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Supporting Moral and Religious Development in Early Childhood Through a Scientific Approach: Evidence from an Indonesian Kindergarten

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Abstract
Moral and religious development in early childhood remains a significant pedagogical concern, particularly in classroom settings where values are often introduced through routine instruction rather than through active meaning-making. This study examined whether a scientific approach could support children's moral and religious development in an early childhood classroom in Indonesia. A quantitative pre-experimental design with a one-group pre-test post-test format was employed in Group B1 at Tunas Harapan Kindergarten, Purwakarta. The analytic sample consisted of 24 children aged 5 to 6 years. Data were collected through an observation sheet covering five indicators: mentioning important religious days, demonstrating polite behavior, identifying places of worship and religion, demonstrating patience, and respecting peers in ways consistent with religious teachings. The data were analyzed using descriptive statistics, N-gain analysis, and a paired-samples t-test. The findings showed an increase in the mean score from 12.62 at pre-test to 17.79 at post-test. The mean N-gain score of 0.70 indicated a moderate level of improvement, and the paired-samples t-test revealed a statistically significant difference between the two measurements ($p < 0.001$). Sub-indicator analysis further showed that improvement in the moral domain was stronger than in the religious domain. These findings suggest that a structured sequence of observing, asking, trying, reasoning, and communicating can provide a meaningful pedagogical pathway for values-oriented learning in early childhood education. Although the evidence is context-bound, the study contributes to wider global discussions on how inquiry-oriented pedagogy can be extended beyond cognitive learning to support moral and religious development in culturally and religiously plural early childhood settings across diverse educational contexts worldwide today.

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Introduction
Early childhood education is a formative period in which foundational dispositions, value orientations, and patterns of social conduct begin to take shape. Within this stage, moral and religious development is often treated as a central educational concern because children gradually learn to distinguish right from wrong, recognize expected forms of conduct, and participate in basic religious practices embedded in their everyday environments (Irdianti, 2024; Iksal, Hayani, & Aslan, 2024). In early childhood settings, this developmental domain is not limited to the transmission of doctrinal knowledge. It also involves the formation of dispositions such as empathy, honesty, responsibility, politeness, cooperation, and respect for others, alongside children's growing familiarity with religious routines, symbols, and expressions encountered at home and in school (Safitri, 2022; Khomsiyatun, Hidayat, Hamid Samiaji, & Marlina, 2022; Tanfidiyah, 2017). For that reason, moral and religious learning in early childhood cannot be understood merely as content delivery. It is a pedagogical process through which children are introduced to values, social expectations, and meaningful forms of participation.

Despite this importance, the development of moral and religious values in early childhood remains pedagogically challenging. Many educational practices still treat this domain in a largely transmissive manner, emphasizing habituation, imitation, or verbal instruction without sufficiently engaging children in active meaning-making. Such an approach risks reducing moral and religious learning to routine compliance rather than helping children connect values with lived experience. A more effective approach should therefore be holistic, contextual, and developmentally appropriate, enabling children to encounter moral and religious ideas through concrete situations, interaction, reflection, and enjoyable learning experiences (Karimullah, 2023; Juih, Yetti, & Dhieni, 2021). In this sense, the issue is not whether moral and religious development is important, but how it can be pedagogically facilitated in ways that are meaningful for young children.

One approach that may offer such pedagogical potential is the scientific approach. In the Indonesian educational context, the scientific approach has been widely associated with five interconnected stages, namely observing, asking, trying, reasoning, and communicating, and has been promoted as a learning orientation that supports active, inquiry-based, and structured engagement with learning materials (Siahaan et al., 2023). Although the approach is commonly associated with the development of cognitive and process skills, its pedagogical logic may also be relevant to moral and religious learning. Observing can direct children's attention to concrete situations and social cues; asking can stimulate curiosity and dialogic engagement; trying can involve active participation in value-laden activities; reasoning can support early reflection on actions and consequences; and communicating can provide space for children to express understanding while learning to listen to others. From this perspective, the scientific approach may function not only as a procedural learning model but also as a pedagogical structure through which values are encountered, interpreted, and enacted in classroom interaction.

