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I-DECOBEST Module: Content Validation and Outcomes of a Sustainability Education Framework

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Abstract: *The I-DECOBEST Module represents an innovative approach to sustainability education, integrating energy literacy, environmental stewardship, and interactive learning activities for primary school students. This study focuses on the content validation of the module, employing the Content Validation Index (CVI) for each activity to ensure alignment with pedagogical standards. Quantitative findings reveal high CVI scores across all activities, with values ranging from 0.85 to 0.95, indicating excellent validity. Qualitative feedback from experts highlights the module's strengths in combining theoretical and practical components, particularly its hands-on tasks such as circuit building and group-based problem-solving. The inclusion of sustainability-focused activities, such as renewable energy simulations and energy conservation discussions, further enhances its relevance and impact. Students reported increased engagement and understanding of core concepts, whilst teachers noted improvements in energy literacy and critical thinking skills among participants. The study emphasizes the importance of quantitative validation and qualitative insights in refining educational modules. Findings demonstrate the effectiveness of the I-DECOBEST Module in fostering attitudinal shifts and knowledge retention, aligning with global educational goals for sustainability. Recommendations include iterative refinements to incorporate emerging technologies and expanded activities to deepen learning outcomes. This research contributes to instructional design by providing a validated framework for integrating sustainability into primary education, offering actionable insights for educators and policymakers.*

Keywords: content validation index (cvi), energy literacy, I-DECOBEST module, instructional design, sustainability education

1. Introduction

Global educational reforms increasingly emphasize equipping students with competencies for sustainable development. In Malaysia, energy literacy, science process skills, and positive attitudes towards energy conservation are key to primary education reform (Firdaus Sidek et al., 2022; Sidek Noah & Jamaluddin, 2005). The I-DECOBEST Module advances these goals by integrating hands-on activities, collaborative learning, and real-world applications for Standard 5 pupils. Content validation, engaging expert reviewers, ensures alignment with educational standards and addresses gaps in traditional teaching methods (Ellison et al., 2024). The I-DECOBEST Module aims to enhance cognitive and attitudinal dimensions of energy education, contributing to sustainable education practices globally.

1.1 Problem Statement and Objective of Study

Science education in Malaysia excels theoretically but lacks practical and attitudinal development. Students are frequently not exposed to hands-on activities that encourage critical thinking and problem-solving, particularly in energy literacy and conservation (Ismail et al., 2021). Current teaching materials frequently fail to engage students or address global sustainability and environmental challenges (Nicolaou et al., 2024). Validating educational modules like I-DECOBEST is crucial to address these issues. Without thorough validation, modules may lack relevance, clarity, or engagement, reducing their effectiveness (Schmitz et al., 2024). This study focuses on:

1) Assessing the content validity of the I-DECOBEST Module through expert evaluations.
2) Analyzing the module's effectiveness in promoting energy literacy, science process skills, and student engagement.
3) Identifying opportunities for refinement to enhance its educational impact.

2. Literature Review

The creation of effective educational modules necessitates a thorough process that harmonises content with academic benchmarks and societal requirements. Contemporary modules emphasise critical thinking, student involvement, and sustainability, blending theoretical concepts with practical applications. Quality assurance is achieved through content validation, which aligns objectives with pedagogical aims (Schmitz et al., 2024). Statistical methods such as the Content Validation Index (CVI) evaluate how well content aligns with educational standards (Mahat et al., 2024), and successful validation enhances module usability and effectiveness (Ellison et al., 2024). Science curricula increasingly incorporate sustainability, with programmes like LINE Pro STEM utilising real-world scenarios to captivate students and foster critical thinking (Mohamed et al., 2024). The I-DECOBEST Module combines theoretical and hands-on elements to bolster energy literacy and environmental stewardship. Interactive learning approaches, including practical experiments and collaborative problem-solving, effectively boost student engagement (Rauf et al., 2024). Modules such as Scratch-Based E-Module showcase the advantages of integrating modern technologies for active learning (Yovita et al., 2024), while the I-DECOBEST Module employs practical tasks like circuit construction to deepen conceptual understanding. Innovative teaching methods, technological progress, and sustainability education are reshaping educational practices, underscoring the potential of well-crafted modules in advancing educational goals and tackling global challenges.

