REVIEW ARTICLE

The project-based learning model and its contribution to student creativity: A review

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Abstract: Currently, students tend to be less innovative and creative in learning and its implementation in everyday life. Project-Based Learning (PjBL) is a learning strategy oriented towards contextual problem solving to find solutions based on the experiences of students so that they can be more creative and innovative. This research aims to reveal how PjBL contributes to increasing student creativity. This research was conducted with a literature review of articles in international journals, international seminar proceedings, and SINTA accredited journals. Based on the results of the analysis carried out, it was found that to realize high creativity, the PjBL model is one of the best solutions to increase students' creativity. This learning model is able to make students more creative and innovative in solving every problem in everyday life by following PjBL syntax. PjBL is suggested to be an alternative for educators to train and foster the formation of students' creativity. It can also be concluded that PjBL can train and increase student creativity because the syntax of this learning model allows students to explore, create, interpret and develop products resulting from their projects.

Keywords: project-based learning; student-centered pedagogy; student creativity

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Introduction

The Sustainable Development Goals (SDGs) reflect the global resolve to improve the quality of life and human capabilities to meet the challenges of the times. In Indonesia, the government has carefully selected the issue focus of the goals and targets of the SDGs, covering a wide range of sectors that holistically form the foundation of sustainable progress. There are 17 goals of the SDGs, one of which is Quality Education. In line with the SDGs, the education agenda aims to ensure not only enrollment and completion but also the delivery of quality education. This investment in education holds the potential to transform learners, families, communities, countries, and the world (Abera, 2023; Nazar et al., 2018). By building a strong educational foundation, it is expected that society will achieve higher levels of productivity, support sustainable economic growth, and ultimately achieve better levels of prosperity (Camilleri & Camilleri, 2020). It is important to recognize that achieving this fourth goal or target is not a responsibility that individuals can shoulder alone. It is a joint effort that involves collaboration between individuals, education and training institutions, and governments. This collaboration provides a solid foundation to ensure that quality education can achieve the SDGs more effectively and sustainably (Boeren, 2019; Kioupi & Voulvoulis, 2019). With quality education, people, especially learners, are given the opportunity to develop their full potential and improve the quality and capacity of their lives. As such, the SDGs and their focus on Quality Education are not only a global development agenda, but also a reflection of a shared determination to create a better and more sustainable future for all.
To realize quality education, educational institutions, especially educators, have a central role in planning and implementing learning that can shape students into individuals who have better quality and life skills.

Quality education is not only about transferring information, but also about developing abilities that are relevant to the demands of the times. One important aspect of life skills that must be instilled in learners is creativity. Creativity is defined as a person's ability to think about things in new ways, develop new and unusual ideas, and create unique solutions to problems and opportunities (Hasanah, 2015). Creativity can maximize as originality, utility, and surprise all approach unity. Creativity is not only about freedom of imagination, but also the ability to apply (Acar et al., 2017; Runco & Jaeger, 2012; Simonton, 2018). Hamzah et al. (2022) added that the dimensions that can be emphasized in developing creativity are at the level of person, process, and product. In the person dimension, creativity involves the development of creative traits in individuals, such as interest in various things, willingness to take risks, and perseverance in pursuing ideas. On the other hand, the process dimension covers how individuals generate new ideas through certain stages, such as observation, analysis, and synthesis. Meanwhile, the product dimension highlights the concrete results of the expression of creativity, such as artworks, inventions, or innovative solutions. By focusing on creativity development, educational institutions can provide a strong foundation for learners to face future challenges. Research results by Ferrari et al., (2009), Sasson et al. (2018) and ŽivkoviĿ (2016) concluded that learning that encourages creativity will not only improve critical thinking skills, but also help learners to become resilient problem solvers and innovators. Thus, quality education includes not only knowledge transfer, but also character building and skills relevant to global dynamics.

