ISSN 2776-5229

The Effectiveness of Contextual Mathematics Learning Based on Religious Moderation in Improving Students' Numeracy Literacy and Tolerance Attitudes

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ARTICLE INFO

Article history
Received September 23, 2026
Revised October 29, 2026
Accepted November 17, 2026

Keywords: Critical Thinking, Integration of Values, Religious Moderation, Mathematics Learning, Tasamuh, Tawassuth, Tawazun, I'tidal.

ABSTRACT

This quasi-experimental study examined the effects of integrating four Aswaja An-Nahdliyah values tawassuth (moderation), tawazun (balance), tasamuh (tolerance), and i'tidal (justice) into mathematics instruction on students' critical thinking skills and religious moderation attitudes. A pretest–posttest control-group design involved 60 students from existing classes (30 experimental and 30 control). The experimental group engaged in contextual problem-solving, argumentation, collaborative discussion, and reflection that explicitly incorporated the four values; the control group followed regular instruction. Critical thinking was measured using a test and religious moderation attitudes using a questionnaire. The experimental group had higher mean gains than the control group in critical thinking (22.84 vs 12.76 points) and religious moderation attitudes (13.84 vs 6.13 points). Reported N-gains were 0.55 vs 0.30 and 0.49 vs 0.22, respectively. Multivariate results (Wilks' $\Lambda = 0.616$, $F = 17.70$, $p < 0.001$) and univariate analyses were statistically significant. The results support the potential of integrating values-based interactions into mathematics instruction, although the quasi-experimental design limits causal generalization.

1. INTRODUCTION

Mathematics education develops reasoning, analysis, and evidence-based decision-making in addition to procedural competence (Aizikovitsh-udi & Cheng, 2015; Baharin et al., 2018; Dashteh et al., 2024). Critical thinking requires learners to examine information, compare strategies, evaluate arguments, and justify conclusions (Barbosa & Vale, 2021; Karjanto & Acelajado, 2022). Instruction involving open-ended tasks, collaborative explanations, and reflection can make these processes visible, while also providing occasions for respectful exchanges of differing ideas (Crismono et al., 2025; Karjanto & Acelajado, 2022; Mujiasih, 2018). In Indonesia's religiously and culturally diverse educational context, religious moderation is also an important educational concern (Alifia & Saputro, 2019; Bora, 2020; Crismono et al., 2025; Handajani et al., 2018). Aswaja An-Nahdliyah frames moderation through tawassuth, tawazun, tasamuh, and i'tidal, emphasizing proportionate judgment, balance, tolerance, and fairness(Alatas et al., 2026; Halid, 2019; Hana et al., 2023; Istiyani & Wibowo, 2020; Mizani, 2022). These principles can be enacted in mathematics classrooms through fair appraisal of arguments, openness to different solution methods, and responsible collective reasoning rather than through decorative religious terminology alone (Alrawili, 2024; Barbosa & Vale, 2021; Biber et al., 2013; Mariana & Kristanto, 2023). Previous mathematics studies have generally evaluated critical thinking in connection with instructional strategies, while research on religious moderation has commonly centered on religious or character education (Alkaf, 2020; Amal, 2020; Amin Abdullah, 2014; Deri Saputra & Andarweni Astuti, 2022; Hakim et al., 2022; Tanjung, 2022). The specific gap addressed here is empirical evaluation of an explicitly values-integrated mathematics intervention against two distinct outcomes simultaneously: mathematical critical

 ISSN 2776-5229

thinking and religious moderation attitudes. Compared with studies focused on one cognitive or socio-religious outcome, this study evaluates both using an experimental control comparison. The novelty is the operationalization of four values through the mathematical reasoning process not a claim that either values-based education or collaborative problem-solving is entirely new (Arlianty, 2020; Murnaka, 2023; Saifuddin et al., 2025). The study therefore asks whether the group experiencing values-integrated mathematics learning demonstrates different improvements in critical thinking skills and religious moderation attitudes compared with the group receiving regular instruction.

