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DEVELOPMENT OF A PROJECT BASED LEARNING HYBRID MODE MODULE TO TRAIN SCIENCE SKILLS FOR PHASE D STUDENTS

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Abstract: One of the subjects in the 8th grade merdeka curriculum is natural science (IPA). Science is involved in education in a variety of ways, from the simple to the complex, from the unclear or abstract to concrete solutions to problems. In an effort to teach students science skills in Phase D science subjects, this research aims to develop a hybrid project-based PJBL (PJBL) module. The method used in this research is Research and Development (R&D) with quantitative descriptive data analysis techniques which consist of several stages, namely needs analysis, module design, expert validation, field trials, and product revision. This research was carried out at MTsN 3 Kediri, with class VIII students. The conclusion of this research is that the project based learning hybrid mode module is very suitable to be used to improve students' science skills based on student response questionnaires and validation by experts that have been carried out.

Keywords: Project Based Learning, Learning Modules, Science Skills, Hybrid Mode

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INTRODUCTION

Education is currently defined as the process of increasing human capacity through coaching, improvement, knowledge and understanding. Formal education is defined as a face-to-face educational process that allows students to learn in a broad knowledge environment (Eva Alvi Nurlaili & Agus Miftakus Surur, 2023). In formal education, there are several standards so that education can be coherent and implemented well, which are usually called national education standards. The Merdeka Curriculum has diverse intracurricular learning, so students have enough time to learn concepts and strengthen their abilities. Teachers have the freedom to choose various educational tools so that learning can be adjusted to the learning needs and interests of students (Kemendikbud, 2022).

The Merdeka Belajar Curriculum aims to transform the learning process into something meaningful and enjoyable rather than just fulfilling obligations. Not only are teachers required to be able to provide optimal teaching, but they are also required to provide more in-depth and meaningful teaching. Learning can be fulfilled in a more flexible timeframe, i.e. in phases, rather than just in one year. There are six phases: Phase A (grades 1 and 2 of elementary school), Phase B (grades 3 and 4 of elementary school), Phase C (grades 5 and 6 of elementary school), Phase D (grades 7, 8 and 9 of junior high school), Phase E (grade 10 of high school), and Phase F (grades 11 and 12 of high school) (Kemendikbud, 2022). This research will focus on Phase D, which means it is located at the junior high school level.

In the Merdeka Curriculum, science lessons include several learning objectives, including comprehension, inquiry skills, values, and behavior. At the comprehension stage, students have the ability to think scientifically if they have a deep understanding of science. If a person has an understanding of a particular field of science, their thinking ability will have a positive impact on the development of that science. Critical thinking in understanding the counter curve is based on what is expected of students (Yusal et al., 2021). Science process skills involve cognitive, affective, and psychomotor skills, such as conducting scientific research, expressing principles and concepts, and various other skills that are designed to describe different concepts. When scientists use their skills, they can encourage others to actively participate in research and long-term skill development. In addition, these skills can also help students learn how to use scientists (Syafmitha et al., 2024).

Students in phase D are expected to be able to identify problems, ask questions, and present hypotheses by creating research designs that prove hypotheses or questions asked. Learners can identify variables that need to be changed, measured, and control the standard rules. They took data and analyzed the patterns, and used them to unravel the theory. During

this phase, the learner also performs actions based on the information gathered, details the wrong actions, and purifies his or her experience by using the right language (adjusted to the conditions). With uses his knowledge of the science concep he has learned to interpret, interpret, and explain how the reaction occurs in everyday life (Utami et al., 2022).

As a result of observations and interviews conducted by teachers in one of the schools in the Kediri area, the learning of students in Junior High Schools today pays less attention to real problems and focuses more on irrelevant values even though phase D students are part of Generation Z who have very much access to explore whatever they want through technology that continues to be attached to their lives. Unfortunately, this has not been taken too much opportunity by science teachers at the junior high school level. So the author chose to develop an educational process that makes technology part of the learning process. The learning process chosen by the author to be developed is a teaching module.