Creativity and innovation in the context of education cannot be ignored and it is a very important factor for educators to pay attention to develop in learners (ŽivkoviĿ, 2016). They are the main drivers of progress and adaptation in a dynamic world. To form individuals capable of making valuable contributions in a changing society, a learning environment is needed that facilitates the development of curiosity, patience, openness to new ideas, a high level of trust, and the ability to learn from mistakes and failures. These abilities, like any other skill, can be developed through practice over time. This approach is in line with Trilling and Fadel (2009) view that creativity and innovation are not innate talents, but rather abilities that can be acquired and enhanced through continuous practice and exploration. By creating learning environments that support the development of curiosity, patience, openness, trust and learning from mistakes, educational institutions can play a key role in shaping individuals who are creative, innovative and ready to face the complex challenges of an ever-evolving world.

One of the most effective ways to develop creative skills is through a challenge to design projects by learners to create solutions to real-world problems. Given the demands of the 21st century to continually innovate new services, better processes, and better products for the world's global economy, and for jobs with creative knowledge to be needed in a growing number of the world's better jobs, it is no surprise that creativity and innovation top the list of 21st century skills (Isabekov & Sadyrova, 2018; Trilling & Fadel, 2009).

According to Lufri et al. (2020), skills related to creativity have two dimensions that can be developed, namely thinking creativity and doing creativity. Thinking creativity will give birth to thoughts, ideas and ideas (G. Gunawan et al., 2017; Suryandari et al., 2018). Doing creativity will produce products that are beneficial to education and society. This is in accordance with Gunawan (2014) research that the learning approach used should be able to develop students' creativity in producing products that come from their understanding of the concepts studied. This means that creativity is not only related to the way of thinking to give birth to ideas and ideas but also related to producing products.

Creativity is more varied in the course of lessons related to implementing Project-Based Learning (PjBL) (Yustina & Suwondo, 2015). Some research results have shown that the PjBL model has an impact on increasing the creativity of students both at school and in college. Several research showed that the use of the PjBL model in the implementation of learning in schools and universities can increase student creativity, both creativity in thinking and creativity in producing products (Hanif et al., 2019; Sari & Angreni, 2018; Ummah et al., 2019; Widyaningrum & Wijayanti, 2019). Wurdinger (2016) also emphasized that schools and colleges need to consider using PjBL to the curriculum. This is because this learning model shows not only improvement in problem solving, critical thinking, creativity, communication, collaboration but also students' confidence, time management, understanding academic content work ethic, motivation, and teamwork.

From the description that has been explained previously, it can be seen that project based-learning has emerged as an effective approach to education that not only enhances students' understanding and mastery of knowledge but also fosters their creativity. Numerous studies have extensively reported the influence of PjBL model on enhancing student creativity, as evidenced by the publications mentioned in the preceding paragraphs. However, scholarly papers that systematically review the contributions of this model to such competencies are still relatively scarce. Therefore, the primary objective of this paper is is to explain how PjBL contributes to enhancing student creativity by revealing its underlying mechanisms.

Method

This research constitutes a literature review study. In this literature review, identification, evaluation, and analysis of all available information are conducted to address the predetermined research questions.

Existing literature is reviewed by summarizing and presenting perspectives on the reviewed articles. In the formulation of research questions, the scope for developing the research focus is determined. The research questions addressed in this study encompass: (a) the effect of implementing project-based learning, (b) the potential improvement of students' 21st century skills through project-based learning, (c) the potential enhancement of student creativity through project-based learning, and (d) additional aspects related to PjBL efficacy. Following this, literature related to the research questions is sought. A comprehensive review of articles from various sources is conducted, utilizing platforms such as Google Scholar and Scopus. Subsequently, the data is evaluated, with several articles obtained being assessed and aligned with the research problems. Finally, the data is analyzed and interpreted, with the research findings being examined and evaluated through narrative synthesis.

