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Developing Materials for Natural and Social Science Project of Motorcycle Engineering Department to Enhance Reading Literacy

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Abstract: This study aims to: (1) develop teaching materials for the IPAS project in the motorcycle engineering department to enhance reading literacy; (2) produce feasible teaching materials for the IPAS project in the motorcycle engineering department to improve reading literacy; and (3) evaluate the effectiveness of these materials in enhancing students' reading literacy. This research follows a Research and Development approach using the ADDIE model, which consists of five phases: Analyze, Design, Develop, Implement, and Evaluate. The study was conducted in a Vocational High School in Wonogiri Regency, Central Java, during the 2024/2025 academic year, involving 216 tenth-grade students from three schools classified as having good, moderate, and low reading literacy levels. The teaching materials were validated by experts in content, media, language, and pedagogy using a validation questionnaire. Instrument trials were analyzed for validity, reliability, discrimination index, difficulty level, and question differentiation. The effectiveness of teaching materials was analyzed by t-test. Based on the research, it's concluded that the characteristics of PjBL-based IPAS teaching materials consist of opening, content, and closing sections. The feasibility of teaching materials is declared valid and feasible to use in learning, and it is effective in improving students' reading literacy skills.

Keywords: Teaching material; IPAS project; PjBL; Reading literacy

Introduction

Literacy is the basis that must be mastered by learners to continue with further learning (Nuranjani et al., 2022). Literacy development is important to pay attention to because literacy is the initial ability that must be possessed by each individual to live life in the future (Lamada et al., 2019). Banik & Kumar (2019) stated that information literacy means the ability to know the need for information and the ability to identify, find, evaluate, and use information effectively to solve practical problems. Vágvölgyi et al. (2024) state that although primary and secondary education is accessible and compulsory in some countries, there is still a large percentage of adults who do not have literacy skills. At a minimum, this includes opportunities to develop conceptual knowledge about the functions of print; procedural knowledge related to letters, sounds, and words; oral language understanding and use; and metalinguistic skills related to phonological and syntactic awareness (Benson-Goldberg & Erickson, 2024). Karlsen's (2021) research states that future literacy functions as Anticipation which has a causal effect in the way it structures our picture of the future as well as implying feed-forward control, feedback and is

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contained in the functional explanatory logic used in socializing

Literacy is a valued skill linked to young people's attainment of academic, vocational and social goals and societal productivity (Merga, 2021). The results of research by Rohim & Rahmawati (2020) found that the obstacles to implementing literacy activities in schools include a lack of infrastructure, the methods that are less varied. Merga et al. (2021) research also concluded that many mainstream secondary school teachers do not perceive that there is a whole-school approach to support struggling literacy learners in their schools, or that there are adequate strategies and supports to meet the needs of struggling literacy learners in their schools. Li (2022) conclude that effective academic literacy instruction often aligns language development with content learning within meaningful disciplinary and social inquiries. Therefore, one of the objectives of this study is to determine the improvement of students' literacy through the development of teaching materials that are in accordance with the indicators of students' literacy skills.

Vocational High Schools (SMK) in Wonogiri Regency are dominated by automotive engineering expertise programs. The automotive engineering expertise program consists of concentrations in light vehicle engineering, motorcycle engineering, heavy equipment engineering, automotive engineering, and light vehicle body engineering (Kemendikbudristek, 2021). Qualifications in vocational education systems are often critical to accessing positions in the labor market, which is often not the case in low- and middle-income countries (Maurer, 2021). There are 25 public and private vocational schools in Wonogiri Regency that have automotive engineering expertise programs with expertise concentrations in light vehicle engineering, motorcycle engineering, heavy equipment engineering, and light vehicle body engineering.

Engineering expertise program in Wonogiri Regency, both public and private, from the minimum competency assessment (AKM) test results were 59.94 with a moderate category. The reading literacy skills of SMK automotive engineering expertise programs are below the average reading literacy skills of Central Java Province SMKs with a value of 62.48, and the lowest concentration of expertise is motorcycle engineering (Kemendikbudristek, 2023).

