



DEVELOPING SCIENTIFIC ETHICS IN EARLY CHILDHOOD EDUCATION AS A MORAL FOUNDATION FOR EMERGING GENERATIONS

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Abstract:

Early Childhood Education (PAUD) plays a crucial role in shaping children's character and knowledge base, which significantly impacts their future development. At this stage, children begin to internalise moral and ethical values that will guide their behaviour throughout life. This study adopts a descriptive qualitative approach, involving PAUD educators, parents, and community members who are actively engaged in children's education. Data were collected through observations, interviews, and document analysis. The main objective of the study is to explore the integration of scientific ethics into the PAUD curriculum and involve all stakeholders in creating a supportive environment for the holistic moral development of children. The findings reveal that ethical principles are widely practised in PAUD settings, contributing to the development of moral values in children. This study's contribution lies in its emphasis on the importance of embedding scientific ethics in early childhood education, offering new insights into the role of ethics in nurturing responsible and empathetic future generations. The study recommends further collaboration among educators, parents, and communities to foster an environment that supports children's continuous moral growth.

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INTRODUCTION

In today's globalised and technologically advanced world, society faces increasingly complex ethical challenges, particularly regarding the moral and critical development of younger generations. This research is significant because establishing a strong moral foundation from early childhood is crucial in shaping ethical, socially responsible, and scientifically literate individuals (Koloszuki Maciel et al., 2022; McNamara et al., 2022; Saab et al., 2023). Studies indicate that insufficient awareness of ethics in scientific contexts can lead to antisocial behaviour, the dissemination of misinformation, and unethical decision-making later in life. Early ethical education, therefore, benefits not only the individual child but also society at large, as ethically conscious children are more likely to become morally responsible citizens (Hewitt et al., 2022; Nair et al., 2023; Padayachee et al., 2023). In conclusion, investigating methods to develop scientific ethics in early childhood is vital to prepare future generations to face scientific, social, and technological challenges with integrity and accountability.

Field observations reveal that ethical education in early childhood science programs remains limited. Many educational institutions primarily emphasise cognitive or technical skills while neglecting moral development, integrity, and scientific responsibility (Kelley, 2024; Palmer, 2024; Quinones et al., 2024). Consequently, children often imitate unethical behaviours, such as cheating, spreading false information, or neglecting social responsibilities in simple scientific activities. Digital media and social environments further exacerbate the problem by normalizing unethical behaviour (Chung, 2022; Dockrell et al., 2024). Observations in several preschools and kindergartens indicate that teachers frequently lack systematic strategies for instilling ethical values within scientific practices. This situation highlights the urgent need for educational models that explicitly integrate scientific ethics into early learning to ensure that children develop a robust moral foundation. Addressing this gap will empower children to approach science not only cognitively but also morally, shaping responsible future citizens.

Previous studies have explored the intersection of moral education, science, and early childhood development. Popović (2023) and Shalabaeva et al. (2024) emphasises the necessity of ethical interventions in early science curricula to prevent antisocial behaviours. Azis (2021), Fitri et al. (2022), and Masykuroh et al. (2024) demonstrates that children exposed to value-based education make more ethical decisions in basic experiments. Rulyansah et al. (2023) and Dakir et al. (2022) highlights the importance of teacher training to instil ethical principles consistently. Similarly, Collado et al. (2023) and Nailasariy et al. (2023) underscores the effectiveness of integrating scientific ethics within project-based learning for internalising moral values. However, these studies often focus on cognitive aspects or specific dimensions of ethics, lacking a comprehensive model that simultaneously combines science, ethics, and character education. This research addresses this gap by proposing a structured, integrative approach applicable in diverse early childhood contexts, offering both theoretical insight and practical implementation guidance.

The novelty of this research lies in developing a model of science education that simultaneously fosters scientific ethics and moral values in young children. Unlike prior studies, this approach emphasises reflective ethical practices, social responsibility, and moral decision-making in all learning activities. The model integrates Kohlberg's (1984) moral development theory with project-based learning methods validated by Bitew (2024) and internalisation strategies suggested by Kelemen (2023). Therefore, this study not only enriches academic literature but also provides practical guidance for teachers and educational institutions in shaping the character of future generations. The societal relevance of this research is underscored by the urgent need for children who can navigate scientific and technological challenges with ethical awareness and moral integrity.