Existing studies have shown that the scientific approach can contribute positively to several areas of early childhood development. Previous research reports its contribution to children's social abilities, particularly in building interactional competence, sustaining peer relationships, and adapting to collaborative activity (Afifah & Sinaga, 2022). Other studies indicate that when integrated with environmental content, the scientific approach can encourage children's environmental awareness and care through practical, problem-based, and discussion-oriented learning experiences (Kurniati, Saleh, & Mirnawati, 2022; Munawaroh & Retyanto, 2016). A substantial body of work has also linked the approach to cognitive outcomes, including logical thinking, critical thinking, multiple intelligences, and creativity (Akromah & Rohmah, 2019; Dista, 2019; Ismawati & Hanifah, 2020; Rahayu, Sri Suryanti, & Setiawan, 2019; Yanti et al., 2024). These studies are important because they demonstrate that the scientific approach has pedagogical flexibility across developmental domains.

However, the existing literature also reveals a clear limitation. Although the scientific approach has been studied in relation to social, environmental, and cognitive development, its role in supporting early childhood moral and religious development remains underexamined. This absence is important because moral and religious development differs from other developmental outcomes. It does not concern skill acquisition alone, but also the formation of value-oriented understanding and socially enacted conduct. As a result, findings from cognitive or social domains cannot simply be transferred to this domain without empirical examination. The current literature therefore leaves an unresolved question regarding whether and to what extent the scientific approach can support children's moral and religious development in early childhood learning.

This study addresses that gap by examining differences in children's moral and religious development before and after the implementation of a scientific approach in classroom learning at Tunas Harapan Kindergarten, Purwakarta. Rather than assuming that an inquiry-based approach is automatically effective for value formation, this study tests that pedagogical assumption within a bounded early childhood context. Its contribution is modest but important. Empirically, it extends prior scholarship on the scientific approach beyond cognitive, social, and

environmental outcomes toward the underexplored domain of moral and religious development. Practically, it offers evidence on whether a structured inquiry-oriented learning process can function as a meaningful classroom strategy for supporting this developmental domain in early childhood education.

Methods

Research Design

This study employed a quantitative pre-experimental design using a one-group pre-test post-test format to examine differences in children's moral and religious development before and after the implementation of a scientific approach in classroom learning (Gall, Gall, & Borg, 2010). In this design, children's initial condition was measured through a pre-test observation, followed by the learning intervention, and then a post-test observation. The design can be summarized as O1 X O2, where O1 refers to the pre-test, X to the classroom intervention based on the scientific approach, and O2 to the post-test. Given the absence of a comparison group, this design was intended to provide preliminary evidence of change within a bounded classroom context rather than strong causal proof.

Research Setting and Participants

The study was conducted at Tunas Harapan Kindergarten, Purwakarta. Although the kindergarten had 75 enrolled children across Group A, Group B1, and Group B2, the analytic sample in this study consisted of 24 children aged 5 to 6 years from Group B1. This group was selected purposively because it was the class in which the scientific approach was implemented and observed throughout the study period. In addition to the child participants, four observers were involved to assist the classroom observation process and scoring of children's moral and religious development during the pre-test and post-test phases.

Instrument

Data were collected using an observation sheet developed to assess children's moral and religious development in classroom learning. The instrument covered five indicators: children's ability to mention important religious days, demonstrate polite behavior through words and actions, identify places of worship and religion, demonstrate patience, and behave in ways that reflect respect for peers in accordance with the teachings of their religion. Each indicator was scored using four developmental categories, namely BB (Belum Berkembang or Not Yet Developing) = 1, MB (Mulai Berkembang or Starting to Develop) = 2, BSH (Berkembang Sesuai Harapan or Developing as Expected) = 3, and BSB (Berkembang Sangat Baik or Developing Very Well) = 4. Because the observations involved four raters, the ratings were combined to obtain composite pre-test and post-test scores for each child before further descriptive and inferential analysis was conducted.

Table 1. Observation Assessment Blueprint

No.	Indicators	Criteria	Result
1	Children can mention important days in religion	The child remains silent when asked about religious holidays.	BB
		The child can name religious holidays with the teacher's help.	MB
		The child can name religious holidays directly without the teacher's help.	BSH
		The child can name religious holidays loudly and confidently.	BSB
2	Children can behave politely through words and actions	Children do not demonstrate polite behavior through words and actions.	BB
		Children are able to demonstrate polite behavior through words and actions.	MB
		Children behave politely through words and actions toward themselves and those around them.	BSH

