

A PROJECT-BASED DIGITAL INSTRUCTIONAL MATERIAL FRAMEWORK: A LITERATURE REVIEW TO ENHANCE STUDENT CREATIVE THINKING SKILLS

Henry Eko Hapsanto^{1a*}

¹Balai Layanan Tata Kelola Sumber Daya Satuan Pendidikan, Kementerian Pendidikan Dasar dan Menengah, Jl. Jenderal Sudirman, Senayan, Jakarta 10270

^aE-mail: henry.eko@kemendikdasmen.go.id

(*) Corresponding Author

henry.eko@kemendikdasmen.go.id

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ABSTRACT

The skills of current vocational high school graduates are currently out of alignment with the needs of the job market. Creative thinking skills are projected to be widely used by 2030, and their application relies on Project-Based Learning (PjBL). However, implementation is still hindered by inadequate assessment methods and instructional materials. In addition, there have not yet been many studies that systematically outline a framework for PjBL-based digital instructional material that can serve as a practical guide for teachers. Based on these issues, the objective of this study is to review PjBL in relation to improving creative thinking skills while developing a framework for PjBL-based digital instructional materials that teachers can implement in their instruction. This study was conducted as a literature review in the form of a narrative review. The result of these studies indicates that the effectiveness of PjBL in its application to digital instructional materials depends on systematic learning stages, namely problem orientation, project design, project implementation, and project monitoring also evaluation. The enhancement of creative thinking skills occurs through the application of the main principles of PjBL, such as challenge problems, authenticity, student voice and choice, sustained inquiry, and revision also critique. Therefore, when implementing PjBL-based digital instructional materials to enhance creative thinking skills, it is crucial to understand the design stages and syntax that must be followed to ensure learning objectives that align with indicators of creative thinking skills.

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INTRODUCTION

Vocational high schools aim to prepare their graduates for employment after graduation. However, in reality, SMK graduates account for the largest share of the unemployed in Indonesia, at 25.78%. (Badan Pusat Statistik Indonesia, 2026). Vocational high schools should, in fact, be able to reduce unemployment rates in Indonesia by

ensuring graduates are absorbed into the job market (Yoana et al., 2024). The main reason vocational high schools contribute to unemployment is the poor quality of their graduates, particularly in terms of job skills that are not relevant to the needs of the job market (Walidayni et al., 2023). Integrating education with the workforce is essential to addressing this issue by facilitating the development of skills relevant to the needs of the job market (Hartanto et al., 2022; Ogawa, 2023). Cholik et al. (2021) also revealed that the learning process has a significant impact on the competencies of vocational high school graduates.

Quoted from World Economic Forum (2025), creative thinking is the second most in-demand skill in Indonesia by 2030, after AI and big data. This skill is essential not only for current workers but also for job seekers entering the workforce, enabling them to succeed in the workplace (The Conference Board et al., 2006). This is also consistent with the statement by Trilling & Fadel (2009) who argue that the need to continually innovate and improve makes creative thinking skills one of the top 21st-century skills essential for preparing the workforce of today and tomorrow.

In an effort to enhance creative thinking skills, the Project-Based Learning (PjBL) model has been implemented in the classroom by giving students the freedom to construct their own ideas and solve problems using various strategies (Apriadi et al., 2020; Sudjimat et al., 2020; Wawan et al., 2023; Widarti et al., 2023). However, the PjBL learning model, which is typically implemented in groups within the classroom, makes the assessment process difficult for teachers because it does not ensure that teachers know whether each member is actively participating in the project (Laila et al., 2024). Furthermore, the learning process cannot proceed effectively without the support of adequate teaching materials (Hadad et al., 2025).

Although various studies have examined PjBL, creative thinking skills, and the development of digital instructional materials, most studies still address these three aspects separately. Research on PjBL generally focuses on the implementation of the learning model, while studies on creative thinking skills emphasize individual measurement or improvement. Furthermore, digital instructional materials are more frequently used to enhance creative thinking. However, studies that discuss a conceptual framework integrating PjBL into instructional materials to enhance creative thinking skills, particularly in vocational high schools, remain very limited.

