



SUPPLEMENTARY MATERIAL

Humanizing Artificial Intelligence for Muslim Community Development: Synthesis of Love-Based Curriculum Practices in Indonesian Madrasahs

Search Strategy, Screening, Coding, Appraisal, and Evidence Matrices

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1. SUPPLEMENTARY OVERVIEW

This supplement accompanies the structured literature synthesis and interpretive framework presented in the manuscript. Numerical study-selection results are reproduced as reported in the article. The 48-record bibliographic register in Appendix S1 is a separate candidate resource and is not presented as a verified list of the 48 studies selected in the original PRISMA process.

SUPPLEMENTARY DOCUMENTATION GUIDE

Sections S1–S4 document the review questions, information sources, search expression, PRISMA 2020 selection totals, eligibility criteria, and nine-domain data-extraction framework. The PRISMA numbers are reproduced from the manuscript and reconcile arithmetically. They do not independently verify the original database exports, individual screening decisions, or the identity of each included study.

Sections S5–S7 set out the evidentiary distinctions and proposed interpretive framework. They separate findings about AI-supported educational practices from findings about Love-Based Curriculum (LBC) values, and distinguish both from studies that directly examine AI–LBC integration. Three propositions identify decisions and outcomes for future empirical assessment: teachers' review of AI output, learners' reflective dialogue, and communities' participation in shared decisions.

SOURCE REGISTER AND REPORTING LIMITS

Appendix S1 presents 48 bibliographic candidate records with DOI links and provisional source categories. The register is a tool for checking source identity and relevance, not a verified study-level list of the 48 records reported as included in the PRISMA flow diagram. A candidate reference should therefore not be treated as an included study without a documented eligibility decision.

The original database search exports, dated search histories, individual title/abstract and full-text screening logs, completed extraction records, and study-by-study quality appraisal judgments are not supplied here. As a result, independent reproduction of the reported corpus is not yet possible from these materials alone. The source register and framework can guide future verification, while claims about study effects, combined AI–LBC outcomes, or community empowerment must remain within the limits of the documented evidence.

S1. REVIEW QUESTIONS

Table S1. Research questions and corresponding supplementary documentation

ID	Review question	Documentation
RQ1	What AI technologies and pedagogical functions are reported in Indonesian madrasahs and related Islamic educational contexts?	S4; S6;
RQ2	Which LBC values provide criteria for guiding AI-supported educational practices?	S4; S6
RQ3	What educational, relational, and community outcomes are discussed, and how directly can they be attributed to AI-LBC integration?	S5; S6
RQ4	What roles, implementation conditions, and testable propositions can be derived for human-centered Muslim community development?	S6; S7

S2. SEARCH SOURCES AND SEARCH STRATEGY

The manuscript identifies Scopus, Web of Science, Dimensions, Google Scholar, and DOAJ as information sources. The following record distribution is reproduced from the PRISMA diagram accompanying the revised manuscript.

Table S2. Records identified by information source

Database/source	Records (n)	Share of identified records
Scopus	520	41.7%
Web of Science	321	25.7%
Dimensions	238	19.1%
Google Scholar	169	13.5%
DOAJ	0	0.0%
Total	1,248	100.0%

MASTER BOOLEAN SEARCH STRING

("Artificial Intelligence" OR "AI" OR "machine learning" OR "generative AI" OR chatbot OR "learning analytics") AND ("Love-Based Curriculum" OR "love-based education" OR compassion OR empathy OR "moral education") AND (madrasah OR "Islamic school" OR "Islamic education") AND ("community development" OR empowerment OR "Muslim community").

S3. PRISMA 2020 STUDY SELECTION

The reported PRISMA totals are internally reconcilable: $1,248 - 312 = 936$; $936 - 675 = 261$; $261 - 37 = 224$; and $224 - 176 = 48$.

