Utilization of Artificial Intelligence in Strengthening the Pancasila Student Profile Project Integrated with STEM

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Abstract

As the essence of education, the curriculum will persistently undergo changes and renewal to align with societal needs and the ever-expanding global challenges. The integration of STEM and the Pancasila Student Profile Strengthening Project is essential in the context of education in Indonesia. By utilizing STEM, educators can contextually and relevantly teach Pancasila values, enabling students to comprehend scientific and technological concepts and incorporate these noble values into their daily lives. However, STEM learning in schools often faces challenges, such as limited resources, less innovative methods, and students' difficulties understanding abstract concepts. Technological advances have brought significant changes in various aspects of life in recent years. Artificial intelligence extends beyond computer science and informatics, permeating multiple disciplines. Educators can utilize the introduction of artificial intelligence (AI) in the education sector as a tool to enhance learning. AI is designed to process cognitive modeling of human thinking related to how a machine can record information, imitate, and modify automatically. Therefore, this study aims to investigate the integration of AI in P5 with STEM. We conducted this research at SMP Negeri 1 Purwosari using a qualitative approach. The research results demonstrate the use of AI in the integrated STEM P5 activities, beginning with activity planning, implementation, and evaluation. AI guides activity planning, integrates directly into technology, and functions as an automated assessment tool, delivering prompt and precise feedback. Therefore, overall, AI has outstanding potential to help improve the effectiveness of the learning process and introduce students to technology that will play an essential role in their future.

Keywords: *Artificial Intelligence, Pancasila, Project, Student Profile, STEM.*

1. Introduction

The vision of Indonesian education is to create an advanced, sovereign, independent, and personality-driven Indonesia through the development of Pancasila student character. The Ministry of Education, Culture, Research, and Technology realizes this vision by initiating the Merdeka Curriculum policy, which supports achieving these goals. The Merdeka Curriculum is the basis for building students with solid character, with Pancasila values as the primary foundation. The Merdeka Curriculum itself is the latest innovation in the Indonesian education system, which aims to provide freedom and flexibility to schools in compiling and implementing curricula according to the needs and characteristics of students [1]. With this freedom, schools can be more adaptive to local potential and responsive to student interests, making the learning process more relevant and meaningful. We anticipate this flexibility will foster a dynamic learning environment and facilitate the advancement of competencies in line with current trends. Updates in the Merdeka Curriculum represent a significant development step from previous curricula [2]. As the essence of education, the curriculum will persistently undergo changes and renewal to align with societal needs and the ever-expanding global challenges. This renewal ensures that education in Indonesia remains relevant and capable of producing the next generation, who are intelligent and have strong characters as citizens who contribute to national development [3].

The Merdeka Curriculum focuses on forming national character through the Pancasila student profile. The Pancasila student profile, a character that students must possess, encompasses six dimensions [4]: 1) Faithful, devoted to God Almighty and noble; 2) Independent; 3) Cooperation; 4) Global diversity; 5) Critical thinking; and 6) Creative. Integration of intracurricular and co-curricular activities,

specifically the Pancasila Student Profile Strengthening Project (P5) and extracurricular activities, is necessary to realize the Pancasila student profile. The Merdeka Curriculum emphasizes a holistic and contextual learning approach, where learning focuses on mastering subject matter and character development, social skills, and Pancasila values. P5 activities are a forum for applying these values in contexts relevant to students' daily lives. Merdeka Curriculum also aims to cultivate 21st-century skills. The learning design should align with the 4C skills: 1) critical thinking, 2) creative and innovative thinking skills, 3) communication skills, and 4) collaboration skills. Students receive critical and creative thinking training through interdisciplinary and problem-based projects, enabling them to find solutions, collaborate with peers, and effectively communicate their ideas. Students acquire these skills academically, ethically, and morally, all while adhering to Pancasila values.

