RISSEJ

Research and Innovation in Social Science Education Journal
Vol. 3 No. 1 June 2025 (47-63)
https://ejournal.ump.ac.id/index.php/rissej

ISSN: 3026-457X

Development of Project-Based Learning and Gallery Learning Methods to Improve Social Competence and Creative Thinking in Elementary School Students in the Era of the New Normal

Suhartono[1]✉
Universitas Terbuka, Indonesia

ARTICLE INFO

Keywords:

Project-Based Learning (PjBL); Gallery Learning; Social Competence; Creative Thinking; New Normal Era

ABSTRACT

This study aims to develop a hybrid learning model (combining offline and online components) based on project-based learning (PjBL) using the gallery learning method to enhance the social and creative thinking competencies of elementary school students in adapting to the new normal. The model was developed through the stages of problem identification, development design, testing, and product evaluation. This learning approach requires students to develop collaboration and reflection skills, helping them improve their social skills. To date, the implementation of PjBL has primarily been conducted through direct learning, with academic achievement as the primary focus of the study. Meanwhile, social competencies are closely related to intercultural skills, language skills, communication skills, networking skills, teamwork skills, compromise and cooperation skills, knowledge transfer skills, and leadership skills. Personalities related to tolerating ambiguity, seeking identification, overcoming obstacles, pursuing self-growth, internal motivation, and choosing adventure need to be cultivated. Both of these competencies are easier to develop in face-to-face learning than in online learning, although adjustments must be made to the situation and conditions at each school. These skills are still inadequate at the elementary school level, which affects the lack of development of project-based learning. In this study, the research subjects involved 226 students and 23 classroom teachers. Data collection was conducted using interview sheets, tests, and questionnaires. Quantitative data analysis techniques included parametric statistical tests for average achievement using SPSS one-sample t-tests, Z-tests for proportions, paired-sample t-tests for mean differences, and N-gain tests. The results of the study indicate that (1) the developed learning tools are suitable for use, namely the syllabus with a score of 40 out of a maximum of 40 (valid), the lesson plan with a score of 60 out of a maximum of 60 (valid), the teaching materials with a score of 54 out of a maximum of 56 (valid), and the questions with a score of 38 out of a maximum of 40 (valid). (2) The project-based learning tools

[1] *Suhartono. Universitas Terbuka, Indonesia
E-mail address: hart@ecampus.ut.ac.id

Received Feb 24, 2025; Received in revised form Apr 26, 2025; Accepted May 31, 2025; Available online Jun 30, 2025

integrated with the gallery learning method can enhance students' social competencies and creative thinking skills. (3) Teacher feedback received a score of 97 out of a maximum of 100, indicating an excellent response. The use of project-based learning materials integrated with the gallery learning method to enhance social competencies and creative thinking skills in students adapted to the new normal era, represents an innovation in elementary school education.

DOI: 10.30595/rissej.v3i1.256

1. Introduction

21st-century skills are competency- and context-oriented, encouraging students to develop higher-order thinking skills (HOTS). These competencies are essential in preparing students to face global challenges, including life and career skills, learning and innovation skills, and information media and technology skills (Trilling & Fadel, 2009). HOTS assesses metacognitive dimensions, not merely factual, conceptual, or procedural dimensions. Metacognitive dimensions describe the ability to connect different concepts, interpret, solve problems (problem-solving), choose problem-solving strategies, discover new methods, reason, and make appropriate decisions. Learning and innovation skills (LIS) are indispensable components of competence. These skills, which include critical thinking, problem-solving, communication, collaboration, creativity, and innovation, are essential drivers of human resource (HR) capabilities.

In the knowledge-based economy, they are crucial for maintaining a strong competitive edge. Currently, the job market increasingly demands new skills such as complex communication and expert thinking (Trilling & Fadel, 2009). Communication and collaboration are part of complex communication, while critical thinking and problem-solving are expert thinking skills. A critical issue in human resources is the urgent need to create an education system that effectively prepares students for their future lives. However, it is noted that graduates of schools and universities still lack focus in developing basic skills and applied skills (Triling & Fadel, 2009). The 5C concept (Creativity, Critical thinking, Communication, Collaboration, and Celebration) is an essential skill for outstanding human resources in the 21st century (Drayton, 2013; Pavlova, 2009).

The development of learning models aims to integrate learning with problem-solving skills, data/information processing and computation; understanding the role of science and technology in society; instilling moral practices, ethics, sensitivity, and social justice; and working in teams (Pavlova, 2009; Rojewski, 2009). The development of creative and innovative thinking skills essential for the 21st century demands three critical elements, as outlined by Piirto (2011): the ability to think creatively, the capability to collaborate creatively with others, and the implementation of innovative ideas. Creative thinking (thinking creatively) involves the ability to use a wide range of creative ideas and techniques without limitations; generating new and useful ideas; breaking down, reconfiguring, analyzing, and evaluating existing ideas to develop and maximize creative efforts.

In the process of creative thinking, an open mindset, willingness to take risks, tolerance for differences, self-discipline, and trust in the group are required. Working creatively with others involves developing, applying, and effectively communicating new ideas to others; being open and responsive to new and different perspectives, incorporating feedback into work; demonstrating originality in creation and work, and fully understanding the realities and limitations of adopting new ideas; viewing failure as an opportunity to learn again, understanding that creativity and innovation are long-term processes, and that success cycles begin with small things and often involve mistakes. Creativity is related to the application of innovation (implement innovation), acting on creative ideas, and making real and meaningful contributions (Piirto, 2011). Creativity is part of a lifestyle, a lifelong process, and the result of critical thinking.

Critical thinking in the process of developing creative thinking and working creatively requires affective strategies, macro-cognitive abilities, and micro-cognitive skills. The government, through the Ministry of Education and Culture (Kemendikbud), issued Circular Letter No. 36962/MPK.A/HK/2020 regarding online learning and working from home as part of efforts to prevent the spread of the coronavirus disease (COVID-19) in March 2020. This policy was implemented in direct response to the rapid spread of the coronavirus in Indonesia, which the World Health Organization (WHO) has officially classified as a pandemic (Sohrabi et al., 2020). Distance learning efforts were implemented to prevent the spread of the coronavirus (Goje, 2017), and to enforce social distancing, physical distancing, and even

social containment (Smith & Freedman, 2020; Long, 2020). Online learning models have become a requirement in the world of education in recent years (He, Xu, & Kruck, 2014).

Online learning is not merely an informal alternative to traditional education; it is a structured and deliberate method of creating a modern learning environment (Huda et al., 2018). Rather than simply accessing information on the internet (Holland, 2019), it establishes a new standard for how education can be delivered effectively and efficiently. Online learning enables coordination among various parties and is recommended not merely as an additional benefit in the form of supplementary learning (William, Birch, & Hancock, 2012). Online learning is indeed expected to become the mainstream in the coming years (Palvia, et al., 2018), so it is necessary to prepare existing resources. The advantage of online learning in the current era is that it is not limited by space and time, so learning can be done anywhere and anytime. This is different from face-to-face learning, which tends to be closed and less flexible and requires complete learning facilities (Panigrahi, Srivastava, & Sharma, 2018).

