



DESIGNS OF DEVELOPING TEACHING MATERIALS BASED ON PROJECT-BASED LEARNING: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

This research aims to determine the various designs that have been used in developing project-based learning-based teaching materials so that they can support the student learning process. This research uses the Systematic Literature Review (SLR) method by conducting a literature study of the designs used in developing project-based learning teaching materials. Data collection techniques are carried out by collecting and reviewing articles appropriate to the topic being studied and related to research keywords. 600 articles have been collected from National and International Journals sourced from online databases such as Scopus, ERIC, and Google Scholar. Next, the articles were selected according to several predetermined research criteria until 13 articles were obtained, which would be used as secondary data and then analyzed. This research shows that many teaching material development designs can be used to prepare teaching materials based on project-based learning. Furthermore, the results of this research can be used as interesting further research by examining the process of developing teaching materials using a particular design to build students' high-level thinking skills.

Keywords: *Teaching Materials, Project-Based Learning, Systematic Literature Review.*

1. INTRODUCTION

Education in the 21st century faces various complex challenges, including the need to prepare students with relevant skills and knowledge to face an ever-changing world. Various educational institutions are starting to implement learning that can encourage students to improve their cognitive knowledge and professional skills, such as teamwork problem-solving (Volger et al., 2018). Of course, education cannot achieve this if it still uses traditional learning methods, where teachers are still the primary source of knowledge and students are passive recipients of knowledge. (Guo et al., 2020). Therefore, it is necessary to change the methods used in learning, where students should be the center of the teaching and learning process (Rungsirisakun et al., 2019).

One learning model that can be applied so that students can be actively involved in the teaching and learning process and create student-centered learning is a project-based learning model. (Nainggolan et al., 2020). Project-based learning combines knowledge with skills to solve a real investigation within a certain period with a focus on solving problems and producing a product. (Santyasa et al., 2021).

PjBL learning can be expressed in exciting teaching materials that suit the needs of the teaching and learning process, where the teaching materials can be equipped with PjBL learning steps such as 1) start with the essential question, 2) design a plan for the project, 3) create a schedule, 4) monitor the students and the progress of the project, 5) assess the outcome, and 6) evaluate the experience (Santyasa et al., 2021).

Teaching materials themselves are all forms of materials or materials that are arranged in a structured and systematic manner, which are designed in accordance with curriculum demands and become learning resources for students, as well as materials or materials for teachers in carrying out teaching and learning activities (Anwar, 2023). Teaching materials can be developed through various development designs, such as several designs that are widely used today, namely ADDIE, 4D, and 4STMD (Anwar & Sumarna, 2022). Then, selecting the design used in developing PjBL-based teaching materials can follow the stages of each design by integrating project-based learning into it.

Based on the background described above, the research focuses on "Designs of Developing of Teaching Materials Based on Project-Based Learning".



2. METHODS

In providing an overview of the designs used in developing project-based learning-based teaching materials, this research uses the Systematic Literature Review (SLR) method. Systematic Literature Review (SLR) is a systematic research method in which researchers collect, critically evaluate, integrate, and present various findings from research that has been conducted regarding research questions or topics of interest (Pati & Lorusso, 2018). There are three main stages in research using this method, namely searching for literature relevant to the chosen theme, selecting the literature to be analyzed, and data analysis. (Albeshree, et al., 2020).

Literature search sources were taken from national journals to international journals, which will be used as secondary data in research by searching home bases such as Scopus, ERIC, and Google Scholar. The keywords used to search for literature are Teaching Materials, Project-Based Learning, and Systematic Literature Review.

There are several criteria for articles that will be used as secondary data, namely the year the article was published, a maximum of five years ago, the article has the same keywords as the research topic, focuses on students in mathematics and science learning, and the article has a review that focuses on designs. Used in developing project-based learning-based teaching materials. The following are the stages of selecting research literature, which are processed using the PRISMA method (Haddaway et al., 2022).