On the other hand, global developments in education require mastery of 21st-century skills, including critical thinking, creativity, collaboration, and communication skills. These skills are essential amidst the increasingly complex dynamics of real life, where success depends not only on theoretical knowledge but also on the ability to practice and apply that knowledge in various real situations. In the modern era, the ability to apply knowledge to generate relevant solutions and innovations determines a person's success. For instance, one needs critical and creative thinking skills to solve complex problems innovatively. Meanwhile, collaboration and communication skills enable the younger generation to work effectively in teams and share ideas clearly and precisely [5]. Therefore, we need to focus the knowledge and skills of the younger generation on deep information analysis and providing solutions to current challenges. This effort will equip them with skills relevant to the world of work and prepare them as adaptive individuals ready to face various changes in the future. Learning is required to facilitate students' realization of the concepts they learn through simple technology development [6]. We hope that the development of simple technology will enable students to apply, evaluate, and even formulate the knowledge itself. One of the learning models that in the process allows students to be able to develop, analyze, and evaluate technology in terms of science, engineering, and mathematics elements in an integrated manner in one learning process is STEM (science, technology, engineering, and mathematics) learning [7]. This causes STEM learning to be used as a reference for learning innovation to build 21st-century skills, namely during the implementation of the Merdeka Curriculum. Integrating STEM and the Pancasila Student Profile Strengthening Project is essential in Indonesia's education context. Students can learn Pancasila values contextually and relevantly through the application of STEM, which not only helps them understand scientific and technological concepts but also helps them apply the noble values of Pancasila in everyday life [8].

Technological advances have brought significant changes in various aspects of life in recent years. In addition to its focus on computer science and informatics, artificial intelligence has permeated multiple disciplines. Educators can utilize the introduction of artificial intelligence (AI) in the education sector as a tool to enhance learning [9]. The design of AI involves the cognitive modeling of human thought, enabling a machine to automatically record, imitate, and modify information. Researchers study AI as a computer science to replace human roles potentially. Thus, AI can play a significant role in learning. Artificial intelligence (AI) is becoming increasingly widespread and is no exception in education. Students can utilize AI to enhance their learning quality and develop their creative potential. The emergence of AI has opened up new opportunities in the learning process, especially in the STEM field. One of the applications of technology in STEM learning is AI [10].

On the other hand, STEM plays a crucial role in equipping students with the skills needed to compete in the digital era and face future challenges. However, STEM learning in schools often faces challenges, such as limited resources, less innovative teaching methods, and students' difficulties understanding abstract concepts. This is where AI can play an important role [11]. We can use AI to develop more interactive and adaptive learning media and design the integration of this technology into the curriculum. AI can provide solutions by creating a more interactive, adaptive, and personal learning environment for students. AI technology tailors the learning process to students' individual needs, provides in-depth explanations, and offers a variety of virtual simulations and experiments [12].

However, the challenge in implementing the Pancasila Student Profile lies in integrating these values into the learning process while prioritizing 21st-century skills, particularly in STEM. This is where AI can play an influential role as a tool. In addition to offering students a more adaptive and personalized learning experience, AI enables the creation of interactive and real-life learning projects, fostering a deeper understanding and internalization of Pancasila values within a scientific and technological framework. Therefore, this study aims to investigate how AI can enhance the Pancasila Student Profile by integrating it with STEM at the junior high school level. This study is expected to contribute to developing a holistic learning model where mastery of science and technology can go hand in hand with character formation based on Pancasila values.

2. Research Method

We conducted this study at SMP Negeri 1 Purwosari from July to August 2024, using a qualitative approach that emphasizes the observation of phenomena in natural conditions, covering the entire research process from the research process to the report writing. The subjects of this study consisted of the principal, vice principal for curriculum, P5 coordinator, and teacher facilitator at the junior high school, with additional document analysis in the form of P5 administration in semester 2 of the 2023/2024 academic year and semester 1 of the 2024/2025 academic year. The research procedure includes several stages: the preparation stage (research design and determination of data sources), field studies (data collection through interviews, observations, and document studies), sample selection and research limitations, instrumentation, data collection, data analysis, and formulation of conclusions. We collected data from primary sources through participatory observation, in-depth interviews, and documentation and then presented it through observation descriptions, interview transcripts, and document analysis. We carried out interactive and continuous data analysis until the data reached saturation.

