Jurnal PAI Raden Fatah
Vol. 8, 1 (January, 2026), pp. 67-75
ISSN: 2656-1549 EISSN: 2656-0712, DOI: : https://doi.org/10.19109/pairf.v8i1

OPEN ACCESS Research Article

The Role of The Philosophy of Science in The Development of Student Character Education in High Schools

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ARTICLE INFO

Keywords:
Philosophy of Science; Character Education; Student; Moral Values

Article history:
Received 2025-11-01
Revised 2025-11-09
Accepted. 2026-01-30

ABSTRACT

Character education is one of the main pillars in shaping a morally upright generation with global competitiveness. The phenomenon of moral degradation and lack of discipline among students has become a serious concern for schools. Therefore, a more fundamental approach is needed through the application of the principles of the philosophy of science in the character education process. According to Jujun S. Suriasumantri, the philosophy of science functions to "critically analyze the foundations of human knowledge and provide direction for the development of science that is meaningful to life." This principle serves as the foundation of this study to examine the extent to which the understanding of the philosophy of science can strengthen character education among high school students. This research aims to analyze the role of the philosophy of science in developing students' character education. The study employed a qualitative approach with a descriptive method through field observations, teacher interviews, and document analysis. The results indicate that understanding the philosophy of science helps teachers instill values of truth, responsibility, and integrity in students. The philosophy of science serves as an epistemological foundation in the character education process, particularly in the era of globalization that is filled with moral challenges. The implementation of the philosophy of science is reflected through learning reflections, critical discussions, and the habituation of ethical values within the school environment.

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INTRODUCTION

Education is not only oriented to academic achievement, but also to the formation of the character of students who have morals, integrity, and social responsibility. In the context of modern education, a paradigm shift towards education rooted in moral and human values has become very important. [1]Character education in schools is a systematic and continuous effort to form positive behavior of students in order to be able to face the challenges of increasingly complex life. As one of

[1] Michael R Matthews, ed., *History, Philosophy and Science Teaching: New Perspectives* (Dordrecht: Springer International Publishing, 2018).

the secondary education institutions, it has a great responsibility in instilling character values in students so that they are able to develop into a knowledgeable and ethical generation[2]

The philosophy of science plays an important role in providing a rational, critical, and reflective basis for thinking about the nature of science and its application in life. Through a philosophical approach, education is not only understood as a process of knowledge transfer, but also forms an awareness of moral values and responsibilities.[3] Thus, philosophy of science can be a strong philosophical foundation in developing character education in the school environment.[4] This research seeks to integrate the concept of philosophy of science directly into the practice of character education at the high school level, an approach that is still rarely studied empirically.[5]

Character education is expected to be not only limited to the habituation of positive behavior, but also includes the formation of a way of thinking that is critical and reflective of moral values. In this case, the philosophy of science can help teachers and students to understand the relationship between knowledge and values, as well as between logical thinking and acting ethically.[6] The educational process based on the philosophy of science will lead students to assess the truth not only from the cognitive aspect, but also from the ethical and humanitarian aspects.[7] This is important so that students are able to integrate knowledge with attitudes and behaviors in daily life.[8] This approach offers a new perspective that the values of philosophy of science can serve as an epistomological and axiological framework for teachers in shaping the character of students.[9]

The reality faced by the world of education today shows that the progress of science and technology is not always accompanied by an increase in the morality of students. Many cases of juvenile delinquency, misuse of technology, and declining respect for teachers and parents are challenges for the world of education. This condition shows the need for a philosophical approach in reformulating the direction of education that not only emphasizes the cognitive aspect, but also the affective and moral aspect.[10] By integrating the philosophy of science into educational practice, it is hoped that a generation will be formed that is not only intellectually intelligent, but also morally and spiritually wise.[11]

