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The Effect of Mathematics Learning Based on Aswaja An-Nahdliyah Values on Students' Religious Moderation Attitudes and Critical Thinking Skills

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ABSTRACT

Education is fundamentally oriented not only toward the acquisition of academic knowledge and skills but also toward the development of students' character, enabling them to live constructively in socially, culturally, and religiously diverse communities. However, in school learning practices, cognitive competency development and character education are often treated as separate objectives, with mathematics primarily focused on academic achievement, while religious moderation is largely associated with religious education subjects. This study aims to examine the effect of mathematics learning based on Ahlussunnah wal Jama'ah (Aswaja) An-Nahdliyah values on students' religious moderation attitudes and critical thinking skills. Employing a quantitative approach with a quasi-experimental design, the study involved 41 students divided into experimental and control groups. Data were collected using a religious moderation attitude scale and a critical thinking skills test and subsequently analyzed using descriptive and inferential statistics. The results revealed that mathematics learning integrated with Aswaja An-Nahdliyah values had a positive and statistically significant effect on both dependent variables. The experimental group demonstrated greater improvements than the control group, with large effect sizes (Cohen's d) for both religious moderation attitudes (1.37) and critical thinking skills (1.57). These findings indicate that integrating Aswaja An-Nahdliyah values into mathematics learning activities through problem-solving, discussions, argumentation, and reflection effectively bridges intellectual competency development and character strengthening simultaneously. Furthermore, this approach offers a pedagogical alternative for promoting contextualized mathematics learning in culturally and religiously diverse societies.

1. INTRODUCTION

Education is fundamentally oriented not only toward the acquisition of academic knowledge and skills but also toward the development of students' character, enabling them to live constructively amid social, cultural, and religious diversity (Gunaidi & Muh. Sholeh, 2026; Hanafi, 2025; Handajani et al., 2018). In the context of Indonesian education, character development has become increasingly important as students encounter complex social environments and rapidly expanding digital information flows that facilitate the dissemination of diverse perspectives, values, and religious practices. Therefore, education should aim not only to develop students' cognitive competencies but also to cultivate individuals who can respond to differences proportionately, engage openly in dialogue, and make decisions based on rational considerations and evidence. The Indonesian Ministry of Religious Affairs identifies national commitment, tolerance, nonviolence, and accommodation of local traditions as key indicators of religious moderation (Arif, 2021; Hasan

& Huda, 2022; Mukhibat et al., 2023). Strengthening religious moderation in education should not be confined to religious education subjects. The values of religious moderation can be internalized throughout the learning process, including in subjects primarily associated with cognitive development, such as mathematics (Awaluddin, 2021; Naim et al., 2022). This perspective is important because mathematics learning involves more than procedures and calculations; it also encompasses understanding problems, identifying relevant information, examining arguments, establishing relationships among concepts, evaluating strategies, and drawing logical conclusions (Crismono et al., 2025; Hidayat et al., 2025; Iman et al., 2025; Mazowiecki et al., 2016; Shodiq, 2024). Thus, mathematics learning provides pedagogical opportunities to develop rational thinking while fostering students' dispositions to respond to differences of opinion objectively and responsibly.

Critical thinking is one of the essential competencies that should be developed through mathematics learning. When solving mathematical problems, students are expected not merely to obtain final answers but also to understand the problems, justify the strategies employed, examine the validity of arguments, and evaluate conclusions (Merdiana et al., 2026; S. Y. N. Sari et al., 2026). Several studies in mathematics education have indicated that students' mathematical critical thinking skills remain an important concern requiring improvement through appropriate instructional designs. Research on mathematical critical thinking continues to expand, particularly in relation to problem-solving, instructional models, and learner characteristics (Angraini & Wahyuni, 2021; Barbosa & Vale, 2021; Merdiana et al., 2025; V. Sari, 2019). Nevertheless, the development of critical thinking skills cannot be separated from the values that shape how students apply these abilities (Angraini & Wahyuni, 2021; Barbosa & Vale, 2021; Crismono et al., 2025; V. Sari, 2019). Critical thinking skills developed without a foundation of values may result merely in cognitive proficiency, whereas education requires the integration of intellectual competence and character development. In this context, mathematics learning can serve as an integrative educational setting that connects mathematical reasoning with social and religious values. Students can be encouraged to construct well-reasoned arguments, appreciate alternative solutions, accept differences in problem-solving strategies, and evaluate opinions objectively. These characteristics are closely aligned with the principles underlying the development of moderate attitudes (Bakar et al., 2020; Javed, 2018; Khumaini et al., 2023). One relevant source of values in the context of Islamic education in Indonesia is Ahlussunnah wal Jama'ah An-Nahdliyah (Aswaja An-Nahdliyah). From a pedagogical perspective, Aswaja An-Nahdliyah values have the potential to provide a foundation for developing learning approaches that integrate academic competencies with character formation (Hana et al., 2023; Ibda et al., 2021; Istiyani & Wibowo, 2020; Nikmah, 2018). Studies examining Aswaja An-Nahdliyah education among students have highlighted its orientation toward strengthening religious understanding while cultivating attitudes that respect differences, foster patriotism, and maintain constructive social relationships. More recent research has also indicated that Aswaja An-Nahdliyah education can interact with educational practices, student organizations, and religious experiences in shaping students' understanding of religious moderation within madrasah environments (Halid, 2019; Istiyani & Wibowo, 2020).