One type of learning used in the learning process is modules. This is given to students by teaching basic materials. Modules are designed to make it easier for students to understand the content independently or receive guidance through interesting materials. Educators see that students have to go through intellectual processes and difficulties in various experiences (Wati et al., 2022). Interactive modules are an excellent choice for Generation Z who are very attached to information technology because interactive modules are modules that have learning features that can ensure two-way communication between students and educators can be established anytime and anywhere. Interactive modules are very generally related to technology where currently interactive modules are in the form of web or applications that are widely used anywhere and anytime (Usmeldi et al., 2023). This is what makes researchers try to develop a hybrid model. The modules are not only available in print version but also available in web version reachable online.

The module that will be developed by the researcher is a module based on Project Based Learning (PjBL). Project-based learning (PjBL) is one of the learning models that allows students to produce a product to solve a problem so that students will have the skills to identify, explore, reason critically, and make decisions from a problem in real life (Zhang & Ma, 2023). Based on research that has been conducted by Rukmi, et al. stated that PjBL is very effective in being used to improve students' science process skills (Rukmi & Perdana, 2023). In addition, Noviati, et al. also stated that learning with PjBL can be used to train the science process skills of students (Noviati et al., 2023). The steps of the PjBL learning model strongly describe the process of student science skills, so that with the PjBL learning model, students' science process skills will automatically be able to achieve the goals of students' science process skills where

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students are required to be able to solve problems by determining their own methods and testing these methods as proof of solutions that can be offered by (Syafmitha et al., 2024).

Based on previous researches, the author decided to develop a PjBL-based teaching module that utilizes technology so that it can be accessed in a hybrid mode to be able to train the science process skills of phase D students. This makes the researcher even more confident that the solution offered by the researcher is to develop a Project Based Learning teaching module with a Hybrid model to train the science skills of phase D students and the purpose of the researcher is to find a development process that is in accordance with the feasibility of the PjBL hybrid mode module to train students' science skills so that the module developed will be different from other teaching modules where generally the teaching module It is only available in print or on the web, but the modules that will be developed in this study will include the print version and the web version at the same time. The difference in this research is that the learning module in this study covers one semester's worth of material and can be accessed both online via the web or offline in print form.

METHOD

The method used in this study is a research and development (RnD) method with 4D models of RnD. The steps in this research followed by re-planning (Figure 1).

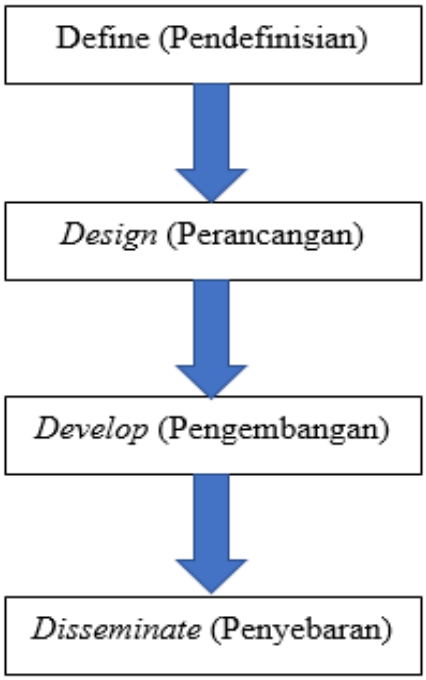

Figure 1. 4D Method

(adapted from Thiagarajan, S., Semmel, D.S., & Semmel, 1974)

This research began with the stage of defining the problems underlying the research by conducting observations and interviews with teachers and students of one of the junior high schools in the city of Kediri. Then the researcher analyzed the needs of students based on their age, cognitive ability and desire of the students. After getting the problem, the researcher conducts a literature review to find a solution to the problem found, then from the many literature reviews, the researcher determines the most suitable solution for the problem found, here the researcher chooses the PjBL hybrid mode teaching module as the solution offered. The second stage of this research is to design the PjBL hybrid mode module to be developed. The design of the print version of the hybrid mode PjBL module will be printed at A4 size with the help of the Canva application to design the inside of the print module's display. The display of the print module is seen in Figure.