Worldwide educational frameworks prioritise sustainability education, with environment-centred modules effectively nurturing critical environmental awareness (Jalinus et al., 2024). The I-DECOBEST Module aligns with these objectives by incorporating discussions on renewable energy and energy conservation. Digital tools and e-modules improve learning outcomes, engagement, and knowledge retention (Irfan et al., 2024). Integrating such tools into the I-DECOBEST Module could facilitate reflective learning and self-assessment. Validated modules with progressive learning sequences highlight the importance of clear instructional guidance (Dewi et al., 2024), suggesting a restructuring of I-DECOBEST activities for a more cohesive learning experience. Introducing environmental education into primary school curricula, such as the TaRL-based Salt Hydrolysis E-Module, enhances long-term knowledge retention through context-specific activities (Parhusip & Iryani, 2024). The I-DECOBEST Module effectively engages Standard 5 pupils in comprehending energy conservation. XR-based learning tools revolutionize education by enhancing interactivity and engagement

(Nicolaou et al., 2024), and their implementation in the I-DECOBEST Module could increase its appeal and applicability. The Scratch Learning Media for Society 5.0 offers insights into scalable and transferable module designs (Yovita et al., 2024), crucial for enhancing I-DECOBEST's goals and methods. Iterative refinements based on expert feedback, as demonstrated by the Database Practicum E-Module (Jalinus et al., 2024), ensure continuous improvement and relevance. LINE Pro STEM modules develop technical skills and foster positive attitudes towards science and technology (Mohamed et al., 2024), aligning with the I-DECOBEST Module's attitudinal objectives for comprehensive energy literacy.

3. Methodology

This study assessed the content validity of the I-DECOBEST Module, designed to enhance science process skills, energy literacy, and positive attitudes towards electricity in Standard 5 pupils. The module's effectiveness was validated through comprehensive quantitative and qualitative methods. Following Sidek Noah and Jamaluddin (2005), content validation examined the alignment of the module's content and activities with its learning objectives. Experts used evaluations, systematic scoring, and thematic analysis of qualitative feedback to offer insights for refinement.

3.1 Study Design

The study employed structured content validation to assess the module's alignment with educational goals and teaching suitability, integrating quantitative and qualitative methods. Quantitatively, experts scored relevance, clarity, and engagement using a detailed rubric. Qualitatively, experts provided descriptive feedback on strengths, weaknesses, and improvement suggestions, ensuring a balanced evaluation with objective scores and contextual insights from experienced educators.

3.2 Participants

A panel of seven experts with diverse backgrounds in science education, curriculum development, and energy literacy validated the I-DECOBEST modules. The experts, labeled with an E code, possessed doctoral and first degrees and had at least five years of experience in fields such as education science, electrical engineering, psychology, and counseling. Validations were received within two to three weeks of the initial meeting, either face-to-face or online, and completed forms were analyzed to interpret the experts' chosen scales and comments. Calculations and thematic analyses identified significant feedback on the I-DECOBEST Module. The experts' experience ranged from 7 to 29 years, aligning with industry standards for Subject Matter Experts (SMEs), instructional designers, and educational technologists (Yelon, 2019; Reigeluth & Carr-Chellman, 2020; Morrison et al., 2019). Table 1 below shows the matrix of expert profiles.

Table 1: Expert Profiles Matrix

Expert Code	Designation	Field and years of expertise	Institution
E1	Senior Lecturer, PhD	Physics (7 years)	School of Physics, Public University
E2	Senior Lecturer, PhD	Curriculum and Instruction (23 years)	Centre of Education Studies, Public University
E3	Specialist, PhD	Science Education (25 years)	Centre for Education in Science and Mathematics, Southeast Asia.
E4	Professor and Dean, PhD	Physics (18 years)	Faculty of Science and Technology, Public University.

