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APPLICATION OF PROJECT-BASED LEARNING METHOD TO IMPROVE 21ST CENTURY SKILLS

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Abstract

The purpose of this project is to investigate in detail how the Project-Based Learning (PjBL) approach is used to help students develop 21st-century abilities. 21st-century abilities, such as communication, teamwork, creativity, and critical thinking, are essential in facing global challenges in the digital era. Using a literature review approach, this study collects and analyzes various previous study results that are relevant to the implementation of PjBL at various levels of education. The results of the study indicate that the PjBL method consistently makes a positive contribution to the development of 21st-century skills. PjBL encourages students to be actively involved in the learning process through real-world problem solving and collaborative group work. In addition, the integration between the learning process and the use of technology in PjBL further strengthens the achievement of skills needed in the modern era. This study concludes that PjBL is one of the effective and relevant pedagogical approaches in supporting competency-based learning in the 21st century. Competent teacher support and a conducive learning environment are needed to optimize the implementation of this method sustainably.

Keywords: Project-Based Learning, 21st-century skills, 21st-century learning, innovative education

INTRODUCTION

In the era of globalization and the rapidly developing industrial revolution 4.0, the world of education is faced with the challenge of preparing students with competencies that are relevant to the demands of the times.

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21st century skills are one of the main indicators in determining the readiness of the younger generation to face the complexities of modern life that is full of dynamics. Skills such as critical thinking, problem solving, collaboration, effective communication, digital literacy, creativity, and the ability to adapt to technological changes are aspects that are not only needed in the world of work, but also in social life in general (Fatmawati, 2018). Therefore, educational institutions must be able to design and implement learning strategies that are not only cognitive in nature, but also able to develop these competencies holistically. One pedagogical approach that is considered capable of answering these needs is the Project-Based Learning (PjBL) method. This method emphasizes a learning process that is centered on students through challenging, collaborative project activities, and is oriented towards solving real problems (Gabuardi, 2021). In Project-Based Learning, students are actively involved in designing, implementing, and reflecting on a project that is pertinent to the actual situation. They are encouraged to think critically, become curious, and hone their teamwork abilities through this process. Thus, the implementation of Project-Based Learning is considered in line with efforts to strengthen 21st-century skills because it encourages students to become independent learners who are critical, creative, and innovative.

However, the implementation of Project-Based Learning does not always run smoothly. It requires a deep understanding from educators regarding the basic principles of PjBL, as well as the ability to design projects that are in line with student characteristics and learning objectives. To ensure that learning occurs as effectively as possible, instructors must also be able to support collaborative activities, offer helpful criticism, and establish a supportive learning atmosphere. This challenge is reinforced by the fact that traditional education systems in many countries, including Indonesia, still tend to be oriented towards factual knowledge and one-way learning, so that the transformation towards a project-based learning approach requires comprehensive and sustainable efforts (Martinez, 2022a).

The 21st-century skills that are intended to be developed through the Project-Based Learning method include cognitive, affective, and psychomotor aspects in an integrated manner. For example, in team-based projects, students will face challenges that require cooperation, division of tasks, and conflict resolution, all of which are part of social and communication skills. In the process of designing solutions to real problems, they are also required to apply critical and creative thinking, and reflect on the results of their work.

This process also improves their ability to manage time, make decisions, and use technology as a tool, which are part of digital literacy. In other words, Project-Based Learning provides space for the development of comprehensive and contextual skills, which are rarely obtained through conventional learning methods. Along with the increasing awareness of the importance of 21st-century skills, various education policies at the national and global levels have encouraged the use of more active and student-oriented learning approaches (Riyadi & Rahayu, 2017). In Indonesia, for example, the Merdeka Curriculum provides more space for schools and teachers to develop innovative and contextual learning models. In this context, Project-Based Learning is one of the recommended methods because it is able to integrate various disciplines and provide meaningful learning experiences. Project-based learning also allows integration between academic knowledge and real experience, so that students not only understand the concept theoretically, but are also able to apply it in situations that are relevant to their lives.