Table S3. Reported selection counts and reconciliation

Selection action	n	Denominator / calculation
Records identified	1,248	$520 + 321 + 238 + 169 + 0$
Duplicate records removed	312	1,248 initial records
Records screened	936	$1,248 - 312$
Records excluded at title/abstract	675	936 screened records
Reports sought for retrieval	261	$936 - 675$
Reports not retrieved	37	261 sought reports
Full texts assessed for eligibility	224	$261 - 37$
Full-text reports excluded	176	224 assessed reports
Studies included in synthesis	48	$224 - 176$

Table S4. Reported reasons for full-text exclusion

Reason for exclusion	n	Share of 176 exclusions
Non-empirical or no quantitative data	62	35.2%
No clear AI application	41	23.3%
No LBC or value-based outcomes	43	24.4%
Outside the Indonesian madrasah or Islamic education context	24	13.6%
Insufficient data for extraction	6	3.4%

Reason for exclusion	n	Share of 176 exclusions
Total	176	100.0%

Note. Totals reproduce the article and establish arithmetic consistency, not independent verification of the original screening decisions or the identity of the included reports. The flow diagram itself is Figure 1 in the main manuscript.

S4. ELIGIBILITY CRITERIA AND DATA EXTRACTION

The reported eligibility criteria covered AI use in education, Islamic or madrasah contexts, at least one value-based/LBC dimension, identifiable learning or empowerment outcomes, and extractable methodological information. The manuscript states that included studies met “all or most” criteria; a formal exception rule is not supplied. Qualitative evidence is retained for descriptive interpretation where relevant.

Table S5. Nine-domain data extraction codebook

Domain	Variables or coding indicators
1. Bibliographic metadata	Author(s), publication year, country, journal, publication type
2. Study methodology	Research design, sample size, instruments, analysis approach
3. AI technology	Generative AI, machine learning, chatbots, learning analytics, adaptive learning, NLP, automation
4. Educational context	Madrasah level, subject, population/learner characteristics
5. LBC dimensions	Empathy, compassion, moral reasoning, spiritual awareness, self-regulation, social engagement
6. Educational outcomes	Engagement, motivation, achievement, personalization, well-being
7. Community outcomes	Digital participation, religious services, community engagement, empowerment
8. Quantitative evidence	Reported mean, SD, correlation, regression coefficient, p-value, CI, or effect size
9. Methodological quality	Study-design-appropriate JBI appraisal, limitations, evidence credibility

The manuscript describes independent coding by two researchers with disagreements resolved through discussion and re-examination of sources. Item-level coding decisions, consensus logs, and inter-rater agreement statistics are not included in the material available for this supplement.

S5. EVIDENCE APPRAISAL AND ATTRIBUTION

Table S6. Evidence categories and limits of interpretation

Evidence category	Required connection	Permissible conclusion
AI application evidence	A specified AI function and an educational practice or outcome	Describes the AI-related function/outcome; does not isolate an LBC contribution
LBC or value-based practice evidence	A defined curricular value enacted through educational activities	Describes the value-based practice; does not isolate an AI contribution
Direct AI–LBC integration evidence	AI tool, LBC criteria, implementation process, and outcome jointly assessed	May inform integration-specific interpretation, conditional on study design
Community empowerment evidence	Community input, influence on decisions, and evidence of collective capability or benefit	May support community-level claims; classroom engagement alone is insufficient

Risk of bias is interpreted with design-appropriate JBI tools. The main synthesis does not supply a study-by-study appraisal matrix or item-level JBI judgments. No new pooled effect sizes, subgroup estimates, or causal effect estimates are reported in the revised article.

S6. INTERPRETIVE FRAMEWORK AND OBSERVABLE INDICATORS

Table S7. Framework components linked to observable decisions

Component	Educational role	Observable indicator
AI capabilities	Generation, feedback, analysis, content adaptation	Selected function; task purpose; stated limits of automation
LBC values	Criteria of care, ethics, spirituality, self-regulation, and compassion	Justification for accepting, revising, or rejecting an AI-supported activity
Teacher judgment	Contextual review and pedagogical mediation	Content checking; revisions; responses to learner concerns
Community participation	Local relevance and shared evaluation	Input into priorities; decision influence; judgment of benefit
Institutional support	Enabling conditions for enactment	Access, time, professional learning, and review procedures

Table S8. LBC dimensions and evaluative questions

Dimension	Evaluative question
Empathy and moral reasoning	How are AI-derived feedback and educational decisions explained respectfully to learners?
Spiritual awareness	How is AI-generated content evaluated against educational and spiritual purposes?

