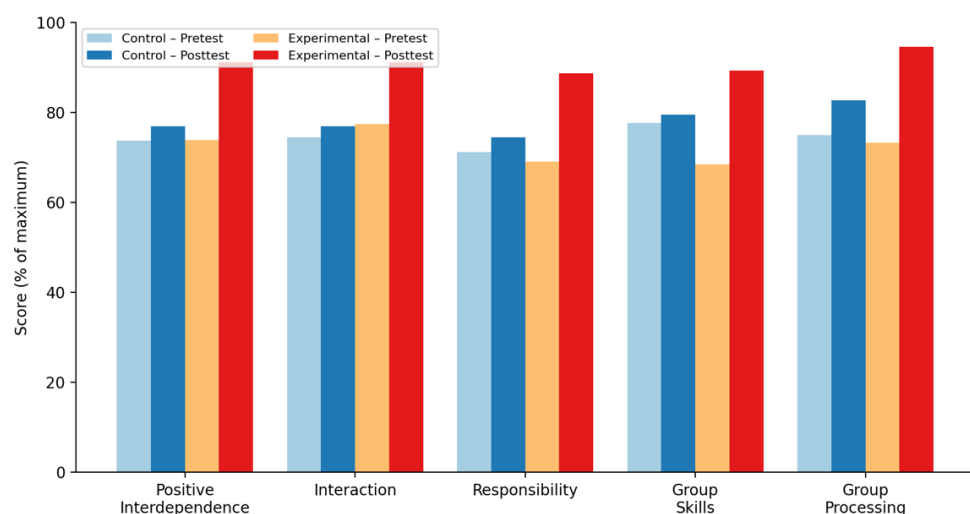


Figure 2. Pretest-posttest comparison of cooperation by indicator (as % of maximum score), control versus experimental group.

3. Hypothesis Testing (MANCOVA)

The three research hypotheses were subsequently tested using Multivariate Analysis of Covariance (MANCOVA), controlling for pretest scores as a covariate (Table 5). For the simultaneous effect, Wilks' Lambda = 0.622, $F(2, 22) = 6.686$, $p = 0.005$, partial $\eta^2 = 0.378$; since $p < 0.05$, the Group Investigation method has a statistically significant simultaneous effect on problem-solving ability and cooperation. Following Cohen's (1988) benchmarks for partial eta squared (small ≈ 0.01 , medium ≈ 0.06 , large ≈ 0.14), this effect size is classified as large, indicating that the instructional method accounts for a substantial proportion (37.8%) of the combined variance in the two outcomes.

Table 5. MANCOVA Results

Effect	Statistic	Value	df (Hypotesis)	df (Error)	Sig.	Partial η^2
Simultaneous (Model)	Wilks' Λ	0.622	2	22	0.005	0.378
Problem-Solving Ability	F	7.022	1	23	0.014	0.234
Cooperation	F	9.455	1	23	0.005	0.291

Follow-up univariate analyses showed that the Group Investigation method had a significant effect on both dependent variables after controlling for pretest scores. For problem-solving ability, the analysis yielded $F(1, 23) = 7.022$, $p = .014$, partial $\eta^2 = 0.234$, indicating a statistically significant difference between the Group Investigation and direct instruction groups. The effect size was large according to Cohen's (1988) criteria, with the intervention accounting for 23.4% of the variance in problem-solving ability. Similarly, for cooperative attitude, the analysis produced $F(1, 23) = 9.455$, $p = .005$, partial $\eta^2 = 0.291$. This result also indicated a statistically significant difference between the two groups after controlling for pretest scores. Based on Cohen's (1988) benchmarks, the effect size was large, with the intervention explaining 29.1% of the variance in cooperative attitude.

Taken together, these results indicate that while raw gain scores for problem-solving ability were comparable between groups, the covariate-adjusted analysis reveals a statistically significant and practically meaningful advantage associated with the Group Investigation method for both outcome variables.

Discussion

As reported in the Results section, the MANCOVA analysis demonstrated a statistically significant multivariate effect of the Group Investigation method on the combined outcomes of problem-solving ability and cooperative attitude, Wilks' $\Lambda = .622$, $F(2, 22) = 6.686$, $p = .005$, partial $\eta^2 = .378$. Although the present study was conducted in a single elementary school, the observed pattern is theoretically consistent with broader cooperative learning research. Consequently, the findings contribute to the growing body of evidence suggesting that Group Investigation can simultaneously support both cognitive and social learning outcomes across different educational contexts, while further replication is still needed to strengthen external validity. The large effect size (Cohen, 2013) indicates that, after controlling for pretest scores, the instructional method accounted for a substantial proportion (37.8%) of the variance in the two learning outcomes. These findings suggest that the Group Investigation method was effective in promoting both cognitive and social learning outcomes simultaneously. This finding demonstrates that instruction deliberately designed around group investigation is capable of developing learners' cognitive and social competencies concurrently, rather than treating them