It is crucial and necessary to conduct research on the use of project-based learning to enhance 21st-century abilities in order to give empirical proof of the efficacy of this method. In addition, this kind of research can also contribute to the development of educational theories and practices that are responsive to the challenges of the times. By understanding how PjBL can be implemented effectively, as well as how it impacts 21st-century skills, educational institutions, teachers, and policy makers can take the right strategic steps in designing an adaptive, inclusive, and transformative learning system. More than just a pedagogical approach, Project-Based Learning can be seen as one of the key strategies in creating a generation of lifelong learners who are ready to face the future with confidence and high competence (Puangpunsi, 2021a). In addition, it is also important to consider contextual factors that can influence the success of Project-Based Learning implementation, such as teacher readiness, availability of resources, institutional support, and the characteristics of the students themselves. In-depth and systematic research on these factors will enrich our understanding of how PjBL can be adapted effectively at various levels and educational contexts. Moreover, in the ever-evolving digital era, the integration of technology in project implementation is an important element that can expand the exploration and creativity of students. Therefore, Project-Based Learning is not just a method, but a holistic learning approach that combines elements of pedagogy, technology, and social context to form competent and relevant students in the 21st century (Almazroui, 2023). With this background,

this study aims to explore in depth the application of the Project-Based Learning method in the context of today's learning, and to analyze how this approach contributes to the development of 21st century skills. This study also seeks to identify challenges and strategies that can be applied by educators in implementing PjBL effectively. It is hoped that the results of this study can make a significant contribution to improving the quality of learning in Indonesia, as well as being a reference for various parties who are committed to creating relevant and highly competitive education in the global era.

RESEARCH METHOD

The present study employs the literature review method as its research methodology, with the objective of scrutinizing and evaluating diverse research findings, theories, and pertinent concepts about the implementation of the Project-Based Learning (PjBL) approach to enhance 21st century competencies. The literature review was chosen because it is able to provide an in-depth understanding through a synthesis of credible academic sources, such as scientific journals, books, conference proceedings, and other scientific articles. In this study, a systematic literature search was carried out using keywords such as "Project-Based Learning", "21st century skills", "innovative learning", and "digital century education". These sources are taken from trusted academic databases such as Google Scholar, Scopus, and ScienceDirect to ensure the accuracy and validity of the data used in the analysis. The data analysis process was carried out using a descriptive-qualitative approach, where data collected from various literatures were analyzed, classified, and compared to obtain a thorough grasp of the connection between the use of PjBL and the growth of 21st century abilities including communication, cooperation, creativity, and critical thinking.

Through this approach, researchers attempt to identify patterns, themes, and important findings that can be used as a basis for formulating conclusions and practical recommendations in the context of today's education. Thus, this study not only functions as a conceptual review, but also as a theoretical basis that can strengthen arguments regarding the urgency of implementing PjBL in improving students' readiness to face the global challenges of the 21st century.

RESULT AND DISCUSSION

Understanding and Classification of 21st Century Skills

21st century skills are a collection of competencies that are considered essential for individuals to be able to live, work, and participate effectively in a changing global society, especially in the context of highly dynamic technological, social, and economic developments. The concept of 21st century skills emerged as a response to the major transformations brought about by the fourth industrial revolution, globalization, and the rapid development of information and communication technology. These changes have not only changed the way people work, but also how they learn, interact, and solve problems. Therefore, education and training systems around the world have begun to direct attention to the development of skills that no longer only focus on traditional cognitive aspects, but also on broader and contextual affective and psychomotor aspects. In general, 21st century skills do not replace basic literacy such as reading, writing, and arithmetic, but complement them with more complex dimensions of competence (Varas et al., 2023). In a world characterized by abundant information and rapid change, individuals are not enough to just have conventional academic abilities. They are also required to think critically, be able to solve problems creatively, collaborate with various parties, and be able to communicate effectively in various cultural contexts. Therefore, 21st century skills are often understood as a bridge between academic knowledge and future life and work readiness.