Results and Discussion

The 21st Century Skills

Science and technology are developing very quickly and becoming more sophisticated, so teachers who have character are needed. A nation whose society is not prepared will almost certainly fall due to the enormity of natural changes and the rapid progress of science and technology. To be able to play a meaningful role in the era of globalization in the 21st century, every citizen is required to have abilities that can respond to the demands of current developments (Kennedy & Sundberg, 2020). 21st century learning is a learning transition where the developed curriculum guides schools to change the approach and orientation of learning from teacher centered to student centered. This is in accordance with future demands where students must have thinking and learning skills.

In order to welcome this era of industrial revolution, just having knowledge is not enough for students. However, we need to instill skills that can support students' competitiveness in the future. Students in this 4.0 revolution era education have at least four (4) skills as capital to survive and develop, namely critical thinking and problem solving, creativity and innovation, collaboration, and communication. These four skills are popularly abbreviated as 4C skills. This means that in learning we need to orient students to be able to communicate, share and collaborate, and use technology to think critically and creatively to find solutions to problems related to the learning material being studied. This process will have a high level of effectiveness and will serve as initial capital for them in facing new demands in life in the future. Rotherham and Willingham (2010) state that to face revolutionary times, students must have 21st Century abilities and skills to face global change.

The existence of Information and Communication Technology (ICT) is both an opportunity and a challenge for education. The implementation of ICT in education needs special attention. This aims to ensure that students are able to learn to make joint decisions, share information, collaborate, innovate and work together quickly and intelligently. Because this is very important for them to face world challenges in the current era of revolution 4.0. This industrial revolution has had a huge impact on the order of life, especially education. This is based on the role of education which is central to producing and producing quality generations who will fill this revolution. Education today is not enough just to provide and increase student motivation, but must also be able to train and improve the 21st Century skills that students must have (Arsyad, 2021).

Next, Lufri et al. (2020) previously stated that 21st Century Education in the era of the industrial revolution is education that integrates various competencies or learning skills (knowledge, attitudes and skills), communication and collaboration skills, as well as mastery of international languages and ICT. These skills are really needed to prepare students to face global challenges. The skills in question can be realized in the form of 4C skills. This skill is very useful in the lives of students, because it is capital for them to have ten main skills needed in the world of work in the future, namely solving problems, critical thinking, creative thinking, the ability to manage people, the ability to coordinate and have the skills to emotional, decision-making ability, service-oriented, negotiation ability, and finally the ability to adapt to cognitive processes in dealing with new things and changing environments. Therefore, teachers as people who have an important role in guiding students to have 21st Century skills need to consider and plan appropriate strategies in learning. In addition, one thing that needs to be considered is the application of learning theory in the learning process. This learning theory is needed as a consideration in choosing learning strategies.

Generational development should also be taken into consideration in the world of education (Arsyad, 2021). Looking at the birth years of generations, there are groupings to differentiate their perspectives. These groups are the veteran generation (1925-1946), baby boom generation (1946-1960), X generation (1960-1980), Y generation (millennial generation) (1980-1995), Z generation (1995-2010), and alpha generation (2010+). These six groups have different characteristics, and we need to realize that teachers and students will have different characteristics according to their generation.

In accordance with current developments, the 21st Century skills that students must have according to the World Economic Forum, OECD, and the Partnership for 21th Century Learning, in Indonesia are

summarized into the Indonesian Partnership for 21st Century Skill Standard (IP-21CSS) where these skills can be adapted on all P21 framework material (21st Century skills). The skills referred to include critical thinking and problem solving, creativity thinking and innovation, communication and collaboration, information, media, and technology skills, life and career skills. 21st Century Skills are universally described in four (4) categories, namely (1) way of thinking, (2) way of working, (3) tools for working, and (4) way of living.