The acceptance of online learning can be demonstrated by students' positive attitudes toward online learning compared to face-to-face learning (Aghajani & Adlo, 2018), and online learning shows significant effectiveness (Baldwin, Ching, & Hsu, 2018). The difference in effectiveness between online and offline learning is not significant if online learning is well-designed. However, there are some perceptions about online learning related to dropout rates, low student motivation (Maltby & Whittle, 2000), and low student satisfaction in learning (Kenny, 2003). Nevertheless, there are also studies showing that many educational institutions face difficulties in implementing online learning. Findings from Saiful Mujani Research and Consulting (SRMC) published the results of its survey between May and August 2020, revealing a significant percentage of difficulties in online learning at 91 percent.

This high percentage indicates that online learning in Indonesia still faces many challenges, as it relies on internet connectivity with varying levels of accessibility, connectivity, flexibility, and platforms offering diverse ease of use. At least eight factors influence online learning, according to Mulenburg & Berge (2005): administrative issues, social interaction, academic skills, technical skills, learner motivation, time and support for studies, cost and access to the internet, and technical problems. Currently, many platforms offer ease of access for online learning due to the use of mobile technology, which allows learning to be accessed anytime and anywhere. Social media platforms like Facebook and Instagram, which were not originally used for learning, can now be utilized for online learning activities (Kumar & Nanda, 2018). Meanwhile, platforms that were earlier introduced for virtual classrooms include Schoology, Google Classroom, and Edmodo (Iftakhar, 2016).

As stated by Mulenburg & Berge (2005), one of the challenges in online learning is social interaction. Social interaction is a key principle of curriculum integrity, encompassing communication skills and collaboration, which can lead to harmonization with the environment (Hernawan, 2010). However, these results do not apply to all students, in all situations, and at all times. What causes individual differences in outcomes for online learners? Research by Zhang et al. (2004) demonstrates that the integration of the internet and multimedia technology fundamentally transforms knowledge delivery, positioning it as a powerful alternative to traditional classroom-based learning. Online learning requires the support of mobile devices such as smartphones, tablets, and laptops that can be used to access information anywhere and anytime (Gikas & Grant, 2013). The use of mobile technology has made a significant contribution to the world of education, including the achievement of distance learning objectives (Korucu & Alkan, 2011).

Various media can also be used to support the implementation of online learning. For example, virtual classrooms use services such as Google Classroom, Edmodo, and Schoology (Enriquez, 2014; Sicat, 2015; Iftakhar, 2016), and instant messaging apps like WhatsApp (So, 2016). Online learning can even be conducted through social media such as Facebook and Instagram (Kumar & Nanda, 2018). Learning is essentially a conscious effort to develop students' abilities and skills, encompassing cognitive, affective, and psychomotor aspects. As stated by Mulenberg & Berge (2005), although online learning has high effectiveness and flexibility, efforts are still needed to minimize its negative impacts. On one hand, online learning, especially during a pandemic like this, has advantages as one of the efforts to reduce virus transmission. On the other hand, the learning process is expected not to compromise the quality of the process, content, and outcomes.

The Project-Based Learning (PjBL) model is a learning model that uses projects as a medium for exploration, interpretation, synthesis, evaluation, and gathering information on student learning outcomes. The implementation of PjBL learning is intended as an alternative to the paradigm where teachers are knowledge providers and students are information recipients. Changes must be implemented to ensure that students have the opportunity to engage in problem-solving and independently construct knowledge in a professional manner.Research findings indicate that PjBL has a positive impact on students' academic performance (Guo et al., 2020). Meanwhile, according to Hacklau (2016), social competence is closely

related to intercultural skills, language skills, communication skills, networking skills, teamwork skills, compromise and cooperation skills, knowledge transfer skills, and leadership skills. Regarding creativity, several studies (Wu, 2020) have shown that it has a significant influence on a person's personality.

According to Sternberg (1988), the related personality traits are tolerance of ambiguity, seeking identification, intent to overcome obstacles, pursuing self-growth, being driven by internal motivation, and choosing adventure. Additionally, individuals with high and low creativity exhibit distinct personality traits. Both abilities are easier to develop in face-to-face learning, despite adjustments to school situations and conditions. However, in online learning, both abilities require specific consideration due to the limited interaction between teachers and students, as well as among students. Project-based learning requires students to develop skills such as collaboration and reflection. According to research studies, project-based learning helps students improve their social skills, often resulting in reduced absenteeism and fewer disciplinary issues in the classroom. Students also become more confident speaking with groups of people, including adults.

Project-based learning also increases enthusiasm for learning. When children are excited and enthusiastic about what they are learning, they often become more engaged in the subject and then expand their interest in other subjects. Enthusiastic students tend to retain what they have learned, rather than forgetting it as soon as they have passed the test. The implementation of PjBL has predominantly occurred through face-to-face learning, prioritizing the measurement of academic achievement as the central focus of the study. There are still few who focus their research on PjBL in online learning as well as to understand the social competencies of students. Therefore, this research aims to develop social competency-based learning through project-based learning for elementary school students. As explained in the background above, there are several issues related to the topic being researched.

Considering the limitations in terms of time, energy, and cost, this research focuses on "Development of a Learning Model Based on Social Competence and Creative Thinking of Elementary School Students Through the Project-Based Learning Model with the Gallery Learning Method." Based on the problem limitations, the formulation of the problem in this research is:

1. What are the results of the analysis of students' social competence and creative thinking skills, as well as the online learning process before using the project-based learning model with the gallery learning method?
2. How is the design of learning using the project-based learning model with the gallery learning method in improving the social competence and creative thinking ability of elementary school students?
3. How is the trial and refinement of the learning design using the project-based learning model with the gallery learning method in improving the social competence and creative thinking ability of elementary school students?
4. How does the learning design using the project-based learning model with the gallery learning method improve students' social competence, creative thinking ability, and environmental awareness after undergoing trials?

The goal of this research is to analyze and develop a robust project-based learning model that employs the gallery learning method, specifically designed to enhance the social competence and creative thinking skills of elementary school students. The research conducted is expected to be beneficial, both theoretically and practically.

1. Theoretically

a. The results of this research can serve as a reference for subsequent researchers with similar studies.
b. The results of this research can serve as a guideline or consideration for relevant researchers in the future.

2. Practically

a. For teachers, can implement the Project Based Learning model using the gallery learning method for elementary school students.
b. For the school, the school provides the same service to all students without differentiating based on their cognitive and psychological conditions.
c. For trainers, developing social skills so that students have the confidence to communicate and interact with peers and teachers.

The findings of this research are poised to make a substantial contribution to the body of knowledge and to the field of research itself. Additionally, the theories articulated in this study are expected to play a vital role in advancing discussions related to the psychological and cognitive development of learners.

2. Literature Review

2.1 Project Based Learning (PjBL) Model

Project-Based Learning (PjBL) is an instructional approach built on learning activities and real-world tasks that challenge students to solve problems related to everyday life in groups (Goodman & Stivers, 2010). Project-based learning (PBL) is also defined as a learner-centered learning model that involves conducting an in-depth investigation into a topic. Learners engage in constructive learning through a research-based approach to address meaningful, real-world, and relevant problems and questions (Grant, 2002). In the PjBL model, students not only understand the content but also develop skills on how to participate in society. Skills developed in PjBL include communication and presentation skills, organizational and time management skills, research and investigation skills, self-assessment and reflection skills, group participation and leadership, and critical thinking.