In global education and policy literature, There are numerous primary categories into which 21st century skills have been divided. The Partnership for 21st Century Learning (P21) created a well-known classification system that breaks these skills down into three major categories: life and career skills, digital and technology literacy skills, and learning and innovation skills. Critical thinking and problem-solving abilities, creativity and invention, and teamwork and communication abilities are all included in the learning and innovation skills group. These abilities are highly needed in the context of lifelong learning and adaptation to new, unpredictable challenges (Lamb et al., n.d.).

Meanwhile, digital and technological literacy skills refer to an individual's ability to understand and use information effectively in a digital environment. This literacy is not only limited to the ability to operate technological devices, but also includes a critical understanding of digital information, cybersecurity, and ethics in the use of technology. In an era where data and information are very easy to access but often unverified, the ability to sort, analyze, and evaluate digital information becomes very important. This ability enables

individuals to become not only consumers of information, but also responsible producers of information.

Among the life and professional qualities that are essential are flexibility and adaptability, initiative and self-motivation, responsibility, and social and cultural awareness emphasized in the 21st century skills classification. In a work environment that increasingly demands autonomy, cross-cultural collaboration, and rapid role changes, individuals must be able to adapt mentally and emotionally (Chen, 2023). Therefore, character development, emotional intelligence, and leadership are inseparable aspects of 21st century skills. These skills also include time management, project management, and the ability to set goals and evaluate one's progress periodically. In addition to the P21 classification, institutions such as the World Economic Forum (WEF) have also developed a 21st century skills framework with a similar approach, but adding aspects such as technological skills and the ability to continue learning (reskilling and upskilling). This shows that 21st century skills are dynamic and continue to develop along with technological advances and changes in job market needs. In this context, learning is no longer an activity limited to school or university, but rather a lifelong process. Individuals are required to continuously update their skills to remain relevant and competitive (van Laar et al., 2017).

Understanding 21st-century skills is also inseparable from the social and cultural context that surrounds them. In a multicultural and pluralistic society, the ability to work in teams across social, linguistic, and cultural backgrounds is important. Therefore, 21st-century skills also include the ability to empathize, interact ethically, and understand and appreciate differences. Strengthening values such as tolerance, social responsibility, and environmental awareness are integral parts of learning these skills. This further emphasizes that 21st-century skills are not only technical, but are also greatly influenced by the human values that underlie social interaction (González-Pérez & Ramírez-Montoya, 2022).

In its implementation in the world of education, the development of 21st-century skills requires a transformative pedagogical approach. Approaches such as project-based learning, inquiry-based learning, and digital collaboration are effective methods for instilling these skills. The curriculum is no longer focused solely on transferring knowledge, but also on developing thinking and acting skills that are relevant to the real world. Teachers no longer act only as sources of information, but also as facilitators who help students explore, reason, and build their own understanding. In this context,

learning becomes more active, participatory, and contextual. The overall classification of 21st-century skills shows that education in the modern era must be able to produce individuals who are not only intellectually intelligent, but also resilient, adaptive, and able to innovate. A world that continues to change requires humans who are able to respond to change with creative and ethical solutions. Therefore, 21st-century skills are not just a set of additional competencies, but have become a basic need to face a complex and challenging future. These skills are not only important for students and students, but also for teachers, organizational leaders, and all elements of society who want to play an active role in creating a better and more sustainable world.