Dimension	Evaluative question
Self-regulation	Can learners articulate why they accept, revise, or challenge an AI suggestion?
Collaborative compassion	Does the activity create reciprocal help and shared responsibility?
Teacher–student relationships	Can learners question automated outputs and obtain meaningful human guidance?
Community engagement	Whose needs inform the activity and who participates in evaluating its benefits?

S7. PROPOSITIONS FOR FUTURE EMPIRICAL ASSESSMENT

Table S9. Propositions, observable indicators, and assessment conditions

Proposition	Proposed relationship	Indicators / assessment conditions
P1. Teacher judgment	Explicit LBC criteria and adaptation of AI feedback may relate to perceived care and pedagogical trust.	Document revision decisions, learner voice, trust; compare different review arrangements for the same tool.
P2. Reflective dialogue	Discussion of accepting or revising AI suggestions may support learners' independent judgment.	Record explanations and disagreement; examine transfer to tasks completed without AI over time.
P3. Community participation	Local participation in decisions may condition whether AI-assisted activities contribute to collective agency.	Record who sets priorities, influences decisions, and receives persistent benefits; compare co-designed and school-led activities.

DATA AVAILABILITY AND REPORTING BOUNDARY

The documented numerical PRISMA pathway and the candidate bibliography support transparency at the level stated above. The original database exports, dated search histories, record-level screening decisions for the reported 1,248 records, full-text extraction sheets for the included 48 studies, and study-level JBI assessments are not included in these materials. These records are necessary to independently reproduce the reported corpus and outcome attributions.

APPENDIX S1. BIBLIOGRAPHIC CANDIDATE REGISTER (48 RECORDS)

The candidate register consolidates bibliographic material associated with the manuscript and later search updates. Its 48 entries are distinct from the original PRISMA inclusion set until study-level screening and identity reconciliation are documented. Preliminary design labels are for triage, not final methodological judgments.

Table S10. Candidate records with DOI links and provisional source category

ID	Bibliographic record and DOI	Provisional type
C001	Adiyono, A., Hendawi, M., Sholeh, M., & Prasetyo, N. T. (2025). AI-Driven Empowerment in Muslim Communities: A Prisma Statistical Review of Love-Based Educational Transformations in Indonesian Madrasahs. https://doi.org/10.21274/dinamika.2025.25.2.119-137	Secondary / contextual
C002	Adiyono, A., Nurhayati, S., Rienovita, E., Setiawati, E., & Kumalasari, C. (2026). From Bias to Belonging: Ethical Pathways for Inclusive and Privacy-Respectful AI in Education. https://doi.org/10.4018/979-8-3373-7467-3.ch009	Secondary / contextual
C003	Alsaid, A. D., Rusdi, I., Muhtar, A., & Setyaningrum, N. (2025). Love-Based Curriculum: Integrating Islam, Humanism, and Local Wisdom in Madrasahs. https://doi.org/10.64929/ta.v1i2.32	Secondary / contextual
C004	Al-Zahrani, A. M. (2024). Unveiling the shadows: Beyond the hype of AI in education. https://doi.org/10.1016/j.heliyon.2024.e30696	Primary / empirical candidate
C005	Badawi, H., & Adiyono, A. (2026). Artificial intelligence in Lebanese upper elementary science classrooms: Readiness, practices, and pedagogical impact. https://doi.org/10.70376/r2ajk953	Primary / empirical candidate
C006	Bai, Y., & Wang, S. (2025). Impact of generative AI interaction and output quality on university students' learning outcomes: a technology-mediated and motivation-driven approach. https://doi.org/10.1038/s41598-025-08697-6	Primary / empirical candidate
C007	Coman, C., Gherheș, V., Bucs, A., Coman, E., Victoria-Rodica, C., Bodi, D., & Șerbănescu, R.-M. (2026). Navigating opportunities and challenges of generative AI in higher education: towards responsible, equitable, and human-centered integration. https://doi.org/10.3389/frai.2026.1750978	Secondary / contextual
C008	Faizin, N., Maarif, A. S., & Hanafi, Y. (2025). Considering religious moderation in Islamic law through AI ChatGPT and Bahsul Masail of Nahdlatul Ulama. https://doi.org/10.1080/17579961.2025.2469351	Primary / empirical candidate
C009	Fu, Y., & Weng, Z. (2024). Navigating the ethical terrain of AI in education: A systematic review on framing responsible human-centered AI practices. https://doi.org/10.1016/j.caeai.2024.100306	Secondary / contextual
C010	Han, X. (2025). Improving pre-service teachers' AI competencies: a quasi experimental study. https://doi.org/10.3389/fpsyg.2025.1642465	Primary / empirical candidate