The IPAS project integrates natural science (IPA) and social science (IPS) subjects with areas of expertise in SMK. Natural science and social science learning is packaged in projects (project-based learning) that integrate several elements and aspects in the IPAS project learning outcomes. Each project is carried out to achieve the competency elements of natural and social sciences which consist of three elements and are contextualized with the characteristics of each field of expertise and concentration of expertise (Kemendikbud, 2022). Therefore, the learning model considered suitable for the IPAS project subject is a project-based learning model.

The project-based learning (PjBL) learning model is considered a unique pedagogical approach that produces relevant, holistic, and learner-centered learning, which can help improve academic performance in the 21st century (Yulhendri et al., 2023). Various PjBL techniques have been described by experts, some of which foreground the practice or characteristics of routine activities that are effective in learning such as modeling or discussion, while others foreground the practice or design of teacher experiences that engage learners in approaching learning, with the aim of advancing learning (Almulla, 2020). Makkonen et al. (2021) detail six main components in the PjBL learning model namely: (a) use of driving questions, (b) focus on learning objectives, (c) scientific practices, (d) collaborative activities, (e) learning technology scaffolding, and (f) artifact creation.

Related to improving the quality of vocational education in the era of revolution, vocational education in the era of industrial revolution 4.0, teachers must understand the methods, strategies, and teaching materials used for learning so that learning can fulfill learning (Novianti & Hardeli, 2024). Several previous studies have shown the relationship between teaching materials and student learning outcomes and skills packaged in various media and various learning approach. Research results by Dewi & Primayana (2019) show that the concept understanding of student groups who learn by facilitating learning modules containing Contextual Teaching and Learning is higher than student groups who learn through direct learning models. Pradana et al. (2017) also concluded that flipbook learning media has an influence on the learning outcomes of class X TBKR 2 at SMK Negeri 2 Pangkep. The results of research from Nanni (2021) concluded that the application of technology in Education and the use of project-based learning promotes content and language learning and results in innovation and better learning. Therefore, researchers want to develop teaching materials for the IPAS project of motorcycle engineering departments to improve the reading literacy of grade X vocational students in the concentration of motorcycle engineering expertise.

Method

The research was conducted at public and private SMKs in Wonogiri Regency, Central Java, in the

manufacturing and engineering technology expertise study area, automotive engineering expertise study program, motorcycle engineering expertise concentration class X in the 2024/2025 academic year. This research was conducted in the odd semester of the 2024/2025 academic year, namely in January-December 2024. The research subjects were students in grade X of the manufacturing and engineering technology expertise study program, automotive engineering expertise study program, concentration of motorcycle engineering expertise at state and private SMKs in Wonogiri Regency in the 2024/2025 academic year. The object of the research is to determine the reading literacy of class X students in the automotive engineering specialty program, motorcycle engineering expertise concentration in the 2024/2025 academic year with the teaching material application of IPAS project of motorcycle engineering departments.

This research is development research or research and development (R&D) with the ADDIE development model. ADDIE is often used because its stages describe a systematic approach to instructional development (Mulyasari et al., 2023). ADDIE consists of analysis, design, development, implementation, and evaluation (Cahyadi, 2019). The procedure/stages of product development are illustrated in Figure 1.

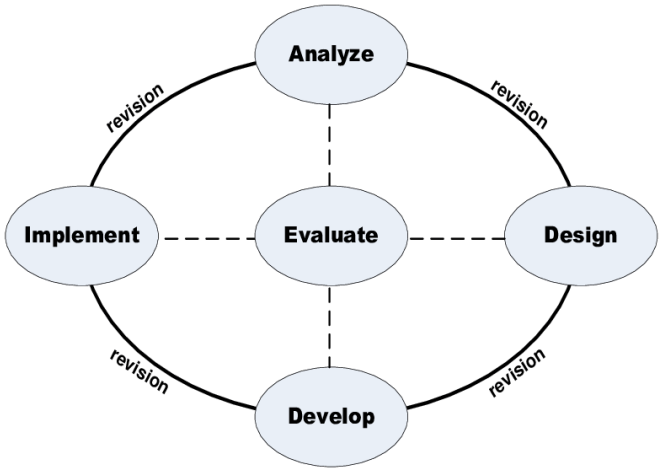


Figure 1. ADDIE Product Development Stage (Mulyasari et al., 2023)