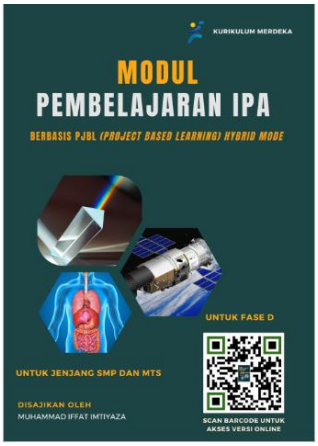

Figure 2. Module Cover Print Version and Subject Cover

The module in the online version will be designed using the mobirisesite web that has been provided by the mobirisesite developer. The author uses tamplate on the mobirisesite web service which is free. The display of the module in the online version can be seen in the figure 3.

Figure 3. Main Cover

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The third stage of this research is the development stage. At this stage, research develops products by validating experts. In this study, the researcher involved learning media experts to validate the printed or online version of the learning module, science teaching material experts to validate the material in the module and learning experts to validate student worksheets and module readability questionnaires to find out the response of users to the developed modules. The readability questionnaire will be given to science teachers and students totaling 20 students. Based on the validation results, the researcher will revise the module according to the suggestions and recommendations from the validator before providing it to users to test its usability.

The last stage of this research is the dissemination stage. At this stage, the researcher disseminates the PjBL hybrid mode module by giving the module to schools so that it can be used and publishes the results of this research into a research journal so that it can be massively conveyed to everyone. The data analysis that will be used in this study is quantitative data analysis to analyze the results of validation and questionnaires. The validation results will be analyzed by determining the percentage using equation 1 (Maulana Husaen & Yuliani, 2023).

$$Result = \frac{Score\ Obtained}{Maximum\ Score}\ x\ 100\%$$

With the determination of eligibility criteria defined by table 1.

Table 1. Module eligibility criteria (adapted from Maulana Husaen & Yuliani, 2023)

No	Interval	Criterion
1.	75%-100%	Highly Worthy
2.	50%-75%	Proper
3.	25%-50%	Less feasible
4.	< 25%	Not eligible

The students' readability questionnaire on the module was analyzed using equation 2 adapted from (Sarip et al., 2022).

$$Result = \frac{Total\ Score\ Data\ Collection\ Results}{Criteria\ Score}\ \text{x}\ 100\%$$

The results of the calculation will be interpreted using table 2 on the criteria for the readability test obtained from (Sarip et al., 2022).

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Table 2. Readability Test Criteria

Percentage	Criterion
80,1% - 100%	Excellent
60,1% - 80%	Good
40,1% - 60%	Keep
20,1% - 40%	Bad
0,0% - 20%	Very Not Good

Adapted from Sarip, et.al

FINDING AND DISCUSSION

Module Development with 4D Model

In this digital era, the world of education continues to transform to keep up with the development of technology and the learning needs of students. One approach that is becoming increasingly popular is the development of hybrid mode modules, which combine face-to-face (offline) and distance learning (online). The 4D model (Define, Design, Develop, Disseminate) is an effective framework for developing quality hybrid mode modules that have an impact on learning (Aziza Anggi Maiyanti, 2024). The hybrid mode module is a learning module that combines elements of offline and online learning.

This module is designed to provide a more flexible, interactive, and personalized learning experience for students. The development of hybrid mode media with a 4D model begins by defining the needs of the science curriculum in phase D. Researchers develop this hybrid mode module by defining material needs in grade 8 semester 2 with 5 available materials, namely Substance Pressure, Respiratory System, Excretory System, Vibration, Wave and Sound and Light and Optics. These 5 materials were selected based on the results of the observation of the teacher's learning tools in the sample school. These materials are science materials that are uninteresting and abstract (Warda Rasidah et al., 2022). The unattractiveness and abstraction of the mater must be conveyed in real terms so that it can reach the students. To express the abstract material, the researcher chose the Project Based Learning learning model, which is a learning model that allows students to find solutions to problems by choosing their own methods (Loyens et al., 2023).