ID	Bibliographic record and DOI	Provisional type
C011	Hanifah, A., Widiyastutik, D., Nitoqoin, D., Zainiyati, H., & Asrohah, H. (2026). The Integration of Technology and Humanism Rooted in Islamic Values: A Strategy for Strengthening Deep Learning in the Era of Smart Society 5.0. https://doi.org/10.38073/jpi.3771	Secondary / contextual
C012	Hsiao, C.-H., & Tang, K.-Y. (2025). Beyond acceptance: an empirical investigation of technological, ethical, social, and individual determinants of GenAI-supported learning in higher education. https://doi.org/10.1007/s10639-024-13263-0	Primary / empirical candidate
C013	Ifenthaler, D., Majumdar, R., Gorissen, P., Judge, M., Mishra, S., Raffaghelli, J., & Shimada, A. (2024). Artificial Intelligence in Education: Implications for Policymakers, Researchers, and Practitioners. https://doi.org/10.1007/s10758-024-09747-0	Primary / empirical candidate
C014	Jumaidah, M., Adiyono, A., & Zahra, N. (2026). Toward a Value-Based Digital Religious Literacy Framework: Contextualizing Akidah-Akhlak in the Digital Era. https://doi.org/10.52620/jeis.v6i1.265	Primary / empirical candidate
C015	Konstantinidou, A., Nisiforou, E. A., & Vrasidas, C. (2026). Enhancing personalized learning with Artificial Intelligence and analytics: university staff's insights. https://doi.org/10.1080/10494820.2026.2619907	Primary / empirical candidate
C016	Leon, C., Lipuma, J., & Oviedo-Torres, X. (2025). Artificial intelligence in STEM education: a transdisciplinary framework for engagement and innovation. https://doi.org/10.3389/feduc.2025.1619888	Secondary / contextual
C017	Liao, Z. (2026). Construction of digital competency model of moral education teachers in colleges and universities based on smart learning environment: an empirical study based on mixed method. https://doi.org/10.3389/fpsyg.2026.1834084	Primary / empirical candidate
C018	Luo, J., Zheng, C., Yin, J., & Teo, H. (2025). Design and assessment of AI-based learning tools in higher education: a systematic review. https://doi.org/10.1186/s41239-025-00540-2	Secondary / contextual
C019	Maskanah, M., Adiyono, A., Muhammad, N., Al-Matari, A. S., & Waziroh, I. (2026). Beyond Digitalization: AI-Driven Administrative Management and Its Impact on School Quality Improvement. https://doi.org/10.23971/muallimun.v6i1.11137	Primary / empirical candidate
C020	Soad Matar (2024). The Development of Educational Technology and Artificial Intelligence and Their Impact on the Future of Education: Opportunities and Risks. https://doi.org/10.63332/joph.v5i7.2915	Secondary / contextual