as separate instructional goals pursued through separate activities. This result aligns theoretically with Dewey's (1997) view that cooperative, inquiry-based learning prepares learners to navigate real social problems within a democratic community; for Dewey, schools function most effectively as miniature communities in which learners practice collective problem-solving, shared responsibility, and democratic participation rather than passively receiving information. Within the Group Investigation model, students play an active role throughout the learning process. Rather than passively receiving information, they identify problems, plan and conduct investigations, participate in collaborative discussions, and communicate their findings to the class. This process simultaneously demands critical thinking and social interaction with group members, positioning learners as active subjects of their own learning rather than passive recipients. Because Group Investigation places learners at the center of the learning process, they bear direct responsibility for both the process and outcome of group work, which plausibly explains why problem-solving ability and cooperation improved together: both competencies are cultivated through the same shared, interdependent learning experience rather than through separate instructional tracks.

The magnitude of this simultaneous effect is also consistent with recent quantitative syntheses of the broader cooperative learning literature. Güngör, Altunbaşak, Aydın, Kaya, and Erdem (2026) conducted a second-order meta-analysis synthesizing 15 first-order meta-analyses on cooperative learning, reporting an overall moderate effect on learning outcomes ($ES = 0.71$) but a substantially higher effect specifically for the Group Investigation technique ($ES = 1.08$), exceeding the effect sizes reported for more procedural techniques such as Jigsaw ($ES = 0.72$). Güngör et al. (2026) attribute this advantage to Group Investigation's emphasis on learner autonomy, self-directed inquiry, and open-ended group decision-making, which engages both cognitive and social processes more deeply than more tightly scripted cooperative formats. Notably, Güngör et al. (2026) reported that studies using quasi-experimental designs, similar to the design adopted in the present study, tended to produce larger effect sizes ($ES = 1.11$) than studies employing fully randomized designs. This finding suggests that the relatively large effect size observed in the present study is consistent with patterns reported in the broader literature, although it should not be interpreted as evidence that the quasi-experimental design itself produced the larger effect. This interpretation is further supported by the systematic literature review conducted by Novita, Sarkadi, and Maksum (2021), which synthesized findings from ten studies on the implementation of Group Investigation in elementary schools. The review concluded that the model consistently enhances students' critical thinking, problem-solving, cooperation, communication, and creativity. These findings align closely with the present study by demonstrating that Group Investigation promotes both cognitive and social competencies, while extending the evidence base through a synthesis of elementary-level research conducted over the past decade. Taken together, the large effect size obtained in the present study (partial $\eta^2 = .378$) converges with cross-national meta-analytic evidence that Group Investigation tends to produce stronger effects than many other cooperative learning techniques, lending external validity to the present result despite its single-site design.

The results further indicate a statistically significant effect of Group Investigation on problem-solving ability specifically, $F(1, 23) = 7.022$, $p = .014$, partial $\eta^2 = .234$, a large effect accounting for 23.4% of the variance after controlling for pretest scores. This finding is consistent with Siregar and Safitri (2020), who similarly found that the Group Investigation model significantly improved elementary students' problem-solving ability. It is further

corroborated by Tanjung, Festiyed, and Mayasari's (2022) meta-analysis of Group Investigation implementations in physics education, which found that the model consistently and substantially improved learners' competence in solving structured problems across multiple studies, despite operating in a very different subject domain. This pattern is further supported by Solikah, Saputro, Yamtinah, and Masykuri's (2024) recent bibliometric analysis of research trends in Group Investigation, which identified a sustained and growing body of evidence linking the model to improved critical thinking and problem-solving outcomes in science education over the past decade, indicating that the effect observed in the present study reflects a well-established and continuing pattern in the literature rather than an isolated result. Taken together with the present findings, this suggests that Group Investigation's problem-solving benefits are not confined to a single academic subject but generalize across disciplines that require learners to reason systematically through open-ended tasks. The remaining unexplained variance is presumably attributable to factors not measured in this study, such as learner motivation, prior academic ability, or the home learning environment.