3. Result and Discussions

3.1. Implementation of P5 at SMP Negeri 1 Purwosari

Current learning uses the Merdeka Curriculum, which emphasizes strengthening differentiated learning according to the level of student achievement. This curriculum combines intracurricular and co-curricular learning through the Pancasila Student Profile Strengthening Project (P5) program. This program aims to provide students with a more meaningful learning experience by adjusting the approach according to their needs and abilities. We design P5 activities to foster collaborative learning across various disciplines, enabling students

to comprehend the material in a broader context and across multiple fields. This collaborative approach encourages students to work together to achieve common goals and improve their ability to communicate, collaborate, and think critically. The main objective of P5 activities is to bring learning closer to real life through contextual and relevant activities. This project considers the resources owned by educational units and students so that the learning process becomes more related to the environment and local potential. The design of P5 activities separates them from intracurricular learning, emphasizing the process of students going through stages such as observation, data collection, processing, execution, evaluation, and reflection. Through this approach, P5 activities allow students to experience each stage of the learning process directly, allowing them to explore each step comprehensively and develop critical observation and analysis skills. We regulate the implementation of P5 activities with adequate time allocation, allowing educators to observe the gradual and continuous development of student competencies and characters. This focus on sufficient time aims to provide space for students to absorb and internalize each lesson they undergo. To achieve the Pancasila student profile, P5 activities offer opportunities for students to gain knowledge that strengthens character and equips them with the ability to learn from their surroundings. Thus, P5 not only functions as a learning medium but also as an effort to strengthen contextual and meaningful character for students.

Based on the research, SMP Negeri 1 Purwosari has implemented P5 activities separately from intracurricular and co-curricular activities. Every week, specifically every Friday, SMP Negeri 1 Purwosari schedules these P5 activities and implements them throughout the school year. The school year applies three themes to each grade level, namely grades VII, VIII, and IX, ensuring consistent and thematic project-based learning. The implementation of P5 activities at SMP Negeri 1 Purwosari was successfully carried out thanks to the coordination between the principal, vice principal for curriculum, P5 coordinator, and facilitator, with support from the supervising supervisor. The synergy among stakeholders ensures optimal coordination of every aspect of the activity, thereby achieving the P5 goal of building student competence and character. P5 activities at this school include several main stages, namely the planning, implementation, monitoring, evaluation, and follow-up stages. Each stage's design ensures the learning process's effectiveness and aligns with the development of the Pancasila student profile, offering students a contextual and relevant learning experience. The planning stage of P5 activities commences with a coordination meeting attended by the principal, vice principal for curriculum, activity coordinator, and facilitator teachers. The meeting delves deeply into the project's objectives, the themes to address, and the planned activities for implementation. The principal provides general direction regarding school policies and ensures that P5 activities align with the institution's vision and mission.

In contrast, the vice principal for curriculum is responsible for ensuring that planned activities align with the applicable curriculum. The activity coordinator is vital in preparing the implementation schedule, preparing learning modules, and dividing tasks among the facilitator teachers who will accompany students during the activities. We design the modules to ensure uniform activity implementation at every grade level. The distribution of modules to facilitators aims to maintain uniformity in implementing P5, ensuring all students get a balanced learning experience by the expected character development goals.

At the implementation stage, P5 activities begin with socialization with all students and teachers regarding the objectives and importance of this project to ensure a good understanding of the benefits and values to be achieved. In its implementation, the facilitator teacher plays an active role in assisting students and guiding them through each stage of the activity, from preparing the action plan to implementing actual activities according to the planning. This assistance aims to provide direction and support so students can carry out the project effectively and meaningfully. The activity coordinator monitors the project's progress, ensures it adheres to the established schedule and plan, and ensures regular implementation at every stage. The principal and vice principal also play a role in directly monitoring the implementation of P5 activities [13]. Their presence ensures that the project runs smoothly and continues to prioritize the instillation of Pancasila values, which are the core of P5 activities, providing learning that is not only academic but also character-based for students. We conduct the evaluation stage after the project's completion to gauge its success and its impact on students. This evaluation includes assessing the project process and results and collecting feedback from students and facilitator teachers. This process aims to obtain a comprehensive picture of the effectiveness of P5 activities in achieving the set goals. The curriculum vice principal and the activity coordinator collect evaluation data and compile it into a comprehensive report. This report includes analyzing the data obtained and recommendations for improving future activities. The principal reviews the completed report and uses it as a reference to plan the following P5 activities, ensuring each project enhances education quality and fosters student character development [14].