The Project Based Learning (PjBL) method has 7 learning stages starting from choosing and determining the project topic, formulating trigger questions, preparing a project plan, implementing the project, monitoring and evaluation, reflecting and presenting and following up (Setiawan et al., 2021). These steps are very suitable for practicing science process skills

that have indicators of observing, grouping, asking questions, making hypotheses, conducting experiments, analyzing data and communicating results (Maulana Husaen & Yuliani, 2023). Based on the stages of PjBL, the researcher formulated the relationship between the stages of the project-based learning process and the indicators of science process skills as shown in table 3.

Table 3. The Relationship Between the PjBL stage and The Science Process Skill Indicator

Stage of Project Based Learning	Science Process Skills Indicators
Selecting and Assigning project topics based on project themes	Observe Group
Formulating a lighter question	Ask a Question
Drawing up a project plan	Making a Hypothesis
Executing Projects	Conducting Experiments
Monitoring and Evaluation	Analyzing Data
Doing reflection and presentation	Communicating Results
Follow up	

Based on the curriculum analysis studied by the researcher for the second semester phase D science material, the researcher selects the materials and projects to be developed as listed in table 4.

Table 4. Materials and Themes of the developed Project

Material	Basic Issues	Project Theme
Substance Pressure	Relationship between pressure and rocket motion	Water Rocket Manufacturing
Human Respiratory System	Oxygen and Carbon Dioxide Flow	Human Respiratory System Props
Excretory System	Occurrence of kidney stone disease	Excretory System Props
Vibration, Waves and Sound	Sound Production	Sound Wave Props
Light and Optics	Seeing objects far away	Simple Telescope

The development of the Project Based Learning Hybrid Mode learning module was developed with the help of technological tools in the form of free applications that are commonly used by the public in general. The print version module was developed with the help of Ms. Word to create a print document size framework while tamplate was developed with the help of the Canva application. The Canva application is an application that can generally be used to design a document and beautify a document with the available tamplates (Miftahul Jannah et al., 2023). In the printed version of the module, there are learning steps, student

worksheets, summative and formative assessments as well as reading materials for teachers and students. As for the online version of the module, it was developed on the mobirise web as a base for the opening of the module.

Web mobirise is a web application that can be accessed online and can be used as a place to put services that can be easily accessed (Sina et al., 2023). The menus in the online version of the module consist of reading materials for teachers and students whose appearance is developed in the form of flipbooks with the Hyzine Flipbooks application, student worksheets that can be downloaded directly by teachers and students, learning steps developed in the form of flipbooks with the Hyzine Flipbooks application, evaluations and quizzes developed with the quizizz application. The flipbook was chosen by the researcher because of the very good and pleasant appearance of the flipbook to see in the online version (Fikriansyah et al., 2023)so that the appearance of the online version of the module becomes more attractive. Quizzizz was chosen as the based application for evaluation and quizz because the Quizzizz application allows teachers to provide more interesting evaluations and get feedback directly and there are levels like in the game (Syafriafdi, 2023).

Validity of Project Based Learning Hybrid Module

Module validation is an important process to ensure that the learning modules developed meet quality standards and are ready to use (Sururuddin et al., 2023). The PjBL Hybrid Mode module is validated by media experts, material experts, evaluation experts. The results of the validation of the PjBL Hybrid Mode module are shown in tables 5 through 7.