E5	Head of Unit, PhD	Psychology and Counselling (10 years)	Teacher Teaching Institution, Public Institution
E6	Senior Science Teacher, Degree	Electrical Engineering/ Science Education (16 years)	Public Primary School
E7	Deputy Dean, PhD	Design and New Media (20 years)	School of Art, Public University

3.3 Evaluation Instrument

The I-DECOBEST Module was assessed using a rubric based on seven criteria: Relevance, Clarity, Engagement, Innovation, Applicability, Accuracy, and Sustainability (Sidek Noah & Jamaluddin, 2005). These criteria ensured the module's alignment with curriculum goals, comprehensibility, student engagement, and accurate energy literacy concepts, emphasizing renewable and non-renewable sources (Firdaus Sidek et al., 2022). By incorporating creative and innovative teaching methods, the module aimed to enhance the learning experience and cater to the diverse needs of students and educators (Touchette et al., 2023). The expert-reviewed aspects are detailed in Table 2.

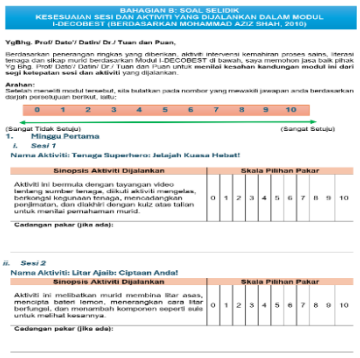
Table 2: Criteria according to the week and activities name

Week	Session	Activity Name	Criteria
Week 1	Session 1	Superhero Energy: A Great Power Tour!	Video presentations about energy sources, classify activities, sharing energy use, savings suggestions, online quizzes.
	Session 2	Magic Circuit: Your Creation!	Building a basic circuit, creating a lemon battery, explaining how the circuit works, adding components such as switches to see the effect.
Week 2	Session 1	Sustainable Home Design with Electric Circuits	Discuss sustainable energy, sketch electrical circuits, explain functions, add additional components, electrical symbol quizzes.
	Session 2	Electrical Safety in Your Home	Electrical hazard video presentation, safety poster design, safety measures presentation, additional hazard discussion, comprehension quiz.
Week 3	Session 1	Which Circuit is Better?	Learning serial and parallel circuits, building circuits, recording differences, daily applications, quizzes to assess comprehension.
	Session 2	Saving Energy in Schools	Discuss electrical appliances in schools, assess energy consumption, create savings posters, analyze electricity usage, quizzes/presentations.
Week 4	Session 1	Power Circuit!	Plan, build, and test electrical circuits using used materials, discuss problems, present circuits, and solutions.
	Session 2	Is Our Circuit Safe?	Learn the dangers of unsafe circuits, inspect circuits, record repairs, presents results, circuit safety quizzes.
Week 5	Session 1	Stories from Circuit	Creating a story about an electric circuit, presenting it through *mahjong* paper or a slideshow, receiving feedback.
	Session 2	The Challenges of Smart Circuits	Adding components to circuits, testing, presenting results, receiving feedback for improvements and troubleshooting.
Week 6	Session 1	Educating the Community on Energy	Planning energy saving campaigns, presenting results, receiving feedback for improvement.
	Session 2	Forming a Positive Attitude towards Electricity	Reflecting on electrical learning, sharing in groups, identifying positive aspects, receiving feedback to improve reflection.
Week 7	Session 1	Powered Buildings: The Magic of Circuits in Community!	Build or simulate a building model with energy circuits, compare energy efficiency, improve circuits, presenting results.