Performance assessment in PjBL can be conducted individually by considering the quality of the products produced, the depth of content understanding demonstrated, and the contributions made to the ongoing project implementation process. PjBL also allows students to reflect on their ideas and opinions, make decisions that influence project outcomes and the overall learning process, and present the final product. Global SchoolNet (2000) in Nurohman reports the results of research by the AutoDesk Foundation on the characteristics of Project-Based Learning. The research findings state that Project-Based Learning is a learning approach with the following characteristics:

1. Students make decisions about a framework,
2. The existence of problems or challenges presented to the students,
3. Students design a process to determine solutions to the problems or challenges presented,
4. Students collaboratively take responsibility for accessing and managing information to solve problems,
5. The evaluation process is carried out continuously,
6. Students periodically reflect on the activities they have undertaken,
7. The final product of the learning activity will be evaluated qualitatively, the learning situation is very tolerant of mistakes and changes (Global SchoolNet, 2000).

The advantages of implementing the project-based learning model are: "(1) increasing students' motivation to learn, encouraging their ability to do important work, and ensuring they are rewarded; (2) improving problem-solving skills; (3) making students more active and successful in solving complex problems; (4) improving collaboration: (5) encouraging students to develop and practice communication skills; (6) improving students' skills in managing resources; (7) providing students with learning and practical experience in organizing projects and allocating time and other resources such as equipment to complete tasks; (8) providing learning experiences that involve students in complex ways and are designed to develop in line with the real world; (9) involving students in learning to gather information and demonstrate their knowledge, which is then implemented in the real world; (10) creating a pleasant learning atmosphere so that both students and educators enjoy the learning process" (Kurniasih in Nurfitriyani, 2016).

2.2 Application of the Project-Based Learning Model

This learning model can be used when educators want to create active, learner-centered learning where learners have more engaging learning experiences and produce work based on real-world (contextual) problems that occur in daily life. This learning model can also be used when educators want to emphasize science skills, such as observing, using tools and materials, interpreting, planning projects, applying concepts, asking questions, and communicating effectively. Additionally, educators can use the PjBL model when they want to develop students' creative thinking skills in designing and creating a project that can be used to systematically address problems. The PjBL model effectively cultivates high-order thinking (HOT) by implementing scientific learning through essential activities such as Observing, Associating, Trying, Discussing, and Communicating.

Furthermore, it aligns perfectly with the demands of 21st-century learning, encompassing the critical skills of 4C: Critical Thinking, Collaboration, Creativity, and Communication. Project-based learning can be implemented if the following conditions are met: a. educators must be skilled at identifying core competencies that emphasize skills or knowledge at the application, analysis, synthesis, and evaluation levels; b. educators must be able to select materials or topics that will be used as project themes to make them interesting; c. educators must be skilled at fostering student motivation in working on projects; d. there must be sufficient facilities and learning resources; d. educators must consider the suitability of the project timeline with the academic calendar so that project activities can be carried out.

2.3 Characteristics of Learning Materials Suitable for the Implementation of the Project Based Learning Model.

As previously explained, the Project Based Learning model is a learning model that emphasizes

scientific process skills and is related to real-life or everyday situations, so the characteristics of the material suitable for the application of the Project Based Learning model are:

1. Have basic competencies that emphasize skills or knowledge at the levels of application, analysis, synthesis, and evaluation (modifying, trying, creating, using, operating, producing, reconstructing, demonstrating, creating, designing, testing)
2. Can produce a product
3. Have a connection with real-life problems or daily life.

2.4 General Stages of the Learning Path in the Project-Based Learning Model

According to the Educational Technology Division-Ministry of Education Malaysia (2006), there are 6 steps to ensure the successful implementation of project-based learning (PBL), which include preparing essential questions related to the topic to be studied, creating a project plan, making a schedule, monitoring the implementation of project-based learning (PBL), conducting assessments, and evaluating project-based learning (PBL).

According to Rais in Lestari (2015), the steps of the Project Based Learning model are as follows:

1. Opening the lesson with a challenging question (start with the big question) Learning begins with a driving question that can assign tasks to students to engage in an activity. The topic chosen should align with real-world realities and begin with an in-depth investigation.
2. Developing a plan for the project involves a collaborative effort between educators and students, fostering a sense of ownership among the students. This planning phase encompasses the establishment of game rules, the selection of activities designed to address essential questions by integrating various supporting subjects, and an overview of the tools and materials necessary for completing the project.
3. Creating a schedule: Educators and students work together to collaboratively develop an activity schedule for completing the project. It is essential that the timeline for project completion is clearly established, allowing students to effectively manage their available time. While students are encouraged to explore new ideas, educators should also provide reminders when activities begin to stray from the project's objectives. As the project is a long-term endeavor, students will complete it in groups outside of school hours. During school hours, the focus will be on presenting the results of their project to the class.
4. Monitoring the project's progress involves overseeing both student activities and the project's overall development. Educators play a crucial role in this process, guiding students at each stage of their work. In essence, they serve as mentors, supporting students as they navigate their tasks. Additionally, educators help students learn how to collaborate effectively in groups. Each student has the opportunity to select a role that aligns with their interests, while still considering the collective goals of the group.
5. Assessment of the produced outcome. Assessment is conducted to help educators measure the achievement of standards, evaluate the progress of each student, provide feedback on the level of understanding that students have reached, and assist educators in developing the next learning strategies. Product assessment is conducted when each group presents its product in front of other groups in turn.
6. Evaluation (evaluate the experience). At the end of the learning process, educators and students reflect on the activities and outcomes of the project that has been carried out. The reflection process is carried out both individually and in groups. At this stage, students are asked to express their feelings and experiences while completing the project.

Based on the explanation, here is the diagram of the stages in the implementation of Project Based Learning (**Figure 1**).

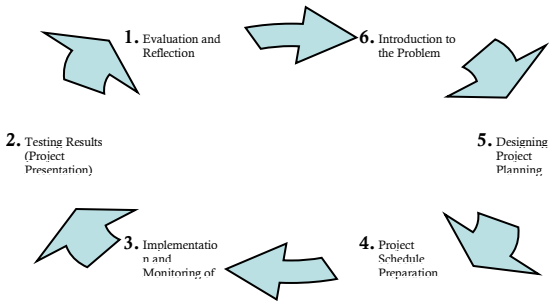

Figure 1. Diagram of the stages in the implementation of Project Based Learning

2.5 Learning Experience and Competence in the Implementation of the Project-Based Learning Model

Description of the learning experiences and competencies obtained by students can be achieved by linking the learning path from the Project Based Learning model and connecting 21st Century Competencies, namely 5C: creative (creative thinking), collaborative (working together), communication (communicating), critical (critical thinking), and collaboration, as well as 1Q, which is Taqwa, with a Scientific approach according to the 2013 Curriculum (K13) integrated with ICT, namely 5M: Observing, Associating, Experimenting, Discussing, and Communicating.

The learning experiences of students during the implementation of the project-based learning model include being encouraged to care about issues in their surrounding environment in their daily lives, practicing sensitivity to the environment, learning to seek essential questions, practicing logical, critical, and detailed thinking, considering the details of the tasks to be done, associative thinking by connecting one aspect of work with another, thinking about the sequence of time, learning to divide tasks according to interests and abilities, students' initiative to direct their learning, striving to find sources of information and knowledge, students trying out methods of work according to their understanding, discussing and collaborating, and learning from mistakes to then correct them themselves.