Apart from the skills mentioned above, according to Arsyad (2021) these 4C skills can be developed through social and emotional learning and this will be more successful if combined with basic literacy learning. The demands of this era are marked by technological developments. Thus, education must also be oriented towards preparing students who have the ability to answer these new challenges. With this technology, the implication in the learning process is that the learning process is not just about introducing technology but can also help develop competencies and improve the quality of students' character. According to WEF & BCG in Arsyad (2021), 21st Century skills in the lifelong scheme are described as in Figure 1.

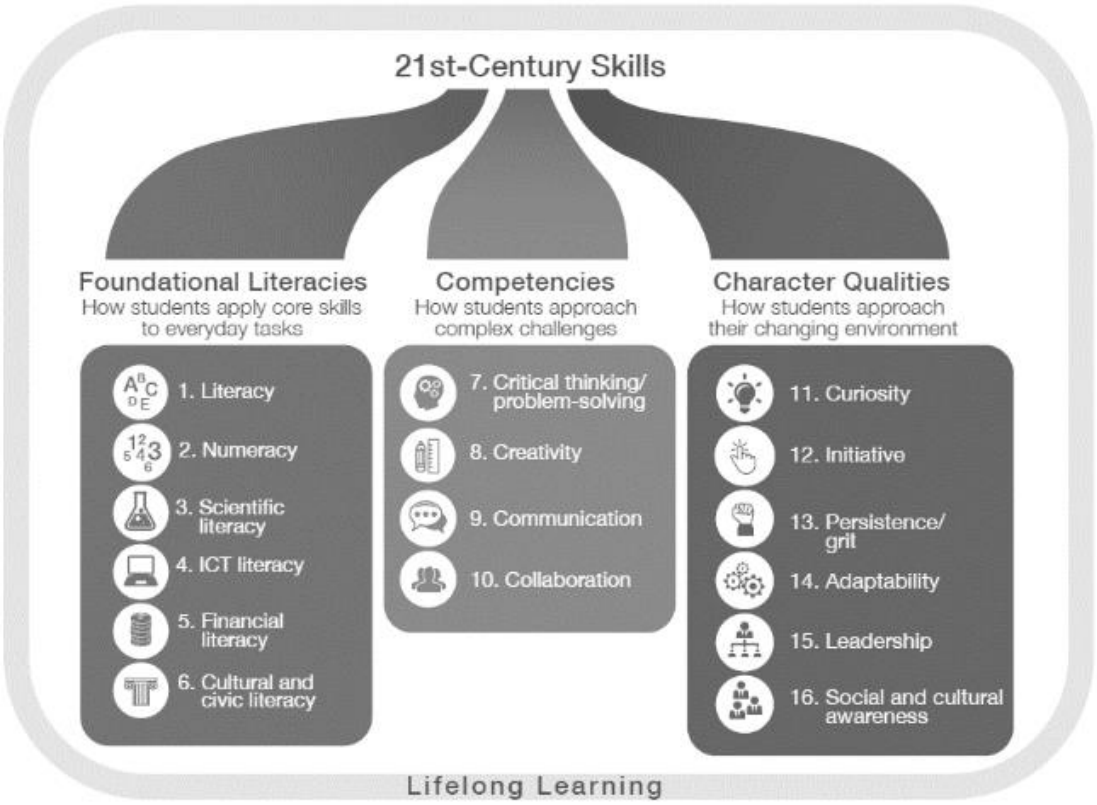

Figure 1. 21st Century skills in the lifelong scheme

Creativity

Our current era of knowledge is quickly giving way to the Era of Innovation, where the ability to solve problems in new ways, create new technologies, create the next application of existing technology, or even discover branches of science and create similar industries once new, it will all be greatly appreciated. Creativity and innovation can be fostered with a learning environment that fosters curiosity, patience, openness to new ideas, high levels of trust, and learning from mistakes and failures. This ability can be developed, like other skills, through practice over time (Trilling & Fadel, 2009).