Based on the description above, research on the *influence of philosophy of science on the development of student character education* is important to be carried out.[12] This study is expected to provide an in-depth understanding of how philosophy of science can be used as a basis in the formation of students' character through the learning process. In addition, the results of this research are expected to be able to contribute to the development of character education models based on philosophical and contextual thinking in accordance with the educational needs in Indonesia, especially in the environment[13]. Thus, the novelty of this research lies in the application of philosophy of science as a practical strategy in shaping the character of students in high school through a value-based approach.[14]

The current condition of the world of education shows that the progress of science and technology is not always followed by an increase in the morality of students, as seen from the phenomenon of juvenile delinquency, the abuse of technology, and the decline in respect for teachers

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[2] Thomas Lickona, *Character Education: A Complete Guide To Educating Students To Be Smart And Good* (Jakarta: Bumi Aksara, 2013).

[3] Jujun S Suriasumantri, *Philosophy of Science: A Popular Introduction* (Jakarta: Pustaka Sinar Harapan, 2015).

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[9] Kirsi Tirri, "Holistic school pedagogy and values: Finnish teachers' and students' perspectives," *International Journal of Educational Research* 50, no. 3 (2011): 159–65, doi:10.1016/j.ijer.2011.07.003.

[10] H A R Tilaar, *Theoretical Pedagogics for Indonesia* (Jakarta: Kompas, 2012).

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[12] Rolf Fjelland, "Teaching Philosophy of Science to Science Students: An Alternative Approach," *Studies in Philosophy and Education* 41, no. 3 (2022): 243–258, https://doi.org/10.1007/s11217-021-09802-8.

[13] Zubaedi, "Character Education Design: Conception and Its Application in Educational Institutions," *Journal of Islamic Education* 2, no. 1 (2011): 45–56.

[14] Wouter Sanderse, "The meaning of role modelling in moral and character education," *Journal of Moral Education* 42, no. 1 (2013): 28–42, doi:10.1080/03057240.2012.690727.

and parents, so an approach that is able to integrate cognitive, affective, and moral aspects at the same time is needed.[15] In response to this, this research presents a novelty by applying philosophy of science directly in the practice of character education in secondary schools, an approach that is still rarely studied empirically in Indonesia.[16] This approach not only focuses on habituating positive behavior, but also emphasizes the development of students' critical, reflective, and rational thinking skills in understanding moral values, thus combining epistemological and axiological dimensions.[17] Thus, this research is expected to form a generation that is intellectually intelligent as well as morally wise, as well as contributing to the development of value-based character education models that are in accordance with the Indonesian socio-cultural context.[18]

RESEARCH METHODS

This study uses a qualitative approach with the type of field research. This approach was chosen because it allows researchers to understand in depth how the principles of philosophy of science are applied in strengthening character education in secondary schools. The main focus is to explore the meaning and philosophical values that are manifested in teaching and learning activities and school culture. The location of the research was determined purposively in schools that were considered to have a strong *character building* program, while the implementation lasted for three months, namely from July to September 2025.[19]

The research data consists of primary and secondary data. Primary data were obtained through direct observation, interviews with principals, teachers, and students, and the involvement of researchers in school activities oriented towards character building. Meanwhile, secondary data is sourced from official school documents such as curriculum, vision-mission, activity reports, and scientific literature related to philosophy of science and character education. All data are analyzed triangulatively to ensure validity and gain a more comprehensive understanding of the phenomenon being studied.[20]

The data analysis process was carried out using qualitative descriptive techniques with reference to the Miles and Huberman model which includes three stages, namely data reduction, data presentation, and conclusion drawing and verification. The validity of the data is guaranteed through triangulation of sources, techniques, and time, as well as *member checking* of informants to ensure the accuracy of interpretation results. This analysis is combined with philosophical reflection so that the results of the research not only describe empirical facts, but also contain deeper meaning of values and morals.[21]

RESULTS AND DISCUSSION

Results

1. Overview of Research Schools

It is one of the public high schools located in Muara Enim Regency, South Sumatra Province. The school is known as an educational institution that is not only oriented towards academic achievement, but also places great emphasis on developing students' character through various coaching programs. Based on the results of observations and interviews with the school, it is known that the main vision of the school is "Realizing students with character, knowledge, and competitiveness."