Previous scholarship has provided complementary but distinct evidence: studies of Aswaja An-Nahdliyah education have primarily addressed religious understanding, moderate attitudes, and social harmony (Hana et al., 2023; Ibda et al., 2021; Istiyani & Wibowo, 2020; Nikmah, 2018), whereas mathematics education studies have typically examined instructional strategies and students' critical thinking (Angraini & Wahyuni, 2021; Barbosa & Vale, 2021). These strands do not by themselves establish whether an explicitly Aswaja-integrated mathematics intervention is associated with improvements in both domains under a common pretest–posttest comparison. The present study addresses this narrower empirical gap by examining religious moderation attitudes and

mathematical critical thinking as distinct outcomes in experimental and comparison classes. Its contribution is the dual-outcome evaluation of a values-integrated mathematics approach, rather than a claim that values integration or critical-thinking pedagogy is entirely new. This research gap is particularly significant because mathematics learning is often positioned primarily as a means of achieving academic competencies, whereas values education and religious moderation are more commonly associated with religious education subjects. Such a separation may prevent the full utilization of mathematics as a means of developing both thinking skills and character. In fact, mathematical activities that require students to justify their reasoning, compare strategies, examine the validity of statements, and appreciate diverse approaches to problem-solving can provide productive learning contexts for developing critical thinking skills and dialogical attitudes simultaneously. Based on this gap, mathematics learning based on Aswaja An-Nahdliyah values can be regarded as an approach that seeks to integrate academic competencies with the internalization of values. This integration does not simply involve incorporating religious content into mathematics lessons; rather, it entails constructing mathematical learning experiences through activities that allow these values to be reflected in understanding problems, participating in discussions, presenting arguments, respecting different perspectives, making decisions, and reflecting on learning outcomes. Through this approach, religious values are not merely presented as declarative principles but are intended to become an integral part of students' learning experiences.

Conceptually, this approach encompasses two complementary objectives. First, in the affective domain, values-based learning is expected to provide experiences that strengthen religious moderation attitudes by encouraging respect for differences, avoiding the imposition of personal views, promoting dialogue, and recognizing diversity in classroom interactions. Second, in the cognitive domain, mathematical learning activities involving analysis, evaluation, reasoning, and drawing conclusions are expected to support the development of critical thinking skills. Consequently, learning effectiveness is evaluated not only through students' abilities to solve mathematical problems but also through the development of attitudes relevant to life in religiously and socially pluralistic communities. On the basis of these arguments, this study aims to examine the effect of mathematics learning based on Aswaja An-Nahdliyah values on students' religious moderation attitudes and critical thinking skills. The study is expected to contribute to the advancement of mathematics education research by extending the role of mathematics learning beyond the development of academic competencies toward an instructional approach that integrates cognitive development and values education. From a practical perspective, the findings are also expected to provide an empirical foundation for teachers and instructional designers in developing contextualized, values-oriented mathematics learning that responds to educational needs in culturally and religiously diverse societies.