At the analysis stage, the first activity carried out is gap performance. Gap performance includes identifying the causes of imbalance between real conditions and ideal conditions or problems that exist in the environment through interviews with vice principals in the curriculum of public and private vocational schools in Wonogiri Regency on the results of the AKM and questionnaires of the needs of vocational students in the motorcycle engineering expertise program and IPAS project subject teachers. The second activity is to determine the research objectives with the main problems that are already known. The next activity is to determine the object of research, namely class X motorcycle engineering students and IPAS project subject teachers.

The second stage, the design stage, aims to produce a learning media design. The results at the design stage are called the initial draft. Activities at the design stage include preparing learning objectives and making initial product designs. The third stage, the development stage, aims to realize the design of a product. Activities at the development stage consist of making product content, selecting or developing product support media, preparing guidelines, preparing research instruments, and validating experts and practitioners. At this stage, the draft 1 science teaching materials were validated by 11 expert lecturers, namely material experts, media experts, linguists, learning experts, and 1 educational practitioner (IPAS project teacher).

The instrument used at this stage is a validation questionnaire. The material expert validation questionnaire includes aspects of material completeness, material breadth, material depth, material accuracy, currency and contextualization, and adherence to laws and regulations. The media expert validation questionnaire includes aspects of learning unit presentation techniques, presentation feasibility, teaching material size, cover design, and learning unit content design. The linguist expert validation questionnaire includes aspects of general appearance, language use in teaching materials, and language clarity. The learning expert validation questionnaire includes aspects of learning content, learning strategies, learning evaluation, and assessment. The validity of the IPAS project teaching materials through quantitative descriptive analysis using the validity content index equation: $CVI = \left(\frac{\Sigma s}{n(c-1)}\right)$ where s= r – l

Remark:

r : rating of respondents
l : lowest rating of respondents
n : number of respondents
c : highest category
CVI : content validity index

IPAS project teaching material draft 1 is declared feasible if it has a high CVI (≥ 0.8) or medium (0.4≤CVI<0.8). In addition to quantitative assessments, experts also provide qualitative assessments through comments/suggestions which then become the basis for improving the IPAS project teaching material draft 1 (Revision 1) so that the IPAS project teaching material draft 2 is produced. This stage is used to produce learning instruments that are feasible and valid so that they can improve students' science literacy skills.

The main data collection used in the research evaluation was done by two techniques, namely tests and non-tests. The test was conducted in the form of a student literacy test. Literacy assessment uses objective tests to measure how far the information is obtained by students after using teaching materials. Non-test techniques consisted of observation, questionnaires, interviews, and document review. The data obtained from quantitative aspects and quantitative aspects. Qualitative aspects are obtained from data from field observations and interviews that describe literacy skills, learning models, approaches, and obstacles faced by educators during the learning process of the IPAS project subject in the concentration of motorcycle engineering expertise. Quantitative aspects are obtained from data from assessing students' science literacy skills in the IPAS project subject. Literacy skills assessment is obtained from the results of knowledge aspect tests in the form of objective tests.

In this study, an objective test form was used for the science literacy assessment instrument. This test consists of 36 items in the form of multiple-choice questions with 5 alternative answers, the correct answer is given a score of 1, and the wrong answer is given a score of 0. The assessment scale uses a scale of 100. Before an objective test is used to collect data in research, the instrument must meet requirements including validity, reliability, difficulty level, and question differentiation.