One of the most effective ways to develop creative skills is through challenging students to design projects to create solutions to real-world problems. Given the 21st century's demands for continued innovation in new services, better processes, and better products for the world's global economy, and for jobs with creative knowledge needed in an increasing number of the world's better jobs, it is not surprising that creativity and innovation tops the list of 21st century skills (Trilling & Fadel, 2009).

Skills related to creativity have two dimensions that can be developed, namely thinking creativity and doing creativity (Lufri et al., 2020). Creativity in thinking will give birth to thoughts, ideas and concepts. Creativity in action will produce products that are beneficial to education and society. This is in accordance with research by Gunawan (2014) that the learning approach used should be able to develop students' creativity in producing products that originate from their understanding of the concepts being

studied. This means that creativity is not only related to the way of thinking to give birth to ideas but also related to producing products.

Creativity is more varied in the course of lessons related to implementing PjBL (Yustina & Suwondo, 2015). Several research results have shown that the PjBL model contributes to increasing students' creativity both at school and at college. Several research results shows that the use of the PjBL Model in implementing learning in schools and universities can increase student creativity, both creativity in thinking and creativity in producing products (Hanif et al., 2019; Sari & Angreni, 2018; Ummah et al., 2019; Widyaningrum & Wijayanti, 2019). Schools and universities need to consider using PjBL in the curriculum (S. D. Wurdinger, 2016). This is because this learning model shows not only an increase in problem solving, critical thinking, creativity, communication, collaboration but also self-confidence, time management, understanding academic content, work ethic, motivation, student teamwork.

The assessment of project product creativity can be seen from the aspects of initiative (gathering information), innovation (material issues), variation of ideas (data display), and suitability of ideas and solutions (Yustina & Suwondo, 2015). The assessment of the creativity of actions that produce this product can be seen from the aspects of preparation for making the product, the process of making the product, and the product results (Mubarikah & Sylvia, 2021). Meanwhile, according to Hindun and Husamah (2019), the assessment of student product creativity can be seen from the aspects of preparation, design planning process, project plan design content, design presentation, product presentation, and product. Trilling and Fadel (2009) said that students have creative competence in two forms, namely thinking creatively and working creatively. Based on the analysis of several theories expressed above, it can be concluded that skills, in this case creative competence, refer to students' ability to think creatively, work creatively, and create new innovations.

Based on the discussion above, it can also be concluded that learning related to the implementation of PjBL provides a richer diversity of dimensions for the development of creativity. In the context of PjBL, creativity is not just a single or limited aspect, but develops in various ways through various stages and dynamics that occur in the learning journey. The PjBL model, by offering challenging and contextual projects, encourages changes in students' creativity through various stages of observation, analysis and synthesis. Experience in PjBL allows students to explore and develop various forms of creativity, including creative aspects in thinking, actions and the results produced. By integrating the dimensions of person, process and product in the context of PjBL, students' creativity is empowered and develops more comprehensively. Along the learning journey designed in PjBL, students are not only faced with various challenges, but are also given space to explore their creative potential from various perspectives. The result is a deeper, more dynamic and enriching learning experience, which reinforces creativity as a process that can develop and manifest in various forms in relevant learning contexts.

Project-based Learning

PjBL is a learning paradigm that provides learners with in-depth and contextualized learning experiences. This model is designed to create learning situations that reflect the real world, where learners not only acquire theoretical knowledge, but also apply it in the context of relevant projects. As an engaging learning strategy, PjBL emphasizes active engagement, collaboration and problem solving. PjBL not only stimulates learners' creativity but also invites them to learn through hands-on experience. The projects implemented in this learning include real-world situations that can cover various disciplines. More than just material delivery, PjBL provides opportunities for learners to develop practical skills that can be applied in everyday life. In this context, learners are not only recipients of information, but also active knowledge makers.

PjBL is the main recommendation in the development of learning methods because this model positions the project or activity as the core of the learning process. PjBL creates an environment where students not only receive information, but also actively engage in the stages of exploration, assessment, interpretation, and synthesis of information. Based on guidelines from the Indonesian Ministry of Education and Culture in 2014, this learning model encourages students to produce various forms of learning outcomes that include in-depth understanding of concepts, application of knowledge in a real context, and development of practical skills.