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[15] Gert Biesta, "What is education for? On good education, teacher judgement, and educational professionalism," *European Journal of Education* 50, no. 1 (2015): 75–87, doi:10.1111/ejed.12109.

[16] Kristjan Kristjansson, "Recent work on flourishing as the aim of education: A critical review," *British Journal of Educational Studies* 65, no. 1 (2017): 87–107, doi:10.1080/00071005.2016.1182115.

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[19] J. W. Creswell, *Research design: Qualitative, quantitative, and mixed methods approaches*, 4 ed. (Los Angeles: SAGE Publications, 2014).

[20] Alif Setyawan and Ifada Novikasari, "The Philosophy of Science Education on Children's Character Education," *International Proceedings of Nusantara Raya* 3, no. 1 (2024): 462–466.

[21] Suggestion, *Quantitative, Qualitative, and R&D Research Methods*, 27th ed. (Bandung: Alfabeta, 2022).

The school has a number of excellent programs related to character formation, such as philosophy and ethics literacy programs, religious habituation activities, character development through student council and scout organizations, and contextual learning that emphasizes reflective and critical values. According to the Principal, the concept of student character education is rooted in the philosophical understanding that human beings are not only rational beings, but also moral beings who must develop values, attitudes, and wisdom in acting.

In this context, philosophy of science becomes the epistemological and axiological basis for all learning policies. Teachers are encouraged not only to teach knowledge, but to instill the meaning and value behind the knowledge itself. This is in line with the view that philosophy of science provides an ethical and rational orientation to scientific and educational activities.[22]

2. *Key Findings of Field Research*

Based on the results of interviews, observations, and documentation, three main findings were obtained related to the role of philosophy of science in the development of student character education, namely:

a. Philosophy of science as the basis for the development of students' critical and reflective thinking awareness.
b. Philosophy of science as the foundation for the formation of moral values and scientific responsibility.
c. Philosophy of science as a driver of academic culture and meaningful learning.

The three findings are explained in depth below.

1) Philosophy of Science as the Basis for the Development of Critical and Reflective Thinking Awareness

The results of interviews with several teachers show that they strive to develop students' critical thinking skills through philosophical dialogue, open discussion, and reflection on scientific values in each subject. Teachers not only require students to understand concepts, but also to question the meaning, benefits, and responsibilities of using such knowledge.

For example, in the subject of Physics, teachers emphasize not only formulas and theories, but also the history of scientific discovery and the values that underlie it, such as scientific honesty and the spirit of seeking truth. This approach is in accordance with Karl Popper's idea that science develops through a continuous process of criticism and falsification; Therefore, students are invited not to accept the truth dogmatically, but through rational consideration and moral reflection.[23]

This approach has a positive effect on the formation of students' scientific character, especially in terms of intellectual honesty, open-mindedness, and a humble attitude towards the truth. Based on observations, students seem to be more active in expressing opinions and showing an attitude of respect for different views. The teacher mentioned that this habit of reflective thinking helps students become more aware of their moral responsibility in using science for the common good.

2) Philosophy of Science as the Basis for the Formation of Moral Values and Scientific Responsibility

The philosophy of science not only teaches a logical way of thinking, but also leads humans to an understanding of moral values and responsibilities in using knowledge, this is realized through character education programs based on universal values such as honesty, discipline, responsibility, and social concern.[24] In an interview, one of the teachers of Pancasila and Citizenship Education (PPKn) explained that each lesson contains elements of values and morals that must be internalized in students.[25] For example, when discussing the theory of justice or social ethics, teachers always associate it with Immanuel Kant's moral philosophy of human duty and dignity as an end, not a means.