2. METHODS

This quantitative study employed a quasi-experimental pretest–posttest nonequivalent control-group design. The study was conducted at MTs. SA. Miftahul Ulum Al-Khairiyah, located in Tempurejo Village, Tempurejo District, Jember Regency, East Java, Indonesia. A total of 41 eighth-grade students participated in the study, comprising 21 students in the experimental group and 20 students in the control group. The participants were assumed to be approximately 13–14 years old. For the provisional methodological description, purposive sampling was assumed, with two existing eighth-grade classes serving as the experimental and control groups without random assignment. The experimental group received mathematics instruction incorporating Aswaja An-Nahdliyah values, particularly tawassuth (moderation), tawazun (balance), tasamuh (tolerance), and i'tidal (justice), whereas the control group followed regular mathematics instruction. The intervention was

provisionally described as lasting four weeks, comprising eight instructional sessions. Both groups completed pretests and posttests measuring religious moderation attitudes and mathematical critical thinking skills. Given the nonrandomized group comparison, the findings should be interpreted within the limitations of a quasi-experimental design (Creswell, 2019; Crismono, 2024).

Table 1. Quasi-Experimental Research Design

Group	Pretest	Treatment	Posttest
Exp.	O_1	X	O_2
Control	O_3	–	O_4

Notes:
O_1 = Pretest of religious moderation attitudes and critical thinking skills in the experimental group.
O_2 = Posttest of religious moderation attitudes and critical thinking skills in the experimental group.
O_3 = Pretest of religious moderation attitudes and critical thinking skills in the control group.
O_4 = Posttest of religious moderation attitudes and critical thinking skills in the control group.
X = Mathematics learning based on Aswaja An-Nahdliyah values.

Religious moderation attitudes were assessed using a structured attitude scale measuring students' tolerance, respect for differences, balanced perspectives, and fairness in social interactions, while mathematical critical thinking skills were assessed through a test evaluating students' abilities to analyze mathematical information, justify solutions, evaluate alternative strategies, and draw logical conclusions. The instructional intervention integrated the core Aswaja An-Nahdliyah values of tawassuth (moderation), tawazun (balance), tasamuh (tolerance), and i'tidal (justice) through contextual mathematical problem-solving, small-group discussions, evidence-based argumentation, collaborative activities, and reflective learning. Students in the experimental group were encouraged to compare different solution strategies, evaluate mathematical arguments objectively, respect alternative viewpoints, and formulate conclusions based on logical reasoning, whereas the control group received regular mathematics instruction. Further methodological documentation is required concerning the number of questionnaire and test items, scoring procedures, expert-based content validation, instrument validity and reliability coefficients, implementation fidelity, and specific instructional activities undertaken by the control group. These details should be reported using the original research records to ensure the transparency, reproducibility, and methodological credibility of the study. Data were analyzed using descriptive and inferential statistical procedures. Descriptive statistics, including means and standard deviations, were calculated to summarize students' pretest and posttest scores in both the experimental and control groups. The Shapiro–Wilk test was employed to assess normality, while Levene's test was used to examine the homogeneity of variances between groups. Differences between the experimental and control groups were examined using t-tests, with the reported results indicating statistically significant differences in religious moderation attitudes ($t = 4.38$, $p < .001$) and mathematical critical thinking skills ($t = 5.02$, $p < .001$). Effect sizes were reported using Cohen's d, yielding values of 1.37 and 1.57, respectively, indicating large standardized differences between the groups. All statistical analyses were evaluated at a significance level of $\alpha = .05$. As the original statistical output did not specify whether the t-tests compared posttest scores or gain scores, the precise test specifications, degrees of freedom, confidence intervals, and any adjustments for baseline differences remain subject to verification. Accordingly, the findings were interpreted as reported between-group differences within the limitations of the quasi-experimental research design.

3. RESULTS AND DISCUSSION

3.1. Description of Research Data

This study involved 41 students divided into two groups: an experimental group consisting of 21 students and a control group consisting of 20 students. The experimental group received

mathematics instruction based on Aswaja An-Nahdliyah values, while the control group received regular mathematics instruction. Measurements were conducted before and after the instructional intervention to examine changes in students' religious moderation attitudes and critical thinking skills. The religious moderation attitude scale was used to assess the affective dimension, while critical thinking skills were measured using a test encompassing the abilities to analyze information, provide justifications, evaluate strategies or arguments, and draw conclusions. The descriptive statistical results are presented in Table 2.

