



Developing Project-Based Learning Instructional Materials through the Dick and Carey Instructional Design Model for Grade VII Science Learning

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Abstract

This study aimed to develop PjBL instructional materials for Grade VII science learning through the Dick and Carey instructional design model, focusing on waste management. The study employed a R&D design. The development process followed the Dick and Carey model, encompassing instructional goal identification, instructional analysis, learner and context analysis, performance objectives, assessment development, instructional strategy, instructional material development, formative evaluation, and revision. The developed module integrated contextual waste-management activities, including ecobrick, eco-enzyme, and hydroponic projects, supported by student worksheets and structured learning activities. Data were collected using non-test questionnaires administered during expert evaluation and formative evaluation. The instructional materials were evaluated by subject matter, instructional design, and media experts, followed by one-to-one, small-group, and field evaluations. The results showed an overall expert evaluation score of 88.80%, while one-to-one, small-group, and field evaluations obtained 93.89%, 94.45%, and 91.62%, respectively, all categorized as Very Good. These findings indicate that the developed instructional materials were systematically designed, positively evaluated, and suitable for supporting contextual and project-based Grade VII science learning. The study contributes an instructional material development model that integrates PjBL with systematic instructional design.

Keywords: Instructional Design; Instructional Materials; PjBL; Science Learning; Waste Management.

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INTRODUCTION

Learning in schools is a systematic process designed to facilitate meaningful interaction between teachers, students, and learning resources in order to achieve predetermined learning objectives. Effective learning therefore requires not only appropriate subject matter but also instructional strategies and materials that are systematically designed according to learners' characteristics, learning objectives, and instructional contexts. In science education, this need is particularly important because science learning is expected to engage students in discovering concepts, solving problems, applying knowledge, and connecting scientific ideas with phenomena in everyday life. Thus, instructional materials should not merely present information but should also provide structured learning experiences that enable students to actively construct knowledge and develop relevant skills (Herliani et al., 2021; Suparman, 2014).

The instructional context at SMP Negeri 1 Martapura indicates that such learning conditions have not yet been fully supported by adequate instructional materials. The preliminary problem identified in the study was the limited availability of instructional materials for science learning, with textbooks remaining the main learning resource and teachers experiencing difficulties in developing instructional modules independently. Consequently, learning tended to remain teacher-centered and provided limited opportunities for students to participate actively in learning activities. This condition was also associated with students' learning outcomes that had not yet reached the established learning achievement criteria. At the same time, the characteristics of science learning require students to engage in discovery, problem solving, and the application of concepts to real-life situations (Hasanah et al., 2024; Kosasih, 2021).

One instructional approach that can address these requirements is Project-Based Learning (PjBL). PjBL provides opportunities for students to learn through meaningful projects, collaborate with peers, communicate ideas, solve problems, and produce tangible outcomes. Previous literature indicates that PjBL can support students' motivation, communication, confidence, problem-solving abilities, conceptual understanding, and active participation in learning (Cooper et al., 2023; Guo et al., 2020; Nurhidayah et al., 2021; Rahmania, 2021). Research has also demonstrated that project-based learning assisted by appropriate learning media can improve students' motivation and science process skills (Safaruddin et al., 2020). However, the implementation of project-based science learning at the research site was still limited. Therefore, the availability of instructional materials specifically designed to operationalize PjBL is important so that the learning model can be translated into systematic activities that students can follow independently and collaboratively.

Instructional materials play an important role in translating instructional objectives and learning strategies into concrete learning experiences. Well-designed instructional materials should be systematically organized, communicative, relevant to learners' needs, and aligned with the intended learning objectives. In this context, the development of instructional materials needs to be supported by a systematic instructional design framework rather than relying solely on the preparation of subject matter (Kosasih, 2021; Suparman, 2014). The Dick and Carey model provides such a framework by connecting instructional goals, instructional analysis, learner and context analysis, performance objectives, assessment instruments, instructional strategies, instructional materials, formative evaluation, and revision (Dick et al., 2015). This systematic relationship is particularly relevant for developing PjBL materials because the quality of a project-based instructional material depends not only on the accuracy of its content but also on the alignment among learner characteristics, learning objectives, project activities, assessment, and the sequence of learning experiences.