3.2. P5 Integrated STEM

STEM, which stands for science, technology, engineering, and mathematics, combines sciences integrated through an interdisciplinary approach. Currently, these disciplines no longer function separately; instead, various sciences can work together in the context of science and engineering groups and across social sciences and humanities. Thus, collaboration between disciplines is essential in facing multiple complex challenges. We expect the application of learning in STEM subjects to enhance the interest and relevance of the teaching and learning process for students. This approach encourages students to participate in learning activities that foster critical thinking, creativity, and collaborative skills, boosting their enthusiasm for learning. By linking scientific concepts with practical applications, STEM learning has the potential to create more meaningful learning experiences and prepare students for future challenges.

STEM learning plays a crucial role in student education, especially in the era of globalization and the industrial revolution 4.0, in preparing them to face the challenges of the 21st century. STEM is a strategy to prepare a generation that can compete effectively in the global market. This integrated approach combines four essential disciplines, namely science, technology, engineering, and mathematics, allowing students to develop critical thinking, creativity, and complex problem-solving abilities. Through STEM learning, students learn theoretical concepts and apply them in practical projects that reflect real-world problems. This approach improves their understanding of the subject matter and prepares them to apply knowledge in everyday life. Thus, STEM learning significantly contributes to developing student competencies, making them better prepared to face the challenges of the modern era [15]. Linking the STEM model to the environment can optimize its development, resulting in learning that presents facts experienced by students in everyday life. Integrating the Pancasila student profile strengthening project with STEM learning is relevant because both have complementary goals in developing student character and competence. The Pancasila student profile and the STEM approach emphasize developing critical thinking skills and problem-solving abilities. Thus, STEM projects that aim to solve various problems in everyday life can directly apply Pancasila values, such as social justice and cooperation. This strengthens students' understanding of scientific concepts and shapes their character as individuals sensitive to social issues and can contribute positively to society [16].

SMP Negeri 1 Purwosari has implemented P5 activities that integrate the STEM approach based on the conducted research. The P5 activities in class VII, which focus on Entrepreneurship and Sustainable Lifestyle, clearly demonstrate this. This activity aims to equip

students with practical experience in enhancing their entrepreneurial skills and raising their awareness of environmental sustainability. Students act as salted egg entrepreneurs in activities with the theme of entrepreneurship. Students participate in various stages, including planning, product creation, sales, and financial analysis to determine profit and loss. This process provides direct experience in business and teaches them about the importance of sound financial planning and management. Like other P5 activities, salted eggs incorporate dimensions, elements, and sub-elements, as illustrated in Table 1. By combining these dimensions and components, this activity aims to equip students with a thorough understanding of the interplay between entrepreneurship and sustainability, fostering critical and creative thinking to solve project-related problems.

Table 1. Dimensions, Elements, and Sub-Elements of P5 Activities on the Entrepreneurship Theme

Pancasila Student Profile Dimensions	Elements	Sub-Elements of Pancasila Students
Independent	Understanding oneself and the situation at hand	Recognizing the qualities and interests of self and the challenges faced
Mutual Cooperation	Collaboration	Cooperation
Creative	Generating original ideas and producing original work and actions	Producing original ideas and producing original works and actions
Critical Reasoning	Obtaining and processing information and ideas	Identifying, clarifying, and processing information and ideas

In addition to developing characters according to the profiles of Pancasila students, this project also integrates STEM learning. Although it looks simple, making salted eggs is a series of STEM lessons for students. Table 2 displays the location of the STEM learning components involved in making salted eggs.