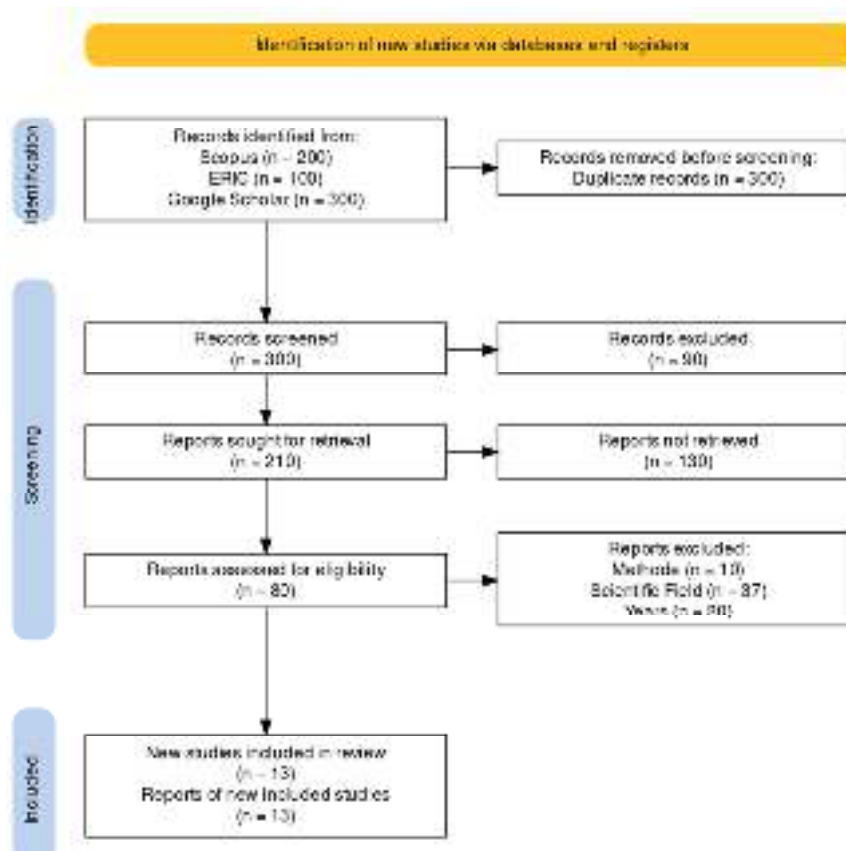


Figure 1: PRISMA Diagram of Secondary Data Analysis Results

Based on the selection results above, a total of 13 articles were obtained, which will be analyzed as literature sources.

3. RESULTS & DISCUSSION

The articles analyzed were collected from various national and international journals and obtained through online databases such as Scopus and Google Scholar, which contain data in the form of designs used in



developing project-based learning-based teaching materials. From the results of the search carried out, 13 articles were obtained, which are presented in Table 1 below:

Table 1. Results of Article Analysis Regarding The Design of Developing Teaching Materials Based on Project-Based Learning

Years	Article Title and Author	Research Result
2023	Validation of the virus teaching module based on project-based learning on creative thinking abilities (Putra et al., 2023)	This research uses a 4D development design with development stages, namely Define, Design, Develop, and Disseminate, but only reaches the product validity stage. The results of this research were that the results of the validity of project-based learning-based teaching modules received a high score so that they could be implemented in the teaching and learning process to improve students' creative thinking skills.
2023	Development of E-Worksheet Based on STEAM-PjBL in Reaction Rate Material to Improve Creative Thinking Skills High School Students (Rr Tasya Noor Nabila & Agus Kamaludin, 2023)	This research uses a 4D development design with development stages, namely Define, Design, Develop, and Disseminate. This research obtained ideal results from media experts, material experts, reviewers, and student responses of 97%, 93%, 90%, and 93%, respectively, in the very good category. Therefore, it can be concluded that the resulting E-Worksheet can improve students' creative thinking and is worthy of being used as an alternative learning media in the learning process.
2023	Module Development through Project-Based Learning to Enhance Students' Creative Thinking (Praptama et al., 2023)	This research uses a 4D development design with development stages, namely Define, Design, Develop, and Disseminate. Based on the validity results, it was found that the module developed was declared valid and practical, with the respective scores obtained for validity and practicality being 83.3% and 85%, so the PjBL-based module developed could improve students' creative thinking skills.
Years	Article Title and Author	Research Result
2022	Creative project-based learning model to increase creativity of vocational high school students (Usmaldi & Amini, 2022)	This research uses a 4D development design with development stages, namely Define, Design, Develop, and Disseminate. It was stated that the teaching materials developed were valid based on the components of appropriateness of content, appropriateness of presentation, appropriateness of language, and appropriateness construct based on three expert assessments. PjBL-based teaching models and materials are effective based on learning outcomes in the realm of students' knowledge, skills and attitudes so that they can increase students' creativity and competence in the form of mastery of