Based on the literature review and reviews carried out, it was found that the PjBL steps expressed by several experts were in accordance with their research needs with the final result being a product, performance, or a solution presentation. The steps or syntax of the PjBL model have been developed by several experts. The comparative analysis for each PjBL model syntax, as analyzed by several experts, is summarized in Table 1.

From Table 1, it can be seen that each PjBL syntax is able to train students' skills, life skills and character, especially training their creativity. PjBL learning model is reported to be able to train 21st Century skills in the era of globalization. This is supported by the results of research by Wurdinger et al. (2007) which revealed that more than 70 schools that applied PjBL showed an increase in 21st Century skills and an increase in the self-concept of students. The PjBL learning model is one of the models that can create a learning atmosphere where the focus of contextual learning shifts to project-based activities. In addition,

the results of research by Mulyani' et al. (2019) stated that practicum-based PjBL can be used to increase the scientific work activities of students' psychomotor competence. This means that this learning model can also develop students' soft skills.

According to Haerullah and Hasan (2017) the advantages of learning by using the PjBL model include (1) It can foster the mindset of students from narrow to more outside and comprehensive in viewing and solving problems faced in life, (2) it can familiarize, apply knowledge, attitudes, and skills in an integrated manner which is expected to be practical and useful in students' daily lives, (3) it can increase learning motivation and encourage their ability to do important work, (4) it can improve problem solving skills. Students become more active and challenged to solve more complex problems, (5) Improve collaboration. The importance of group work in projects is to encourage students to develop and practice communication skills. Cooperative working group student evaluation, online information exchange are collaborative aspects of a project, (6) improve resource management skills. Well-implemented PjBL provides students with learning and practice in organizing projects, and making allocations of time and other resources such as supplies to complete tasks, (7) PjBL models provide learning experiences that involve students in a complex manner and are designed to develop in accordance with the real world, (8) project-based learning involves students to learn to retrieve information and demonstrate their knowledge, then implemented with the real world, and (9) PjBL makes the learning atmosphere fun, so that students and educators enjoy the learning process.

Table 1. Syntax of the PjBL Model according to several experts

PjBL (Lucas, 2007)	PjBL-STEM (Rush, 2015)	PjBL Yaron (Doppelt, 2005)	PJBL (Yudiono et al., 2019)	Creative PjBL (Alacapınar, 2008)	Blended PjBL (Hujjatusnaini et al., 2022)
Start with the essential question	Reflection	Design purpose	Alignment for the product	Identify the project	Questioning (analyze issue and relevant scientific articles)
Design a plant for the project	Research	Inquiry field	Determination product	Creative and original thinking regarding the solution to that problem	Planning design of an experimental project
Create a schedule	Discovery	Solutions: alternative, ideas, and factors	Analysis and identification of the product	Pick one of these, plan for it in detail and implement it step by step	Researching (implementation in project based practicum)
Monitor the student and the progress of the project	Application	Choosing the preferred solution	The scheduling of the product implementation	Observe and report the outcomes	Creating
Assess the outcome	Communication	Operation steps	Product development		Improving (improvement and evaluation of product)
Evaluate the experience		Evaluation	Evaluation process and product		Presenting (reflecting and evaluating project)

Based on the expert opinion above, it can be concluded that in the learning process, especially in lectures in higher education, the learning model chosen should be able to encourage students as individuals and citizens who are faithful, productive, creative, innovative and able to contribute to the life of society, nation, state, and world civilization. Sousa and Pilecki (2018) said that the real purpose of a school and college is to prepare a person for their life after they go through the school and college. This statement is also supported by the results of research by Kortam et al. (2018) that students who learn using PjBL enjoy the experience during their learning. They feel more interested and challenged in learning because with PjBL they feel encouraged to be free to act and express.