2.6 Student Social Competence

Student social competence refers to the ability, knowledge, and skills that enable individuals to interact effectively. As students prepare to enter the world after completing their education, whether in society or the workforce, they will engage with their peers. Psychologically, every individual seeks acceptance within their social environment. Therefore, students need to develop their social competence through well-structured programs integrated into the educational process. This preparation ensures that they can be accepted by others, adapt to various situations, and contribute positively to the lives of those around them.

Ultimately, social competence is an integrative, comprehensive, and holistic concept that encompasses abilities leading to flexible and adaptive responses necessary to meet the demands of achieving goals (Rosyada, 2016). Every child will enter the workforce after school, whether as a civil servant in public service offices, an employee in private companies, in commercial public service sectors, starting a career as an entrepreneur, or even being interested in entering the world of politics. Similarly, they will interact with others, so these children are expected to have social competencies, including the following:

1. Able to make individual contributions to a situation or opportunity to receive a response from that environment
2. Able to gain recognition from an environment or an opportunity to receive a response, even if not through contribution, but with the hope that their presence in a situation will be beneficial to the environment.
3. Able to elaborate on various options regarding the achievements that have been obtained, to determine the most appropriate steps to take to achieve the goal.
4. Capable of determining the most appropriate choices in response to various reactions encountered in each situation or environment entered.
5. Having strong motivation, passion, and desire to respond to situations or environments that are appropriate or needed by various changes.

Meanwhile, Sharon A. Lynch & Cynthia G. Simpson explain that students should be trained and accustomed to several good social attitudes and behaviors, namely:

1. Empathy, In this case, students should be accustomed to understanding the conditions of other students, whether they are in the same class or the same school, meaning they should be able to understand their souls and, if possible, be able to position their classmates or school friends as part of themselves.
2. Participation in group activities, meaning students should be accustomed to participating in various group activities, whether academic, non-academic, or social activities initiated by the school.
3. Generous, meaning the students are trained to get used to sharing with others. However, sharing in the context of getting used to being generous, not as a helper like Santa Claus, because they are not yet well-off, but their social spirit must be trained from an early age so that they can become generous people in the future.
4. It is imperative that students receive structured training in effective communication with their classmates and peers. Fostering an environment that encourages openness is essential to prevent students from becoming socially isolated, introverted, or hesitant to form friendships. Developing strong interpersonal skills not only enhances individual student experiences but also contributes to a more cohesive and collaborative academic community.

5. Negotiation is an essential skill for students, who should be trained to engage in negotiations or bargaining with one another. This could occur in various contexts, such as addressing learning needs, collaborating on assignments, or working on group tasks. Such training fosters a give-and-take dynamic, emphasizing the importance of asking and offering, ultimately enhancing social relationships to achieve shared goals.
6. Problem-solving, meaning that students must be trained to have problem-solving skills. Therefore, students should be allowed to do so in a more realistic context through case-based learning. Thus, when they become professionals, they will already have a foundation of problem-solving skills that are more scientific because they were developed through guided practice by teachers.

About this matter, Heejeong Sophia Han and Kristen Mary Kemple assert that there are at least six facets of social competence that educators should cultivate in their students. The objective is to prepare students for success in both their professional and social lives. The six facets are as follows:

1. Self-regulation refers to the ability to manage one's emotions effectively. Students need to be trained in emotional regulation to foster positive interactions with their classmates and schoolmates, as well as facilitate meaningful communication with teachers and school staff. Key emotional skills that need to be developed in students for successful future careers and social engagements include the management of impulsive behavior—acting instinctively rather than logically. Students who exhibit impulsivity should receive guidance to help them remain calm and better control their emotions, enabling them to make more rational decisions. Additionally, they should learn to temper their satisfaction upon achievement, resist temptations, and withstand peer pressure. Understanding and empathizing with others' feelings, alongside developing self-control, are also critical components of this training.
2. The capacity to empathize with others is essential. Each student should learn to recognize the feelings and needs of others, express their thoughts and ideas clearly, solve problems, and engage in collaboration and negotiation. Additionally, students should learn to express their emotions, accurately interpret social situations, adapt their attitudes and actions to fit the context, and initiate and maintain friendships.
3. Positive self-identity is crucial for students, as it helps them develop their strengths and establish a constructive self-concept. By fostering a positive identity, students can enhance their social relationships and interactions. Those who possess a strong self-identity—characterized by a sense of ability, self-confidence, good self-esteem, and a clear sense of purpose—are likely to approach social situations with a positive attitude and anticipate success in their endeavors. This, in turn, leads to greater acceptability and achievement, reflecting an increase in their self-esteem and competence. Conversely, children with low self-esteem may find themselves trapped in a cycle of failure and feelings of rejection. In this context, teachers in preschool education play a vital role in nurturing and enhancing their students' self-identity.
4. Cultural Competence. In this context, it is important for students to be educated to enhance their knowledge and understanding of respect for others, as well as to develop the ability to interact effectively and comfortably with individuals from diverse ethnicities, races, religions, and cultures. Furthermore, students should be encouraged to question unfair treatment from other groups and take proactive steps toward achieving justice. They should also engage in cultural sharing with one another, learning what can be appropriately shared and what should be kept private. Additionally, they should explore the aspects in which they can teach each other, including what can be expressed and what should be approached with caution. A limited understanding of one another's cultures is likely to lead to misunderstandings.
5. Adopting social values. In this case, students must be taught to adopt several social values, such as caring attitudes, equality and justice, honesty, responsibility, a healthy lifestyle, and flexibility in the implementation of social actions.

Various experiences recorded by these academics show three aspects directly related to the development of social competence in students. First, emotional competence is in the form of a belief in something good to be done. Second, the aspect of external power that encourages or even forces everyone to do what is right in society based on an agreement about the truth they adhere to. Third, the ability to establish social relationships, both in professional and community life. In line with that, Michaelene M. Ostrosky & Hedda Meadan state that in order to interact in social groups in their class and school, every student must possess several competencies as follows,

1. Must have good self-confidence
2. Must have the ability to develop social relationships with classmates, and friends from curricular, co-curricular, and extracurricular activities
3. Must have the ability to focus on completing school assignments school, thus producing work that meets expectations

4. Always able to attend and listen to the principal's instructions.
5. Have the ability to solve problems within their social context
6. Can communicate effectively.

In Indonesia, all school and madrasa students need to be cultivated with open-mindedness and an appreciation for ethnic, religious, and cultural diversity. For instance, Muslim students should learn to embrace and respect the religious beliefs of their classmates, whether they identify as Christian, Catholic, Hindu, Buddhist, or Confucian. Moreover, they should be encouraged to collaborate in both their professional and social interactions, thereby broadening their career opportunities. Students must understand that to gain acceptance within their communities, they need to embody an attitude and behavior that fosters comfort, respect, and a sense of belonging for others. Therefore, every student must be trained to be able to pay attention to others, to care, and to give, not only in social life but also in professional life. All these social competencies cannot be well-developed if the teachers themselves do not possess better social competencies.

Therefore, teachers and prospective teachers must practice becoming individuals who can be accepted in their environment, contribute to their environment, and care for their students. Teachers with various social competencies must transform these competencies for their students so that they can achieve success in their professional and social lives in the future. However, due to the absence of specific subjects to train these competencies, including relevant teaching materials, social competence learning can be integrated into two subjects, namely Religious Education and Citizenship Education.