No.	Indicators	Criteria	Result
		Children do not demonstrate polite behavior through words and actions.	BB
3	Children can know places of worship and religion	Children behave politely through words and actions by consistently instilling this in themselves and those around them.	BSB
		Children do not know the names of places of worship and their religion.	BB
		Children learn the names of places of worship and their religion with the help of teachers.	MB
		Children learn the names of places of worship without confidence.	BSH
		Children learn the names of places of worship and their religion through their own understanding.	BSB
4	Children can demonstrate behavior that reflects patience	The child does not exhibit behavior that reflects patience.	BB
		The child is able to demonstrate patience well.	MB
		The child can demonstrate patience for himself.	BSH
		The child can demonstrate patience for himself and those around him.	BSB
5	Children can behave according to the teachings of their religion by respecting their peers	The child does not respect his peers.	BB
		The child can respect peers with teacher guidance.	MB
		The child can respect peers through initiative from other peers.	BSH
		The child can respect peers through initiative from within himself	BSB

Procedure

The study was conducted in three stages: preparation, implementation, and evaluation. During the preparation stage, the researchers identified the problem, formulated the research focus, developed the instrument, and arranged the learning plan for the intervention. In the implementation stage, a pre-test observation was first conducted to document children's initial level of moral and religious development. The intervention was then carried out over seven classroom meetings using the scientific approach, which emphasized the stages of observing, asking, trying, reasoning, and communicating. After the intervention had been completed, a post-test observation was conducted using the same instrument in order to assess changes in children's development following the learning process.

Data Analysis

Data analysis combined descriptive and inferential procedures. Descriptive statistics were used to summarize the pre-test and post-test scores, including the number of participants, minimum and maximum scores, mean scores, and category distributions. To estimate the magnitude of improvement between pre-test and post-test performance, N-gain scores were also calculated. Because the study compared two repeated measurements from the same group of participants, the main inferential analysis used a paired-samples t-test. Prior to this analysis, the distribution of the difference scores was examined through a normality test. Statistical significance was determined at $p < 0.05$. Data entry and preliminary tabulation were completed using Microsoft Excel, while the final statistical analyses were conducted in SPSS version 29.

Ethical Considerations

Prior to data collection, permission to conduct the study was obtained from the head of Tunas Harapan Kindergarten. Parents were informed that the study would be conducted in the classroom setting, and the observations were limited to routine educational activities associated with the implementation of the learning intervention. Because the participants were young children, particular attention was given to confidentiality and responsible data handling. No

personally identifying information was reported in the manuscript, and all results were presented in aggregate form for research purposes only.

Result

Researchers present the results of data analysis on the application of a scientific approach to stimulate moral development and knowledge of religious diversity in early childhood Group B1 at Tunas Harapan Kindergarten. The data were processed based on the pre-test and post-test results.

Results of Data Analysis on Moral and Religious Development Before Implementing a Scientific Approach in Learning at School

Children's moral and religious development prior to the intervention was assessed through the pre-test observation. As shown in Table 2, the analytic sample consisted of 24 children, with a total pre-test score of 303. The minimum score was 11, the maximum score was 14, and the mean score was 12.62. Based on the category distribution reported in the table, all participants were classified in the BSH category at the pre-test stage.

Table 2. Descriptive Results of Pre-test Scores

Data	Amount of Data	Total Score	Minimum Score	Maximum Score	Average
Pretest	24	303	11	14	12,62
	Number of children and percentage				Percentage
	BB	MB	BSH	BSB	100%
	0 (0%)	0 (0%)	24 (100%)	0 (0%)	

Table 2 shows that the pre-test scores were concentrated within a relatively narrow range, with values spanning from 11 to 14 across 24 participants. The mean score of 12.62 indicates that children entered the intervention with a fairly similar initial level of performance. Based on the category distribution reported in the table, all participants were placed in the BSH category at the pre-test stage. This pattern suggests limited variation in baseline scores within the observed group. These pre-test findings provide the reference point for the post-test results presented in the next subsection.

Data Analysis of Moral and Religious Development after the Implementation of the Scientific Approach in Learning at School

After the implementation of the scientific approach, children's moral and religious development was reassessed through the post-test observation. Table 3 shows that the total post-test score reached 427, with a minimum score of 15.5, a maximum score of 19.5, and a mean score of 17.79. In the post-test distribution, all 24 children were classified in the BSB category.

Table 3. Descriptive Results of Post-test Scores

Data	Amount of Data	Total Score	Minimum Score	Maximum Score	Average
Post-test	24	427	15,5	19,5	17,79
	Number of children and percentage				**Percentage**
	BB	MB	BSH	BSB	
	0 (0%)	0 (0%)	0 (0%)	24 (100%)	100%

Table 3 indicates that the post-test scores were higher than the pre-test scores across the observed group, with values ranging from 15.5 to 19.5. The mean score increased to 17.79, showing a notable rise in the overall level of performance after the intervention. The category distribution also shifted fully to BSB, with all 24 children classified in the highest developmental category. This pattern suggests that improvement was observed not only in the mean score but also in the overall categorical distribution of performance. The difference between the pre-test and post-test mean scores is further illustrated in Figure 1.