		teaching materials, skills in making creative products and work attitudes.
2022	The Development of Teaching Materials Based on Project Oriented TPACK Approach to Improve the Creative Thinking Skills of Elementary School Teacher Prospective Students (Rahayu et al., 2022)	This research uses an R&D development design with stages initial research and information gathering, planning, initial product format development, initial trial, initial product revision, Test field trials, product revisions, Validation and field trials, Final product revisions, and Dissemination and implementation. Teaching materials are demonstrated to be appropriate for utilization in learning with the criteria of being substantial, viable, and successful, so commonsense educating materials are connected in learning and demonstrated viable in moving forward the imaginative considering abilities of imminent instructors.
2021	The Development of Scientific Teaching Materials Based on Stem-Pjbl As a Chance to Improve Students' Creative Thinking Ability on the Topic of Analyzing Light and Optics (Sari, PR, et al., 2021)	This research uses a 4D development design with development stages, namely Define, Design, Develop, and Disseminate. Educating materials are demonstrated to be appropriate for utilization in learning with the criteria of being substantial, viable, and successful, so it can be concluded that commonsense educating materials are connected in learning and demonstrated viable in moving forward the imaginative considering abilities of imminent instructors.
2021	Student Worksheet Oriented on Project-Based Learning to Train Student Creative Thinking Skills on Acid-Base Material (Zahro & Mitarlis, 2021)	This research uses a 4D development design with development stages, namely Define, Design, Develop, and Disseminate. The investigation found that the worksheet utilized was demonstrated to be doable based on the legitimacy, common sense, and adequacy that came about. So, educational materials are appropriate for utilizing within the learning process to progress imaginatively and consider abilities.
2020	Improving the problem-solving skills through the development of teaching materials with STEMPjBL (science, technology, engineering, and mathematics-project based learning) model integrated with TPACK (technological pedagogical content knowledge) (Purwaningsih et al., 2020)	This research uses a 4D development design with development stages, namely Define, Design, Develop, and Disseminate. Material science educating materials with the STEM-PjBL (Science, Innovation, Building, Science and Project-based Learning) show coordinates with TPACK (Innovative Educational Substance Information) are exceptionally substantial, commonsense, and measurably compelling for making strides in students' problem-solving capacities, so they are exceptionally viably actualized in learning.
2020	Development of mathematical teaching materials based on project-based learning to improve students' HOTS and character (Sofiyan et al., 2020)	This research uses the ADDIE development design with development stages, namely Analysis, Design, Development, Implementation, and Evaluation. The conclusions were that the PjBL-based education materials created were appropriate and great for learning, and based on approval tests, the components of substance, plan, and dialect met the criteria for the