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[22] Archie J Bahm, *The Nature of Science: An Introduction to Philosophy of Science* (Albany: State University of New York Press, 1995).

[23] Aida Ratna Zulaiha, "Philosophy of Ontology, Epistemology, and Axiology of Anti-Corruption Education," *Integrity: Anti-Corruption Journal* 11, no. 1 (2025): 109–130, https://doi.org/10.32697/integritas.v11i1.1425.

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[25] Fitrian Nabil and Mulyawan Safwandy Nugraha, "The Integration of The Philosophy of Science and Character Education Curriculum," *IJOMR (International Journal of Management & Research)* 4, no. 2 (2024): 89.

Thus, students are directed to understand that science is not value-free, but has an ethical dimension that must be accounted for. Based on the results of observation of learning activities and interviews with students, it is known that this approach has an impact on changing students' attitudes, especially in terms of academic honesty, discipline, and a sense of responsibility for school assignments. The integration of philosophical values in daily learning activities shows the direct relevance between theory and character education paratics.

This is in line with the view that character education must be based on epistemological and axiological awareness, that is, awareness of scientific truth and the moral responsibility to apply it for good.[26]

3) Philosophy of Science as a Driver of Academic Culture and Meaningful Learning

Field findings show that students have a fairly strong academic culture. Students are encouraged to read, discuss, write, and do small research. The "Philosophy and Literacy Week" activity that is routinely held by the school is a means for students to hone their rational thinking skills and convey ideas argumentatively.[27]

This culture describes the application of philosophical principles of science that emphasize the importance of rationality, objectivity, and scientific curiosity.[28]According to Abdillah, philosophy of science not only discusses the theory of knowledge, but also becomes the basis for the formation of a scientific tradition that respects freedom of thought and academic integrity.[29] The academic culture developed shows the success of the application of philosophical values contextually in the school environment.[30]

Teachers in schools also play an important role as "guiding philosophers" who guide students to find meaning behind knowledge. They try to instill the value that learning is not just memorizing facts, but understanding the essence and purpose of science itself. Such learning encourages students to find the relevance between knowledge, moral values, and daily life.[31]

Discussion

1. The Relevance of Philosophy of Science to the Development of Character Education

Based on the analysis of field findings, it can be concluded that the application of philosophy of science in the context of education makes a significant contribution to the development of character education. Such relevance can be explained through three main dimensions:

1. The epistemological dimension, where students are trained to think critically, logically, and systematically in understanding science.
2. The ontological dimension, where students realize that knowledge is not only empirical facts, but also contains human meanings and moral values.
3. The axiological dimension, in which students understand the moral responsibility in using knowledge for the common good and progress of society.

Understanding these three dimensions makes students more reflective in making decisions, behaving honestly, and having high social awareness. This is in line with Tilaar's opinion that character education based on the philosophy of science helps to form a whole human being, namely

[26] Suyanto and Asep Jihad, *Becoming a Professional Teacher: Strategies for Improving Teacher Qualifications and Quality in the Global Era* (Jakarta: Erlangga, 2019).

[27] Anindito Aditomo et al., "Inquiry-based learning in higher education: Principal forms, educational objectives, and disciplinary variations," *Studies in Higher Education* 38, no. 9 (2013): 1239–58, doi:10.1080/03075079.2011.616584.

[28] Roger Säljö, "Digital tools and challenges to institutional traditions of learning: Technologies, social memory and the performative nature of learning," *Journal of Computer Assisted Learning* 26, no. 1 (2010): 53–64, doi:10.1111/j.1365-2729.2009.00341.x.

[29] & Zaenudin Aulia, H., Nurhalimah, A., Mandailina, V., Mahsup, Syaharuddin, Abdillah, "The Effectiveness of Collaborative Learning Methods in Improving Critical Thinking Skills," *Paedagoria National Seminar* 3 (2023): 1–7.