The central research problem is how to develop scientific ethics in early childhood education as a moral foundation for emerging generations. The main argument is that a structured ethical science education program from an early age promotes consistent moral behaviour, critical thinking, and social responsibility throughout life. This study proposes a preliminary solution in the form of an integrated educational model combining science learning, ethical reflection, and moral decision-making activities. Its original contribution lies in providing a conceptual framework and practical implementation guidelines suitable for diverse early childhood education settings,

offering insights for both classroom practice and policy development in character and science education.

This study contributes both theoretically and practically. Theoretically, it enriches the literature on scientific ethics and early childhood character education, bridging the gap between moral development theory and science education practices. Practically, the developed model can be implemented by teachers, schools, and educational institutions to cultivate ethical, critical, and socially responsible children. The study's implications also inform educational policy, addressing society's increasing demand for generations capable of facing global challenges with integrity. By establishing a moral foundation through ethical science education, emerging generations are expected not only to achieve academic competence but also to uphold strong moral values, ultimately contributing positively to society and the broader environment.

RESEARCH METHODS

This research uses a qualitative research design with a case study approach to explore in depth the role of scientific ethics in early childhood education (ECE) (Soesana et al., 2023). The choice of a case study design is based on the need to understand the context and processes that occur in the implementation of ethical values in ECE. With a case study, researchers can observe how the application of scientific ethics occurs in a specific ECE setting and how this influences children's character development. This design allows researchers to collect rich qualitative data and provides more comprehensive insights into the application of ethics in early childhood education.

This research was conducted in several early childhood education (PAUD) institutions located in urban and rural areas. The reason for choosing these research locations was to obtain a broader comparison of the application of scientific ethics across various types of PAUD, both in urban areas with more advanced educational access and in rural areas that face challenges in implementing ethics in education. By examining different locations, this research seeks to provide a more comprehensive picture of the factors influencing the implementation of ethics in PAUD and how various social and cultural contexts shape it (Harahap, 2020; Nurhayati et al., 2024).

Data collection in this study was conducted using three main techniques: observation, interviews, and a documentation study (Fadli, 2021). Observations were conducted in early childhood education centres (PAUD) to examine how ethical values are applied in daily interactions between educators and children. Furthermore, in-depth interviews were conducted with PAUD educators, parents, and community members involved in early childhood education. The purpose of these interviews was to explore their views, experiences, and understanding of the role of scientific ethics in early childhood education. Furthermore, a documentation study was conducted by collecting relevant documents, such as curricula, evaluation records, and learning materials used in PAUD, to assess the application of scientific ethics in educational policies and practices.

Data analysis in this study was conducted through several stages, beginning with data condensation, which is the process of summarising data collected from observations, interviews, and documentation. Relevant data were selected and grouped based on emerging themes (Kekeya, 2023). Data reduction was then carried out to refine and further analyse the data, identifying patterns related to the application of scientific ethics in early childhood education. The results of this analysis will then be presented as a data display, a structured descriptive presentation using tables, diagrams, or interview

excerpts to support a deeper understanding. The final process is data verification, which aims to ensure the findings are valid and reliable. This process involves reviewing the collected data and comparing it with relevant literature to ensure consistency and accuracy.

To ensure data validity and reliability, this study employed data triangulation techniques. Triangulation was conducted by comparing information from various sources, including educators, parents, and educational documents. This ensures the findings are credible and provide a more comprehensive picture of the application of scientific ethics in early childhood education. Furthermore, member checking techniques were employed, in which the results of the data analysis were returned to the study participants to ensure that the interpretations aligned with their experiences.

RESULTS AND DISCUSSION

Result

This section presents the study's findings on the application of scientific ethics in Early Childhood Education (PAUD). The results highlight how educators implement ethical principles in daily interactions, classroom management, and collaboration with parents and the community. Observations and interviews demonstrate the pivotal role of teachers as moral role models in fostering children's honesty, fairness, social responsibility, and holistic character development.

The Importance of Scientific Ethics in PAUD

Scientific ethics in Early Childhood Education (PAUD) focuses on the moral behaviour that educators and the entire school community must uphold in carrying out structured activities. This ethics aims to guide educators in creating an educational environment that supports children's character and moral development, while also conveying values appropriate to children's needs and development at an early age. In this context, scientific ethics not only regulates the relationship between teachers and students but also serves as the foundation for creating a learning process that not only fosters children's cognitive abilities but also instils moral values important for their social lives.