The instructional content selected in this study is waste management because it provides a meaningful context for connecting science concepts with environmental problems encountered in students' surroundings. The developed instructional materials integrate the principles of Reduce, Reuse, and Recycle (3R) with project activities involving the production of ecobricks, eco-enzyme, and hydroponic media from used materials. Such activities provide opportunities for students to explore environmental problems, conduct practical activities, collaborate, analyze findings, and reflect on their learning. Previous studies show that environmental-based learning activities using 3R principles can improve students' environmental awareness and understanding of waste management issues (Nizaar et al., 2020; Rudiyanto et al., 2021). Previous studies have demonstrated the potential of PjBL-based instructional materials in science education. Triyanti and Sulistiyono (2023) developed an IPA module based on PjBL to improve students' factual and conceptual knowledge, while Minati (2023) developed an IPA module based on PjBL for environmental pollution material. These studies demonstrate the relevance of PjBL-based modules as instructional materials in science education. Furthermore, research related to project-based learning using environmental contexts has shown positive contributions to students' environmental attitudes and learning experiences (Susilawati et al., 2017). Nevertheless, a research gap remains in the development of instructional materials that systematically integrate PjBL with a comprehensive instructional design process and contextual waste-management projects while also undergoing staged formative evaluation involving expert review, individual evaluation, small-group evaluation, and field testing.

The present study addresses this gap by positioning the instructional material as a systematically designed instructional product rather than merely as supplementary learning content. This approach is consistent with the Dick and Carey framework, in which instructional materials are developed in relation to instructional objectives, learner characteristics, instructional strategies, assessment, and formative revision (Dick et al., 2015). The importance of systematic development is also supported by previous studies emphasizing that instructional materials require careful design and evaluation processes to ensure their effectiveness in supporting student learning (Kreps et al., 2024).

The novelty of this study lies in the integration of Project-Based Learning, contextual waste-management activities, and the Dick and Carey instructional design framework into a single Grade VII science instructional material development process. Unlike an approach that treats a module primarily as a collection of subject matter, the instructional material developed in this study is structured as an integrated learning system consisting of learning objectives, instructional content, project activities, student worksheets, practical activities, observation, discussion, analysis, and reflection. The product is also refined through sequential expert validation and formative evaluation with individual students, a small group, and a larger classroom group. The resulting material therefore represents an instructional product developed through a systematic cycle of analysis, design, development, evaluation, and revision.

Based on the background, the present study aims to develop Project-Based Learning instructional materials for Grade VII science learning through the Dick and Carey instructional design model, with a particular focus on waste management. More specifically, the study seeks to describe the development of the instructional materials and examine their quality through expert evaluation and staged formative evaluation involving individual, small-group, and field-level trials. The study is expected to contribute a systematically designed instructional material that can support active, contextual, collaborative, and project-oriented science learning while demonstrating how the Dick and Carey instructional design model can be applied to the development of PjBL-based instructional materials in junior secondary science education.

RESEARCH METHODS

This study employed a research and development (R&D) design to develop PjBL instructional materials for Grade VII science learning on waste management. The development process was guided by the Dick and Carey instructional design model, which provides a systematic framework for connecting instructional goals, learner and context analysis, instructional objectives, assessment, instructional strategies, instructional materials, formative evaluation, and revision. The developed instructional materials were subsequently evaluated through expert review and staged formative evaluation involving individual students, a small group of students, and a field test. The methodological procedure was therefore designed to ensure alignment among the instructional needs, learning objectives, PjBL activities, instructional material components, and evaluation results.

Research Design

The selection of the model was based on its systematic structure for designing instruction by linking instructional goals, learner characteristics, instructional analysis, performance objectives, assessment instruments, instructional strategies, instructional materials, formative evaluation, and revision. In this study, the model was used to guide the development of PjBL instructional materials rather than merely to produce subject-matter content.

The instructional material developed in this study was a science learning module for Grade VII students focusing on waste management. The module integrated Project-Based Learning activities with contextual environmental problems, particularly activities involving ecobricks, eco-enzyme, and hydroponic media made from used materials. The instructional material also incorporated student worksheets (LKPD), project instructions, observation, discussion, analysis, conclusion development, and reflection.

The development was limited to the formative evaluation stage. Although the original Dick and Carey model includes summative evaluation, this study did not conduct a summative evaluation. The product evaluation consisted of expert review, one-to-one evaluation, small-group evaluation, and field testing, followed by product revision based on the evaluation findings.