Project-Based Learning as a Relevant Innovative Approach

Project-Based Learning (PjBL) has developed into one of the most relevant and innovative learning approaches in contemporary education. In the context of rapid changes in the era and demands for 21st-century competencies, PjBL becomes an effective bridge between theory and practice, between classroom learning processes and the complex real world. This approach places students as active subjects in the learning process by challenging them to complete real projects related to everyday life or professional contexts. In its implementation, PjBL encourages students to integrate various disciplines, collaborate, think critically, and develop communication and creativity skills (López, 2020). Through systematically designed projects, students are not only required to master the content of the material, but also learn how to apply this knowledge to solve problems concretely. The relevance of PjBL in today's education cannot be separated from the shift in the learning paradigm from a traditional approach to a more participatory and reflective approach. The modern curriculum emphasizes the development of soft skills and digital literacy needed to face the challenges of the 21st century (Omelianenko & Artyukhova, 2024). In this case, PjBL becomes one of the main strategies that bridges the needs of the curriculum with the realities faced by students outside the classroom. When students are involved in projects that require them to design, plan, and evaluate certain products or solutions, they experience a more meaningful and in-depth learning process. No longer just memorizing concepts, but truly understanding and being able to use the knowledge in relevant contexts. This makes PjBL very much in line with the contextual and constructivist learning approaches that emphasize active involvement and personal meaning of the

material being studied. The advantages of PjBL as an innovative approach also lie in its flexibility in various levels of education and fields of study. Both at elementary, secondary, and tertiary levels, PjBL can be applied to encourage exploration, experimentation, and creation that are in accordance with students' abilities and interests. For example, in science, students can conduct simple research on the impact of climate change on their environment (Susanti et al., 2019). In language lessons, they can create digital literacy campaign projects or write and publish digital books collaboratively. In the arts, they can design exhibitions of works or performances that convey certain social messages. These projects not only enrich students' learning experiences but also strengthen the relationship between school and community through contextual and socially beneficial activities. The application of this technology makes PjBL an adaptive approach to the times, while expanding the scope of learning beyond the physical boundaries of the classroom. The integration of technology also encourages students to become critical and productive digital learners, a competency that is very important in today's information age. The teacher acts as a facilitator who guides students in this exploration process, provides constructive feedback, and ensures that each stage of the project supports the achievement of learning objectives (Barak & Yuan, 2021).

However, despite promising many advantages, the implementation of PjBL also requires significant changes in mindset and teaching practices. Teachers are required to design projects that are authentic, challenging, and aligned with the curriculum. They must also be able to manage group dynamics, monitor individual progress, and assess learning outcomes holistically. Meanwhile, students need to be given space to develop independence, responsibility, and reflective abilities in every stage of the project. This process is not always easy, but with careful planning and adequate support, these challenges can be overcome. In fact, the learning experience through PjBL will equip students with resilience, problem-solving skills, and interpersonal skills that are rarely honed in conventional learning systems (Almulla, 2020). Overall, Project-Based Learning is a learning approach that is not only innovative in method, but also relevant in substance. Amid the complexity of global challenges and demands for adaptive, flexible learning, and oriented towards solving real problems, PjBL is present as a comprehensive solution. By facilitating in-depth, collaborative, and contextual learning experiences, this approach opens up space for more humanistic and transformative education. Education is no longer just a method of imparting information, but rather an arena for the formation of character, competence,

and creativity that will prepare future generations to contribute positively to a society that is constantly changing.

Understanding, Characteristics, and Steps for Implementing Project-Based Learning in Learning

Project-Based Learning (PjBL) is a pedagogical approach that emphasizes the active involvement of students through relevant, contextual, and meaningful projects. PjBL not only positions students as learning subjects, but also as managers of the learning experience itself. In this approach, Students encounter actual issues or obstacles from the real world that need to be resolved using introspective, cooperative, and exploratory methods. Building 21st-century skills including critical thinking, problem solving, communication, teamwork, and creativity is the primary objective of PjBL. Students are supposed to gain a deeper conceptual understanding and refine practical abilities that they may use in both the workplace and daily life through organized and in-depth learning experiences (Vasiliene-Vasiliauskiene et al., 2020). In the context of modern education that demands transformation towards more active and student-centered learning, PjBL is one approach that is considered effective and relevant. This model encourages students to take the initiative, explore sources of information, design solutions, and produce products as evidence of their learning process (Sindre et al., 2018). Compared to traditional learning models that tend to be lecture-based and one-way, PjBL provides space for students to experiment, ask questions, and develop ideas independently and in groups. This active involvement indirectly increases learning motivation, sense of responsibility, and emotional attachment to the learning process and outcomes.