According to Wandy, a PAUD educator, "Scientific ethics in early childhood education encompasses teachers' obligations to uphold professional and moral values, where teachers must be role models for the children they teach." Wandy added that a teacher must possess high integrity and the ability to teach ethical values in a good and correct manner. In this interview, Wandy discusses the importance of teachers' role as direct role models for children, which will shape their character in the long term. Researchers interpret this statement as evidence that the application of scientific ethics is not only the individual responsibility of educators but also a collective responsibility to create an environment that supports morality and ethics.

Monika, another early childhood education teacher, stated, "Moral education implemented from an early age has a significant impact on children's character development. Research shows that sound moral education can influence individual development within the family, school, and community." Monika emphasised that sound moral education must begin early because it will lay the foundation for children's character development later in life. Researchers interpret this statement as supporting the importance of scientific ethics in early childhood education, where character

development through moral values is a primary focus, ensuring children grow up to be responsible individuals in society.

Observations conducted at Early Childhood Education revealed that educators consistently demonstrated behaviours reflecting scientific ethics, including honesty, fairness, and social responsibility, in their interactions with children. Teachers frequently modelled positive behaviour, such as showing mutual respect, conveying information truthfully, and providing equal attention to every child regardless of their background. Interviews with the educators confirmed these observations, emphasising that their role goes beyond academic instruction to include actively demonstrating ethical values. They reported intentionally modelling honesty, justice, and social responsibility so that children could observe, internalise, and practice these principles in their daily lives. This combined evidence indicates that the implementation of scientific ethics in early childhood education is strongly influenced by educators' consistent moral behaviour, which serves as a practical guide for children to develop and apply ethical values.

The data suggest that early childhood educators play a pivotal role in shaping children's moral and social development by consistently applying scientific ethics. By serving as role models and integrating ethical behaviours into daily routines, teachers facilitate the internalisation of values such as honesty, fairness, and social responsibility. This pattern demonstrates that moral education at the early childhood level is not merely theoretical but is most effective when embedded in practical interactions and daily practices. Consequently, the consistent demonstration of ethical behaviour by educators significantly contributes to character formation, encouraging children to become responsible, just, and socially sensitive individuals. These findings highlight the importance of intentional, value-based teaching strategies in fostering a strong moral foundation in emerging generations.

The Importance of Scientific Ethics in PAUD

Scientific ethics in early childhood education encompasses the application of moral principles that educators must uphold to create a learning environment that supports children's character and ethical development. The application of scientific ethics extends beyond academic aspects to the development of children's character and morals. In early childhood education, teachers must deeply understand professional ethics and relevant theories to create an effective educational environment that supports children's holistic development. Therefore, early childhood education must integrate ethical theories into educational practices to ensure that sound moral values are instilled in children from an early age.

Table 1. Observation of the Importance of Scientific Ethics in PAUD

Observation Indicator	Observation Findings
Teachers demonstrate honesty and integrity through their actions and communication with children.	Teachers consistently convey information truthfully and model honesty in daily interactions.
Teachers consistently model respect and patience, guiding children through positive interactions.	Educators show patience, listen attentively, and treat all children with equal respect.
Teachers create an environment where children feel safe and supported to express emotions and values.	Classrooms provide emotional safety, allowing children to express feelings and personal ideas freely.
Children demonstrate honesty and respect by mimicking the teacher's actions during class activities.	Children imitate teacher behaviours such as sharing, fairness, and truthful communication.

Teachers emphasise moral education through storytelling, group activities, and role-modelling ethical behaviour.	Educators integrate ethical lessons in stories, collaborative activities, and daily routines, reinforcing moral values.
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The observation data presented in Table 1 indicate that teachers at Early Childhood Education actively implement scientific ethics in their daily interactions with children. The indicators show that educators consistently demonstrate honesty and integrity, model respect and patience, create a supportive environment, and emphasise moral education through storytelling, group activities, and role-modelling ethical behaviour. Children, in turn, reflect these values by imitating teachers' behaviours, such as fairness, sharing, and honesty, during class activities. The researcher interprets these findings as evidence that ethical behaviour is effectively transmitted through the consistent example set by educators. Restating the data, it is clear that teachers serve not only as knowledge providers but also as ethical role models whose actions directly influence children's moral and social development. The observations reinforce the notion that integrating scientific ethics into early childhood education is crucial for shaping responsible, socially aware, and morally grounded individuals.