These two subjects are relatively relevant in competency learning because both are related to the character development of students. It is important to remember that the development of student's social competencies is the responsibility of all teachers. For that reason, the transformation of social competence can be carried out in various ways, whether through classroom atmosphere arrangement, teaching strategies, or even through co-curricular and extracurricular activities.

2.7 Development of Students' Social Competence Through Learning

Teachers with good social competence will have a high awareness to nurture their students so that they possess the same social competence in facing the future world and their professions. For that reason, teachers must prepare a good classroom arrangement so that students can develop their social interactions, thereby training them to become empathetic individuals. Thus, the seating arrangement must facilitate students to discuss, share understanding, and work in groups.

With such seating arrangements, teachers are already making efforts to prepare their students to cultivate empathy, contribute to their classmates in knowledge, understanding, skills, and abilities, learn effective communication using group members as communicators, train cooperation, train group work, teach students to appreciate others, and various other social competencies that can be developed through the learning process. In line with that, teachers must develop a learning process that simultaneously trains students' social competencies through the following steps:

1. Giving students the opportunity to ask questions to their peers and also to the teacher, so they can develop the skill of communicating with others.
2. Developing class discussions on topics that are appropriate for their age development.
3. Preparing a guidebook on working with others, conducting class discussions, and so on.
4. Providing short and funny stories about good and bad that they can discuss again outside the classroom.
5. Teaching four steps to solve problems. Fourth, first, express our attitude about the problem at hand and use the words "I". Like: "I am disappointed that you arrived late." Then, listen to the explanation from those who are having issues. Next, restate the core of their problematic explanation. Then think about formulating solution options. Finally, decide on the problem-solving option.

Developing students' social competencies is a mandate that falls upon the teacher. The development of students occurs not only through academic subjects but also through the learning processes they engage in, guided by their teachers and the school environment. It is essential for students to be encouraged to learn actively alongside their peers—asking questions, providing answers, and engaging in discussions.

This collaborative interaction fosters a sense of togetherness and gradually nurtures their social attitudes, which ultimately manifest in their actions. Therefore, the curriculum should be viewed not merely as a written document but as a dynamic learning plan devised by teachers that promotes meaningful interactions among students.

2.8 Development of Students' Social Competence Through Learning

Teachers with good social competence will have a high awareness to nurture their students so that

they possess the same social competence in facing the future world and their professions. Teachers should create effective classroom arrangements to enhance students' social interactions, helping them develop empathy. Thus, the seating arrangement must facilitate students to discuss, share understanding, and work in groups. With such seating arrangements, teachers have already made efforts to prepare their students to cultivate empathy, contribute to their classmates in knowledge, understanding, skills, and abilities, learn effective communication using group members as communicators, train cooperation, train group work, teach students to appreciate others, and various other social competencies that can be developed through the learning process. In line with that, teachers must develop a learning process that simultaneously trains students' social competencies through the following steps:

1. Giving students the opportunity to ask questions to their peers and also to the teacher, so they can develop the skill of communicating with others.
2. Developing class discussions on topics that are appropriate for their age development.
3. actively developing a comprehensive guidebook that will focus on effectively collaborating with others and leading dynamic class discussions.
4. Providing short and funny stories about good and bad that they can discuss again outside of class.
5. Teaching four steps to solve problems. Fourth, first, express our attitude about the problem at hand and use the words "I." Like: "I am disappointed that you arrived late." Then, listen to the explanation from those who are having issues. Next, restate the essence of their problematic explanation. Then think about formulating possible solutions. Finally, decide on the problem-solving option.

Developing students' social competence is a mandate that falls upon teachers. It is developed not only through subjects but also through the learning process that students undergo, facilitated by teachers and the school. Students must be facilitated to learn actively with their peer group, asking and answering each other, discussing with one another, and developing togetherness, so that their social attitudes will gradually grow within them, which will manifest in the form of actions. Thus, the curriculum is not solely a written document, but also a learning plan prepared by teachers that facilitates students to interact with one another.

Students can cultivate their social competencies not only through classroom discussions—where they engage in topics collaboratively, compile reports from group discussions, and present findings together—but also through extracurricular activities such as scouting, sports, and various student organizations. Additionally, co-curricular programs that focus on preparing scientific works further enhance these skills. All these opportunities serve to effectively develop strong social competence among students. However, it is essential for teachers to possess a higher level of social competence than what they impart to their students. Consequently, the expectation for students to develop social skills also necessitates that teachers demonstrate superior social competencies in their teaching practices.

2.9 Creative Thinking Skills

Creative thinking or creativity itself remains an interesting issue among researchers. Designing learning experiences that provide students with more opportunities to explore problems with multiple solutions can enhance their ability to think creatively (Silver, 1997; Hamza and Griffith, 2006). Identifying and recognizing students' creative thinking abilities can be done by developing creative thinking tasks or tests (Haylock, 1997; Lee, Hwang, and Seo, 2003; Siswono, 2004; Mann, 2005; Mahmudi, 2010). Comparing and establishing connections between creative thinking abilities and other skills can enrich teachers' insights into the potential or talents possessed by their students (Wang, 2011; Anwar, 2012). Until now, there has been no single definition of creativity that is accepted or used in research, but creative thinking can be divided into two main approaches: process and product (Haylock, 1997).

Creative thinking from the process perspective is seen as the student's response to solving problems using appropriate methods. In this study, the process of creative thinking begins with students recognizing the existence of a problem, to communicating the results of their thoughts. Viewed as a product or outcome, Isaksen, Puccio, and Treffinger (Babij, 2001) explain that creative thinking emphasizes the aspects of fluency, flexibility, originality, and elaboration. Fluency can be assessed based on the number of relevant responses provided by students. These responses can be further classified into various categories related to the aspect of fluency. It is possible for students to generate a high number of responses that all fall within a single category. A student's response is deemed original if it is unique, atypical, and produced by only a small number of students.

A response is considered detailed when it follows a sequential, logical, clear, and well-reasoned procedure. (Torrance, 1974) describes creativity as a process of: 1) recognizing a problem, information gap, or missing element, 2) understanding the problem, 3) making guesses and formulating hypotheses, 4) testing hypotheses and evaluation, 5) communicating the results. Meanwhile, Krathwohl and Anderson in Bloom's Taxonomy summarize the cognitive process domain of the creating aspect, which includes

generating ideas, planning solutions, and producing outcomes. The aspects of the creative thinking process described by Torrance and in the revised Bloom's Taxonomy are interconnected with each other. Measuring creative thinking is an essential endeavor. Various researchers employ creative thinking assessments, including the Torrance Test of Creative Thinking (TTCT), the Creative Ability in Mathematics Test (CAMT), and the Guilford Alternative Uses Task, among other measurement tools.

Additionally, Getzel and Jackson utilize tasks that allow for multiple answers or diverse approaches to problem-solving (Silver, 1997). An open-ended problem is a problem that has many correct answers (Suherman, 2003). Becker and Shimada, as quoted by Takahashi (2005), describe open-ended learning as a type of learning that begins with presenting an open-ended problem, followed by the use of multiple correct answers with the aim of providing students with the experience of discovering something new. Cooney (2002) outlined the characteristics of open-ended questions, which should involve important mathematical information, elicit varied responses, require communication, be clearly stated, and use scoring rubrics.