Table 5. Media Expert Validation Results

Assessment Aspects	**Validator**		**Result Score (%)**	**Criterion**
	1	2		
Media Engineering	24	23	97	Highly Worthy
Visual Communication Aspects	50	46	92	Highly Worthy
Total Results	**74**	**69**	**94**	**Highly Worthy**

Table 6. Material Expert Validation Results

Assessment Aspects	**Validator**		**Result Score (%)**	**Criterion**
	1	2		
Learning	11	11	91,7	Highly Worthy
Content of the material	25	25	89	Highly Worthy
Total Results	**36**	**36**	**90**	**Highly Worthy**

Table 7. Results of Evaluation Expert Validation (Readability Questionnaire)

Assessment Aspects	**Validator**		**Result Score (%)**	**Criterion**
	1	2		
Construction	3	3	100	Highly Worthy
Technical	4	3	80	Highly Worthy
Content and Presentation	3	2	83	Highly Worthy
Total Results	**10**	**8**	**90**	**Highly Worthy**

Based on Tables 5 to 7, it can be seen that the PjBL Hybrid Mode Module produces a figure of 94% for media validation with a very feasible category, 90% for material validation with a very feasible category and 90% for readability questionnaire validation. These three things mean that the PjBL Hybrid Mode module is very feasible to use for the learning process that can train science process skills. It can be seen that the highest value of the validation results is found in the validation results of media experts in the aspect of media engineering assessment which shows a figure of 97%. This means that the display of the print or online version of the module is very appropriate in the selection of media used to develop this PjBL module. This designation of very feasible results shows that this module can be used for science learning in the classroom. This is in accordance with research conducted by Nurlaelah et.al which states that e-modules are very feasible to be used to train science process skills (Nurlaelah et al., 2023).

After going through the validation process by experts, the PjBL Hybride mode module was tested on educators and students with a total of 11 respondents by providing them with a module readability questionnaire. The module readability questionnaire can see how users respond to the modules that have been developed so that researchers get feedback on the product (Wati et al., 2022). The results of the readability questionnaire by users are seen in table 8.

Table 8. Results of the Readability Test of the Hybrid Mode PjBL Module

Assessment Aspects	Yield (%)	Category
Construction	94	Excellent
Technical	97,5	Excellent
Others	85	Excellent
Total Results	**87,9%**	**Excellent**

From the 11 respondents based on table 8, it can be concluded that the PjBL Hybrid Mode Module has a Very Good category in terms of construction, technical and module content. It is very good here to mean that the user's response to the PjBL Hybrid Mode mode in terms of display, content and use when it can be used properly without significant problems. This means that this module will be very useful for practicing science process skills. This module gets very good results because the learning model chosen is a PjBL learning model that is very suitable if used to construct concepts independently by students through project steps that will automatically train students' science process skills. This is very consistent with the theory of constructivism which states that learning by constructing material or concepts by yourself will be a very meaningful learning (Mones et al., 2023). Based on the results of the feasibility analysis and readability test, it can be concluded that the project-based learning hybrid mode module is very feasible and very good to use to train students' science process skills in science materials.

Strengths

1. **Effective Development:** The module can be successfully developed using the 4D model, resulting in a high-quality product.
2. **Feasibility:** The module is suitable for implementation in a specific context (Phase D science material, Grade 8, Semester 2) and aligns well with the curriculum.
3. **Effectiveness:** The module has demonstrated positive outcomes in training science process skills.

Weaknesses

- **Limited Scope:** The provided information focuses on the module's development and feasibility, with limited data on its actual impact on student learning outcomes.
- **Lack of Comparative Data:** There is no comparison made with other teaching methods or modules to assess the module's superiority.
- **Contextual Limitations:** While feasible for the specified context, the module's effectiveness in other grade levels, subjects, or learning environments is unknown.

CONCLUSION

Based on the exposure of data from the development of the project based learning hybrid mode module to train science process skills, it can be concluded that: 1) The project based learning hybrid mode module can be developed with a 4D development model with excellent results, 2) The project based learning hybrid mode module is very feasible to be used to train science process skills in Phase D science material grade 8 semester 2 and is very good for

training science process skills in Science Phase D Grade 8 material. So that for the next stage, direct implementation is needed to measure whether the project-based learning hybrid mode module is effectively used to improve science process skills. Results indicate that the developed project-based learning hybrid mode module is effective for training science process skills in Grade 8 and can be successfully implemented using the 4D model. To assess its impact on student learning, full-scale implementation is recommended.

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