Table 2. STEM Learning in P5 Entrepreneurship Theme

STEM Fields	Material Studied
Science	Osmosis is when salt seeps into the egg. Determining the right concentration of salt solution for making salted eggs.
Technology	Simple food preservation technology by salting.
Engineering	Designing an adequate container for the egg soaking process. Optimizing the method of wrapping eggs with salt or ash dough. Measuring the optimal soaking time.
Mathematics	Analyzing business profits and losses by determining the amount of capital and estimating the selling price.

Another integration of STEM in P5 activities focuses on the theme of sustainable lifestyle, with the activity title of creating eco-enzymes. Table 3 displays the dimensions, elements, and sub-elements developed in P5. Table 4 illustrates the STEM learning that is possible in producing eco-enzymes.

Table 3. Dimensions, Elements, and Sub-Elements of P5 Activities on the Theme of Sustainable Lifestyle

Dimension	Element	Sub-Elements
Faith, devotion to God Almighty, and noble character	Morals towards nature	Understanding the interconnectedness of the Earth's ecosystem
Mutual Cooperation	Collaboration	Cooperation Responsive to the social environment

Table 4. STEM Learning in P5 Sustainable Lifestyle Theme

STEM Fields	Subjects Studied
Science	Fermentation involving microorganisms to decompose organic materials
Technology	Use of simple technology to carve temperature and acidity during the fermentation process
Engineering	Engineering design of a container for making eco-enzymes that is safe and has minimal contamination
Mathematics	Ratio or comparison of ingredients for making eco-enzymes

The research suggests that the Pancasila Student Profile Strengthening Project integrates STEM as a strategic effort to develop student competencies holistically. The STEM approach not only invites students to master science, technology, engineering, and mathematics knowledge and skills but also demands their application in real-world contexts. This approach encourages students to think critically and creatively and equips them with problem-solving skills that are relevant to the challenges faced by society. Thus, the implemented learning emphasizes academic aspects and fosters character development and social skills essential for everyday life. The integration of STEM in this project also aligns with the national education goal of creating a generation that is academically intelligent and has social and environmental awareness. This approach prepares students to tackle 21st-century challenges and positively contribute to community development [17]. The STEM education at SMP Negeri 1 Purwosari aligns with 21st-century learning principles, prioritizing project-based and problem-based learning. In this context, students acquire theoretical knowledge and receive training to apply it in creating products that address existing problems. This process begins with problem identification, followed by an in-depth investigation to find the right solution. This approach encourages students to think critically and creatively when formulating solutions to their problems [18]. They learn to plan, design, and test their ideas, equipping them with technical, social, and collaborative skills that are very important in

everyday life. This training prepares students to tackle increasingly complex challenges in the future. This habituation pattern plays a vital role in equipping students with the ability to solve problems they encounter in their surroundings. Direct experience with real-world issues enhances their preparedness and confidence to tackle everyday situations, enabling them to contribute to society positively.

3.3. Utilization of AI in STEM Integrated P5 Activities

Artificial intelligence (AI), also known as artificial intelligence in Indonesia, is a branch of computer science that aims to develop systems and machines capable of performing tasks that usually require human intelligence. Over the past few years, technological advances have significantly changed various aspects of life, including education. Educators must fully utilize the introduction of artificial intelligence (AI) in the education sector as a tool to enhance learning innovation and support digital transformation. AI is unrelated to human intelligence. Some AIs are indeed made to simulate human intelligence. AI relies on algorithms to achieve results related to goals and methods of achieving goals. An artificial intelligence system is computer hardware capable of performing tasks requiring human intelligence. The rapid development of information and communication technology has changed many aspects of life, including learning and teaching methods. Artificial intelligence plays an increasingly important role in educational institutions' learning. In STEM-integrated P5, artificial intelligence (AI) begins at the planning stage, where AI is a valuable source of ideas. Using algorithms and data analysis, AI can help teachers identify the most intriguing and relevant STEM topics for students, increasing their interest and motivation to participate in learning activities.