Result and Discussion

A gap analysis was conducted by researchers with a questionnaire through a needs questionnaire to students and teachers of motorcycle engineering and IPAS project educators. The observation and literature study of the characteristics of students, and also material that is considered difficult for students so that the products produced are more effective (Astiti et al., 2020). The needs questionnaire for students was distributed to 367 students and 10 vocational school teachers in Wonogiri Regency. The questionnaire results about the habit of reading material related to motorcycle material can be seen in Figure 2.

The questionnaire results show that most students are still in the "occasionally" category in reading material related to motorcycle material. This is because students still struggle to understand reading material as shown in the questionnaire results in Figure 3.

Based on the results of the initial questionnaire, this is because most students find it "sometimes" difficult to understand the reading material, which makes them not read the reading material related to motorcycles very often. Arthur et al. (2021) stated that when referring to the concept of literacy, most students only focus on memorization, so with the lack of understanding when entering the secondary school level, the input obtained by the school is students with weak literacy skills on average.

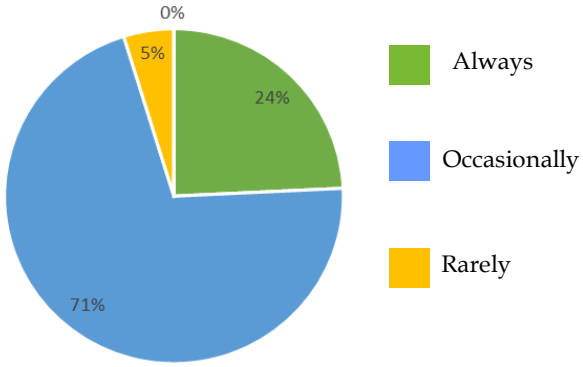


Figure 2. Results of the Student Reading Habits Questionnaire on Motorcycle Material

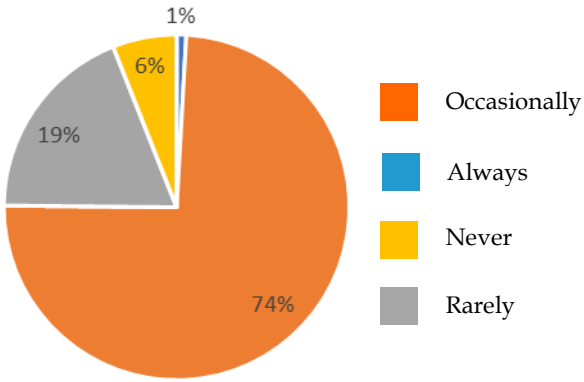


Figure 3. Results of the Student's Reading Comprehension Difficulty Questionnaire

At the design stage, researchers determine learning objectives that are in accordance with the learning outcomes for phase E of the IPAS project subject. The learning objectives in the teaching materials are learning objective 1 consists of a) students can find information about Indonesia's geographical conditions and connectivity between spaces in Indonesia, b) students can find information about the history of motorcycles and their impact. Learning objective 2 consists of a) students can understand elements, compounds, and mixtures in motorcycle engineering, b) students can understand physical and chemical properties, as well as physical and chemical changes in substances in motorcycle engineering. Learning objective 3 consists of a) students can understand electrochemistry on motorcycles, b) students can understand electrolysis on motorcycles, c) students can understand the laws of thermodynamics on motorcycles, d) students can evaluate and reflect on information about elements, compounds, mixtures; physical and chemical properties

and changes, electrochemistry, electrolysis and the laws of thermodynamics.

The design of teaching materials is to be made in the form of teaching materials for the concentration of motorcycle engineering expertise in IPAS project subjects that are integrated with the PjBl model and student literacy skills. Humaidi et al. (2022) state that teaching materials help in the learning process because they can help teachers and students in learning activities so that teachers do not present too much material, in addition, teaching materials can replace some of the teacher's role and support individualized learning. The learning model used in teaching materials is the PBJL. The PjBL model which is a derivative of the scientific approach is a model in accordance with literacy learning activities (Krismawati, 2019). The scientific approach to science learning is very compatible with constructivist theory so that learning becomes more meaningful (Sari et al., 2019).