Table 1. Alignment of the Dick and Carey Model with the development of the instructional materials

Dick and Carey Stage	Application in This Study
Identify instructional goals	Identification of instructional needs and formulation of general learning goals
Conduct instructional analysis	Identification of knowledge, skills, and attitudes required to achieve the learning goals
Analyze learners and context	Analysis of students' characteristics, prior abilities, motivation, learning outcomes, and learning context
Write performance objectives	Formulation of specific learning objectives and expected student performance
Develop assessment instruments	Preparation of instruments for assessing the achievement of learning objectives and product quality
Develop instructional strategy	Design of learning activities based on PjBL and the instructional sequence
Develop and select instructional materials	Development of the science module, project activities, and LKPD
Design and conduct formative evaluation	Expert review, one-to-one evaluation, small-group evaluation, and field test
Revise instruction	Revision of instructional materials based on evaluation results and expert feedback
Summative evaluation	Not conducted in this study

The Table 1 demonstrates that the instructional material development was embedded within a systematic instructional design process. The stages of analysis and design provided the basis for developing the learning material, while formative evaluation and revision were used to refine the product before its final use.

Research Subject

The research was conducted at SMP Negeri 1 Martapura and focused on Grade VII science learning. The participants involved in the formative evaluation were Grade VII students who participated at different stages of product evaluation. The one-to-one evaluation involved three students representing high, medium, and low levels of ability. The small-group evaluation involved nine students, while the field test involved 32 students. These stages were conducted sequentially as part of the formative evaluation process.

Table 2. Research subjects and their roles in product evaluation

Evaluation Component	Participants	Role
Subject matter evaluation	1 subject matter expert	Evaluate content appropriateness and accuracy
Instructional design evaluation	1 instructional design expert	Evaluate instructional design and learning presentation
Media evaluation	1 media expert	Evaluate presentation and media characteristics
One-to-one evaluation	3 Grade VII students	Identify individual responses and difficulties in using the material
Small-group evaluation	9 Grade VII students	Examine student responses and usability in a small learning group
Field test	32 Grade VII students	Examine the use of the material in an actual learning setting

In addition to student participants, the quality of the instructional material was evaluated by three categories of experts: a subject matter expert, an instructional design expert, and a media expert. The subject matter expert evaluated the appropriateness of the instructional content, the instructional design expert assessed the design and presentation of the learning process, and the media expert assessed the presentation and media characteristics of the instructional material. The use of different evaluation participants enabled the instructional material to be examined from complementary perspectives before being considered ready for broader classroom use.

Research Procedure

The development procedure followed the Dick and Carey instructional design model. The procedure began with the identification of instructional goals and continued through instructional analysis, learner and context analysis, formulation of performance objectives, development of assessment instruments, development of instructional strategies, development and selection of instructional materials, formative evaluation, and instructional revision. The summative evaluation stage was not implemented in this study.

The first stage, identification of instructional goals, involved analyzing the instructional problems and determining the competencies that students were expected to achieve. The second stage, instructional analysis, identified the knowledge, skills, and attitudes required to achieve the intended competencies. The third stage involved learner and context analysis, including consideration of students' abilities, reading experience, motivation, learning outcomes, attitudes, and the learning context in which the competencies would be applied.