Therefore, this study aims to review relevant literature and construct a framework for PjBL-based digital learning materials designed to enhance students' creative thinking skills, thereby making it easier for teachers to assess students since the assessment is conducted on an individual basis. Digital learning materials were chosen because technology-based approaches in education play a crucial role in the digitalization process, incorporating diverse multimedia resources, hypertext, and effective tools for developing literacy skills (Selfa Sastre, 2022). Digitization makes it easier for students to access materials quickly and allows them to visualize the objects depicted in books, which can enhance their creative thinking (Borisova et al., 2021).

METHOD

The research design for this study is a literature review using narrative review approach. Data sources were obtained from Scopus, SINTA and Google Scholar. The search terms used in the literature search process were: "Project-Based Learning", "PjBL", "Bahan Ajar", "Instructional Materials", "Bahan Ajar Digital", "Digital Instructional Materials", "Berpikir Kreatif", "Creative Thinking", "Keterampilan Berpikir Kreatif" dan "Creative Thinking Skills". The selected article publication period is 2015-2025. The inclusion criteria for this study include: (1) scientific articles discussing PjBL, digital instructional materials, or creative thinking skills; (2) research conducted in an educational context; (3) articles in English or Indonesian. Exclusion criteria include: (1) articles irrelevant to the research topic; (2) publications consisting of subjective opinions. The analysis technique in this study employs thematic analysis to analyze themes. The framework development process adapts the ADDIE model, commonly used in instructional design.

RESULT AND DISCUSSION

Creative Thinking Skills

Creative thinking is a cognitive process typically used to address a problem by imagining and developing new perspectives or ideas. Creative thinking skills refer to an individual's ability to analyze new information and combine

it with unique ideas to solve a problem (Puspita et al., 2024). Creative thinking skills are characterized by independent exploration of topics and the search for solutions (Li & Tu, 2024). Creative thinking involves identifying a problem and then experimenting with one's ideas (Fakaruddin et al., 2024). The creative thinking process involves the stages of stimulating an idea and generating ideas from the one that has been stimulated (Rahmawati et al., 2024).

The indicators used to measure creative thinking skills, according to Hidayah et al. (2024) are fluency, flexibility, originality and elaboration. More specifically, Rizal et al. (2024) explain each of these indicators as follows: fluency is defined as the ability to generate unusual ideas that come to mind quickly, even if they are sometimes inaccurate. Flexibility is defined as the ability to think flexibly and to produce a variety of ideas, answers, and questions from different perspectives. Originality is defined as ideas conveyed based on one's own thoughts or viewing the individual as the originator of the idea. Elaboration is defined as an individual's ability to develop ideas and integrate them with details that can be elaborated upon within the existing ideas, making them more detailed and engaging. In addition to the four indicators mentioned above, Mulyono et al. (2023) note that problem sensitivity is also a key indicator of creative thinking, whereby an individual can detect, recognize, understand, and respond to a statement or problem in a given situation.

Digital Instructional Materials

Instructional materials are systematically organized resources, whether in print or non-print formats, created by teachers to serve as aids in delivering content during the learning process (Dwi Hasanah et al., 2024). Digital learning materials, on the other hand, are learning materials in digital format, meaning they are not printed in physical form and are typically in the form of PDF files, PowerPoint files, or other electronic files (Annisa Salsabila et al., 2023).

According to Area-Moreira et al. (2023), there are three dimensions to digital teaching materials: the role of textbooks in classroom practice, the origins of Digital Educational Research (DER), and the creation of digital materials by teachers. The role of textbooks in classroom practice is as a tool for teachers to help convey content to students, thereby assisting students in better understanding the material presented by the teacher, which can then be reinforced by the teacher's explanations in class. Meanwhile, DER encompasses the evaluation and analysis of: (a) the design and development of digitally created instructional materials, including e-books, educational multimedia, serious games, Augmented Reality (AR), and learning scenarios; (b) the use, selection, and evaluation of instructional materials, which involve decisions regarding models, strategies, and processes in the production and utilization of digital elements within learning materials; (c) content and ideological analysis of instructional materials, focusing on the variations present in the materials used to develop ideas or concepts; (d) analysis of the role of instructional materials in learning, specifically how these materials assist in teaching learning content and integrating them into the curriculum in use; (e) the resources and materials used in instructional materials, guided by the suitability of the selected instructional materials and the content to be taught to students; (f) teachers' opinions regarding the instructional materials used, as well as the ethical standards and competencies that students are expected to demonstrate and achieve; (g) access to instructional materials should be facilitated so as not to burden students, and it would be preferable if teachers created the materials themselves, as this would make it easier for them to provide students with access to the materials. In addition, digital materials should be created by teachers.