Descriptively, students who learned through the Group Investigation method demonstrated improvement across all four dimensions of problem-solving ability: understanding the problem, planning a solution, implementing the plan, and reflecting on the results. This pattern is consistent with Polya's (1973) four-stage problem-solving framework, which emphasizes understanding the problem, planning, execution, and reflection as essential components of effective problem solving. The structure of Group Investigation itself plausibly explains this improvement: at each stage of investigation, learners are trained to confront social problems grounded in situations close to their everyday lives, actively identifying problems, gathering information, and discussing alternative solutions with group members. This finding reinforces prior evidence from Siregar and Safitri (2020) and Huda (2013), who documented that Group Investigation effectively improves learners' problem-solving performance, extending this evidence beyond mathematics and social studies into the specific context of Pancasila Education. It is important to note that the raw N-Gain values for problem-solving ability were similar in the control (0.247) and experimental (0.235) groups, with both falling within Hake's (1998) low category. At first glance, this finding may appear inconsistent with the significant treatment effect identified through MANCOVA. However, as reported in the Results section, the experimental group began with a substantially higher pretest score than the control group (49.4 versus 32.7), leaving less opportunity for improvement on the posttest. Consequently, the unadjusted N-Gain values should be interpreted with caution because they do not account for initial differences between the groups. This phenomenon indicates a ceiling effect, where an already high baseline score restricts the room for further improvement, making the low N-Gain score a statistical artifact rather than an indication of ineffectiveness. By statistically controlling for these pretest scores, the MANCOVA provides a more accurate and adjusted estimate of the treatment effect that is not influenced by baseline differences. For this reason, the MANCOVA findings offer a more appropriate basis for evaluating the effectiveness of the Group Investigation method in improving students' problem-solving ability. More broadly, this comparison illustrates that raw gain scores and covariate-adjusted estimates may yield different conclusions when the groups are not equivalent at baseline.

The results also indicate a statistically significant effect of the Group Investigation method on cooperative attitude, $F(1, 23) = 9.455$, $p = .005$, partial $\eta^2 = .291$. According to Cohen's (1988) benchmarks, this represents a large effect, with the instructional method accounting for 29.1% of the variance after controlling for pretest scores. Unlike the findings for

problem-solving ability, this result is supported by the descriptive analysis. As reported in the Results section, the experimental group achieved a substantially higher N-Gain (0.66, medium category) than the control group (0.13, low category). The consistency between the adjusted MANCOVA results and the descriptive N-Gain analysis provides converging evidence for the positive effect of Group Investigation on students' cooperative attitude. Classroom observations offer further insight into this finding. Compared with students in the control class, those in the experimental class participated more actively in group discussions, distributed tasks more evenly, and demonstrated greater shared responsibility in completing group assignments. Throughout the Group Investigation activities, students exchanged ideas, responded constructively to their peers' contributions, and worked collaboratively to reach consensus. These observed behaviors reflect the principle of positive interdependence, whereby the success of the group depends on the meaningful contribution of each member, as described in the cooperative learning framework proposed by Johnson, Johnson, and Smith (2017). Learners with stronger academic ability were frequently observed assisting peers who struggled, fostering a mutually supportive learning atmosphere consistent with the goals of Group Investigation. Communication and willingness to respect differing opinions also appeared to improve over the course of the intervention, although some learners remained hesitant to voice their ideas; even so, learners increasingly contributed to discussion without dominating it, reflecting the development of democratic and interpersonal skills central to genuine cooperation (David W. Jhonson et al., 2017).

In contrast, classroom observations in the control class revealed more limited collaborative interaction. Group discussions were often dominated by a small number of students, whereas others participated only minimally and contributed relatively little to the group's work. As a result, responsibility for completing group tasks tended to remain at the individual rather than the collective level. These observations suggest that, within the context of this study, conventional direct instruction provided fewer opportunities for students to develop cooperative attitudes than the Group Investigation method. The observed differences were evident across all five dimensions of cooperative learning: positive interdependence, promotive interaction, individual accountability, interpersonal and small-group skills, and group processing. These dimensions correspond directly to the cooperative learning framework proposed by Johnson et al. (2017). The consistent advantage demonstrated by the experimental group across these dimensions is also consistent with the findings of Basirun and Tarto (2022), who reported that Group Investigation promotes cooperation, responsibility, and social awareness through structured collaborative learning activities. This finding is broadly consistent with meta-analytic evidence on cooperative learning's affective and social benefits: although Güngör et al. (2026) found that cooperative learning's effect on affective outcomes tends to be somewhat smaller on average than its effect on academic achievement and higher-order thinking, the effect remains consistently positive across the studies they synthesized, supporting the plausibility of a genuine, non-trivial improvement in cooperation of the magnitude observed here. The present study's effect size for cooperation (partial $\eta^2 = .291$) is therefore not an anomalously large or implausible finding relative to the wider empirical base, but sits within the range of effects reported for cooperative learning interventions on social and affective outcomes more broadly.