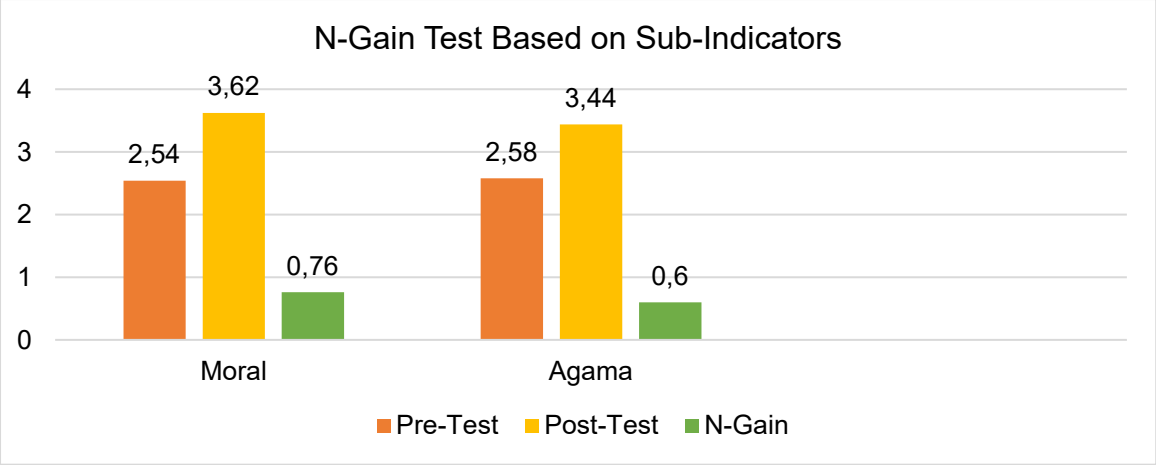

Figure 1. Difference in Overall Average Pre-test and Post-test Scores
Pre-test mean = 12.62; Post-test mean = 17.79; Mean increase = 5.17.

The pattern shown in Figure 1 indicates a clear upward shift in children's overall scores following the implementation of the scientific approach. This increase suggests that the post-intervention performance was consistently higher than the initial condition observed at the pre-test stage. Although the figure presents only the difference in mean scores, it provides an initial descriptive indication that children's moral and religious development improved after the intervention, which is then examined further through the N-gain and paired-samples t-test analyses.

Data Analysis of Moral and Religious Development after the Implementation of the Scientific Approach in Learning at School

N-Gain Test

To estimate the magnitude of improvement between the pre-test and post-test scores, an N-gain analysis was conducted. As presented in Table 4, the mean N-gain score was 0.70, which falls within the moderate category. The minimum N-gain score was 0.47, whereas the maximum N-gain score was 0.92.

Table 4. Overall N-Gain Results

Data	Number of Participants	Minimum N-Gain Score	Maximum N-Gain Score	Mean N-Gain Score	Category
N-Gain	24	0.47	0.92	0.70	Moderate

Table 4 shows that the mean N-gain score reached 0.70, indicating a moderate level of improvement across the sample. The observed N-gain values ranged from 0.47 to 0.92, which suggests that the magnitude of change varied among participants. Even so, all reported gains remained positive, indicating that no decline was observed between the pre-test and post-test measurements. The overall pattern therefore supports the view that the intervention was associated with measurable improvement at the group level. To determine whether this difference was statistically significant, the paired-samples t-test results are presented in the following subsection.

T-Test

A paired-samples t-test was used to examine whether the difference between the pre-test and post-test scores was statistically significant. As shown in Table 5, the test indicated a statistically significant difference between the two measurements at the 0.05 significance level.

Table 5. Paired-Samples t-Test Results

Type of Test	df	Significance Value	Significance Level	Information
Paired-samples t-test	23	< 0.001	0.05	H1 accepted

Table 5 shows that the paired-samples t-test produced a significance value below 0.05, indicating that the difference between the two measurements was statistically significant. This result means that the pre-test and post-test scores were not equivalent within this sample of 24 children. In other words, the higher post-test scores were unlikely to have occurred by chance alone within the analytical framework used in this study. The inferential result therefore strengthens the descriptive trend reported in the preceding tables and figure. A more detailed view of change across domains is presented in the sub-indicator results in the next subsection.