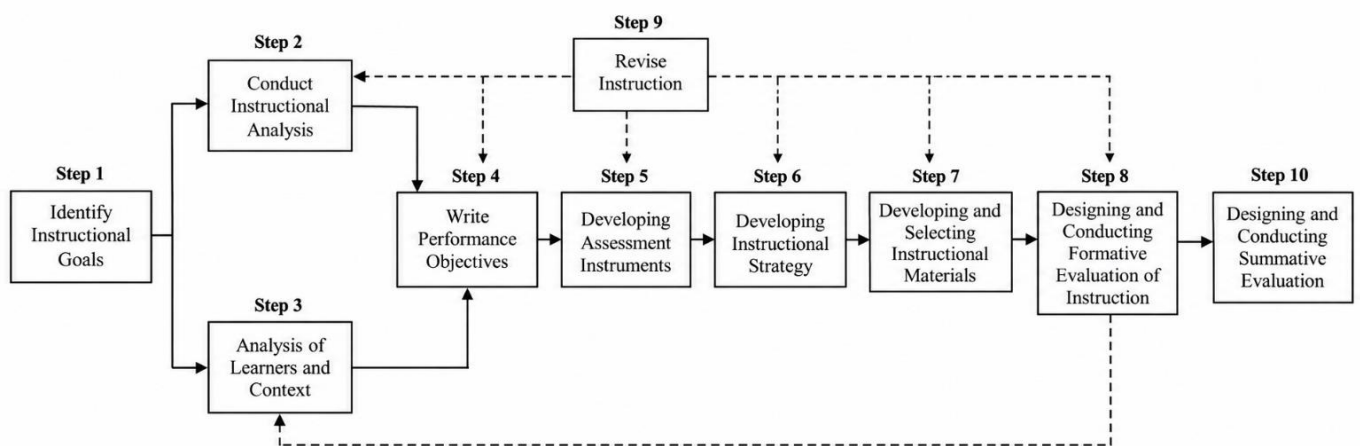


Figure 1. Dick and Carey Instructional Design Process Applied to the Development of Project-Based Learning Instructional Materials

The fourth stage involved writing performance objectives, which translated the general instructional goals into specific learning outcomes that students were expected to demonstrate. The fifth stage was the development of assessment instruments, which provided the means for determining whether the instructional objectives and competencies had been appropriately addressed. The sixth stage involved developing the instructional strategy, with PjBL selected as the primary instructional approach. The strategy incorporated initial activities, material presentation, student participation, assessment, and follow-up activities.

The seventh stage involved developing and selecting instructional materials. At this stage, the instructional content was organized into a Grade VII science module on waste management and integrated with PjBL activities. The module included learning instructions, contextual examples, project activities, practical activities, LKPD, discussion, observation, analysis, and reflection. The projects focused on ecobricks, eco-enzyme, and hydroponic media using used materials.

The eighth stage involved formative evaluation, which was conducted progressively through expert review, one-to-one evaluation, small-group evaluation, and field testing. The expert review involved subject matter, instructional design, and media experts. The one-to-one evaluation involved three students with high, medium, and low abilities, followed by small-group evaluation with nine students and a field test involving 32 students. The ninth stage involved instructional revision based on feedback obtained during the evaluation stages. The summative evaluation stage was not conducted.

Instruments, and Data Collection Techniques

Data were collected using non-test instruments in the form of questionnaires. The questionnaires were used to obtain expert judgments and learner responses during the formative evaluation of the instructional materials. The expert evaluation covered three dimensions: subject matter, instructional design, and media. The subject matter evaluation focused on the alignment and accuracy of the content, the instructional design evaluation examined the design and presentation of learning activities, and the media evaluation considered the presentation and characteristics of the instructional material.

The expert evaluation instruments consisted of 10 items for the subject matter expert, 16 items for the instructional design expert, and 11 items for the media expert. The evaluation used a four-point assessment scale, with the resulting scores interpreted according to the qualification criteria applied in the study. For the learner evaluation, questionnaires were administered during the one-to-one, small-group, and field-test stages. The one-to-one evaluation was conducted with three students representing different ability levels to identify individual difficulties and responses to the product. The small-group evaluation involved nine students, while the field test involved 32 students in the actual learning context.

Data collection was conducted sequentially. First, the developed instructional materials were reviewed by experts. Feedback obtained from the experts was used to revise the product. Second, the revised product was evaluated individually by three students. Further revisions were made based on the findings. Third, the product was evaluated by a small group of nine students. Finally, the revised product was subjected to a field test involving 32 students. This sequential procedure enabled the researchers to identify weaknesses and improve the instructional material before progressing to the next stage of evaluation.

Table 3. Instruments and data collected

Evaluation Stage	Instrument	Aspect Evaluated	Data Produced
Expert review	Expert questionnaire	Subject matter	Content quality score and feedback
Expert review	Expert questionnaire	Instructional design	Instructional design score and feedback
Expert review	Expert questionnaire	Media	Media/presentation score and feedback
One-to-one evaluation	Student questionnaire	Individual response to the instructional material	Percentage score and response
Small-group evaluation	Student questionnaire	Group-level response and usability	Percentage score and response
Field test	Student questionnaire	Response to the instructional material in classroom learning	Percentage score and response

The qualitative comments provided by the experts were also used as a basis for product revision. In particular, recommendations included strengthening project instructions and feedback in the LKPD and improving typography, font size, spacing, paragraph organization, and overall presentation.