Xu (2023) explains that digital instructional materials must include at least the following elements:

1. Material ID: A unique identifier used in instructional materials to make them easily recognizable by others, commonly referred to as an identity.
2. Subject: The subject matter, which can be a specific subject selected for inclusion in the instructional material.
3. Topic: The specific topic to be covered in the lesson, ensuring that the material in the instructional material is clearly understood by students.
4. Content: The core content of the instructional material, derived from the learning material in a more specific form, consisting of systematically organized textual data.
5. Number of pages: A numerical value indicating the length of the material contained in the instructional materials.

6. Difficulty level: The level of difficulty of the material presented in the instructional materials, classified into three categories: easy, moderate, and difficult.
7. Rating: The average rating of the material presented in the instructional materials, typically displayed on a scale of 1 to 5.

Project-Based Learning (PjBL)

PjBL is a learning approach that involves creating and presenting a mini-project in the classrooms (Kibet et al., 2024). PjBL is defined as a learning approach that involves students in designing a project to reinforce knowledge and motivation, as well as to enhance cognitive skills and the application of dynamic thinking (Yu, 2024). PjBL is designed around challenging questions or problems, engaging students in project design, problem-solving, decision-making, and investigative activities, and providing opportunities for independent work (Chowdhury, 2015). PjBL can encourage active participation in various activities, thereby increasing students' interest and emphasizing practical experience (Kim & Cho, 2017).

Rahman et al. (2024) describe the syntax of PjBL as follows:

1. Observing and thinking about the project
 In this stage, students are asked to observe a product and/or phenomenon; based on these observations, they are then asked to come up with an idea for a product that will later become the project they will work on.
2. Designing a project
 After observing and considering what project to create, the students design and make the product.
3. Project monitoring and evaluation
 At this stage, several steps are carried out after the students have designed and created their projects, namely:
 - a. Monitoring the progress of the project for the product being developed.
 - b. Authenticating the context and tasks.
 - c. Revising the product.

In line with the PjBL framework, Pan et al. (2020) identified five processes involved in implementing PjBL, namely:

1. Asking questions or identifying problems to be solved.
2. Actively participating in the investigation of authentic situations to explore guiding questions, learn, and apply key concepts in relevant disciplines.
3. Students, teacher, and institutions engage collaboratively.
4. Constructing solutions using previously acquitted knowledge.
5. Creating tangible outcomes as answers to the questions or problems.

In addition, the use of PjBL in teaching must take into account the following principles:

1. Challenging problem or question: the complexity of the issues makes learning more beneficial for students.
2. Authenticity: the problems addressed in the project must be real, authentic issues.
3. Reflection: teachers and students work together to reflect on the students' work, identify difficulties, and suggest possible ways to address the issues.
4. Sustained inquiry: peers and/or teachers should provide feedback on the results they have achieved and the information they have gathered.
5. Student voice and choice: students have the freedom to choose the method they use to complete the project.
6. Revision and critique: constructive feedback should be provided throughout the project development process.
7. Public product: increasing students' motivation to work harder because the results of their projects will be presented in front of their classmates.

Synthesis of the Literature

Based on the results of the literature review, it was found that the integration of creative thinking skills, digital instructional materials, and PjBL enables the development of the same learning outcomes. PjBL fosters creative thinking skills through the generation of ideas, flexibility of thought, originality of ideas, and the development of ideas that all of that are cultivated during learning activities. Digital instructional materials serve as an interactive medium that helps teachers stay on track and follow parameters to ensure effective learning.