Table 2. Descriptive Statistics of Pretest and Posttest Scores

Variable	Group	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD
Religious Moderation Attitudes	Exp.	21	72.48	6.21	84.76	5.18
Religious Moderation Attitudes	Control	20	71.95	6.47	76.35	6.12
Critical Thinking Skills	Exp.	21	61.43	7.35	79.52	6.24
Critical Thinking Skills	Control	20	60.85	7.11	68.10	7.02

Table 2 shows similar descriptive pretest means across groups, although mean similarity alone does not establish statistical baseline equivalence. In religious moderation, experimental and control pretest means were 72.48 and 71.95, respectively, compared with posttest means of 84.76 and 76.35. In critical thinking, the corresponding pretest means were 61.43 and 60.85 and posttest means were 79.52 and 68.10. The design therefore supports descriptive comparison of observed change, subject to possible initial group differences. Regarding religious moderation attitudes, the experimental group exhibited a mean increase of 12.28 points, compared with an increase of 4.40 points in the control group. Meanwhile, critical thinking skills increased by 18.09 points in the experimental group and 7.25 points in the control group. These descriptive findings suggest that mathematics learning based on Aswaja An-Nahdliyah values was associated with greater improvements than regular mathematics instruction.

3.2. Statistical Assumption Tests

Prior to hypothesis testing, the data were examined for normality and homogeneity of variance. These tests were conducted at a significance level of 5% ($\alpha = 0.05$), in accordance with the statistical analysis procedures established in this study.

Table 3. Results of the Normality Test

Variable	Group	Shapiro–Wilk W	Sig.	Interpretation
Religious Moderation Attitudes	Exp.	0.962	0.548	Normal
Religious Moderation Attitudes	Control	0.957	0.491	Normal
Critical Thinking Skills	Exp.	0.948	0.312	Normal
Critical Thinking Skills	Control	0.951	0.352	Normal

Table 4. Results of the Homogeneity of Variance Test

Variable	Levene Statistic	Sig.	Interpretation
Religious Moderation Attitudes	0.286	0.596	Homogeneous
Critical Thinking Skills	0.174	0.679	Homogeneous

The Shapiro–Wilk test results indicate that all significance values exceeded 0.05. Therefore, the data on religious moderation attitudes and critical thinking skills in both groups met the normality assumption. The homogeneity of variance test yielded significance values of 0.596 for religious moderation attitudes and 0.679 for critical thinking skills. Since both values exceeded 0.05, the variances of the two groups were considered homogeneous.

3.3. Effect of Mathematics Learning on Religious Moderation Attitudes

The first hypothesis was tested to determine the effect of mathematics learning based on Aswaja An-Nahdliyah values on students' religious moderation attitudes. Based on changes between pretest and posttest scores, the experimental group demonstrated greater improvement than the control group.

Table 5. Results of the Difference Test for Religious Moderation Attitudes

Group	Pretest Mean	Posttest Mean	Gain	t	Sig. (2-tailed)	Cohen's d
Exp.	72.48	84.76	12.28	4.38	<0.001	1.37
Control	71.95	76.35	4.40	—	—	—

For religious moderation attitudes, the reported experimental-group mean gain was 12.28 points, compared with 4.40 in the control group, a descriptive difference in gain of 7.88 points. The original analysis reports $t = 4.38$, $p < .001$, and Cohen's $d = 1.37$. This indicates a substantial reported between-group contrast, but interpretation of the exact inferential comparison requires confirmation of the tested outcome (gain or posttest), degrees of freedom, and effect-size denominator from the original output. Substantively, this improvement suggests that integrating Aswaja An-Nahdliyah values into mathematics learning activities has the potential to provide educational experiences that emphasize not only academic achievement but also the development of respect for differences, dialogue, collaboration, and consideration of diverse perspectives. This approach is consistent with the instructional design implemented in the study, which integrated these values through problem-solving, discussions, argumentation, collaborative activities, respect for differing opinions, and learning reflection.

3.4. Effect of Mathematics Learning on Critical Thinking Skills

The second hypothesis was tested to examine the effect of mathematics learning based on Aswaja An-Nahdliyah values on students' critical thinking skills.

Table 6. Results of the Difference Test for Critical Thinking Skills

Group	Pretest Mean	Posttest Mean	Gain	t	Sig. (2-tailed)	Cohen's d
Exp.	61.43	79.52	18.09	5.02	<0.001	1.57
Control	60.85	68.10	7.25	—	—	—

For critical thinking, the experimental group gained 18.09 points versus 7.25 points in the control group, a descriptive difference in gain of 10.84 points. The reported test yielded $t = 5.02$, $p < .001$, and Cohen's $d = 1.57$. As for the attitude outcome, these statistics are retained from the source document and should be checked against the underlying analysis to establish the exact test specification and confidence intervals before submission. These results indicate that mathematics learning based on Aswaja An-Nahdliyah values can contribute to the development of students' critical thinking skills. The integration of problem analysis, justification, strategy evaluation, discussions, and conclusion-drawing provides opportunities for students not only to obtain correct answers but also to justify and critically examine their reasoning processes. This is consistent with the characteristics of critical thinking skills emphasized in the study.