Data Analysis Technique

The collected questionnaire data were analyzed quantitatively using a percentage analysis. The percentage was calculated by comparing the obtained score with the ideal score and expressing the result as a percentage. The analysis was used to determine the quality and qualification of the developed instructional materials based on expert evaluation and learner formative evaluation. The percentage was calculated using the following formula:

$$P = \frac{F}{N} \times 100\%$$

where P represents the percentage score, F represents the frequency or obtained score, and N represents the number of cases or the maximum/ideal score used as the denominator in the calculation. The original study used the percentage formula to analyze the questionnaire results. The overall percentage of the instructional material was determined by comparing the total obtained item score with the total ideal item score and multiplying the result by 100%. The resulting percentage was then interpreted according to the qualification criteria used in the study.

Table 4. Product qualification criteria

Percentage	Scale	Qualification	Product Interpretation
86–100%	4	Very Good	Very Feasible
76–85%	3	Good	Feasible
56–75%	2	Fair	Moderately Feasible
10–55%	1	Poor	Not Feasible

The qualification criteria were used to interpret the results of expert validation and learner formative evaluation. A higher percentage indicated a stronger level of quality and feasibility of the developed instructional material.

The quantitative results were then interpreted together with qualitative feedback from the evaluators. Quantitative scores provided an indication of the overall quality of the instructional material, while qualitative comments were used to identify aspects requiring revision. This combination allowed the evaluation results to function not only as a measure of product quality but also as a basis for iterative improvement within the Dick and Carey instructional design process.

RESULTS AND DISCUSSION

RESULTS

Development of Project-Based Learning Instructional Materials

The development process resulted in a PjBL instructional module for Grade VII science learning, focusing on waste management. The development was guided by the Dick and Carey instructional design model, which provided a systematic sequence for identifying instructional needs, analyzing learners and learning contexts, formulating learning objectives, developing assessment instruments, designing instructional strategies, developing instructional materials, and conducting formative evaluation.

The resulting instructional material was designed to address the identified instructional problem at SMP Negeri 1 Martapura, where science learning was still predominantly supported by conventional textbooks and the availability of structured instructional materials was limited. The developed module therefore integrates science content on waste management with project-based learning activities that encourage students to explore environmental problems, work collaboratively, conduct practical activities, and reflect on the results of their projects.

The instructional material consists of several interconnected components, including a module cover, instructions for use, learning activities, project activities, and student worksheets (LKPD). The project activities focus on contextual waste-management practices, particularly the production of ecobricks, eco-enzyme, and hydroponic media from used materials. These activities represent the application of PjBL within a real environmental context.

Table 5. Main characteristics of the developed project-based learning instructional materials

Component	Development Characteristics
Instructional material	Science instructional module
Target learners	Grade VII junior high school students
Subject	Science
Learning topic	Waste management
Instructional model	Project-Based Learning
Instructional design framework	Dick and Carey model
Main learning orientation	Student-centered and contextual learning
Project activities	Ecobrick, eco-enzyme, and hydroponic media
Supporting component	Student Worksheet (LKPD)
Learning activities	Exploration, discussion, project planning, practice, observation, analysis, conclusion, and reflection
Intended learning characteristics	Active, collaborative, contextual, and problem-oriented learning

The module was designed not merely as a source of subject matter but as an instructional material that guides students through a structured learning experience. The instructions for use direct students to read the material, identify learning objectives, observe examples, conduct environmental exploration, perform activities through the LKPD, discuss findings, answer analytical questions, and conduct reflection.

The LKPD further operationalizes the PjBL learning process through group formation, discussion, project planning, practical activities, observation, conclusion development, and reflection. These components were designed to support collaboration, communication, responsibility, and critical thinking during the learning process.