The development stage consists of product content creation activities, guide development, and validation stages. Product content creation activities are preparing product content processes based on or in accordance with the initial design, learning objectives, tasks, and student evaluations. The cover of the teaching material developed is shown in Figure 4.

Figure 4. Teaching Material Cover

The cover contains the title, author's name, and illustrative images with themes that match the module content. The opening section consists of a preface, a table of contents, and instructions for using the module. The development of guidelines can facilitate educators and students in using the developed teaching materials (products). Generally, the guide is located at the beginning of the product/opener so that it can guide users to use the product appropriately. Instructions for using the module are placed in the opening section so that users (students and teachers) get an overview of the teaching materials to be used. Guidelines can be seen in Figure 5.

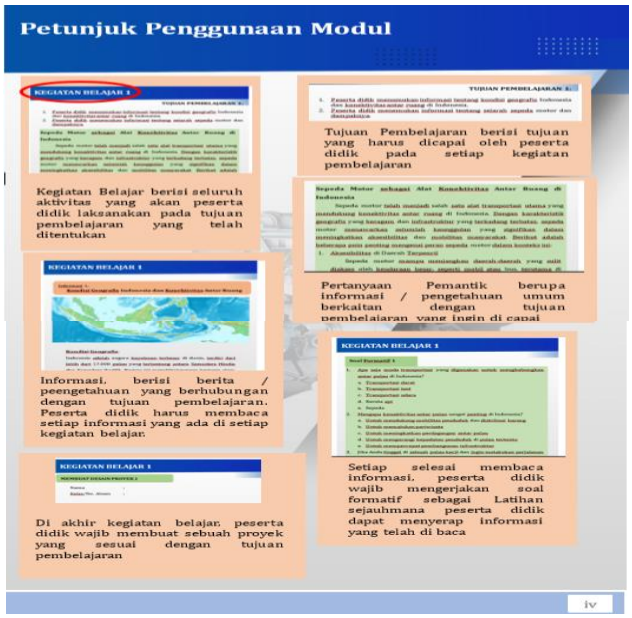
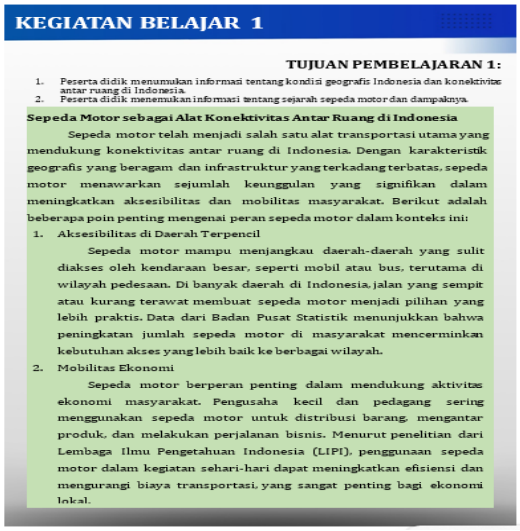


Figure 5. Teaching Material Guideline

The preface and table of contents are arranged in the opening section of teaching materials to make it easier for users so that teaching materials can be utilized effectively. This is to the statement of Sunarsih & Yuliyanti (2021) that teaching materials are able to provide easy access to be able to study anytime and anywhere students can easily and freely control the desired learning activities in the form of learning speed, depth of understanding of learning, range of content of learning activities, and time used. The teaching material content consists of several parts, namely learning objectives, literacy, literacy questions, projects, and evaluations as in the following figure 6.

The content section of teaching materials contains learning activities that refer to the syntax or stages of the PjBL model. Learning objectives are displayed after the title of the learning activity. Core learning in teaching materials begins with literacy activities. An article with the context of science info is presented at the beginning of the material so that students can carry out literacy activities with information about knowledge and application of material in everyday life. The info presented also contains illustrative images that match the context of the info. Harahap et al. (2021) stated that the use of illustrations in teaching materials is adapted to reading skills and is also related to the material so that students are more motivated to read so that literacy skills can increase.