These findings have important theoretical implications for constructivist and cooperative learning. The significant simultaneous improvement in problem-solving ability and cooperative attitude suggests that cognitive and social competencies develop through active engagement

in collaborative learning rather than through the passive transmission of information. This interpretation is consistent with Vygotsky's (1978) social constructivist perspective, which proposes that cognitive development originates in social interaction before being internalized by the individual. Within this framework, learners achieve higher levels of understanding through guided collaboration with peers within their zone of proximal development than through independent learning alone. The Group Investigation method reflects these principles by engaging students in collaboratively identifying problems, planning investigations, discussing alternative ideas, and constructing shared understanding throughout the learning process. The findings are also consistent with the social interdependence theory proposed by Johnson and Johnson (2017), which argues that positive interdependence promotes greater engagement, shared responsibility, and collective effort than competitive or individualistic learning structures. By organizing learning around shared goals and mutual accountability, Group Investigation creates conditions that support the development of both cognitive and social competencies. Taken together, these findings suggest that the theoretical principles underlying constructivist and cooperative learning are applicable beyond the mathematics and science contexts in which Group Investigation has been most extensively studied. In the context of Pancasila Education, the present study extends the existing evidence by demonstrating that the model supports the development of both problem-solving ability and cooperative attitude, two competencies that are central to the objectives of the Pancasila Student Profile.

Practically, these findings suggest that the Group Investigation method can serve as an effective instructional alternative for improving the quality of Pancasila Education at the elementary level. Within this approach, the teacher's role shifts from primarily delivering content to facilitating students' collaborative inquiry by guiding them in planning, conducting, and evaluating their own learning activities. This shift has important implications for lesson design, encouraging teachers to create learning experiences that actively engage students in discussion, collaboration, and the solution of authentic social problems rather than relying predominantly on teacher-centered instruction. For students, participation in Group Investigation provides repeated opportunities to develop problem-solving ability and cooperative attitude within the same learning process, two competencies that are central to the Pancasila Student Profile (Maulida & Oktavia, 2025). Although the present study focused specifically on Pancasila Education, these implications may also be relevant to other learning contexts that require the simultaneous development of cognitive and social competencies. This broader applicability is supported by Güngör et al.'s (2026) cross-domain synthesis, which reported positive effects of Group Investigation across mathematics, science, and social studies. However, successful implementation depends on teachers' ability to facilitate collaborative inquiry effectively. Without careful planning, clear task structures, and active facilitation, group work may result in unequal participation, limiting the collaborative learning processes that the Group Investigation method is intended to promote.

This study has several limitations that should be considered when interpreting the findings. First, the sample consisted of only two intact classes from a single elementary school, which may limit the generalizability of the results to other educational settings. Second, because the study employed a quasi-experimental rather than a randomized experimental design, baseline differences between the two groups could not be completely eliminated, although they were statistically controlled using MANCOVA. Third, the intervention was conducted over a relatively limited instructional period; therefore, the study was not designed to examine the long-term retention of problem-solving ability or cooperative attitude. Future studies involving

larger samples, multiple schools, randomized assignment where feasible, and longitudinal follow-up are recommended to strengthen the external validity of these findings.

Conclusion

This study demonstrates that the Group Investigation method has a significant effect on elementary school students' problem-solving ability and cooperative attitude in Pancasila Education. Specifically, the findings show that Group Investigation has a significant simultaneous effect on both outcomes after controlling for students' initial abilities, while also producing significant improvements in problem-solving ability and cooperative attitude when each outcome is examined separately. These results suggest that Group Investigation is not merely an alternative approach to content delivery but an instructional model capable of fostering cognitive and social competencies through a structured, inquiry-based, and collaborative learning process.

The findings also highlight the potential of Group Investigation as an effective instructional approach for Pancasila Education at the elementary level. Beyond improving academic performance, the model supports the development of competencies that are central to the Pancasila Student Profile, particularly students' ability to solve social problems and work cooperatively with others. The results therefore reinforce the value of designing learning experiences that actively engage students in inquiry, discussion, and collaboration rather than relying predominantly on teacher-centered instruction.

Based on these findings, elementary school teachers are encouraged to consider adopting the Group Investigation method to promote students' problem-solving ability and cooperative attitude, while ensuring adequate preparation for facilitating collaborative inquiry. Schools can further support its implementation by fostering instructional policies that encourage collaborative and participatory learning environments. Future research should replicate and extend this study across different subjects, grade levels, educational contexts, and comparison models. Where feasible, studies employing randomized assignment across multiple schools and larger samples would provide stronger evidence regarding the effectiveness and generalizability of the Group Investigation method. Despite these limitations, the present study provides empirical evidence that integrating inquiry and cooperative learning through the Group Investigation method offers a promising instructional approach for simultaneously fostering cognitive and social competencies among elementary school students.

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