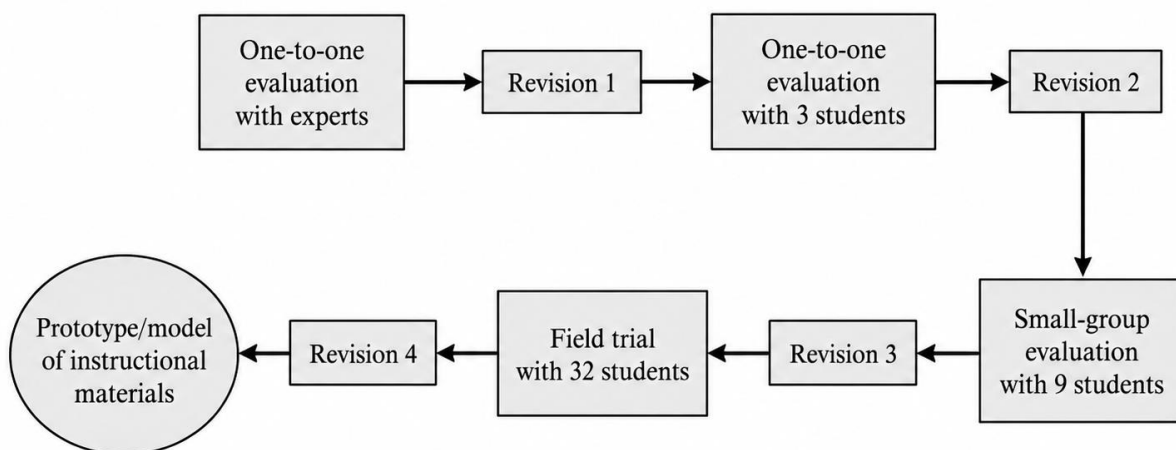


Figure 2. Components of the Developed Project-Based Learning Instructional Materials

Expert Evaluation of the Instructional Materials

Following the development stage, the instructional material underwent expert evaluation involving three areas of expertise: subject matter, instructional design, and media. The evaluation was conducted to examine the alignment of the instructional content, instructional design, and presentation characteristics of the developed module.

The subject matter expert evaluated the appropriateness of the content with respect to the learning objectives, learning outcomes, content accuracy, and assessment components. The instructional design expert evaluated the design and presentation of the learning activities, while the media expert evaluated the visual presentation and characteristics of the instructional material. The results are presented in Table 6.

Table 6. Expert evaluation results of the developed instructional materials

No.	Expert	Number of Items	Percentage	Category
1	Subject Matter Expert	10	93.90%	Very Good
2	Instructional Design Expert	16	86.06%	Very Good
3	Media Expert	11	86.45%	Very Good
Overall Mean			88.80%	Very Good

The subject matter evaluation produced a score of 93.90%, indicating that the instructional content was considered highly appropriate. The instructional design evaluation produced 86.06%, while the media evaluation produced 86.45%. The overall mean score was 88.80%, classified as "Very Good."

The expert evaluation also generated qualitative feedback for product refinement. The instructional design expert recommended strengthening the project instructions and feedback components in the LKPD, while the media expert recommended improvements to typography, font size, spacing, paragraph organization, and overall visual presentation. The recommendations were subsequently incorporated into the revision of the instructional materials.

These findings indicate that the Dick and Carey-based development process provided a structured mechanism for aligning the instructional content, learning activities, and presentation of the developed material before its use in learner trials.

Formative Evaluation with Learners

After expert review and revision, the instructional material was evaluated through three stages of formative evaluation: one-to-one evaluation, small-group evaluation, and field testing. This sequence was intended to identify learner responses and potential problems in the use of the instructional material at progressively broader levels.

The one-to-one evaluation involved three students representing high, medium, and low ability levels. The small-group evaluation involved nine students, while the field test involved 32 students.

Table 7. Results of formative evaluation with learners

Evaluation Stage	Participants	Percentage	Category
One-to-one evaluation	3 students	93.89%	Very Good
Small-group evaluation	9 students	94.45%	Very Good
Field test	32 students	91.62%	Very Good

The one-to-one evaluation resulted in a score of 93.89%, while the small-group evaluation produced 94.45%. The field test involving 32 students resulted in 91.62%. All three stages were categorized as "Very Good."

The results demonstrate that the instructional material maintained a high level of learner acceptability across different stages of formative evaluation. The progressive evaluation structure also provided opportunities to identify and address potential problems before the instructional material was considered ready for broader classroom use.



Figure 3a. Module Cover Page



Figure 3b. Module User Guide Page

Figure 3. Layout of the Front-page Developed Teaching Materials

Development Outcomes

The overall results indicate that the developed instructional materials achieved consistently high ratings across both expert evaluation and learner formative evaluation. The expert evaluation produced an overall score of 88.80%, while the learner evaluations ranged from 91.62% to 94.45%.

Table 8. Summary of instructional material evaluation

Evaluation Dimension	Evaluation Stage	Result	Category
Content quality	Subject matter expert	93.90%	Very Good
Instructional design	Instructional design expert	86.06%	Very Good
Media/presentation	Media expert	86.45%	Very Good
Overall expert evaluation	Combined	88.80%	Very Good
Learner response	One-to-one	93.89%	Very Good
Learner response	Small group	94.45%	Very Good
Learner response	Field test	91.62%	Very Good

The pattern of results indicates that the instructional material was positively evaluated from three complementary perspectives: content appropriateness, instructional design quality, and media presentation. The subsequent learner evaluations further indicated that the developed material could be used by students through individual, small-group, and classroom-level learning situations.

