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The effect of multimodal media-assisted discovery learning on students' conflict resolution skills

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ABSTRACT

Interactive media may support students' conflict resolution skills in Social Studies. This study examined the effect of Discovery Learning assisted by multimodal media on junior high school students' conflict resolution skills. A quasi-experimental nonequivalent control group design involved 64 eighth-grade students at SMP Negeri 2 Trawas. Data were collected through pretests and posttests comprising 25 multiple-choice and five essay questions. The intervention integrated Canva visuals and animations, instructional videos, Wordwall, and Quizizz via a smartboard. ANCOVA revealed a significant group effect after controlling for pretest scores ($F = 181.073$, $p < .001$). The experimental group's mean increased from 53.12 to 84.69, compared with 50.78 to 57.97 in the control group. The smartboard's independent contribution remains undetermined.

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Introduction

Education plays an important role in developing students' knowledge, critical-thinking skills, and social competence. Social Studies helps students understand concepts related to social life and consider ways to address social issues (Afifah et al., 2020). Conflict resolution is an important social skill involving the ability to identify problems, understand different perspectives, consider alternative solutions, and select appropriate ways to resolve disagreements. This skill is particularly relevant to junior high school students, who interact with peers with diverse opinions, personalities, and interests. Technology can make learning materials more engaging and contextual when integrated with appropriate instructional strategies (Altaftazani et al., 2025; Santamaría-Villar et al., 2021; Goldberg et al., 2019).

The topic of social conflict was selected because it is directly related to the dependent variable, namely students' conflict resolution skills. This topic allows students to examine the causes, forms, and consequences of conflict and consider possible ways to resolve it. These skills cannot be adequately assessed solely through students' ability to recall definitions or lists of conflict types. Students also need to identify problems and the parties involved, consider different perspectives, and formulate appropriate solutions. Case analysis and problem-solving activities can connect Social Studies concepts with real-life situations. Habibah et al. (2025) found that Discovery Learning supported by interactive Canva media was relevant to Social Studies learning outcomes and critical-thinking skills, although their study did not specifically measure conflict resolution skills (Altaftazani et al., 2025; Johnson & Johnson, 2004; Filella et al., 2018).

Technology can support more interactive Social Studies learning. A smartboard can display visual materials, videos, animations, and interactive activities as part of digital learning. Initial observations at SMP Negeri 2 Trawas indicated that the smartboard had not been used optimally in Social Studies lessons and that learning activities could be further developed to engage students in analyzing social issues. Limited digital competence and teacher training may hinder effective technology use. Providing digital devices needs to be accompanied by teachers' ability to design learning activities aligned with the technology and learning objectives. Ndwandwe et al. (2024) examined smartboard use in learning, while Heine et al. (2023) reviewed teachers' professional digital competence and the use of digital resources in education (Ndwandwe et al., 2024; Heine et al., 2023; Revuelta-Domínguez et al., 2022).

Optimizing smartboard use requires instructional planning that goes beyond content delivery and actively engages students. This study integrated multimodal media, defined as the presentation of information in multiple formats, including text, images, videos, animations, audio, and interactive activities. Canva was used to present visual materials and animations; videos depicted conflict situations; Wordwall provided interactive exercises; and Quizizz was used for quizzes and feedback. The media were selected to complement one another and were displayed via a smartboard in accordance with the learning objectives. Heine et al. (2023) discussed digital resources as part of teachers' professional digital competence, while David et al. (2025) addressed technology-related competence and teacher development approaches. These studies provide a basis for considering the purposeful selection and use of digital resources in learning (Mayer, 2019; Cromley & Chen, 2025; Tamim et al., 2011).

Multimodal media were combined with the Discovery Learning model to align technology use with learning objectives. Discovery Learning encourages students to construct understanding by observing, identifying problems, collecting and processing information, verifying findings, and drawing conclusions. In the context of social conflict, students can observe a case video, identify causes, consider the perspectives of the parties involved, and develop alternative solutions. Canva, videos, and animations can support observation and analysis, while Wordwall and Quizizz can reinforce learning through interactive activities. Habibah et al. (2025) studied Discovery Learning supported by Canva in Social Studies, whereas Mutmainnah et al. (2025) examined Discovery Learning assisted by Powtoon animation in elementary Social Studies. These studies provide relevant context but differ from the present study in educational level, media combination, and outcome variable (Habibah et al., 2025; Mutmainnah et al., 2025; Ningsih et al., 2025).