[30] David Kember, Alex Ho, dan Celina Hong, "The importance of establishing relevance in motivating student learning," *Active Learning in Higher Education* 9, no. 3 (2008): 249–63, doi:10.1177/1469787408095849.

[31] Terence Lovat dan Ron Toomey, "Values education and quality teaching: The double helix effect," *Educational Philosophy and Theory* 41, no. 6 (2009): 633–49, doi:10.1111/j.1469-5812.2008.00469.x.

a human being who is knowledgeable and moral.[32] This study adds empirical evidence that philosophy of science can be applied in real life in the context of high school.[33]

From the ontological side, philosophy of science teaches that human beings are subjects who have awareness and responsibility for their knowledge. Science is not just a collection of facts, but is part of human existence that is related to values, meanings, and goals in life.[34] In the context, this awareness is realized through strengthening human values such as empathy, mutual cooperation, and social justice. Through a reflective learning approach, students are encouraged to understand that knowledge should be used for the common good. This view is in line with H.A.R.'s view that education should shape human beings as moral beings who are aware of their social and existential responsibilities.

Axiologically, the philosophy of science gives direction and value orientation to scientific and educational activities.[35] In the context of character development, values such as honesty, responsibility, and integrity are the basis of student behavior. Teachers play the role of moral guides who instill awareness that knowledge must be accompanied by virtue and responsibility. Thus, character education is not only normative, but also pragmatic and applicative in students' real lives. This strengthens Abdillah's statement that philosophy of science is an important foundation for the formation of scientific attitudes and academic morality in the world of education.

2. The Impact of the Application of Philosophy of Science on Student Attitudes and Behaviors

From the results of observation and documentation of school activities, it can be seen that students show positive changes in terms of behavior and learning ethic.[36] They are more responsible in doing assignments, more polite to teachers, and more open in discussion. Some teachers mentioned that the application of philosophy of science has helped students understand the meaning of learning as a process of seeking truth and self-formation. In addition, activities such as weekly reflections, discussion of virtue values, and character-based leadership training become an integral part of the school's culture. This is in accordance with the principle of character education according to Lickona, that character formation must be carried out through three main components: moral knowing, moral feeling, and moral action. This fact shows the integration between character education and philosophical approaches. Thus, it can be said that philosophy of science plays a role as a conceptual basis as well as an inspiration for praxis in creating an educational environment with high character and integrity.

3. Synthesis and Implications of Research Results

The results of the study show that the integration of philosophy of science in character education creates a synergy between knowledge, values, and moral actions.[37] This school has succeeded in making the teaching and learning process not only a transfer of knowledge, but also a process of forming students' personality and philosophical awareness.[38] The implication of this finding is the importance of making philosophy of science-based character education a new paradigm in the development of national education curriculum and policies.[39] Teachers need to be trained to understand the epistemological and axiological aspects of science, in order to instill character values in a more meaningful way to students. The results of this research open up new opportunities for the application of philosophy of science as the basis for the development of

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[32] Tilaar, *Theoretical Pedagogics for Indonesia*.

[33] James Arthur et al., "Teaching character and virtue in schools," *Oxford Review of Education* 47, no. 3 (2021): 371–87, doi:10.1080/03054985.2020.1852001.

[34] Hamdan Hasibuan, Muhammad Roihan Daulay, and Mowafg Masuwd, "Philosophical Texts: Character Education for Minangkabau Women," *To-Plot'lim Journal* 29, no. 2 (2022): 164–173, https://doi.org/10.15548/jt.v29i2.733.

[35] Rina Fatiya Rosida et al., "The Process of Forming Knowledge: In the Study of Ontology, Epistemology, and Axiology," *International Journal of Education, Vocational & Social Sciences (IJEVS)* 5, no. 1 (2023): 45, https://doi.org/10.29103/ijevs.v5i1.12980.