More importantly, the results demonstrate the contribution of the Dick and Carey instructional design process to the development of the product. The development process did not end with the production of the module; instead, the material underwent expert review, learner evaluation, and revision. The resulting instructional material therefore represents a product developed through a systematic instructional design process rather than through material preparation alone.



Figure 4a. Learning Activities Cover

Tugas Kelompok

Buatlah kembali Lembar Kerja berikut dalam kertas kelompokmu !

LEMBAR KERJA PESERTA DIDIK (LKPD)

Mata Pelajaran : IPA
Alokasi Waktu : 2 x 40 menit

Nama : _____
Kelas : _____
Kelompok : _____
Tanggal : _____

A. Tujuan Kegiatan
Setelah mengikuti kegiatan ini, peserta didik mampu:

1. Menjelaskan pengertian ecobrick.
2. Mengidentifikasi sampah plastik yang dapat digunakan.
3. Membuat ecobrick yang padat dan sesuai prosedur.

B. Petunjuk Kegiatan

1. Bentuklah kelompok yang terdiri dari 3–5 orang peserta didik.
2. Bacalah tujuan kegiatan dan dasar teori pada LKPD agar memahami kegiatan yang akan dilakukan.
3. Diskusikan bersama kelompok mengenai pertanyaan mendasar yang terdapat pada LKPD.
4. Susun rencana proyek bersama kelompok dengan menentukan bahan yang digunakan, cara memperoleh bahan, serta pembagian tugas setiap anggota kelompok.
5. Buat jadwal kegiatan praktikum sesuai tabel yang tersedia pada LKPD.
6. Siapkan alat dan bahan yang diperlukan sebelum memulai kegiatan praktikum.
7. Lakukan kegiatan praktikum pembuatan ecobrick dengan mengikuti langkah kerja pada LKPD secara berurutan.
8. Amati proses kegiatan yang dilakukan dan catat hasil pengamatan pada tabel yang tersedia.
9. Diskusikan hasil kegiatan bersama kelompok untuk menjawab pertanyaan pada bagian analisis.
10. Tuliskan kesimpulan dan refleksi berdasarkan kegiatan yang telah dilakukan.
11. Mintalah umpan balik (feedback) dari guru terhadap hasil kegiatan yang telah dilakukan.
12. Setelah kegiatan selesai, bersihkan alat yang digunakan dan rapikan kembali tempat praktikum.

C. Dasar Teori Singkat
Ecobrick adalah botol plastik yang diisi padat dengan sampah plastik bersih dan kering hingga keras dan dapat dimanfaatkan kembali sebagai bahan bangunan atau produk kreatif. Ecobrick merupakan salah satu bentuk penerapan prinsip 3R (Reduce, Reuse, Recycle) dalam pengelolaan sampah plastik.

Figure 4b. Student Activity Sheet

Figure 4. Revision Sequence of the Developed Instructional Materials

The final instructional material integrates PjBL learning activities, contextual science content, project tasks, LKPD activities, observation, discussion, analysis, and reflection into one instructional sequence. The project context of waste management provides a concrete learning environment in which students can engage with science concepts through meaningful activities related to their surroundings.

DISCUSSION

The development of PjBL instructional materials through the Dick and Carey instructional design model produced a learning module that was consistently evaluated positively by experts and students. The overall expert evaluation and formative evaluation results indicate that the developed material achieved alignment among content, instructional design, presentation, and learner use through a systematic development process. This finding supports the view that instructional materials should be developed through structured planning, evaluation, and revision rather than simply compiling learning content (Mardin et al., 2024; Nurhayati et al., 2024).

The positive evaluation results also indicate that the developed module successfully integrated pedagogical strategies with instructional material design. Previous research emphasizes that instructional materials function effectively when learning objectives, content organization, learning activities, and assessment procedures are systematically connected (Marniati, 2023; Susila & Qosim, 2022). Therefore, the contribution of this study is not only the production of a PjBL module but also the application of a systematic instructional development process that connects learning theory with classroom implementation.