3. Research Design

This research uses the Design Based Research (DBR) approach. Barab & Squire (in Akker, et. al, 2013); and Anderson & Shattuck (2012) define Design-Based Research (DBR) as an approach aimed at generating new theories or developing design principles that can guide, informing, and enhancing practices and research in the educational context, potentially impacting learning and teaching in naturalistic environments. Furthermore, Anderson & Shattuck (2012) state that DBR is designed and intended for educators as an effort to enhance the impact and significance of educational research on the improvement of practices in the field.

The researchers chose the DBR approach because it is believed to bridge the gap between the research conducted by researchers and the learning practices carried out by teachers and students. This aligns with Brown's (1992) statement that "an effective intervention should be able to migrate from our experimental classroom to average classrooms operated by and for average students and teachers, supported by realistic technological and personal support." The researcher aims to develop a learning design grounded in naturally occurring problems. This design is anticipated to address the identified issues and support teachers in facilitating classroom lessons effectively. Below are the steps for conducting research utilizing the Design-Based Research (DBR) approach (**Figure 2**), as outlined by Amiel & Reeves (2008):

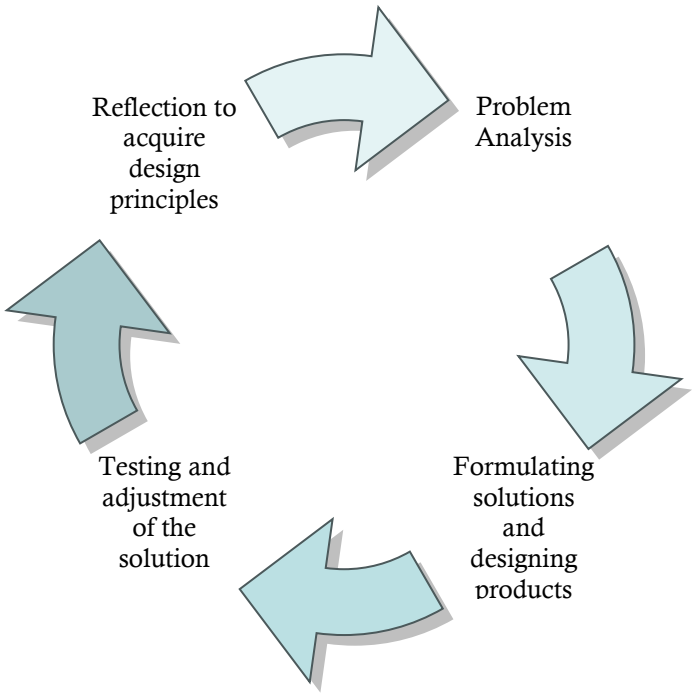

Figure 2. Research Design: Design Based Research (DBR)

3.1 Participants and Research Locations

The participants in this study are fifth-grade students from UMP Elementary School, Al-Irsyad 1

Purwokerto Elementary School, Sokaraja 2 Elementary School, Karangpucung 1 Elementary School, and Karangdadap 2 Elementary School. The five elementary schools are located in Banyumas Regency, Central Java.

3.2 Data Collection Techniques and Research Instruments

Data collection techniques are one of the most important aspects to obtain optimal research results. In relation to the research title, which focuses on developing learning designs through the project-based learning model to enhance students' social competence and creative thinking, it is essential to employ appropriate data collection techniques and research instruments to address each research question. Table 1 utilizes the following data collection methods and research instruments.

Table 1. Data Collection Techniques and Research Instruments

No.	Data	Data Collection Techniques	Instrument
1	Students' social competence and creative thinking, as well as the learning process before obtaining learning using a project-based learning model	Observation and interview	Observation sheet and interview guidelines
2	Learning design using a project-based learning model in developing social competence and creative thinking of elementary school students	Documentation study	Documentation sheet
3	Trial and refinement of learning design using project-based learning model in developing social competence and creative thinking of elementary school students	Observation	Observation sheet
4	Students' social competence after obtaining learning through the application of a project-based learning model	Observation	Observation sheet
5	Students' environmental care attitude during learning through the application of a project-based learning model	Test	Essay
6	Online learning design based on social competence and creative thinking using a project-based learning model	Focus group discussion	Validation and observation sheets

3.3 Validity Test

The researcher conducted an instrument validity test using construct validity testing. Construct validity is a depiction that shows the extent to which a measuring instrument can yield results that align with the theory (Azwar, 2005). The construct validity test is carried out to assess the appropriateness of the instruments through expert evaluations. The researcher engaged three experts to conduct the validity test on the instruments utilized. The validated instruments consist of essay questions designed to evaluate critical thinking skills and observation sheets aimed at assessing students' environmental awareness.

3.4 Data Analysis

Data analysis in this study is conducted to provide an overview of all data related to the development of learning designs using the project-based learning model to enhance the social competence and creative thinking of elementary school students. There are several stages involved in the data analysis, which are as follows.

3.5 Data Collection

Data on students' social competence and creative thinking, collected by the researcher through observation during the problem analysis stage, serves as the basis for the researcher in designing the learning plan. The design stage of the learning plan involves documentation studies utilizing various data sources, including books, journals, and the Internet.

The data on students' creative thinking after receiving instruction using the project-based learning model were analyzed and categorized into several categories: very high, high, medium, low, and very low. Meanwhile, the data on students' social competence were analyzed and categorized into several categories: very good, good, sufficient, and poor. The final learning design, which serves as the final product, has undergone several stages of improvement and has been validated by several experts (judgment experts) consisting of lecturers, teachers, and school principals.

3.6 Presentation of Data

Data presentation is conducted after all the collected research data has been analyzed. The

researcher presents data on students' social competence and creative thinking before and after receiving instruction using the project-based learning model, the design of learning using the project-based learning model, the trial and refinement of the design, as well as the completed learning design using the project-based learning model through descriptions in words, images, and charts.

3.7 Conclusion Drawing

Drawing conclusions is the final stage in the research process conducted. The conclusion can provide clarity on the issues that arose at the beginning of the research through the presentation of the obtained data.

3.8 Implementation of Research

This research was conducted by adapting the research stages using a design-based research approach, namely the problem analysis stage, design planning stage, design testing, and refinement stage, and design reflection stage, followed by the data processing and analysis stage, and the research report presentation stage.

1. Problem analysis stage

The problem analysis stage aims to gather information about the social competence and creative thinking skills of fifth-grade elementary school students, as well as to assess the initial conditions of the current learning process.

2. Design phase

The design phase is carried out as an effort to build solutions and design products. The design phase involves collaboration between researchers, teachers, and lecturers. The design phase is carried out through several stages, namely 1) selecting themes and learning materials, 2) analyzing basic competencies and formulating indicators, 3) choosing innovative learning models, 4) preparing lesson plans, 5) preparing student worksheets, and 6) preparing instruments.

3. Testing and refinement stage

The trial phase represents the stage where the researcher executes the prepared learning design, which utilizes a project-based learning model aimed at enhancing the social competence and creative thinking skills of elementary school students. This trial phase consisted of five sessions, each with a duration of 2x35 minutes. Below is an overview of the learning activities that were conducted in alignment with the principles of the project-based learning model.

The testing and refinement phases of the design are carried out concurrently. The process of design refinement is carried out after a joint evaluation between the teacher and the researcher, which is obtained at the end of each learning session in every meeting. Joint evaluations serve as a basis for researchers to revise the learning designs implemented in previous sessions and those planned for future sessions.