2. METHODS

The study adopted a quantitative quasi-experimental pretest–posttest control-group design using existing school classes rather than randomized individual assignment. Sixty students participated: 30 in the experimental group and 30 in the control group (Creswell, 2010; Crismono, 2024). Both groups completed pretests and posttests for critical thinking and religious moderation attitudes. The treatment combined contextual mathematical problems, comparison and justification of solution strategies, collaborative discussion, and reflection. Tawassuth was operationalized as proportionate claims supported by reasoning; tawazun as consideration of alternative evidence and strategies; tasamuh as respect for differences in contributions; and i'tidal as fair evaluation of mathematical arguments. The control group followed regular mathematics lessons (Crismono, 2025; Mauá et al., 2020).

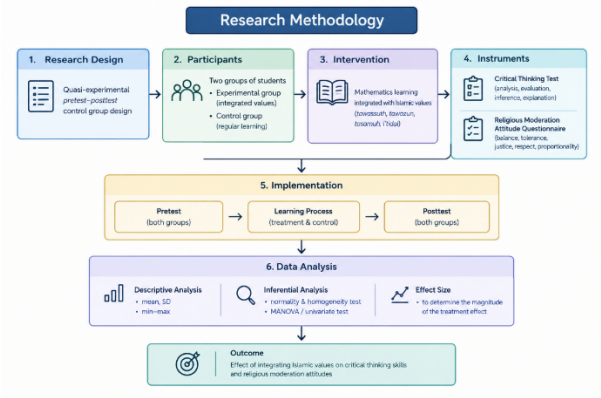


Figure 1. Research Methodology Framework for Integrating Islamic Values into Mathematics Learning

Critical thinking skills were measured with a test covering information analysis, argument evaluation, strategy comparison, and logical justification. Religious moderation attitudes were assessed with a questionnaire addressing balance, tolerance, fairness, and respect for differences. The submitted manuscript does not provide item counts, scale anchors, validation coefficients, reliability statistics, the school/grade, implementation duration, or teacher-fidelity records. These must be supplied from the original study records before submission; they cannot be inferred from aggregate results (Arikunto, 2021; Crismono, 2023).

3. RESULTS AND DISCUSSION

3. 1. Description of Research Data

The study involved 60 students divided into two groups, comprising 30 students in the experimental group and 30 students in the control group. The experimental group received mathematics instruction integrating the values of tawassuth, tawazun, tasamuh, and i'tidal, while the

control group received mathematics instruction using a regular teaching approach. The research data consisted of critical thinking skills and religious moderation attitudes, both of which were measured before and after the instructional intervention.

Table 1. Descriptive Statistics of Critical Thinking Skills

Group	N	Pretest Mean	SD	Posttest Mean	SD
Experimental	30	58.43	8.21	81.27	7.14
Control	30	57.87	7.96	70.63	8.02

The descriptive analysis showed that the initial mean critical thinking score was 58.43 for the experimental group and 57.87 for the control group. These findings indicate that the two groups had relatively comparable initial abilities. Following the intervention, the mean critical thinking score in the experimental group increased to 81.27, whereas the control group achieved a mean score of 70.63. Accordingly, the experimental group demonstrated a mean improvement of 22.84 points, compared with 12.76 points in the control group. These results suggest that mathematics instruction integrating the values of tawassuth, tawazun, tasamuh, and i'tidal produced greater improvements in critical thinking skills than regular mathematics instruction.

Table 2. Descriptive Statistics of Religious Moderation Attitudes

Group	N	Pretest Mean	SD	Posttest Mean	SD
Experimental	30	71.83	6.47	85.67	5.21
Control	30	72.10	6.15	78.23	6.02

Regarding religious moderation attitudes, the initial mean score was 71.83 in the experimental group and 72.10 in the control group. After the instructional intervention, the mean score increased to 85.67 in the experimental group and 78.23 in the control group. Thus, the experimental group achieved a mean improvement of 13.84 points, whereas the control group demonstrated an improvement of 6.13 points. This difference suggests that integrating the values of tawassuth, tawazun, tasamuh, and i'tidal may contribute positively to the development of students' religious moderation attitudes.

3. 2. Results of the Normality Test

The normality of the data was assessed using the Shapiro–Wilk test at a significance level of 0.05.