Additionally, AI assists in designing schedules and organizing the necessary resources for P5 activities. By analyzing existing patterns and needs, AI can recommend efficient scheduling and optimal resource allocation so that the learning process can run smoothly and effectively. The use of AI in this planning stage not only improves the planning quality but also makes it easier for educators to organize activities that meet students' needs. Thus, the integration of AI in STEM-integrated P5 planning provides additional benefits, facilitating teaching that is more adaptive and responsive to the needs of students. This creates a more dynamic and interactive learning environment, which can produce a deeper and more meaningful learning experience for students.

During the implementation stage of STEM-integrated P5 activities, students actively utilize artificial intelligence (AI) as part of their technology. AI aims to stimulate students' creativity, providing them with tools that allow them to create innovative solutions in their projects. Students can enhance their efficiency and effectiveness in completing their assignments by utilizing various AI-integrated applications. Students use Canva, an application, to design product labels for salted eggs and produced enzymes. With intuitive graphic design features, Canva allows students to express their creative ideas visually.

Additionally, students use Google Docs to create P5 reports, facilitating real-time collaboration and document processing. Students can work together to compile reports, make revisions, and share ideas effectively, creating a more interactive learning experience. Thus, integrating AI in the implementation of P5 not only enhances students' creativity but also encourages cooperation and collaboration between them. Using applications such as Canva and Google Docs facilitates a more dynamic learning process where students can directly apply their STEM knowledge and skills in relevant and exciting contexts [19]. This creates a learning environment that prepares them to face real-world challenges. Artificial intelligence (AI) plays an important role in assessing student learning outcomes at the evaluation stage. Quizizz is a tool that integrates with AI to enable automatic assessment. By using Quizizz, teachers can quickly assess student work, saving time and effort in the assessment process. AI in Quizizz speeds up the assessment process and provides an in-depth analysis of student performance. With this feature, teachers can access data on students' understanding of concepts, common mistakes, and areas that need improvement. This allows teachers to get a clearer picture of each student's progress. In addition, AI also helps teachers provide swift and accurate feedback. With AI's ability to analyze assessment results, teachers can provide students with more specific and helpful advice. This timely and relevant feedback can encourage students to understand the material better and improve their shortcomings, thus supporting the ongoing learning process. Therefore, integrating AI in this evaluation stage enhances efficiency and the quality of student feedback [20].

Overall, artificial intelligence (AI) has tremendous potential to enrich students' learning experience in STEM-integrated P5 activities. AI provides comprehensive support in various stages, from planning to implementation and evaluation. In the planning stage, AI helps teachers design intriguing and relevant activities, while during implementation, AI serves as a tool to stimulate students' creativity and facilitate collaboration. In the evaluation stage, AI improves the efficiency of assessment and enriches the feedback process so that students can receive helpful information for self-improvement. Thus, integrating AI in STEM-integrated P5 enhances the learning process's effectiveness and helps students develop relevant skills for their future. By introducing students to advanced technologies such as AI, they are prepared to face academic challenges and adapt and compete in an increasingly technologically influenced world. This will ensure that they have the skills and knowledge needed to contribute positively to society.

4. Conclusion

Technological advances have significantly changed various aspects of life, including education. The emergence of AI has opened up new opportunities in the learning process, especially in the STEM field. From planning to implementation to evaluation, STEM-integrated P5 activities utilize AI. AI can guide activity planning, integrate directly into technology, and function as an automated assessment tool that delivers prompt and precise feedback. Therefore, overall, AI has outstanding potential to help improve the effectiveness of the learning process and introduce students to technology that plays a vital role in their future. Overall, artificial intelligence (AI) has tremendous potential to enrich students' learning experience in STEM-integrated P5 activities. AI provides comprehensive support in various stages, from planning to implementation and evaluation. In the planning stage, AI helps teachers design intriguing and relevant activities, while during implementation, AI serves as a tool to stimulate students' creativity and facilitate collaboration.

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