3.9 Assessment of students' critical thinking skills and environmental awareness

Once the learning design was implemented, the researcher assessed students' social competence and creative thinking after they received instruction using the project-based learning model.The students' creative thinking ability was measured using an instrument in the form of essay questions. Meanwhile, students' social competence is measured using an observation sheet.

3.10 Reflection stage

The reflection stage is conducted by involving several experts (judgment experts) consisting of teachers, school principals, and lecturers. The reflection stage involves the researcher gathering ideas, solutions, suggestions, findings, and design principles. The ultimate outcome of this reflection stage is a learning design that utilizes the project-based learning model aimed at enhancing students' social competence and creative thinking following a series of trials.

a. The stage of data processing and analysis

The data obtained during the research is collected, then processed and analyzed. The researcher selects relevant data and disregards data that is considered less relevant. The findings and data analysis will be combined with supporting theories.

b. The stage of presenting the research report

The final step of a research study is to draw conclusions and implications based on the findings. This conclusion is supported by definitive suggestions and actionable recommendations for future research.

4. Results and Discussions

4.1 Students' Creative Thinking Ability

Creative thinking refers to the cognitive ability to generate new solutions to problems (Arends & Kilcher, 2010). This skill is often described as divergent thinking, which involves producing a variety of possible answers based on the information at hand. Divergent thinking emphasizes the quantity and relevance of ideas, drawing from multiple methods and perspectives (Anwar, 2010; Guilford in Munandar, 2015). The development of creative thinking is facilitated by a creative process that offers solutions. This ability is recognized as one of the higher-order thinking skills, transcending mere memorization, understanding, and application to focus instead on analysis, evaluation, and creation. Creative thinking ability is a habit that is trained to reveal new possibilities and generate unexpected ideas, resulting in something new, whether in the form of concepts or tangible works that are relatively different from what already exists (Apriliani & Suyitno, 2016; Noviyana, 2017).

Creative thinking ability is one of the cognitive aspects that must be considered in learning activities (Antika & Nawawi, 2017). Creative thinking ability is a skill that can hone original thinking, flexibility, and fluency, thereby encouraging students to be curious and confident (I. M. Fathoni et al., 2018). Students are not encouraged to develop their creative thinking skills, resulting in them only being able to remember what they have learned and not knowing how to apply that knowledge. This is also evident in daily life, where students become consumers and do not know how to create (Arisanti et al., 2017). Discovery activities in learning can encourage students to think creatively (Fathoni, 2018). Thus, the ability to think creatively is a mental activity to develop and discover new (original), aesthetic, constructive ideas related to conceptual views, and emphasizes aspects of intuitive and rational thinking.

Creative thinking skills can be developed through learning by using analytical problem-solving tasks that have multiple solutions or strategies for resolution (Ismayani, 2016). Creative thinking is one of the skills that can be developed in science education (Ishak, 2017). Creative thinking ability is one of the things that students must possess to face technological challenges (Ulinnuha et al., 2019). In general, the indicators of creative thinking ability that will be observed in this study are students' ability to provide multiple answers in problem-solving, to seek various alternative answers, to generate new and unusual expressions or answers, to create uncommon combinations, and to enrich and develop ideas occurring in the surrounding environment related to energy sources present in the surrounding environment. The indicators used by the researcher according to Munandar's theory (2014: 65) are originality, elaboration, fluency, and flexibility.

The fluency aspect of creative thinking involves generating a multitude of ideas or responses, while elaboration pertains to the ability to enrich or detail specific aspects of an object in relation to processes, answers, or particular situations (Amalia et al., 2015). In the natural sciences curriculum focused on energy sources, four dimensions of creative thinking skills are specifically nurtured: fluency in generating numerous ideas, relevance in offering solutions, and the capacity to deliver those solutions accurately and effectively.. Flexibility in the ability to express various problem-solving strategies, generate a range of ideas, answers, or questions, and view problems from different perspectives. The originality of the ability to provide relatively new ideas that are rarely found in most people, the ability to offer solutions using one's own language. Elaboration of the ability to expand answers, and the ability to respond in detail (Huda et al., 2019).

The four aspects are summarized into novelty in thinking, which shows that students can solve problems with several different solutions and answers that result in new resolutions not typically found by students (Apriliani & Suyitno, 2016). The simplest way to generate new ideas is by adding or subtracting from existing ideas, but without deviating from the discussion guidelines. Creative thinking is an essential component of the creative process, characterized by specific criteria that reflect students' abilities to engage in creative behavior (Firdaus et al., 2018; Herayani et al., 2015; Ramastiwi & Suwarma, 2018). In addition, in the ability to think creatively, there are five stages of the creative thinking process: (1) preparation, (2) incubation, (3) deep understanding (insight), (4) evaluation, and (5) elaboration (Wang in Mahanal & Zubaidah, 2017).

This research aims to enhance students' creative thinking skills through e-learning, encouraging them to take a more active role in independently exploring solutions to complete their tasks. Wallas in Munandar (2014: 39) stated that before a creative product is produced, there are four stages in the creative process: the preparation stage, the incubation stage, the illumination stage, and the verification stage. The preparation stage is characterized by students gathering relevant information to equip themselves for problem-solving. The incubation stage involves students temporarily stepping away from the problem, allowing them to draw inspiration and insights from their subconscious, which can lead to discovery or creative solutions. The illumination stage is defined as the stage where students obtain a solution to a problem, followed by the emergence of inspiration and new ideas.

Meanwhile, the verification stage is defined as the stage where students test or examine the reality that requires thinking at a point of discovery (Sunaringtyas, Asikin, & Junaedi, 2017). Silver (in Muntaha

& Hartono, 2013) explains that to assess students' creative thinking abilities, "The Torrance Tests of Creative Thinking (TTCT)" are often used. The measurement of creative thinking ability is conducted by asking students to generate as many answers as possible within a specified time. To be converted into scores, the answers are interpreted in terms of fluency, flexibility, originality, and elaboration. To assess students' creative thinking abilities, their responses to each question item are scored. The criteria for evaluating the creative thinking ability test utilized in this study are derived from the rubric scores established in the Rubric for Creative Thinking Skills Evaluation created by Bosch (Moma, 2015).

4.2 Research Hypothesis

The hypothesis in this study is as follows:

1. The average creative thinking ability of students through project-based learning (PjBL) integrated with STEM-based e-learning reaches the minimum completion value of 45.
2. The proportion of students demonstrating creative thinking abilities in project-based learning (PjBL) integrated with STEM through e-learning will reach 75% or higher.
3. The average creative thinking ability of students has shown improvement compared to their performance before the implementation of project-based learning (PjBL) integrated with STEM-based e-learning.
4. Overall, students' creative thinking abilities have enhanced as a result of project-based learning that integrates STEM.

5. Conclusions

Based on the results and discussion, this research has the following conclusion. The feasibility of the project-based learning devices integrated with STEM-based e-learning was conducted through the stages of problem identification, data collection, design of science teaching materials based on project-based learning integrated with STEM, design validation, design revision, small-scale trials, and large-scale trials. The results of the validation of the developed learning devices deemed suitable for use are as follows: syllabus with a score of 3.97 (valid), lesson plan with a score of 3.96 (valid), teaching materials with a score of 3.87 (valid), and questions with a score of 3.82 (valid).