Table 3. Results of the Normality Test

Variable	Group	Statistic	Sig.	Interpretation
Critical Thinking Skills	Experimental	0.965	0.414	Normal
Critical Thinking Skills	Control	0.971	0.573	Normal
Religious Moderation Attitudes	Experimental	0.957	0.267	Normal
Religious Moderation Attitudes	Control	0.968	0.481	Normal

The Shapiro–Wilk test results showed that all significance values exceeded 0.05. Therefore, the data on critical thinking skills and religious moderation attitudes in both groups were considered normally distributed, satisfying one of the assumptions required for parametric statistical analysis.

3. 3. Results of the Homogeneity Test

The homogeneity test was conducted to examine the equality of variances between the experimental and control groups. Levene's test produced significance values of 0.392 for critical thinking skills and 0.475 for religious moderation attitudes. Since both values exceeded 0.05, the variances between the experimental and control groups were considered homogeneous.

Table 4. Results of the Homogeneity of Variance Test

Variable	Levene's Statistic	Sig.	Interpretation
Critical Thinking Skills	0.742	0.392	Homogeneous
Religious Moderation Attitudes	0.516	0.475	Homogeneous

3. 4. Improvement in Critical Thinking Skills

Normalized gain (N-Gain) analysis was conducted to determine the extent of improvement in students' critical thinking skills.

Table 5. N-Gain Results for Critical Thinking Skills

Group	Pretest Mean	Posttest Mean	N-Gain	Category
Experimental	58.43	81.27	0.55	Moderate
Control	57.87	70.63	0.30	Moderate

The analysis showed that the N-Gain score for critical thinking skills was 0.55 in the experimental group and 0.30 in the control group. Although both groups were classified in the moderate improvement category, the experimental group demonstrated a greater improvement than the control group. This difference suggests that instructional activities involving problem analysis, consideration of alternative solutions, discussion, argumentation, and reflection provide students with greater opportunities to develop their critical thinking skills.

3. 5. Improvement in Religious Moderation Attitudes

Table 6. N-Gain Results for Religious Moderation Attitudes

Group	Pretest Mean	Posttest Mean	N-Gain	Category
Experimental	71.83	85.67	0.49	Moderate
Control	72.10	78.23	0.22	Low

The N-Gain score for religious moderation attitudes was 0.49 in the experimental group and 0.22 in the control group. These results indicate that the improvement in religious moderation attitudes was greater in the experimental group than in the control group. This improvement is consistent with instructional practices that encourage students to respect different problem-solving strategies, listen to their peers' arguments, consider multiple perspectives, and make decisions based on reasoning and evidence.

3. 6. Results of the Multivariate Analysis

Since the study involved two dependent variables, namely critical thinking skills and religious moderation attitudes, multivariate analysis was conducted to examine the simultaneous effects of the instructional intervention.

Table 7. Results of the Multivariate Analysis

Statistic	Value	F	Sig.	Partial Eta Squared
Pillai's Trace	0.384	17.70	<0.001	0.384
Wilks' Lambda	0.616	17.70	<0.001	0.384
Hotelling's Trace	0.623	17.70	<0.001	0.384
Roy's Largest Root	0.623	17.70	<0.001	0.384

The multivariate analysis yielded a Wilks' Lambda value of 0.616, with an F-value of 17.70 and a significance level of $p < 0.001$. Since the significance value was below 0.05, the results indicate a statistically significant difference between the experimental and control groups in the combined outcomes of critical thinking skills and religious moderation attitudes. The partial eta squared value of 0.384 indicates a relatively strong effect of the instructional intervention on the combined dependent variables. These findings suggest that integrating the values of tawassuth, tawazun,

tasamuh, and i'tidal into mathematics instruction simultaneously influences students' critical thinking skills and religious moderation attitudes.

3. 7. Results of the Univariate Analysis

Table 8. Results of the Univariate Analysis

Variable	F	Sig.	Partial Eta Squared	Interpretation
Critical Thinking Skills	28.64	<0.001	0.332	Significant
Religious Moderation Attitudes	19.87	<0.001	0.259	Significant

Further analysis was conducted to examine the effects of the instructional intervention on each dependent variable separately. The univariate analysis revealed a statistically significant effect on critical thinking skills, with an F-value of 28.64 and $p < 0.001$. The partial eta squared value of 0.332 indicates a relatively strong effect of values-integrated mathematics instruction on students' critical thinking skills. For religious moderation attitudes, the analysis yielded an F-value of 19.87 and $p < 0.001$. The partial eta squared value of 0.259 similarly indicates a relatively strong effect on students' religious moderation attitudes.