KEGIATAN BELAJAR 1

TUJUAN PEMBELAJARAN 1:

1. Peserta didik menemukan informasi tentang kondisi geografis Indonesia dan konektivitas antar ruang di Indonesia.
2. Peserta didik menemukan informasi tentang sejarah sepeda motor dan dampaknya.

Sepeda Motor sebagai Alat Konektivitas Antar Ruang di Indonesia

Sepeda motor telah menjadi salah satu alat transportasi utama yang mendukung konektivitas antar ruang di Indonesia. Dengan karakteristik geografis yang beragam dan infrastruktur yang terkadang terbatas, sepeda motor menawarkan sejumlah keunggulan yang signifikan dalam meningkatkan aksesibilitas dan mobilitas masyarakat. Berikut adalah beberapa poin penting mengenai peran sepeda motor dalam konteks ini:

1. Aksesibilitas di Daerah Terpencil

   Sepeda motor mampu menjangkau daerah-daerah yang sulit diakses oleh kendaraan besar, seperti mobil atau bus, terutama di wilayah pedesaan. Di banyak daerah di Indonesia, jalan yang sempit atau kurang terawat membuat sepeda motor menjadi pilihan yang lebih praktis. Data dari Badan Pusat Statistik menunjukkan bahwa peningkatan jumlah sepeda motor di masyarakat mencerminkan kebutuhan akses yang lebih baik ke berbagai wilayah.

2. Mobilitas Ekonomi

   Sepeda motor berperan penting dalam mendukung aktivitas ekonomi masyarakat. Pengusaha kecil dan pedagang sering menggunakan sepeda motor untuk distribusi barang, mengantar produk, dan melakukan perjalanan bisnis. Menurut penelitian dari Lembaga Ilmu Pengetahuan Indonesia (LIPI), penggunaan sepeda motor dalam kegiatan sehari-hari dapat meningkatkan efisiensi dan mengurangi biaya transportasi, yang sangat penting bagi ekonomi lokal.

Figure 6. Teaching Material Content

At the end of each piece of information, there are formative questions related to the information that students have read. Formative questions at the end of each piece of information are used to measure students' literacy skills. Saeful & Giyartini (2022) states that reading literacy is the ability of students to understand, use, evaluate, and reflect on various types of texts. There are three components in AKM reading literacy questions, namely content, context, and cognitive processes. The content contains informational text and fiction text. Then the context contains socio-cultural, scientific, and personal. The cognitive process contains 3M, namely finding, understanding, evaluating/reflecting information from the reading text in the question.

The next core learning activity is learning activities with PjBL syntax. The teaching materials developed aim to help students learn with the PjBL model. This means that in the teaching materials, there are learning activities that are by the PjBL syntax. In each learning activity, students are invited to determine the project that they'll carry out by the learning objectives that have been determined at the beginning and the product that will be produced at the end of the learning activity. This is according to the research result of Panjaitan (2022), which shows that the PjBL learning model can be interpreted as a learning model based on projects or producing products. The PjBL learning model provides many opportunities for students to choose topics, conduct investigations, and complete their projects when applied in practice, gain knowledge through projects as a learning tool, as if there is a real world that can produce products realistically, where students work in real-time (Zulyusri et al., 2023). These results are also in accordance with the research results by Yanti et al. (2023) which shows that there are differences in the learning outcomes of students who learn using the PjBL-STEAM model assisted by multiple scaffolding and the PjBL model in science learning.

Expert appraisal is a technique to validate or assess the feasibility of the product design. The results of the initial draft were validated by validators. Validators in this study include material experts, media experts, learning experts, and language experts. The material expert validation results can be seen in Table 1.