C021	Mohamed, A. M., Shaaban, T. S., Bakry, S. H., Guillén-Gámez, F., & Strzelecki, A. (2025). Empowering the Faculty of Education Students: Applying AI's Potential for Motivating and Enhancing Learning. https://doi.org/10.1007/s10755-024-09747-z	Primary / empirical candidate
C022	Mouta, A., Torrecilla-Sánchez, E. M., & Pinto-Llorente, A. M. (2025). Comprehensive professional learning for teacher agency in addressing ethical challenges of AIED: Insights from educational design research. https://doi.org/10.1007/s10639-024-12946-y	Primary / empirical candidate
C023	Msambwa, M. M., Wen, Z., & Daniel, K. (2025). The Impact of AI on the Personal and Collaborative Learning Environments in Higher Education. https://doi.org/10.1111/ejed.12909	Secondary / contextual
C024	Nadlir, N., Fahmi, M., Alfiah, H. Y., Syaifuddin, S., Mas'ud, A., Sudirman, S., & Ibrahim, A. (2026). Building Harmony through a Local Wisdom-Based Curriculum at a Madrasah in a Muslim Minority Setting. https://doi.org/10.31538/nzh.v9i2.322	Primary / empirical candidate
C025	Okada, A., Sherborne, T., Panselinas, G. E., & Kolionis, G. (2025). Fostering Transversal Skills Through Open Schooling Supported by the CARE-KNOW-DO Pedagogical Model and the UNESCO AI Competencies Framework. https://doi.org/10.1007/s40593-025-00458-w	Primary / empirical candidate
C026	Prasetyo, G., Fauziah, Y. R., & Syafii, A. (2025). From Policy to Pedagogy: Religious Moderation as a Counter-Radicalization Strategy in Islamic Education — A Systematic Literature Review. https://doi.org/10.14421/jpi.2025.142.233-251	Secondary / contextual
C027	Nabrisi Rohid; Siti Masitoh; Fajar Arianto; Lutfi Isn Badiah; Nibrosu Rohid (2026). The Influence of Learning Management System Management on Islamic Character Development in Madrasahs. https://doi.org/10.31538/munaddhomah.v7i1.2372	Primary / empirical candidate
C028	M. Isroul Laili (2024). Implementasi Kurikulum Cinta dalam Pembelajaran Bahasa Arab Madrasah. https://doi.org/10.55102/alyasini.v9i2.95	Secondary / contextual
C029	Salim; Mohamad Aji Prasetya; Muhammad Bagas F.; Fatkhur Rohman; Abdurrahman (2024). The Impact of Blended Learning an Educational Innovation as on Student Character Building in Islamic Religious Education. https://doi.org/10.48161/qaj.v4n3a739	Primary / empirical candidate
C030	Samirah, S., Adiyono, A., & Safitri, E. N. (2025). Artificial Intelligence for Teacher Professional Development in Islamic Education: A Systematic Literature Review and Future Competency Framework. https://doi.org/10.21580/rjtpd.v3i02.33595	Secondary / contextual
C031	Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. https://doi.org/10.1186/s41239-021-00292-9	Primary / empirical candidate