3. 8. Summary of Hypothesis Testing

Table 9. Summary of Hypothesis Testing Results

No.	Hypothesis	Sig.	Decision
1	The integration of tawassuth, tawazun, tasamuh, and i'tidal values affects students' critical thinking skills.	<0.001	Supported
2	The integration of tawassuth, tawazun, tasamuh, and i'tidal values affects students' religious moderation attitudes.	<0.001	Supported
3	The integration of tawassuth, tawazun, tasamuh, and i'tidal values simultaneously affects students' critical thinking skills and religious moderation attitudes.	<0.001	Supported

Overall, the findings indicate that mathematics instruction integrating the values of tawassuth, tawazun, tasamuh, and i'tidal resulted in greater improvements in students' critical thinking skills and religious moderation attitudes compared with regular mathematics instruction. These values were integrated through problem-solving activities, discussions, argumentation, collaboration, and reflection. Tawassuth was implemented by encouraging students to adopt proportionate positions based on reasoning and evidence; tawazun through the consideration of various sources of information and alternative solutions; tasamuh through respect for differences in problem-solving strategies and opinions; and i'tidal through the fair use of reasoning and evidence in evaluating arguments. These forms of integration were consistent with the instructional intervention described in the research methodology. The findings suggest that values-based mathematics instruction not only has the potential to enhance cognitive competencies, particularly critical thinking skills, but can also provide a learning environment that fosters moderate attitudes when encountering differences.

DISCUSSION

The higher critical-thinking gain in the experimental group is compatible with learning activities that require students to compare alternatives, defend reasoning, and assess evidence. Such activities align with scholarship on mathematical critical thinking and dialogic problem-solving (Aizikovitsh-udi & Cheng, 2015; Alifia & Saputro, 2019; Baharin et al., 2018). The moderation-attitude pattern is likewise compatible with structured opportunities to listen, disagree respectfully, and deliberate fairly, echoing the educational role attributed to the Aswaja values (Halid, 2019; Hana

et al., 2023; Istiyani & Wibowo, 2020; Mizani, 2022). The distinctive contribution of this study lies in placing these two outcome domains within a single quasi-experimental mathematics setting and making the four values visible in classroom tasks. Unlike work that treats religious moderation as a separate instructional subject, the present intervention uses the practice of reasoning itself as a context for moderation. Nevertheless, the group differences cannot isolate the values component from associated instructional changes such as more discussion, collaboration, novelty, or teacher engagement. A comparison group receiving identical problem-solving pedagogy without explicit values integration would better identify the additional contribution of Aswaja values. Important limitations include the nonrandomized classes, limited sample of 60 students, lack of reported institutional/grade characteristics, unspecified intervention duration, and missing instrument-validity and reliability coefficients. The manuscript also lacks full statistical output (degrees of freedom, covariance assumptions, model specification). Affective self-report may be susceptible to social-desirability bias. Findings should therefore be interpreted as evidence from the studied sample rather than proof of general effectiveness across educational settings.

4. CONCLUSION

In the reported quasi-experimental comparison (30 students per group), contextual mathematics learning that integrated tawassuth, tawazun, tasamuh, and i'tidal was associated with larger gains in critical thinking (22.84 versus 12.76 points) and religious moderation attitudes (13.84 versus 6.13 points) than regular instruction. The reported multivariate and univariate differences were statistically significant. These results suggest that structured mathematical argumentation and values-based classroom interaction may support cognitive and socio-affective learning together. However, group allocation was nonrandomized and several essential methodological and statistical details remain undocumented. Future research should use better-matched controls, more diverse samples, validated measures, treatment-fidelity records, and longitudinal follow-up to determine whether benefits persist and whether values integration adds effects beyond active pedagogy.

5. REFERENCES

Aizikovitsh-udi, E., & Cheng, D. (2015). Developing Critical Thinking Skills from Dispositions to Abilities : Mathematics Education from Early Childhood to High. *Scientific Research Publishing*, *6*(March), 455–462.