Designing PjBL-based Digital Instructional Materials

PjBL-based instructional materials were developed using the ADDIE model, which is one of the most commonly used instructional design models in research and development. The ADDIE model is a systematic design framework well-suited for developing instructional materials (Bachri et al., 2024).

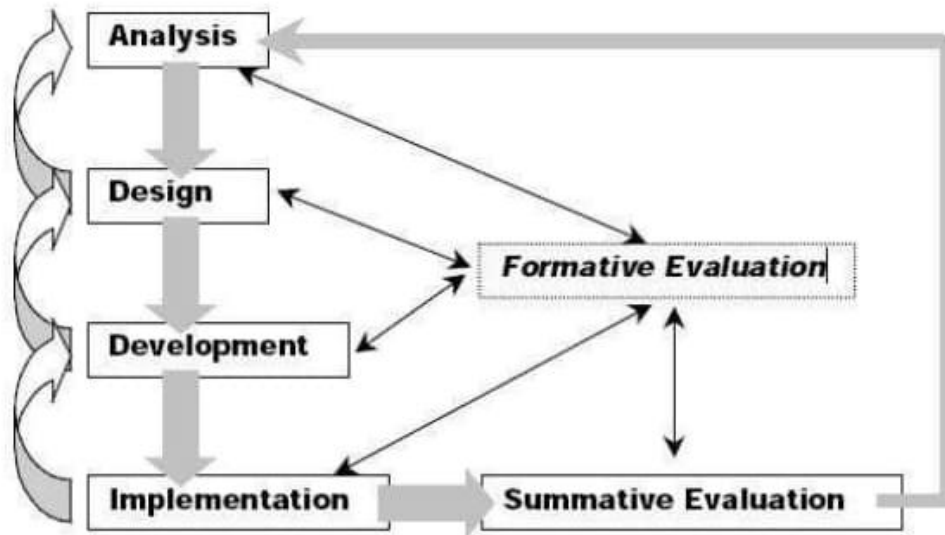


Figure 1. The ADDIE Model of Instructional Design

Source: Sari et al. (2020)

In Figure 1 above, the ADDIE instructional design model includes the stages described by Mutlu (2016) as follows:

1. Analyze
 During the analysis phase, both performance analysis and needs analysis are conducted. Performance analysis is conducted to identify and clarify the programs needed by the students. Needs analysis, on the other hand, is conducted to determine what specific skills the students need to improve. During this phase, issues that need to be addressed will also be identified.
2. Design
 During the design phase, learning objectives are established, materials and activity frameworks are developed, and evaluation methods are determined to address the issues identified during the analysis phase.
3. Development
 The development phase is the stage where the design is brought to life through testing.
4. Implementation
 During the implementation phase, the development steps are carried out, and the program's success is evaluated. Implementation involves delivering the material using a variety of models or methods.
5. Evaluation (formative and summative evaluation)
 The evaluation stage is the assessment phase of the learning process. Evaluation is conducted in two forms: formative evaluation and summative evaluation.

Based on the steps in the ADDIE instructional design model, the design of PjBL-based learning materials aims to enhance creative thinking skills. However, it is limited to only four steps because it is still a framework and has not yet been tested. The research framework in this study is illustrated as follows:

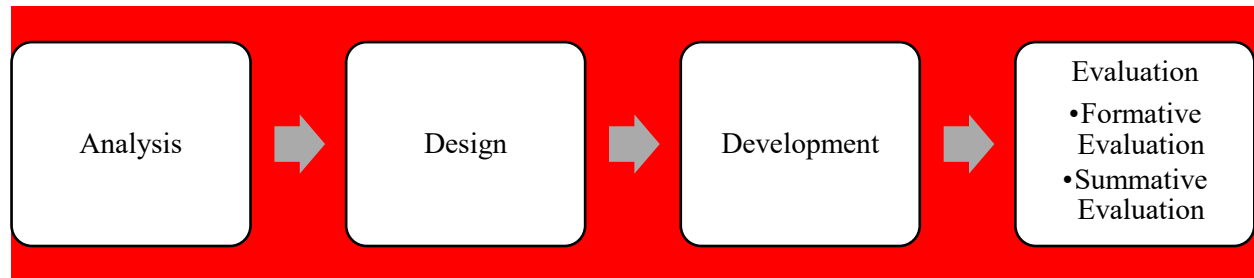


Figure 2. A Project-Based Digital Instructional Material Framework

Source: Researcher, 2026

1. Analyze

According to reviews, teachers find it difficult to assess students when PjBL is conducted in groups. In addition, the lack of adequate instructional materials hinders the learning process. Therefore, there is a need for adequate teaching materials that can enhance students' creative thinking skills.

2. Design

The learning objective are defined as follows:

- a. Students will be able to independently identify real-world problems.
- b. Generate a variety of creative solutions.
- c. Develop innovative products on their own.
- d. Students are asked to create a product or project to address a problem or case study that needs to be solved.
- e. Students are allowed to discuss with peers and ask questions to the teacher.
- f. Assessment is conducted by the teacher based on creative thinking indicators.
- g. Feedback is provided by the teacher and peers.

The syntax in the learning process is designed as follows:

- a. The teacher presents a contextual problem through a video or case study.
- b. The teacher conducts an initial exploration using open-ended questions.
- c. Based on the results of the exploration, the teacher gathers preliminary information about the students' characteristics and then designs a project that can be carried out independently.

The indicators of creative thinking skills achieved in this learning process are as follows:

- a. Students are able to propose various ideas or possible solutions to problems (fluency).
- b. Students are able to view problems from various perspectives (flexibility).
- c. Students are able to choose approaches to problem-solving (flexibility).
- d. Students are able to generate unique and innovative ideas or solutions (originality).
- e. Student produce innovative products (originality).
- f. Students are able to develop ideas in detail and systematically (elaboration).
- g. Students are able to explain and improve their work (elaboration).
- h. Students are able to generate follow-up ideas or improvements (fluency).

3. Development

a. Product design

The product is a PDF developed using FlipHTML, containing content tailored to the subjects being taught. The digital teaching materials also include QR codes and links to enhance interactivity and functionality. The QR codes and links are connected to videos related to the material being taught. The teaching materials also include projects for students to complete. These projects align with the research approach used, namely Project-Based Learning (PjBL). The identity of the digital teaching materials is reflected in the cover, which displays the title of the material being taught.

b. Product design validation

The product design was validated by several experts, including an Indonesian language instructor, to assess whether the product's writing conforms to PUEBI standards. Additionally, the content was validated by an Office Administration instructor to ensure that the material included in the teaching resources is appropriate, thereby making the product suitable for use by students.

c. Product design revision

Product design improvements are made based on product design validation. Once the design has been approved by experts, the product is no longer revised and the process proceeds to the creation of a product prototype.

d. Evaluation

The evaluation phase consists of two parts: a formative evaluation, which involves teacher observation and assessment during the learning process, and a summative evaluation, which takes place at the end of the semester and involves writing a final report and presenting project results.

The development of this framework aligns with J.P. Guilford theory of divergent thinking (Azaryahu et al., 2024). This PjBL-based digital instructional material framework is designed that students work on their own projects, ensuring that the results truly reflect their individual skills. As a results, teacher can grade more accurately and objectively. Additionally, with clear guidelines, teachers can track students' progress, allowing them to assess the process rather than just the final outcome, which could introduce bias.

CONCLUSION

This study contributes by proposing a conceptual framework for digital instructional materials that integrates PjBL principles to systematically enhance students' creative thinking skills. The framework, develop based on a synthesis of the literature, adopts the ADDIE instructional design model. Through the integration, the framework emphasizes not only content deliver but also development of creative thinking skills, including idea generation, problem solving and reflective thinking, in a more interactive, contextual and learner centered learning environment.

However, this study is limited to conceptual and literature-bases approach without empirical validation. Therefore, future research is recommended test the effectiveness of the proposed framework through empirical studies across different educational contexts, as well as to examine its impact on individual learning outcomes and assessment practices.

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