ID	Bibliographic record and DOI	Provisional type
C032	Fatah Syukur; Ahmad Maghfurin; Uswatun Marhamah; Phaosan Jehwae (2024). Integration of Artificial Intelligence in Islamic Higher Education: Comparative Responses between Indonesia and Thailand. https://doi.org/10.31538/nzh.v7i3.13	Primary / empirical candidate
C033	Fengchun Miao; Wayne Holmes (2023). Guidance for Generative AI in Education and Research. https://doi.org/10.54675/EWZM9535	Secondary / contextual
C034	Walter, Y. (2024). Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education. https://doi.org/10.1186/s41239-024-00448-3	Secondary / contextual
C035	Warisno, A., Anshori, A., Hidayah, N., & Dwianto, A. (2025). Transformative Islamic Education Management in Madrasah and Pesantren Integrating Tradition and Digital Innovation. https://doi.org/10.64753/jcasc.v10i2.1596	Secondary / contextual
C036	Zhu, H., Sun, Y., & Yang, J. (2025). Towards responsible artificial intelligence in education: a systematic review on identifying and mitigating ethical risks. https://doi.org/10.1057/s41599-025-05252-6	Secondary / contextual
C037	Choirotullaili, A.; Yaqin, A.; Wachidah, H. N. (2026). Using Artificial Intelligence in Islamic Religious Education at Madrasah Aliyah in Indonesia. https://doi.org/10.58485/jie.v5i2.825	Primary / empirical candidate
C038	Fauzan, T. S. (2025). Implementation of Artificial Intelligence in Tahfidz Al-Qur'an Learning at Madrasah Tsanawiyah: A Study on the Effectiveness of Machine Learning-Based Applications. https://doi.org/10.63738/aslim.v2i3.42	Primary / empirical candidate
C039	Setiadi, I. (2026). What makes AI-assisted teacher training effective? Evidence from ChatGPT-supported lesson planning in Madrasah education. https://doi.org/10.22515/attarbawi.v11i1.14811	Primary / empirical candidate
C040	Azis, D. K.; Musonif, I.; Salsabila, S.; Fatah, M. A.; Aji, M. (2026). Integrating Artificial Intelligence and Humanistic Values in Islamic Elementary Education: A Case Study at Madrasah Ibtidaiyah NU Ma'arif Karangnangka. https://doi.org/10.30868/ei.v15i02.10039	Primary / empirical candidate
C041	Nurrohman, F. A.; Zakarya, M. A.; Akyas, G.; Saputra, A. H. (2026). Adaptive Curriculum Integration in Islamic Primary Education: Bridging the Kurikulum Merdeka and Kurikulum Berbasis Cinta in an Indonesian Madrasah. https://doi.org/10.14421/hjie.2026.61-06	Primary / empirical candidate
C042	Rofiah, F. Z.; Nuraini, D. I. (2026). Implementasi Kurikulum Berbasis Cinta (KBC) dalam Pembelajaran Akidah Akhlak di MI NU Walisongo Sumberrejo. https://doi.org/10.23969/jp.v11i03.64713	Primary / empirical candidate
C043	Basori, R.; Zainuri, A.; Mahendra, A. (2025). Implementation and Management of a Love-Based Curriculum in Madrasah Ibtidaiyah of Palembang. https://doi.org/10.31258/jes.9.5.p.3731-3743	Primary / empirical candidate
C044	Syukran, R.; Lismay, L.; Suhendra, A.; Adriansyah, A.; Kardena, A.; Bayu, E. P. S. (2026). Implementation of Kurikulum Berbasis Cinta in Islamic Primary Education: A Phenomenological Study at Madrasah Ibtidaiyah. https://doi.org/10.58485/jie.v5i2.735	Primary / empirical candidate
C045	Mahfuzah, A.; Azhari, M.; Nadiyah, N. (2026). Implementasi Kurikulum Berbasis Cinta dalam Pembelajaran IPAS di Madrasah Ibtidaiyah Kota Banjarbaru. https://doi.org/10.20961/jkc.v14i3.125011	Primary / empirical candidate
C046	Hidayat, L. A.; Sumarna, E.; Hyangsewu, P. (2024). Inovasi Pembelajaran PAI: Penerapan Kecerdasan Buatan untuk Meningkatkan Motivasi Siswa. https://doi.org/10.37985/jer.v5i4.1846	Secondary / contextual
C047	Bariroh, A. M. (2025). Analisis Implementasi Chatbot AI pada Pembelajaran Pendidikan Agama Islam di Sekolah Menengah Pertama Indonesia. https://doi.org/10.47759/a9xkap77	Secondary / contextual
C048	Engkizar, E.; Jaafar, A.; Alias, M. F. B.; Guspita, R.; Albizar, A. (2025). Utilisation of Artificial Intelligence in Quranic Learning: Innovation or Threat?. https://doi.org/10.67055/8170mw54	Primary / empirical candidate

RECOMMENDED RECORD-LEVEL VERIFICATION

Before an updated synthesis is attempted, each candidate reference should be matched to its publisher record and full text to confirm bibliographic identity, publication type, and availability. Eligibility should then be documented against the stated AI application, Islamic educational setting, LBC or value-based dimensions, and outcome criteria. The resulting study-level record should include an inclusion or exclusion decision, the reason for exclusion where applicable, the extracted evidence, and a design-appropriate quality appraisal. This procedure would permit direct reconciliation between the candidate register and the 48 studies reported in the PRISMA diagram. Until such records are available, the appendix should be treated as a source-verification aid rather than proof of the original inclusion set or support for pooled effect estimates.