Table 1. The Material Expert Validation Results

No	Aspect	Average Score	Criteria
1	material completeness	0.917	High
2	material breadth	0.833	High
3	material depth	0.667	Medium
4	material accuracy	0.767	Medium
5	currency and contextualization	0.833	High
6	adherence to laws and regulations	0.817	High
Average CVI Score		0.806	High

Experts also provided suggestions for improving teaching materials in draft 1 that questions in the reflection section use open questions so that it is expected that the answers are broad and in-depth. The feasibility of teaching materials for motorcycle engineering IPAS projects based on the CTL approach PjBL model to improve student literacy is seen from the results of the experts' assessment. The results of the material expert validation showed an average CVI score of 0.806 and were included in the high category. This reveals that the teaching materials developed have met the eligibility requirements for material completeness, material breadth, material depth, material accuracy, currency and context, and compliance with laws and regulations. The material presented in the teaching materials can meet the learning objectives of the IPAS project learning outcomes. In the aspects of breadth, depth of material, and accuracy of the material, teaching materials have met the eligibility requirements because the material presented remains focused on learning objectives so that students will not feel confused in learning activities with the PjBL model. In the aspects of currency and contextualization, the material presented is by the times and exists in the environment around students. This makes students feel that learning in the IPAS project subject is not only theory but also applied to daily activities. The results of the development of teaching materials in terms of this material are in accordance with the results of Widiastuti's (2020) research which concluded that the teaching materials developed use a contextual approach so that students can more easily understand the relationship between the real world of students and the science material being

studied. PjBL teaching materials can provide active and interesting learning activities, help students understand teaching materials well, and form critical and creative thinking skills in dealing with real-world problems in the environment (Izzania et al., 2021). The material expert validation results can be seen in Table 2.

Table 2. The Media Expert Validation Results

No	Aspect	Average Score	Criteria
1	learning unit presentation techniques	0.771	Medium
2	presentation feasibility	0.917	High
3	teaching material size	0.833	High
4	cover design	0.861	High
5	learning unit content design	0.954	High
Average CVI Score		0.867	High

The results of media expert validation showed that the teaching materials developed obtained an average CVI score of 0,867 and included a high category. It reveals that the teaching materials developed have met the requirements of learning unit presentation techniques, completeness of presentation, size, cover design, and learning content design which are categorized as suitable for use. This is appropriate with the statement Sunarsih & Yuliyanti (2021) that the feasibility of graphics in teaching materials reflects the content of teaching materials so that it must be displayed in detail to match the title and harmony of the layout in the parts of the teaching materials is considered there are several parts to be labeled to make it easier for readers. Good learning design will affect the effectiveness of learning, therefore, a learning media must be able to meet standards and it can help students better understand the material and make learning more enjoyable (Pattaufi et al., 2023).

In the validation of learning media, there are suggestions from experts who state that there is no overview of the module and glossary developed. On the cover page, there needs to be consistency of information about the module for the umpteenth meeting, (Modules for meetings 3 and 4 have information on the cover, but 1 and 2 have no information on the cover). In the learning model section, it is sufficient to write "PJBL" without any information on reading literacy, because reading literacy includes student skills not learning models. The learning expert validation results can be seen in Table 3.

The results of learning expert validation obtained an average CVI score of 0.801 and included in the high category. The experts stated that they agreed that the teaching materials could be used without revision. This shows that the teaching materials developed have met the requirements of learning content, learning strategies, learning evaluation, and assessment. Rokhim et al. (2020) stated that the PjBL is a learning model that integrates problem-based learning and project-based solutions where the project becomes an effective solution for cognitive and psychomotor improvement. Therefore, the learning aspects must be fulfilled so that the evaluation and assessment of learning can be carried out. The linguist expert validation results can be seen in Table 4.