Alatas, M., Crismono, P. C., Faisol, A., & Yakoh, M. (2026). Integrating Religious Moderation Values into Islamic STEM Education : Its Impact on Students ' Critical Thinking Skills and Scientific Literacy. *EDUSOSHUM Journal of Islamic Education and Social Humanities*, *6*(2), 1443–1454.

Alifia, N. N., & Saputro, D. R. S. (2019). Mathematical critical thinking skills profile of high school students in solving linear program word problems. In D. null (Ed.), *Journal of Physics: Conference Series* (Vol. 1211, Issue 1). Institute of Physics Publishing. https://doi.org/10.1088/1742-6596/1211/1/012101

Alkaf, M. (2020). Agama, Sains, Dan Covid-19: Perspektif Sosial-Agama [Religion, Science and Covid-19: Socio-Religious Perspectives]. *Maarif*, *15*(1), 93–108.

Alrawili, K. S. R. (2024). The Effect of Phenomena-Based Education on Developing Lateral Thinking Skills Among Science Students. *International Journal of Science, Mathematics and Technology Learning*, *32*(1), 155–171. https://doi.org/10.18848/2327-7971/CGP/v32i01/155-171

Amal, M. K. (2020). Anti-Shia mass mobilization in Indonesia's democracy: Godly alliance, militant

groups and the politics of exclusion. *Indonesian Journal of Islam and Muslim Societies*, *10*(1). https://doi.org/10.18326/ijims.v10i1.25-48

Amin Abdullah, M. (2014). Religion, science and culture: An integrated, interconnected paradigm of science. *Al-Jami'ah*, *52*(1), 175–203. https://doi.org/10.14421/ajis.2014.521.175-203

Arikunto, S. (2021). *Penelitian Tindakan Kelas: Edisi Revisi*. Bumi Aksara.

Arlianty, W. N. (2020). Analysis of students' understanding ability in scientific writing technique course. In *AIP Conference Proceedings* (Vol. 2229). https://doi.org/10.1063/5.0002912

Baharin, N., Kamarudin, N., & Manaf, U. K. A. (2018). Integrating STEM Education Approach in Enhancing Higher Order Thinking Skills. *International Journal of Academic Research in Business and Social Sciences*, *8*(7), 810–821. https://doi.org/10.6007/ijarbss/v8-i7/4421

Barbosa, A., & Vale, I. (2021). Exploring the potential of the outdoors with digital technology in Teacher Education. *... and Innovation in Learning, Teaching and Education ...*. https://doi.org/10.1007/978-3-030-73988-1_3

Biber, A. C., Tuna, A., & Incikabi, L. (2013). An investigation of critical thinking dispositions of mathematics teacher candidates. *Educational Research*, *4*(February), 109–117.

Bora, A. (2020). Critical Thinking and Creative Thinking as the Focus on Mathematics Education. *International Journal of Scientific Development and Research (IJSDR)* , *5*(3), 235–241. www.ijsdr.org235

Creswell, J. W. (2010). Research design pendekatan kualitatif, kuantitatif, dan mixed. *Yogyakarta: Pustaka Pelajar*.

Crismono, P. C. (2023). *Statistik Pendidikan: untuk penelitian dengan pendekatan kuantitatif baik parametric maupun nonparametrik dan dilengkapi dengan penggunaan SPSS*. UIJ Kyai Mojo.

Crismono, P. C. (2024). *Metode Penelitian Pendidikan : Pendekatan Kuantitatif, Kualitatif, Ptk, dan Penelitian Pengembangan* (F. Hanifiyah & I. Erdiansyah (eds.)). KHD Production.

Crismono, P. C. (2025). *Statistik Pendidikan* (A. N. Budiono (ed.); I). Nanopedia.

Crismono, P. C., Hudi, S., Ilyas, M., Yanuardianto, E., Dahri, H., & Yakoh, M. (2025). Rethinking Religious Influence on Mathematics Learning Behavior : A Mathematical Model of Planned Behavior amid Shifting Educational Paradigms. *Bidayatuna : Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, *08*(01), 79–98. https://doi.org/10.54471/bidayatuna.v8i1.3298

Dashteh, A. H., Nourian, M., & Asgarpour, S. (2024). Validation of the model of factors affecting creative activities of students in mathematics course in the secondary school. *Thinking and Children*. https://fabak.ihcs.ac.ir/article_9459.html