A clear pattern emerges from the observation data, showing that the implementation of scientific ethics in PAUD is consistently reflected across multiple aspects of classroom practice. Teachers' ethical behaviour is systematically mirrored by children, indicating a strong modelling effect. The data reveal a holistic approach where moral values are embedded not only in explicit teaching activities such as storytelling or group exercises but also in the daily interactions and routines of the classroom. Children are observed actively internalising and expressing ethical principles such as honesty, fairness, and respect in their interactions with peers. Overall, the pattern suggests that when ethical behaviours are consistently modelled and reinforced by educators, children naturally adopt and practice these values, creating an environment in which moral development and social responsibility are integral to the learning process.

Application of Scientific Ethics in Early Childhood Education Practices

The operational definition of the application of scientific ethics in early childhood education (PAUD) refers to the concrete actions, principles, and behaviours that educators implement to ensure that learning environments are grounded in ethical and moral values. In practice, this includes respecting children's rights, prioritising their interests, protecting their well-being, and promoting collaborative engagement among educators, parents, and the wider community. Scientific ethics in PAUD also requires adherence to legal and regulatory frameworks, such as Law Number 35 of 2014 on Child Protection, which outlines children's fundamental rights and the responsibilities of adults to safeguard and support their development. Operationally, it involves both tangible and intangible actions that embody ethical principles, such as fair treatment, consistent attention to children's needs, and creating conditions that allow children to thrive emotionally, socially, and academically.

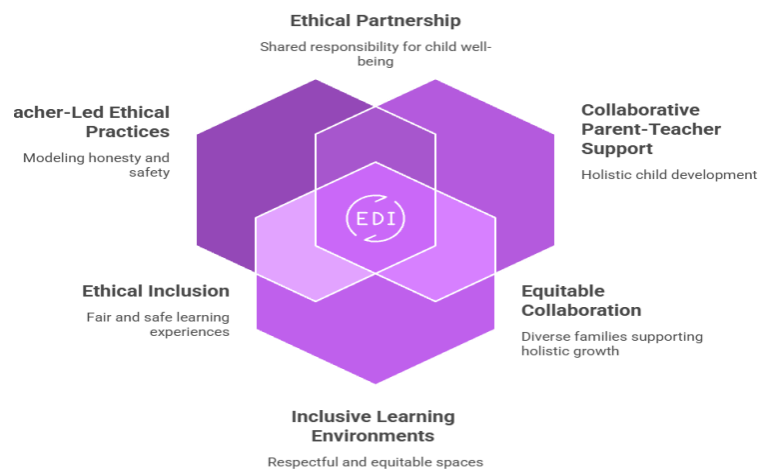


Figure 1. The Synergy of Scientific Ethics in PAUD

Restating the data, it is evident that the implementation of scientific ethics in PAUD focuses on three primary aspects: respecting children’s rights, prioritising children’s interests, and fostering collaboration with parents and the community. Educators actively ensure that children’s physical, emotional, and psychological well-being is safeguarded, while also embedding moral lessons in classroom activities and daily interactions. This integration of ethics into practical teaching demonstrates that educators’ actions directly shape children’s understanding and practice of ethical behaviour. The research findings highlight that scientific ethics extends beyond academic instruction, encompassing the holistic development of children as morally responsible and socially aware individuals.

A clear pattern emerges from the observations and findings: the application of scientific ethics in PAUD is consistently demonstrated through teacher behaviour, classroom organisation, and activity design. Ethical principles are embedded across multiple dimensions, including child-teacher interactions, peer engagement, and collaborative activities involving parents. Children’s behaviour reflects the modelling provided by educators, indicating a reciprocal learning process where ethical practices are observed, internalised, and enacted. Overall, the pattern suggests that a structured, ethically guided learning environment effectively supports both moral development and social competence, ensuring that children develop as responsible, fair, and empathetic individuals.