This study addresses the need to optimize smartboard use by integrating multimodal media with an instructional model suited to classroom needs. Previous studies have examined smartboards in technology-based learning (Ndwandwe et al., 2024), digital resources and teacher competence (Heine et al., 2023; Osorio Vanegas et al., 2025), and digital-media-assisted Discovery Learning, primarily in relation to learning outcomes, learning interest, or critical-thinking skills (Habibah et al., 2025; Mutmainnah et al., 2025). Based on the literature reviewed for this study, the combination of Discovery Learning, Canva, Wordwall, videos, Quizizz, animations, and animated songs delivered through a smartboard was not identified as an approach specifically investigated to develop junior high school students' conflict resolution skills. This research gap is limited to the literature reviewed and should not be interpreted as evidence that no similar study has ever been conducted (Ndwandwe et al., 2024; Heine et al., 2023; Habibah et al., 2025; Mutmainnah et al., 2025).

This study asked whether Discovery Learning assisted by multimodal media affects junior high school students' conflict resolution skills in Social Studies lessons on social conflict. The objective was to analyze the effect of this instructional approach on students' conflict resolution skills. The study focuses on conflict resolution, which differs from the learning outcomes, learning interest, creativity, and critical thinking examined in many related studies. The findings are expected to contribute to research on technology-based Social Studies learning and provide practical guidance for teachers designing interactive lessons that encourage students to analyze social issues and develop solutions. The findings may also inform future research on digital learning approaches and students' social skills (Altaftazani et al., 2025; Johnson & Johnson, 2004).

Method

Research Design

This study employed a quantitative approach with a quasi-experimental nonequivalent control group design. The design involved an experimental group and a control group without individual random assignment. Both groups completed a pretest before instruction and posttest after instruction to measure changes in students' conflict resolution skills. This design is appropriate for school settings in which class assignments have already been established (Creswell & Creswell, 2018; Shadish et al., 2002). The study was conducted in August 2026 at SMP Negeri 2 Trawas, Indonesia, during the first semester of the 2026/2027 academic year. The participants

were eighth-grade students from two existing classes: class VIII C as the experimental group and class VIII A as the control group, with 32 students in each class. The intervention was implemented over two instructional meetings for each group, conducted according to separate class schedules. Each meeting consisted of two instructional periods (2 lesson hours). The experimental group received Discovery Learning assisted by multimodal media through a smartboard, whereas the control group received conventional Social Studies instruction using PowerPoint presentations. A pretest was administered to both groups before the intervention, while a posttest was administered after the completion of the two instructional meetings in each group.

Population and Sample

The study was conducted in Social Studies lessons on social conflict at SMP Negeri 2 Trawas. The population comprised all eighth-grade students in the academic year in which the study was conducted. The sample consisted of 64 students: 32 students from class VIII C in the experimental group and 32 students from class VIII A in the control group. Purposive sampling was used based on previous assessment information indicating that the two classes had relatively similar learning outcomes. Both groups completed a pretest to measure their initial conflict resolution skills before the intervention (Shadish et al., 2002).

Procedures and Data Collection Techniques

Data were collected through initial observations and a conflict resolution skills test administered as a pretest and posttest. The observations documented Social Studies instruction and the use of learning media at the school. Both groups completed tests with comparable indicators and levels of difficulty. The experimental group received Discovery Learning instruction supported by multimodal media displayed through a smartboard. The learning activities followed the six stages of Discovery Learning stimulation, problem identification/formulation, data collection, data processing, verification, and generalization as described by Syah in Hosnan (2014). (Hosnan, 2014; Mayer, 2019).

During the stimulation stage, the teacher displayed Canva images on the smartboard to attract students' attention and activate prior knowledge, followed by a video depicting social conflict. During problem formulation, students identified the problem, determined the parties involved, and raised questions about the causes of conflict and possible resolutions. During data collection, students worked in groups using student worksheets to analyze the video, identify causes, consider the parties' perspectives, and explore possible solutions (Hosnan, 2014; Corella, 2023; Johnson & Johnson, 2004).

During data processing, students discussed their findings and developed alternative solutions based on the information collected. Each group presented its discussion findings to the class. During verification, the teacher provided feedback, corrected misconceptions, and explained social conflict and principles of peaceful conflict resolution. The teacher and students then evaluated whether the proposed solutions could address the problem shown in the video. During generalization, students drew conclusions about the causes of conflict and possible resolutions. Students' understanding was reinforced and assessed through Wordwall activities and Quizizz quizzes displayed on the smartboard. The control group received conventional instruction using PowerPoint presentations covering the same social conflict content. Instructional time, content coverage, and testing procedures were kept comparable across the two groups (Hosnan, 2014; Filella et al., 2018; Turnuklu et al., 2010).