The sub-indicator analysis also showed that the magnitude of improvement was not identical across domains. For the moral sub-indicator, the mean pre-test score was 2.54 and the mean post-test score was 3.62, producing an N-gain score of 0.76, which falls into the high category. For the religious sub-indicator, the mean pre-test score was 2.58 and the mean post-test score was 3.44, producing an N-gain score of 0.60, which falls into the moderate category. These results indicate that improvement was observed in both sub-indicators, with a stronger gain in the moral domain than in the religious domain.

Discussion

The findings show a marked improvement in children's moral and religious development after the implementation of the scientific approach in this classroom setting. The rise from a pre-test mean of 12.62 to a post-test mean of 17.79, together with a moderate N-gain score and a statistically significant paired comparison, indicates that the intervention was associated with meaningful developmental progress in the observed group. Because the study used a one-group pre-experimental design, the result should be read as evidence of improvement within a bounded context rather than as definitive proof of causality. Still, the pattern is important because it suggests that a structured sequence of observing, asking, trying, reasoning, and communicating may support not only cognitive learning but also values-oriented development in early childhood. This point gives the study broader relevance to international discussions on how inquiry-based pedagogy can be adapted for moral and religious learning, especially in settings where value formation and social diversity are closely intertwined (Bustamante et al., 2018; Chen et al., 2024; Alali & Al-Barakat, 2024; Grenell et al., 2024).

One of the most meaningful findings is the uneven pattern of gain across domains. The moral sub-indicator improved more strongly than the religious sub-indicator, suggesting that the scientific approach may work more readily for forms of learning that are enacted in everyday social behavior than for knowledge tied to religious diversity. This difference is understandable because moral conduct in early childhood is often practiced directly through interaction such as waiting, listening, showing patience, speaking politely, and respecting peers. Knowledge of religious diversity, by contrast, asks children to recognize symbols, practices, and meanings that are not always equally present in their immediate experience. Earlier studies likewise show that moral and character formation in early childhood is often strengthened through routines, modeling, songs, stories, and repeated interpersonal engagement rather than through abstract explanation alone (Birhan et al., 2021; Istiyani et al., 2024). Hasanah (2020) also notes that children's moral development may unfold unevenly across dimensions such as politeness, discipline, honesty, and helping behavior, which supports the view that not all aspects of development respond in the same way or at the same pace.

The classroom process described in this study helps clarify why gains appeared in both domains. When children were invited to recount their Ramadan experiences, revisit relevant prayers, and share forms of worship from different religious backgrounds, they were not only receiving information but also connecting religious content with lived experience. That movement from abstract content to meaningful encounter matters in early childhood education, where values are more easily grasped when they are attached to concrete situations and social interaction. Research from different countries has similarly shown that religion and religious diversity in early childhood settings need to be approached in ways that are visible,

sensitive, and pedagogically manageable for young children (Iversen, 2022; Hovdelien & Sødal, 2022; Knoblauch, 2023). Related scholarship on multicultural children's literature, locally grounded multicultural strategies, and local-wisdom approaches to religious moderation also points in the same direction: children learn openness and recognition of difference more effectively when diversity is introduced through accessible and relational forms of learning (Bennett et al., 2021; Suri & Chandra, 2021; Lestari & Nopiana, 2024). Viewed from this angle, the scientific approach became more than a procedural classroom model; it opened a space in which religious diversity could be observed, discussed, and socially negotiated.

The role of demonstration and learning media also appears central in explaining the improvement recorded in this study. The use of a maze activity to introduce religious holidays turned a relatively abstract topic into a concrete task that children could follow, explore, and complete. That matters because young children often respond more productively when ideas are translated into manipulable forms rather than delivered only through verbal explanation. This interpretation is consistent with the view that demonstration can support explanation while also strengthening memory and evaluative thinking in children (Supriatna, Kuswandi, & Sopyan, 2020). It also fits studies showing that maze-based activities can help children understand paths, positions, and goal-directed action through guided exploration (Bafadal, 2016; Rosidah, 2014). A similar line of reasoning appears in research on learning media more broadly, where interest, curiosity, motivation, and engagement are strengthened when instructional content is presented in forms that are vivid and interactive (Suraya & Amir, 2024; Falahudin, 2014), including digital formats such as augmented reality for learning about religious diversity (Li et al., 2023).