		exceptionally substantial category. Educating fabric that's tried in learning can move forward HOTS and understudy character. So those instructing materials are considered viable in progressing understudy character and HOTS.
2020	The Development of Local-Based Teaching Materials in Project-Based Learning (Wardani et al., 2020)	This research uses an R&D development design with the stages Research and Information Collection, Planning, Develop Preliminary form of product, Preliminary Field Testing, operational field testing, operational product revision, main field testing, Main Product Revision, Final Product Revision, Dissemination and Implementation. This inquiry appears to show that the education materials created have substantial legitimacy and down-to-earth scores that can be utilized in learning.
2019	Development of Motion-Theme Teaching Materials for Science Learning in Junior High School (Pursitasari et al., 2019)	This research uses a 4STMD development design with development stages, namely Selection, Structuring, Characterization, and Didactic Reduction. It can be concluded that created educational materials on the subject of movement had substantial categories, were profoundly organized, simple to get, and had a really great possibility. So, instructing materials can be actualized in learning.
2019	The Effectiveness of Teaching Materials Using Project-Based Learning (PjBL) in Concrete Stones Practice Course (Syah et al., 2019)	This research uses a 4D development design with development stages, namely Define, Design, Develop, and Disseminate. It was found that the teaching materials developed were declared valid and effective, so they had a good impact on improving students' cognitive, affective, and psychomotor abilities, which resulted in increased student learning outcomes.
2019	Development of mathematics teaching materials using project-based learning integrated STEM. (Priatna et al., 2019)	This research uses an R&D development design with stages of Data Collection and information, Design, Product Creation, small-scope trials, and Evaluation and revision. The results showed that it has a high flexibility value because it has a number of instructions that are easy to understand. Experts elaborated on the development of teaching materials using the PjBL syntax model, and they were then integrated with STEM syntax. So, teaching materials can be implemented in learning.

Based on the results of the analysis of all the secondary data literature above, it was found that there are several designs that can be used in developing project-based learning-based teaching materials so that these teaching materials are able to improve creative thinking skills, HOTS, and other high-level skills in students.

Discussion

Project-based learning is a learning model that can encourage students to implement and apply the knowledge and skills they have through an interesting project, which often results in a product that can be utilized.



Project-based learning is very suitable for application in mathematics and science learning. Students will be more active in the learning process by completing problem-based projects so that students will have a better understanding of mathematics and science concepts and can apply them to real concepts.

Project-based learning can be integrated into learning through the use of PJBL-based teaching materials. In several studies, it is explained that PjBL-based teaching materials can be developed using 4D development design with the Define, Design, Develop and Disseminate stages (Putra et al., 2023; Nabila & Kamaludin, 2023; Praptama et al., 2023; Usmeldi & Amini, 2022; pursitasari, et al., 2021; Zahro & Mitarlis, 2021; Purwaningsih et al., 2020; Syah et al., 2019). PjBL-based teaching materials developed using 4D design obtain good validity, practicality, and effectiveness results. They can be used to support the learning process and help students improve their high-level skills, such as creative thinking skills and HOTS.

Not only 4D design, the development of PjBL-based teaching materials can use ADDIE design with stages, Design, Development, Implementation, and Evaluation (Sofiyana et al., 2020), where PjBL-based teaching materials developed using this design can improve HOTS and student character, so they are considered effective for use in learning. Then, there are the Four Steps Teaching Material Development(4STMD) design used in developing teaching materials with stages Selection, Structuring, Characterization, and Didactic Reduction (Pursitasari et al., 2019) that developed teaching materials on the subject of motion had valid categories, highly structured, easy to understand and having a very good feasibility. So, teaching materials can be implemented in learning.

Furthermore, there is an R&D design that can be used in developing teaching materials by following several stages, such as stages Initial research and information gathering, Planning, Initial product format development, initial trial, Initial product revision, Test field trials, Product revisions, Validation and field trials, Final product revisions, and Dissemination and implementation (Rahayu et al., 2022) and stages Research and Information Collection, Planning, Develop Preliminary form of product, Preliminary Field Testing, operational field testing, operational product revision, main field testing, Main Product Revision, Final Product Revision, Dissemination and Implementation (Wardani et al., 2020). Development at this stage is proven to be suitable for improving students' thinking skills based on the results of valid, practical and effective criteria.

Apart from that, the development of teaching materials uses designated Collection and information, Design, Product Creation, Small Scope Trials, and Evaluation and revision (Priatna et al., 2019) are seen as having high flexibility value because they have a number of instructions that are easy to understand so that teaching materials can be implemented in learning.

4. CONCLUSION

Based on the research results and discussions that have been described, it can be concluded that there are several teaching material development designs that can be used in compiling or developing project-based learning-based teaching materials, including 4D, ADDIE, 4STMD and other R&D developments. Teaching materials developed using several designs are considered suitable for use based on the results of valid, practical, and effective criteria. PJBL-based teaching materials can be used in learning to improve students' knowledge, skills, and character.

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