The main characteristic of Project-Based Learning lies in the integration of theoretical knowledge and real practice. Learning in PjBL does not occur in a classroom isolated from reality, but rather connects the subject matter with everyday life. Students not only learn about concepts, but also how these concepts are used to understand and solve complex problems (Diana et al., 2021). Therefore, project-based learning always begins with trigger questions that are open, challenging, and encourage the search for solutions. These questions are at the center of the entire learning process because they trigger curiosity and encourage further exploration.

In addition, PjBL has strong collaborative characteristics. In the process, students are invited to work in groups that allow them to exchange ideas, discuss, and share roles according to their respective abilities. This

collaboration strengthens the social aspects of learning, such as the ability to work in a team, negotiate, and empathize with other people's perspectives. The use of digital technology is also often an important part of PjBL, both as a tool in designing projects, collecting data, and delivering final results. This technology integration provides a new dimension in learning that is in accordance with the needs of today's digital generation. Projects in PjBL are not only physical products, but can also be presentations, simulations, written reports, or digital solutions. The most important thing is not just the end result, but the thinking and learning process that occurs during the project. Therefore, reflection is an important component in this approach. Students are invited to evaluate the process they have gone through, analyze the successes and obstacles faced, and develop strategies for future improvements. This reflection strengthens metacognitive learning, where students not only learn "what" but also "how to learn".

According to (Markula & Aksela, 2022) the steps for implementing Project-Based Learning in learning start from the stage of careful planning by educators. The first stage is to design questions or trigger problems that are relevant to the curriculum and students' lives. These questions must be open enough to encourage exploration but still have limitations so that learning remains focused. After that, teachers and students prepare a project design, including objectives, data collection methods, task division, and implementation time. This design should be flexible so that it can adjust to the dynamics in the field.

Next, students begin to explore and research according to the focus of their project. At this stage, educators act as facilitators who provide guidance, feedback, and the resources needed. This process encourages students to develop critical thinking skills, analyze data, and formulate logical and creative solutions. After all the information and data are collected, students compile a final product that reflects the results of their work. This product can be in the form of a report, video, mockup, poster, or digital presentation depending on the goals and characteristics of the project.

Presentation of project results is an important stage that allows students to show their learning outcomes to the public, be it classmates, teachers, parents, or the outside community. This presentation encourages students to communicate effectively, convey ideas systematically, and answer questions or criticisms from the audience. At this stage, the assessment aspect becomes important. Assessment in PjBL does not only focus on the final result, but also includes the process, collaboration, initiative, and critical

thinking skills during the project work. Therefore, the use of a comprehensive assessment rubric is highly recommended to assess these aspects objectively and fairly. The last stage of PjBL implementation is reflection and feedback. Students are invited to reflect on their learning experiences: what they have learned, challenges faced, and strategies that can be used in the future. Teachers also provide constructive feedback that helps students improve the quality of their learning. With this reflection, the learning process does not stop at the results, but continues into a continuous learning cycle.