Discussion

The findings of this study highlight the significant role of scientific ethics in Early Childhood Education (PAUD) in shaping both children’s cognitive and moral development. The research aligns with existing literature on the importance of ethics in early education, where studies such as those by Jali (2025) and Sain (2025) emphasise the need for educators to integrate moral values such as honesty, justice, and responsibility into their teaching. The findings of this research reaffirm that ethical behaviour among PAUD educators positively influences children’s character, as children tend to imitate their teachers’ moral conduct, which aligns with findings from previous studies (Widiasari & Zahro, 2024). This study supports the notion that the early stages of education are critical for instilling moral values that guide children throughout their lives.

However, the research also extends previous work by highlighting the pivotal role of teachers as moral role models, a point underscored by Wandy's statement that educators must serve as living examples of integrity and ethical behavior. This is consistent with the work of Hina (2024) and Aziz et al. (2025) who discussed the significance of teachers' actions in developing children's virtues through consistent demonstrations of moral values. Unlike many studies that emphasise curriculum or theory, this research focuses on the teacher's direct influence as a moral guide, suggesting that the ethical behaviour of teachers is not merely part of the curriculum but an inherent part of the learning environment that directly affects children's behaviour. (Abdullah, 2024; Bali & Heru, 2024).

The study's implications suggest that integrating scientific ethics into PAUD is not merely an educational framework but a moral imperative. As Monika pointed out, moral education in early childhood impacts character development, supporting the claims by Munawwaroh (2024) and Baharun (2023) that early character education shapes individuals' long-term social and moral behaviour. This collaborative approach is crucial for ensuring that children are raised in an environment that supports both their cognitive and moral development, as discussed in the findings by Herlina (2024) and Khoiroh et al. (2024). This reinforces the importance of incorporating ethical theories, such as Virtue Ethics and the Rawlsian Theory of Justice, into PAUD curricula to enhance moral and social development. It suggests that early childhood education should not only focus on intellectual growth but also create a morally supportive environment to foster well-rounded individuals who can contribute positively to society (Nisa' & R, 2024; Umar & Khaer, 2024).

The theoretical implications of this study further suggest that the consistent integration of scientific ethics in early childhood education can serve as a foundational model for moral pedagogy. By observing and internalising the ethical behaviour of educators, children develop an early understanding of virtues such as honesty, fairness, empathy, and social responsibility. This supports the broader theoretical framework that moral development is not solely a product of cognitive learning but is deeply influenced by social modelling and environmental context, as highlighted by Bandura's social learning theory. The findings reinforce the notion that ethical education in PAUD extends beyond teaching abstract moral concepts; it actively shapes children's character through practical, observable behaviours. The study thus contributes to theory by emphasising that early childhood moral education should be embedded in everyday practice, ensuring that ethical principles are learned experientially rather than only theoretically.

From a practical standpoint, the study underscores the necessity of structured strategies and collaborative practices to implement scientific ethics effectively. Educators must be trained not only in curriculum delivery but also in ethical modelling and in child-centred approaches that prioritise children's holistic well-being. In addition, practical guidelines for engaging parents and the community are essential to reinforce ethical learning beyond the classroom. For instance, activities such as guided storytelling, cooperative projects, and role-modelling ethical behaviour can be documented and shared with families to foster continuity between school and home environments. The research indicates that embedding these practices consistently within PAUD operations fosters a comprehensive support system for children's cognitive, social, and moral growth, demonstrating that the practical application of scientific ethics has tangible effects on both immediate classroom outcomes and long-term character formation.

CONCLUSION

The research highlights the critical importance of scientific ethics in Early Childhood Education (PAUD) for shaping both cognitive development and children's moral foundation. The study found that educators' role in fostering values such as honesty, justice, and social responsibility directly impacts children's ability to understand and internalise these values, which guide them to become empathetic, responsible, and active members of society. The research also emphasises the significance of collaboration between educators, parents, and the community in creating a supportive learning environment for children's holistic development. By incorporating these ethical principles into PAUD practices, we lay a strong moral foundation for the next generation, ensuring they are prepared to thrive in a diverse and interconnected world.

The strength of this study lies in its contribution to understanding how ethical practices in early childhood education shape character development, beyond cognitive achievements. By addressing the essential role of ethics in creating responsible and empathetic individuals, the research enriches the field of PAUD. However, the study is limited by its scope, focusing on a specific region, and further research could explore a broader range of educational settings or assess the long-term impact of ethical education in early childhood on later life stages. Future studies could also examine the influence of different cultural contexts on the application of scientific ethics in PAUD.

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