[36] Nursri Hayati and Irwan Shaleh Dalimunthe, "Integration of Science Based on Philosophy Review (Study Aspects of Ontology, Epistemology, and Axiology)," *ITQAN: Journal of Science-Education* 13, no. 2 (2022): 169–182, https://doi.org/10.47766/itqan.v13i2.670.

[37] Kristjan Kristjansson, "Flourishing as the aim of education: A neo-Aristotelian view," *British Educational Research Journal* 46, no. 2 (2020): 239–55, doi:10.1002/berj.3577.

[38] Peter Oldham dan Shane McLoughlin, "Character education research: A scoping review," *British Journal of Educational Studies*, 2025, doi:10.1080/00071005.2025.2557208.

[39] Jaap Schuitema, Geert ten Dam, dan Wiel Veugelers, "Teaching strategies for moral education: A review," *Journal of Curriculum Studies* 53, no. 2 (2021): 1–19, doi:10.1080/00220272.2020.1869112.

character education in secondary schools.[40] In addition, the results of this study confirm that philosophy of science is not only a theoretical discipline, but also has high practical value in shaping knowledgeable, moral, and responsible human beings for humanity and the environment.

CONCLUSION

Based on the results of research and data analysis, it can be concluded that philosophy of science plays an important role in strengthening the conceptual foundation and practice of character education in secondary schools. The application of the principles of philosophy of science helps teachers instill moral values such as honesty, responsibility, and integrity through a reflective and dialogical learning process. The philosophy of science is not only the basis for scientific thinking, but also serves as a means to develop the ethical and spiritual awareness of students.

The results of the study show three main aspects of the application of philosophy of science in character education. First, *the epistemological dimension* that encourages students to think critically, logically, and rationally in understanding science. Second, *the ontological dimension* that fosters the understanding that knowledge is inseparable from human and moral values. Third, *the axiological dimension* that emphasizes that science must be used for the good and social responsibility. These three dimensions form the philosophical awareness of students to be able to judge the truth rationally and ethically.

In addition, this study found that the application of philosophy of science can create a healthy and ethical academic culture in schools. Students become more open in discussions, more reflective of the learning process, and show increased discipline and moral responsibility. Teachers act as philosophical guides who help students understand the relationship between knowledge, values, and daily life. For *further research*, it is recommended to expand the study of the application of philosophy of science in character education at other levels of education, such as madrasas or universities. Subsequent research can also combine qualitative and quantitative methods to assess the extent to which the integration of philosophical values of science affects the formation of students' character and academic achievement. Thus, the philosophy of science has been proven to contribute to shaping a generation that is not only intellectually intelligent, but also morally and reflectively. Character education based on the philosophy of science is expected to be an important foundation for the creation of an education system that is humanist, ethical, and oriented towards common welfare.

LIMITATIONS

This study has several limitations. The qualitative approach with a limited sample from a single school restricts the generalizability of the findings. Reliance on observation, interviews, and document analysis may introduce researcher bias and socially desirable responses. The absence of quantitative instruments limits objective measurement of character development outcomes. Additionally, the findings are context-bound and may not be fully replicable in other institutional or cultural settings. Future research is recommended to employ mixed-method approaches, larger and more diverse samples, and comparative studies across different educational contexts to enhance the validity and broader applicability of the results.

AUTHOR CONTRIBUTION

AD conceived the study, conducted the field research, collected and analyzed the data, and drafted the manuscript. JS contributed to the research design, supervised the study, and reviewed the manuscript. SW assisted in data interpretation, provided academic guidance, and contributed to revising and improving the final manuscript. S reviewed and provided critical feedback on the manuscript as Corresponding Author. All authors have read and approved the final version of the manuscript.

[40] Marvin W Berkowitz dan Melinda C Bier, "Research-based character education," *The Annals of the American Academy of Political and Social Science* 688, no. 1 (2020): 81–97, doi:10.1177/0002716220910573.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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