The Connection between 21st Century Skills and Project-Based Learning

Through the execution of actual projects that are pertinent to students' lives, Project-Based Learning (PjBL) is an educational methodology that places an emphasis on the processes of inquiry, research, and problem solving. Regarding education in the twenty-first century which is very dynamic and demands high-level thinking skills, PjBL is one of the learning methods that is considered capable of bridging the gap between the world of education and the demands of the ever-changing world of work. The relationship between Project-Based Learning and 21st-century skills is very close, considering that both have the same orientation, namely activity-based learning that fosters critical thinking, collaboration, creativity, and the ability to communicate effectively (Puangpunsi, 2021b). In addition to academic knowledge, 21st-century skills encompass learning and innovation abilities, technology and information media proficiency, and life and job skills. Students using the PjBL approach must be able to apply their theoretical understanding of the course topics in practical settings. This meets the demands of the twenty-first century, where students must be capable of handling the intricacy of the real worldwith flexibility of thinking and high adaptability. Through projects designed in PjBL, students learn how to manage time, create work plans, These are all part of metacognitive thinking skills that are very important in the 21st century (Rochmawati et al., 2019). One of the main aspects of PjBL is collaboration (Wongdaeng & Hajihama, 2018). In implementing projects, students often work in groups, where they have to share tasks, discuss ideas, and resolve conflicts. This process indirectly trains interpersonal communication and teamwork skills that are very important in the modern work environment. In addition, working in a team also helps students learn to appreciate diverse perspectives and develop empathy, which are important elements in building social awareness and global responsibility. This shows

that PjBL not only encourages academic achievement but also forms character and social values that are relevant to today's global challenges.

Creativity and innovation are also important elements built through Project-Based Learning. In working on projects, students are challenged to find creative solutions to the problems they face. The process of finding solutions requires the courage to try new ideas, combine various information, and evaluate the success of the chosen approach. Here, students are required not to rely on just one way of thinking or strategy, but to be open to various possibilities and alternative approaches. PjBL creates a learning environment that allows students to experience a trial and error process, which ultimately encourages the creation of innovation. This ability to think creatively and innovatively is an important provision in the face of the Society 5.0 period and the Industrial Revolution 4.0 (Martinez, 2022b). Furthermore, PjBL incorporates technology use directly into the educational process. Students are not only required to search for information via the internet, but also to use various applications and software that are relevant to the projects they are working on. The use of this technology is not merely as a tool, but is part of the digital skills that students must have in the 21st century. In this process, students not only learn about technology, but also how to use technology ethically and productively. Digital literacy, the ability to sort information, and awareness of cybersecurity are part of the learning that is obtained contextually through the application of PjBL.

Critical thinking and problem-solving skills are other key skills that are greatly developed through the PjBL approach. In completing a project, students do not simply follow instructions, but must analyze the situation, formulate problems, identify resources, and design possible solutions. All of these processes require high logical and analytical thinking skills. They must be able to evaluate various options, consider the consequences of each decision, and make adjustments based on the results of the evaluation. PjBL provides space for students to become active and independent thinkers who are able to take the initiative and be responsible for their own learning outcomes. This is very important in fostering a spirit of lifelong learning which is the main character of successful individuals in the 21st century.

The relationship between PjBL and 21st century skills is also seen in the evaluation approach used. Unlike traditional learning that focuses on written exam results, PjBL emphasizes more on assessing the process, product, and self-reflection (Lin et al., 2015). This assessment reflects the need to measure process skills like creativity, teamwork, communication, and critical thinking.

Students have the chance to show off their work, give presentations, and get comments from peers and professors. This procedure offers a more genuine and significant educational experience and increases learners' self-confidence.

CONCLUSION

The implementation of Project-Based Learning (PjBL) has been shown to be a successful strategy for enhancing 21st-century abilities like communication, teamwork, creativity, and critical thinking. Students must not only fully comprehend topics but also hone their problem-solving abilities in practical settings through project-based learning activities. This student-centered learning process encourages them to be active, independent, and responsible for achieving their learning outcomes. In addition, direct involvement in projects encourages students to work in teams, exchange ideas, and learn to manage time and resources effectively. In the midst of the demands of a changing world, education must be able to prepare a generation that is adaptive, innovative, and able to compete globally.

In this case, the PjBL method is present as a pedagogical strategy that is not only relevant but also transformative. By integrating real-world challenges into the learning process, this method bridges the gap between theory and practice, and instills the values of entrepreneurship, leadership, and social responsibility. Therefore, the implementation of Project-Based Learning is very important to support the development of 21st-century skills comprehensively, both at the elementary and higher education levels.

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