3.5. Summary of Hypothesis Testing

Table 7. Summary of Hypothesis Testing Results

No.	Hypothesis	Test Statistic	Sig.	Effect Size	Decision
H1	Mathematics learning based on Aswaja An-Nahdliyah values affects students' religious moderation attitudes.	t = 4.38	<0.001	1.37	Supported
H2	Mathematics learning based on Aswaja An-Nahdliyah values affects students' critical thinking skills.	t = 5.02	<0.001	1.57	Supported

Overall, the findings demonstrate that mathematics learning based on Aswaja An-Nahdliyah values had a positive and statistically significant effect on students' religious moderation attitudes and critical thinking skills. The effect size for critical thinking skills was slightly larger than that for

religious moderation attitudes. These findings reinforce the notion that mathematics learning can be developed as an integrative educational setting that connects cognitive competency development with character formation. In this study, Aswaja An-Nahdliyah values were not introduced merely as supplementary learning content but were embedded in students' learning experiences through problem-solving, argumentation, group interactions, respect for differences, and reflection. Thus, the findings suggest that values-based mathematics learning can serve as an alternative pedagogical approach to simultaneously develop students' critical thinking skills and strengthen their religious moderation attitudes. These results are consistent with the primary objective of the study, which was to examine the effects of mathematics learning based on Aswaja An-Nahdliyah values on both dimensions within a single instructional framework.

DISCUSSION

The observed gains in both outcomes are consistent with the possibility that combining mathematical justification, dialogic learning, and Aswaja An-Nahdliyah values supports both cognitive and affective learning. However, the two outcomes should not be conflated. Reasoning tasks and argument evaluation provide a more direct pedagogical pathway to critical thinking, whereas respect for different opinions and cooperative discussion may support moderate classroom attitudes. Prior studies of Aswaja education foreground character and social harmony (Hana et al., 2023; Istiyani & Wibowo, 2020), while research on mathematics pedagogy focuses more directly on critical thinking (Angraini & Wahyuni, 2021; Barbosa & Vale, 2021). The current study contributes a joint assessment of these domains; it cannot isolate which component of the combined intervention produced each change. The experimental group's larger attitude gain and the reported large effect size ($d = 1.37$) accord with the proposed role of tolerance, balance, and dialogic engagement in values-oriented education. Unlike studies focused on religious-education settings, the intervention was delivered through mathematics activities. Nevertheless, the increase may also reflect teacher facilitation, greater opportunities for group discussion, social-desirability responses on the attitude scale, or differences in learning exposure, which this design did not separately measure. Thus, the result warrants a context-sensitive interpretation rather than a universal effectiveness claim. The experimental group also had a larger critical-thinking gain, with a reported $d = 1.57$, consistent with research stressing mathematical argumentation and evaluation of solution strategies (Angraini & Wahyuni, 2021; Barbosa & Vale, 2021). The contrast between prior disciplinary emphases is important: gains in critical thinking may stem from inquiry-rich mathematical tasks independently of the explicitly religious value content. Limitations include a small sample ($N = 41$), nonrandom group assignment, incomplete reporting of the setting and treatment duration, and lack of fully documented instrument psychometrics and test specifications. No follow-up measurement was presented, so persistence of the observed changes is unknown. Larger multi-site studies should document intervention fidelity, distinguish effects of pedagogical activities from value integration, and use baseline-adjusted models and longer-term follow-up where appropriate.

4. CONCLUSION

In this sample of 41 students, the group receiving mathematics instruction integrated with Aswaja An-Nahdliyah values showed larger pretest–posttest improvements in religious moderation attitudes (12.28 versus 4.40 points) and mathematical critical thinking (18.09 versus 7.25 points) than the comparison group. The article reports significant group contrasts and large effect sizes ($d = 1.37$ and 1.57). These findings suggest the approach is promising for jointly supporting affective and cognitive outcomes within the studied setting. However, the quasi-experimental design, small sample, unspecified setting and treatment details, and unverified statistical reporting limit causal interpretation and generalizability. Future research should specify sampling and implementation

procedures, report complete measurement and inferential evidence, control baseline differences, and evaluate whether effects remain after instruction.

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