Research Instrument

The research instrument was a conflict resolution skills test consisting of 25 multiple-choice questions and five essay questions. Its indicators were adapted by the researchers to the context of social conflict resolution from the problem-solving process discussed by Santos-Trigo (2024). Santos-Trigo discusses problem formulation, solution strategies, reasoning, and the use of tools in problem-solving but does not provide an instrument specifically designed to measure social conflict resolution. The four indicators used in this study were understanding the problem, formulating a solution plan, implementing the plan, and reviewing the outcome. The multiple-choice questions assessed students' understanding of conflict situations and possible resolutions. The essay questions assessed students' ability to explain their reasoning, propose alternatives, and evaluate conflict-resolution outcomes. Multiple-choice responses were scored using an answer key, while essay responses were assessed using a rubric aligned with the indicators. Evidence of content validity, item analysis, reliability, and consistency in essay scoring should be reported only if these analyses were actually conducted (Santos-Trigo, 2024).

Data Analysis

Pretest and posttest scores were analyzed using descriptive and inferential statistics. Descriptive statistics included the mean, standard deviation, minimum, and maximum scores for each group. ANCOVA was used to compare posttest scores between groups while controlling for pretest scores; posttest score was the dependent variable, group was the fixed factor, and pretest score was the covariate. Before conducting ANCOVA, the

analysis should assess the linear relationship between pretest and posttest scores, homogeneity of regression slopes, residual distribution, homogeneity of variance, and influential outliers. The significance level was set at 0.05. Results were reported using the test statistic, p-value, adjusted mean difference, confidence interval, and an appropriate effect size. If ANCOVA assumptions were not met, an alternative analysis should be selected based on the characteristics of the data and the research objective (Field, 2018; Pallant, 2020).

Table 1. Nonequivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experimental (VIII C)	O_1	X	O_2
Control (VIII A)	O_3	–	O_4

Note: O_1 and O_3 indicate the pretest; O_2 and O_4 indicate the posttest; X indicates Discovery Learning assisted by multimodal media delivered through a smartboard; the dash (—) indicates conventional instruction using PowerPoint.

Results and Discussions

Descriptive Analysis of Students' Conflict Resolution Skills

Descriptive statistics were used to summarize students' conflict resolution skills before and after instruction in the experimental and control groups. The analysis included the number of students, mean, standard deviation, minimum, and maximum scores for the pretest and posttest. These statistics describe students' initial skills and the observed score changes in each group (Field, 2018).

Table 2. Descriptive Statistics for Students' Conflict Resolution Skills

Group	Measurement	N	Mean	SD	Min.	Max.
Experimental	Pretest	32	53.12	7.91	40	65
Experimental	Posttest	32	84.69	7.92	70	95
Control	Pretest	32	50.78	8.34	40	65
Control	Posttest	32	57.97	7.92	45	80

Source: Primary data processed by the researchers using SPSS (2026).

As shown in Table 2, the experimental group's mean pretest score was 53.12, while the control group's mean was 50.78, a difference of 2.34 points. Thus, the experimental group had a slightly higher mean score at baseline. This initial difference should be considered when comparing the groups' posttest results; the comparison needs to account for both final and initial scores.

After instruction, the experimental group's mean posttest score reached 84.69, compared with its mean pretest score of 53.12, representing an increase of 31.57 points. The minimum score increased from 40 to 70, while the maximum increased from 65 to 95. This descriptive change indicates higher scores after students participated in Discovery Learning assisted by multimodal media.

The control group's mean score increased from 50.78 at pretest to 57.97 at posttest, an increase of 7.19 points. Its minimum score increased from 40 to 45, while the maximum increased from 65 to 80. The control group also improved after conventional instruction, and this should be considered when interpreting the change in the experimental group.

The experimental group's mean score increased by 31.57 points, compared with 7.19 points in the control group. The difference between the two groups' descriptive gains was 24.38 points. This pattern indicates a larger increase in the experimental group, although statistical conclusions must be based on inferential analysis and the fulfillment of the relevant assumptions.

The experimental group's standard deviation remained almost unchanged from pretest to posttest, at 7.91 and 7.92, respectively. In the control group, the standard deviation decreased from 8.34 to 7.92. These values describe the spread of scores around the mean but do not, by themselves, indicate whether every student improved to the same extent or whether the between-group difference was statistically significant.

Overall, the mean scores increased in both groups, with a larger increase in the experimental group. These descriptive findings provide context for the ANCOVA results, which assess between-group differences after adjustment.

Hypothesis Testing

ANCOVA was used to test the difference in posttest conflict resolution scores between the experimental and control groups after controlling for pretest scores. The results are presented in Table 3.

Table 3. ANCOVA Results for Students' Conflict Resolution Skills

Source of Variation	F	Significance	Interpretation
Pretest	5.087	0.028	Significant
Instructional group	181.073	p < .001	Significant
Overall model	99.574	p < .001	Significant

Source: SPSS output based on the research data (2026).