Many research results have proven that this PjBL Model can improve student learning outcomes, both

learning outcomes in the knowledge aspect and the skills/psychomotor aspect (Alacapınar, 2008; Desgamalia & Syamsurizal, 2019; Hehakaya et al., 2022; Salybekova et al., 2021). In addition to improving learning outcomes in the knowledge and psychomotor aspects of students, this PjBL model can also improve 21st Century skills. To improve these 21st Century skills, Cahya et al. (2023) said that education, especially in the learning process, must also be oriented to prepare students to have the ability to answer new challenges in the global world. Learners are expected not only to have 4C Competencies which are one part of 21st Century skills but also to be able to develop basic literacy and the quality of students' characters. This is illustrated in the Lifelong Learning scheme, WEF and BCG in Arsyad (2021) convey that 21st Century skills consist of 3 aspects, namely foundational literacies, competencies, and character quality.

Several studies have proven that in the learning process both in universities and schools the PjBL model is not only able to improve students' knowledge (cognitive) abilities or competencies but other abilities, especially 21st Century skills. The positive effects of the PjBL Model in improving 21st Century skills include being able to improve creative thinking skills (Hehakaya et al., 2022; Salybekova et al., 2021), higher order thinking skills (Alacapınar, 2008; Hujjatusnaini et al., 2022), enhanced creativity (Alacapınar, 2008; Indrawan & Jalinus, 2019), problem solving and critical thinking and analysis skills (Amalia et al., 2022; Handayani et al., 2021; Panasan & Nuangchalerm, 2010), communication and collaboration skills (Elsamanoudy et al., 2021).

In addition to improving students' 21st century competencies, the PjBL model is also able to improve the basic literacy and character qualities of learners. Research results show that this model can improve students' motivation and attitudes (Huysken et al., 2019; Kortam et al., 2018), time management skills (Elsamanoudy et al., 2021), soft skills and life skills of students (Hizqiyah et al., 2023; Indrawan & Jalinus, 2019), performance skills (Huysken et al., 2019), scientific writing skills (Probosari, 2015), and science process skills (Panasan & Nuangchalerm, 2010). The improvement of 21st Century skills consisting of basic literacy, competence, and character quality can be realized with this PjBL Model because in the implementation of learning using this model, learning is carried out actively and dynamically, students are required to communicate and work together (collaboration) with classmates or groups, and be creative. Based on this, it can be concluded that the PjBL model is a learning strategy that is suitable for learning theory and constructivism approach because it allows students to build their own knowledge from the knowledge they have previously obtained.

In addition, the learning process in schools or lectures in universities should look for learning approaches that can build student understanding so that it is meaningful and can involve students actively and creatively develop student soft skills. Rohman et al. (2021) said that the advantages of the STEAM-integrated PjBL model include being able to train students to think critically, connect science with technology, collaborate, communicate and be independent. The STEAM-integrated PjBL model can also develop students' inquiry skills. The STEAM integrated PjBL model can also develop the ability to investigate by utilizing equipment / machinery and technology, utilizing IT media to find information sources, training students to think at a high level, critically and creatively. Another positive impact is that students are trained to utilize technology and machines to design products with accurate calculations and have artistic value. Furthermore, some publication also revealed that the PjBL-STEAM learning model can be a learning innovation and can improve the critical thinking and creative thinking skills of students in schools and students in universities (Ahmad et al., 2020; Cahyani & Sulastri, 2021; Fitriyah & Ramadani, 2021; Hehakaya et al., 2022; Priantari et al., 2020).