Deri Saputra, & Andarweni Astuti. (2022). Moderasi Beragama Dalam Pandangan Abdulrahman Wahid (Gus Dur) Dan Muhammad Jusuf Kalla Dalam Perspektif Kebhinekaan. *Prosiding Seminar Nasional Pendidikan Dan Agama*, *3*(2), 1–12. https://doi.org/10.55606/semnaspa.v3i2.134

Hakim, M. L., Hidayat, M. T., & Sifa, Mu. (2022). Implementasi Prinsip Prinsip Aswaja Dalam Pendidikan Untuk Memperkokoh Karakter Bangsa Dan Mewujudkan Entitas Nkri. *Al-Fikr: Jurnal Pendidikan Islam*, *8*(1), 10–18. https://doi.org/10.32489/alfikr.v8i1.260

Halid, A. (2019). *Analisis Khittah Nahdliyah sebagai membentengi Aqidah Aswaja dan NKRI dari gerakan kelompok Sesat*. UIJ Kyai Mojo.

Hana, M. Y., Mahmud, M. E., & Ridani, A. (2023). Internalisasi Nilai Ahlussunnah Waljama ' ah An -Nahdliyyah dalam Penguatan Moderasi Beragama Pada Pondok Pesantren. *Borneo Journal of Islamic Education*, *3*(2), 269–281.

Handajani, S., Pratiwi, H., & Mardiyana, M. (2018). The 21st century skills with model eliciting activities on linear program. In D. null (Ed.), *Journal of Physics: Conference Series* (Vol. 1008, Issue 1). Institute of Physics Publishing. https://doi.org/10.1088/1742-6596/1008/1/012059

Istiyani, D., & Wibowo, A. M. (2020). Internalizing nationalism awareness in early childhood islamic education institution with the spirit of Aswaja an-Nahdliyah. *Analisa: Journal of Social Science …*. https://journal.blasemarang.id/index.php/analisa/article/view/1168

Karjanto, N., & Acelajado, M. J. (2022). Sustainable Learning, Cognitive Gains, and Improved Attitudes in College Algebra Flipped Classrooms. *Sustainability (Switzerland)*, *14*(19), 1–18. https://doi.org/10.3390/su141912500

Mariana, E. P., & Kristanto, Y. D. M. (2023). Integrating STEAM Education and Computational Thinking: Analysis of Students' Critical and Creative Thinking Skills in an Innovative Teaching and Learning. *Southeast Asia Mathematics Education Journa*, *13*(1), 1–18.

Mauá, D. D., Ribeiro, H. R., Katague, G. P., & Antonucci, A. (2020). Two Reformulation Approaches to Maximum-A-Posteriori Inference in Sum-Product Networks. In J. M. & N. T.D. (Eds.), *Proceedings of Machine Learning Research* (Vol. 138, pp. 293–304). ML Research Press. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85128570018&partnerID=40&md5=03bdf0e29225590a4253f380e836e351

Mizani, Z. M. (2022). Inclusive-Pluralistic Islamic Religious Education Model As an Alternative To Investing the Values of Religious Moderation. *Muslim Heritage*, *7*(2), 487–504. https://doi.org/10.21154/muslimheritage.v7i2.5018

Mujiasih. (2018). Growing geometric reasoning in solving problems of analytical geometry through the mathematical communication problems to state Islamic university students. In *Journal of Physics: Conference Series* (Vol. 983, Issue 1). https://doi.org/10.1088/1742-6596/983/1/012159

Murnaka, N. P. (2023). Need assessment: Development of 6C skills-oriented interactive mathematics teaching materials for senior high school students. In *AIP Conference Proceedings* (Vol. 2734, Issue 1). https://doi.org/10.1063/5.0156481

Saifuddin, T., Yousuf, U., Jabeen, S., & Matloob, F. (2025). A Comparative Study Of Student Centered -Interactive Teaching Strategies And Traditional Approaches In History Education. *Policy Research Journal*, *3*(3). https://doi.org/10.5281/zenodo.15043632

Tanjung, S. R. (2022). Implementasi Moderasi Beragama pada Program kerukunan Umat Beragama dan Layanan Kehidupan Umat Beragama. *Kompetensi*, *7*(1), 17–28. https://doi.org/10.47655/kompetensi.v7i1.22