The ANCOVA results indicated a statistically significant effect of instructional group, $F = 181.073$; $p < 0.001$. Because the p-value was below the 0.05 significance level, the adjusted posttest scores differed significantly between the experimental and control groups.

The adjusted mean was 84.371 for the experimental group and 58.286 for the control group, yielding a difference of 26.085 points. The pairwise comparison with Bonferroni adjustment was statistically significant ($p < 0.001$), with a 95% confidence interval from 22.209 to 29.961 points. Thus, after controlling for pretest scores, the experimental group had a higher adjusted conflict resolution score. The model's coefficient of determination ($R^2 = 0.766$) indicates that pretest scores and instructional group together explained approximately 76.6% of the variance in posttest scores. This value describes the explanatory capacity of the overall model and should not be interpreted as the percentage attributable solely to the instructional approach.

The hypothesis-testing results support the expectation that posttest conflict resolution scores differed between students who received Discovery Learning assisted by multimodal media and those who received conventional instruction. The findings indicate an association between the combined instructional approach and higher adjusted scores in this sample.

Discussion of the Effect of Discovery Learning Assisted by Multimodal Media

ANCOVA identified a statistically significant difference in conflict resolution skills between the experimental and control groups after pretest scores were controlled ($F = 181.073$; $p < 0.001$). The adjusted mean was 84.371 in the experimental group and 58.286 in the control group, a difference of 26.085 points. Therefore, students who participated in Discovery Learning assisted by multimodal media achieved higher adjusted scores than students who received conventional instruction.

Discovery Learning engages students in identifying problems, analyzing the causes of conflict, considering the perspectives of the parties involved, and developing alternative solutions. These activities encourage students to examine a problem before deciding how to respond. Corella (2023) discussed communication in conflict, while Habibah et al. (2025) reported relevant findings on Canva-assisted Discovery Learning in Social Studies and students' critical-thinking skills (Corella, 2023; Johnson & Johnson, 2004; Habibah et al., 2025).

Multimodal media—including images, videos, animations, audio, and interactive quizzes—present information in different formats. In this study, Canva, Wordwall, and Quizizz were used to support students' understanding of social conflict. Digital media should be selected in line with learning objectives and integrated into activities that promote student engagement (Ningsih et al., 2025; Oktavia et al., 2025).

The smartboard served as a means of integrating media into the stages of Discovery Learning. Images and videos introduced conflict situations, visual materials supported discussion and analysis, and Wordwall and Quizizz were used for practice and assessment. A smartboard can support interactive and collaborative learning when accompanied by appropriate instructional planning. The device does not, by itself, guarantee effective learning; rather, it provides a means for students to interact with content and learning activities (Ndwandwe et al., 2024; Pila et al., 2026; Kaharuddin et al., 2026).

The experimental group's mean score increased from 53.12 to 84.69, while the control group's mean score increased from 50.78 to 57.97. The ANCOVA results showed that the posttest difference remained statistically significant after baseline scores were controlled. This combined approach may be an option for Social Studies instruction aimed at developing conflict resolution skills. However, because the intervention combined Discovery Learning, several types of media, and a smartboard, the study cannot isolate the independent effect of the smartboard. The findings are also limited to the school, sample, topic, and implementation examined.

Comparison with Previous Studies and Implications

The findings revealed a statistically significant difference in conflict resolution skills between students in the experimental and control groups. ANCOVA yielded $p < 0.001$, with adjusted posttest means of 84.371 and 58.286, respectively. Previous studies have examined digital-media-assisted Discovery Learning in relation to Social Studies learning outcomes and critical thinking (Habibah et al., 2025). The present study is similar in its use of Discovery Learning and digital media but specifically focuses on conflict resolution skills among junior high school students (Habibah et al., 2025; Mutmainnah et al., 2025; Altaftazani et al., 2025).

Conclusions

This study found a statistically significant difference in students' conflict resolution skills between the group that received Discovery Learning assisted by multimodal media through a smartboard and the group that received conventional instruction. The experimental group's mean score increased from 53.12 to 84.69, while the control group's mean score increased from 50.78 to 57.97. After pretest scores were controlled, the experimental group had a higher adjusted posttest mean than the control group. These findings suggest that this combined instructional approach may be an option for Social Studies lessons on social conflict. The results should be interpreted in light of the study's limitations, including the use of two pre-existing classes at one school and the combination of several instructional components. The independent contribution of the smartboard cannot be determined. Future research should involve more schools and compare the same instructional model and media across different devices to clarify the specific contribution of smartboard use.

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