Table 3. The Learning Expert Validation Results

No	Aspect	Average Score	Criteria
1	learning content	0.750	Medium
2	learning strategies	0.826	High
3	learning evaluation	0.833	High
4	assessment	0.889	High
Average CVI Score		0.801	High

Table 4. The Linguist Expert Validation Results

No	Aspect	Average Score	Criteria
1	general appearance	0.944	High
2	language use in teaching materials	0.833	High
3	language clarity	0.833	High
Average CVI Score		0.870	High

The results of linguist expert validation obtained an average CVI score of 0,870 and included in the high category. The experts suggest The experts suggest several things, such as pay attention to word writing errors; the picture in the instructions for using the module needs to be enlarged because the writing is too small; do not use the conjunction "with" at the beginning of the sentence; a good paragraph consists of a minimum of 3 sentences, paragraphs that do not have 3 sentences should be added; if there are terms from foreign languages, they should be italicized; there is learning activity 1, each task (command sentence) / each question should be given an exclamation mark (!), for example: determine ... (should end with an exclamation mark). This result shows that the developed teaching materials have met the requirements of general appearance, language use in teaching materials, and language clarity. Well-developed oral language provides a foundation for academic achievement, predicts reading and writing success, and supports learning across the curriculum (Dobinson et al., 2024). Burhanuddin (2024) states that learning approaches that place more emphasis on student activity and interaction, such as communication-based approaches, are becoming increasingly recognized as more effective and efficient methods of facilitating language acquisition. Therefore, good

language usage in teaching materials can increase the effectiveness of using teaching materials.

The validation test results show that all questions are relevant so that the instrument questions are proven valid. The CVI score in the feasibility test, got a score of 1, so it can be concluded that the instrument trial question is valid and feasible to use as an instrument question. The reliability test results using the KR 20 formula, also show that the instrument question is reliable. The difficulty level test and differentiating power test results can be seen in Table 5 and Table 6.

Table 5. The Difficulty Level Test Results

Criteria	Number
Easy	1,3,5,13,22,36,38,46,48,52
Medium	2,4,6,7,8,9,11,12,14,15,16,17,18,21,24,25,27,28,29,30,32,34,35,37,42,44,45,47,49,56,57
Difficult	10,19,20,23,26,31,33,39,40,41,43,50,51,53,54,55

Table 6. The Differentiating Power Test Results

Criteria	Number
Very Good	11
Good	2,4,6,7,9,12,27,28,37,44,45,57
Enough	1,10,14,16,17,18,21,25,26,29,30,32,34,36,38, 39,40,42,47,49,52,53,54,56
Bad	3,5,8,13,19,22,24,31,35,41,48,50,51,55
Too Bad	15,33,46

The instrument question analysis test results became the basis for taking a trial question of 36 questions that were eligible for use as a test instrument. The broad scale test results can be seen in Table 7.

Table 7. The Broad Scale Test Results

Category	Sig.(2-tailed)	Criteria
A	0.002	Effective
B	0.000	Effective
C	0.000	Effective

The effectiveness of teaching materials for motorcycle engineering IPAS projects to improve student literacy is seen from the t-test results on the value of the broad-scale trial. The t-test results show a significant difference between the post-test scores in each class. This reveals that the teaching materials for motorcycle engineering IPAS projects are effectively increasing students' reading literacy. These results are appropriate with the statement (Abidin et al., 2020) that literacy PjBL has been effective in facilitating reasoning skills because literacy PjBL can present contextual material with literacy works made and invites the thinking process about the use of the context of science in everyday life. The PjBL model is seen as one approach to creating a learning environment because it encourages students to construct knowledge and skills personally so that they can form the skills, environmental literacy skills, and attitudes that students need to play an active role in the future (Kamil et al., 2020). The results of the development of teaching materials to improve students' literacy skills are also in accordance with the results of the development of literacy books from de Bondt et al. (2020) which concluded that book giveaway programs promote children's home literacy environment which subsequently results in more interest in reading and children scoring higher on measures of literacy-related skills prior to and during the early years of school.

Conclusion

Based on the research it's concluded that the characteristics of PjBL-based IPAS teaching materials are consist of opening, content, and closing sections. Each learning activity contains the syntax of the PjBL learning model. The feasibility of teaching materials is declared valid and feasible to use in learning. The teaching materials can be declared effective in improving students' reading literacy skills.

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