Another point that deserves emphasis is the relational dimension of the findings. The scientific approach in this study did not only support recognition of religious content; it also appeared to support children's capacity to engage respectfully with peers. Activities that required listening, taking turns, responding to others, and acknowledging different experiences created a setting in which moral learning was practiced through interaction rather than merely stated as a rule. This is especially relevant for the indicator concerning behavior in accordance with religious teachings by respecting friends, because respect for difference is formed in participation before it is stabilized as a principle. That reading aligns with arguments that tolerance education in childhood should help children recognize difference, respect the rights of others, and appreciate diversity in their surroundings (Sumaatmaja, 2000; Anang & Zuhroh, 2019). The importance of this point extends beyond the local case because questions of coexistence, difference, and respectful participation are central to early childhood education in many culturally and religiously plural societies.

The wider contribution of this study lies in how it repositions the scientific approach within current discussions of early childhood pedagogy. Much of the existing literature associates structured inquiry-oriented learning with science, cognition, self-regulation, or environmental learning (Chen et al., 2024; Grenell et al., 2024; Alali & Al-Barakat, 2024). The present findings suggest that the same pedagogical architecture may also be useful for domains often treated separately from inquiry-based learning, namely moral and religious education. Comparable differences in children's moral and religious development have also been reported following demonstration-based learning, although the present study advances a more specific argument: when the scientific approach is understood as a sequence that organizes observation, questioning, exploration, reasoning, and communication, it can function as a framework for values-oriented learning rather than only for academic content delivery (Assidiki, 2023). The broader developmental potential of early childhood science-related pedagogies has also been noted elsewhere, and the present study extends that insight by showing their relevance for a domain that matters across many global contexts, particularly where early education is expected to cultivate both personal values and social coexistence (Bustamante et al., 2018).

The study also has clear limits, and these limits matter for how the findings should be read.

The evidence comes from one class in a single kindergarten, involves a modest sample, and does not include a comparison group, so the results should not be generalized too quickly. Even so, the study offers a practical insight with relevance beyond the immediate setting: moral and religious learning may become more meaningful when children are not only told what is right, but are guided to observe, ask, try, reason, and communicate within activities that connect values to social experience. This implication speaks to a wider international concern that moral and religious education in early childhood can become superficial when it relies too heavily on routine symbolism without adequate developmental grounding (Istiyani et al., 2024). Future research could test similar interventions with stronger comparative designs, while also examining how media, multicultural materials, teacher mediation, and local context shape children's understanding of moral action and religious diversity over time.

Conclusion

This study found that the implementation of the scientific approach was associated with an improvement in children's moral and religious development in Group B1 at Tunas Harapan Kindergarten, Purwakarta. The overall scores increased from a pre-test mean of 12.62 to a post-test mean of 17.79, supported by a moderate N-gain score of 0.70 and a statistically significant paired-samples t-test result. The sub-indicator analysis further showed that the gain in the moral domain was stronger than in the religious domain, indicating that the approach may be more readily translated into socially enacted behavior than into knowledge related to religious diversity. These findings suggest that a structured sequence of observing, asking, trying, reasoning, and communicating can provide a meaningful pedagogical pathway for values-oriented learning in early childhood classrooms.

The contribution of this study lies in extending discussion of the scientific approach beyond its more familiar association with cognitive and science-related outcomes toward the domain of moral and religious development. In substantive terms, the findings indicate that inquiry-oriented classroom processes may also support early forms of respect, patience, politeness, and recognition of difference when learning is connected to children's lived experiences and supported by interactive media. This point carries wider relevance for early childhood education in culturally and religiously plural settings, where the challenge is not only to transmit values but also to cultivate respectful participation and social coexistence from an early age. Because the study was conducted in one class without a comparison group, the findings should be read as context-bound evidence rather than definitive causal proof. Future research could therefore test similar interventions in broader and more comparative designs, while examining more closely how teacher mediation, classroom interaction, and learning media shape children's moral action and understanding of religious diversity over time.

Declarations

Author Contribution Statement

Suci Utami Putri: Conceptualization, Methodology, Formal analysis. Asep Kurnia Jayadinata: Methodology, Resources. Aries Legita Permana Putri: Investigation, Data curation. Aan Yuliyanto: Writing – original draft, Writing – review & editing, Formal analysis.

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Data Availability Statement

The dataset generated and analyzed during the research is available from the corresponding author upon reasonable request.

Declaration of Interests Statement

The author declares that there are no competing interests, financial or personal, that could have

influenced the work reported in this manuscript.

Additional Information

No additional information is available for this paper.

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