Based on the above discussion about PjBL, it can be concluded that by using projects as the main medium of learning, PjBL opens the door for students to take an active role in managing and directing their own learning. In the process of project exploration, they can develop research skills, critical analysis, and creativity. Through assessment and interpretation of the information found, students not only understand the material, but are also able to relate it to the real-world context. The synthesis of the results of this exploration and assessment then forms a deeper and more sustainable understanding. One of the advantages of PjBL is its ability to motivate students, as they engage in relevant and meaningful projects. This model not only creates contextualized learning, but also builds skills that can be applied in various life situations. Thus, PjBL is not just a learning method, but also a holistic approach that embraces students' cognitive, affective and psychomotor development. PjBL also provides room for the development of collaborative, communicative and problem-solving skills, as students often work in teams to complete complex projects. This is in line with the demands of the world of work which values individuals who can collaborate effectively and have the ability to face real challenges. By involving students in various stages of learning integrated in a project, PjBL emphasizes that learning is not only about the absorption of information, but also about a well-rounded learning experience. Therefore, the recommendation to use PjBL in learning contexts is very reasonable, because this model not only provides an enjoyable and authentic learning experience, but also shapes individuals who are ready to face the complexity of the world with holistically integrated skills and knowledge.

Correlation between PJBL and Creativity

The PjBL model has a close relationship and connection with the development of creativity competencies in students. Wurdinger et al. (2007) revealed that the application of the PjBL model can improve the 21st Century skills and self-concept of students. Creativity is part of the 21st century skills and self-concept that students must have. Through this learning model, students not only gain theoretical understanding, but are also given opportunities to apply their knowledge and skills in the context of real projects. By integrating PjBL in the curriculum, especially in learning, education can make a significant contribution in shaping students who are creative and innovative, which is necessary in facing the demands of the world of work and society.

This discussion highlights various aspects that illustrate the relationship and correlation between PjBL and creativity and entrepreneurship competencies. PjBL serves to develop students' problem-solving skills (Amalia et al., 2022; Faozi et al., 2020; Handayani et al., 2021; Panasan & Nuangchalerm, 2010; Susanto et al., 2020), fostering their ability to identify, analyze, and solve problems within the context of real projects. This process hones problem-solving abilities, a crucial component of creativity and entrepreneurship. Moreover, PjBL stimulates student creativity through innovative projects (Ahmad et al., 2020; Indrawan & Jalinus, 2019), encouraging them to devise and execute their projects or collaborate within a team. This fosters creative thinking in generating innovative ideas, solutions, and strategies, allowing students to transcend conventional boundaries and nurture their creativity. Furthermore, PjBL facilitates direct application of student creativity in project design, execution, and completion, establishing a direct link between creativity and the learning process. PjBL projects also prompt students to seek innovative solutions to encountered problems, instilling in them the essence of innovation crucial for entrepreneurship. Additionally, PjBL enhances learners' sense of initiative, motivation, and independence (Huysken et al., 2019; Kortam et al., 2018), as students take ownership of their projects, thereby fostering qualities highly esteemed in both creativity and entrepreneurship. Lastly, PjBL entails a continual process of evaluation and reflection on project outcomes, enabling students not only to produce final products but also to learn from the experience, fostering a continuous learning environment supportive of creativity and entrepreneurship growth (Latif & Muharam, 2023; Nisah et al., 2021). Through the implementation of PjBL in education, learning can become more pertinent, equipping students with the requisite skills to confront real-world challenges, including the development of their creativity.

Conclusion

One of the 21st century skills that students need most is creativity. Creativity is the highest level of competency in 21st century skills. Students will have high creativity if they are able to be critical and find solutions to problems. To realize this high level of creativity, the PjBL model can be used as one of the best solutions to increase students' creativity. PjBL is suggested to be an alternative learning strategy that educators (teachers and lecturers) can use to train and foster the formation of student creativity. The findings from several articles that have been reviewed show that PjBL can train and increase student creativity because the syntax of this learning model allows students to explore, be creative, interpret and develop project products.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

R. Fitri: methodology, analysis, writing original draft preparation, review, editing; **L. Lufri:** analysis, review; **H. Alberida:** analysis, review; **A. Amran:** analysis, review; and **R. Fachry:** Methodology, editing

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