The high score obtained from the subject matter expert indicates that the waste-management content was appropriate for science learning. The integration of ecobricks, eco-enzyme, and hydroponic media provides students with opportunities to understand environmental concepts through authentic activities. This finding is consistent with studies showing that contextual and project-oriented learning can strengthen students' conceptual understanding by connecting scientific knowledge with real-world problems (Redhana & Suardana, 2025; Wigalina et al., 2024).

The instructional design evaluation results further demonstrate the importance of systematic instructional models in developing learning materials. The Dick and Carey framework enables developers to analyze learner characteristics, determine objectives, design instructional strategies, and conduct formative evaluation before implementation. Previous studies have shown that systematic instructional design models contribute to improving learning independence and learning outcomes because learning components are developed in an integrated manner (Sapri et al., 2019; Sari & Surya, 2017).

The implementation of PjBL within the module also reflects the characteristics of active learning. Students are involved in planning projects, conducting investigations, discussing findings, and producing solutions related to environmental problems. These characteristics are consistent with previous findings that project-based learning supports collaboration, creativity, communication, and problem-solving skills (Ukobizaba et al., 2025; Sundstrom et al., 2025). Furthermore, active learning approaches provide opportunities for students to construct knowledge through direct involvement rather than passive reception of information (Tanti et al., 2021).

The media evaluation results highlight that instructional material quality is influenced not only by content accuracy but also by presentation and readability. Aspects such as typography, layout, organization, and visual communication determine how easily students interact with learning resources. Previous research on digital and technology-supported learning environments also emphasizes that representation and presentation influence how students interpret scientific concepts (Bogner, 2020; Cirkony et al., 2022; Pebriantika et al., 2021). Therefore, the revision process in this study represents an important stage to ensure that the instructional product is accessible and functional.

The formative evaluation results further strengthen the interpretation that the developed material achieved a high level of feasibility. The sequence of individual evaluation, small-group evaluation, and field testing reflects the principles of formative assessment, where instructional products are continuously examined and improved before wider implementation (Sudijono, 2014; Nurgiyantoro, 2012). This process allows researchers to identify weaknesses in content presentation, student understanding, and instructional procedures.

The positive student responses during field testing indicate that the project-based module was able to facilitate meaningful science learning experiences. Students were guided to explore environmental problems, conduct activities, analyze information, and reflect on their findings. Similar findings have been reported in studies examining innovative learning models that improve student engagement and conceptual development (Kastur & Riyanto, 2020; Kartini et al., 2026).

The contextual nature of waste management projects also supports the development of environmental awareness. Through activities based on Reduce, Reuse, and Recycle principles, students interact directly with environmental issues that exist around them. Previous research indicates that project-based environmental learning can support students' awareness and understanding of sustainability issues (Sukardi et al., 2022; Susbiyanto et al., 2025). However, the findings of this study should be interpreted within the scope of product development research. The high evaluation scores demonstrate the feasibility and acceptance of the instructional material but do not directly prove its effectiveness in improving learning outcomes. Future research should conduct experimental studies to examine changes in students' knowledge, skills, attitudes, and problem-solving abilities after using the developed module (Pebriantika et al., 2024; Syamsurijal, 2024).

CONCLUSION

This study developed PjBL instructional materials for Grade VII science learning through the Dick and Carey instructional design model, with waste management as the learning context. The development process systematically connected instructional goals, learner and context analysis, learning objectives, instructional strategies, instructional materials, and formative evaluation. The resulting module integrates contextual science content with project activities involving ecobricks, eco-enzyme, and hydroponic media, supported by structured student worksheets, practical activities,

observation, discussion, analysis, and reflection.

The evaluation results indicate that the developed instructional materials achieved a very good level of quality. Expert evaluation produced an overall score of 88.80%, comprising 93.90% for subject matter, 86.06% for instructional design, and 86.45% for media. Formative evaluation also produced very good results, with scores of 93.89% in the one-to-one evaluation, 94.45% in the small-group evaluation, and 91.62% in the field test. These findings indicate that the instructional materials were appropriately designed and positively received across expert and learner evaluations after iterative refinement.

The study therefore demonstrates that the Dick and Carey instructional design model can provide a systematic foundation for developing PjBL instructional materials that integrate contextual content, structured project activities, and formative evaluation. However, the findings establish product quality and learner responses rather than causal effectiveness in improving learning outcomes. Future research should therefore examine the instructional effectiveness of the developed materials using appropriate learning-outcome measures and comparative or pretest-posttest designs.

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