The design of the project-based learning device integrated with STEM and based on e-learning produced a full-color cover teaching material, which includes the title of the material, images related to examples of the material to be taught in everyday life, images showing the elementary school level, the author's name, and the department's name printed on art carton paper. The structure of the teaching materials encompasses the title, preface, table of contents, concept map, content/material, exercises, and bibliography. These materials primarily focus on exploring various energy sources.

The e-learning platform also features a question evaluation system available on the student account home screen, along with clear steps for completing the e-learning-based questions. The top menu includes options for Material 1, Material 2, Material 3, Material 4, and a tutorial video that guides users on how to answer questions and log out. Thus, the project-based learning devices integrated with STEM and based on e-learning produced are valid and can be used in elementary schools.

1. The project-based learning devices integrated with STEM and based on e-learning are effectively used, resulting in an increase in students' creative thinking abilities after the implementation of distance learning activities.
2. The teachers' feedback on the project-based learning devices integrated with STEM and e-learning to enhance students' creative thinking skills was overwhelmingly positive. They found these learning tools to be user-friendly and effective in facilitating distance learning activities, which are essential in the current educational landscape.

Suggestions

The following are recommendations related to research and development.

1. The integrated project-based learning devices with STEM and e-learning can effectively facilitate learning activities.
2. Teachers can make the best use of project-based learning devices integrated with STEM and e-learning to enhance students' creative thinking abilities, so they become accustomed to original thinking.
3. For those who want to implement distance learning activities based on e-learning, they can be adjusted to the needs of the students at the school.
4. To ensure an optimal learning process, it is essential that students utilize a mobile phone or computer.
5. Providing guidance and attention from educators to students during learning activities is vital. The implementation of e-learning-based question evaluation applications, facilitated through website

hosting and domains, is essential for optimizing the learning process.

6. Research on improving students' creative thinking skills needs to be continued because it requires a considerable amount of time for creative thinking abilities to be ingrained in each indicator and to achieve better results.

This project-based learning tool integrates STEM elements and e-learning is designed to assist teachers in conducting distance learning activities during the COVID-19 pandemic. The project-based learning materials, which incorporate STEM concepts, aim to facilitate discussions around energy sources for students, serving as a foundation for project creation and addressing the provided evaluation questions. The e-learning evaluation program, hosted on a website platform, assists teachers by enabling them to easily access the evaluation results submitted by students.

Additionally, it offers practicality for students as they complete their assessments. The dissemination of the final product for the project-based learning device integrated with STEM and based on e-learning can be done through the provision of e-learning-based question evaluation scripts in the form of website hosting and domain to classroom teachers, articles, and so on, thereby helping teachers address the current challenges that require remote learning activities. This can provide engaging learning activities for students and enhance their creative thinking skills, training them to think originally.

References

Aghajani, M., & Adloo, M. (2018). The Effect of Online Cooperative Learning on Students' Writing Skills and Attitudes through Telegram Application . *International Journal of Instruction*.

Baldwin, S., Ching, Y.-H., & Hsu, Y.-C. (2018). Online Course Design in Higher Education: A Review of National and Statewide Evaluation Instruments. *Journal of Computing in Higher Education*.

Enriquez, M. A. S. (2014). Students ' Perceptions on the Effectiveness of the Use of Edmodo as a Supplementary Tool for Learning. DLSU Research Congress. https://doi.org/10.1017/CBO9781107415324.004

Firman, Sari Rahayu Rahman, Pembelajaran Online di Tengah Pandemi Covid-19, Indonesian Journal of Educational Science (IJES), Volume 02, No 02 Maret 2020

Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. Internet and Higher Education. https://doi.org/10.1016/j.iheduc.2013.06.002

Goje, K. (2017). Preventative Prophetic Guidance in Infection and Quarantine . *Journal of Ushuluddin*.

He, W., Xu, G., & Kruck, S. (2014). Online IS Education for the 21st Century . *Journal of Information Systems Education*.

Holland, A. A. (2019). Effective principles of informal online learning design: A theory- building metasynthesis of qualitative research . *Computers & Education*.

Huda, M., Maseleno, A., Teh, K. S., Don, A. G., Basiron, B., Jasmi, K. A., . . . Ahmad, R. (2018). Understanding Modern Learning Environment (MLE) in Big Data Era . *International Journal of Emerging Technologies in Learning (IJET)*.

Iftakhar, S. (2016). GOOGLE CLASSROOM: WHAT WORKS AND HOW? Journal of Education and Social Sciences.

Korucu, A. T., & Alkan, A. (2011). Differences between m-learning (mobile learning) and e- learning, basic terminology and usage of m-learning in education. Procedia - Social and Behavioral Sciences. https://doi.org/10.1016/j.sbspro.2011.04.029

Kumar, V., & Nanda, P. (2018). Social Media in Higher Education. International Journal of Information and Communication Technology Education. https://doi.org/10.4018/ijicte.2019010107

Long, N. J. (2020). From social distancing to social containment: reimagining sociality for the coronavirus pandemic . *Medicine Anthropology Theory*.

Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R., Rosner, R., & Sindhi, S. (2018). Online Education: Worldwide Status, Challenges, Trends, and Implications . *Journal of Global Information Technology Management*.

Panigrahi, R., Srivastava, P. R., & Sharma, D. (2018). Online learning: Adoption, continuance, and learning outcome—A review of literature . *International Journal of Information Management*

Pavlova, M., 2009, Conceptualisation of technology education within the paradigm of sustainable development, International Journal of Technology and Desaign Education Vol. 19. 109-132.

Piirto J. (2011) Creativity for 21st Century Skills. In: Creativity for 21st Century Skills. SensePublishers. https://doi.org/10.1007/978-94-6091-463-8_1

Sicat, A. S. (2015). Enhancing College Students' Proficiency in Business Writing Via Schoology. International Journal of Education and Research.

Smith, A. W., & Freedman, D. O. (2020). Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak . *Journal of Travel Medicine*.

Sohrabi, C., Alsafi, Z., O'Neil, N., Khan, M., Kerwan, A., Al-Jabir, A., . . . Aghad, R. (2020). World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19) . *International Journal of Surgery*.

Trilling B & Fadel C 2009 21st Century Ski. Learn. Llife Our Times (New York: John Wiley & Sons) pp 2009

Wahyudin Darmalaksana; R. Yuli Ahmad Hambali; Ali Masrur; Muhlas, Analisis Pembelajaran *Online* Masa WFH *Pandemic* Covid-19 sebagai Tantangan Pemimpin Digital Abad 21, *Karya Tulis Ilmiah (KTI) Masa Work From Home (WFH) Covid-19 UIN Sunan Gunung Djati Bandung Tahun 2020*

Williams, A., Birch, E., & Hancock, P. (2012). The impact of online lecture recordings on student performance. *Australasian Journal of Educational Technology*.

Wu, Ting-Ting, Wu, YU Tzu, Applying project-based learning and SCAMPER teaching strategies in engineering education to explore the influence of creativity on cognition, personal motivation, and personality traits, Thinking Skills and Creativity 35 (2020) 100631

Zhang, D., Zhao, J. L., Zhou, L., & Nunamaker, J. F. (2004). Can e-learning replace classroom learning? Communications of the ACM. https://doi.org/10.1145/986213.986216