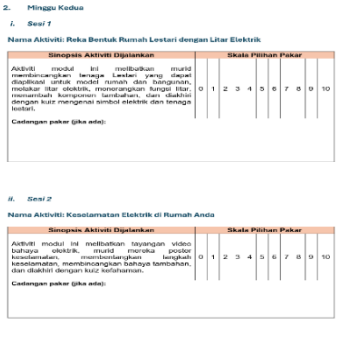
Week	Session	Activity Name	Criteria
	Session 2	Presentation Exercise	Preparing and presenting building models, explaining energy sources, receiving feedback, improving presentations.
Week 8	Session 1	Open Day Presentation!	Completing projects, presenting to the audience, answering questions, receiving feedback, making reflections for improvement.
	Session 2	Reflection & Feedback	Reflect on project achievements, write reflections, share in groups, set future goals, receive feedback.

Each criterion was scored on a scale of 1 (not suitable) to 10 (highly suitable), with a maximum score of 70 points per session. Experts also provided qualitative feedback for each session and the overall module. In obtaining expert validity information, the use of the expert validity questionnaire involves the use of the following validity form shown in Figure 1:

(a)



(b)



(c)

(d)

Figure 1: (a) Instruction and front page (b) First page of criterion (c) Subsequent page criterion (d) Last page of expert comment

3.4 Module Overview and Evaluation Procedure

The I-DECOBEST Module was developed as an eight-week program with two sessions per week. Each session included a variety of hands-on activities, group discussions, and collaborative tasks designed to promote active learning. The module's activities were structured to progressively develop students' understanding of energy concepts and science process skills. The evaluation process involved the following steps:

1) **Distribution**: The module, along with the evaluation rubric, was provided to the experts for independent review.
2) **Scoring**: Experts assessed each session using the rubric and assigned scores for each criterion.
3) **Qualitative Feedback**: Experts provided detailed comments on the strengths, weaknesses, and potential improvements for each session and the module overall.
4) **Data Compilation**: Scores and comments were compiled for analysis.

3.5 Content Validation and Data Analysis

This process involves two important parts, namely the validity of the content and the analysis of the data carried out to obtain important results for the findings of this study. This process consists of the following quantitative and qualitative processes:

3.6 Quantitative Analysis

The quantitative analysis involved calculating the **Content Validation Percentage (CVP)** for each session using the formula:

$$\text{CVP} = \left(\frac{\text{Total Score}}{\text{Mazimum Score}}\right) \text{x } 100$$

The CVP scores provided an objective measure of the module's content validity. A CVP of 70% or above was considered acceptable, as suggested by Sidek Noah and Jamaluddin (2005). Descriptive statistics, including mean and range, were used to summarize the scores across all sessions.

3.7 Qualitative Analysis

The qualitative feedback from experts was analyzed using Thematic Analysis to identify key themes and actionable insights. This process involved familiarizing with the data, coding key ideas, developing and refining themes, and interpreting these to provide recommendations. The analysis highlighted areas for improvement, including adding reflective assessments, emphasizing environmental impacts, and integrating advanced tools like digital simulations. These findings underscore the value of qualitative feedback in enhancing the module's design and effectiveness.

3.6 Ethical Considerations

The study adhered to ethical research standards to ensure the integrity and fairness of the evaluation process. Participation by experts was voluntary, and their identities were anonymized in the report to maintain confidentiality. All experts were fully informed about the study's purpose and objectives, and their feedback was used exclusively for improving the module. This methodology provided a comprehensive framework for evaluating the I-DECOBEST Module. By combining quantitative scoring with qualitative thematic analysis, the study ensured a balanced and thorough assessment of the module's validity and potential for classroom implementation.

4. Findings

The I-DECOBEST Module consistently received high suitability scores over eight weeks, with total session scores between 61 and 65 (see Table 3). Week 8 sessions both achieved the highest score of 65, demonstrating excellent alignment with educational goals, innovation,

engagement, and sustainability. These sessions effectively integrated hands-on learning and sustainability concepts, ideally culminating the module's objectives.

Table 3: Experts assign scale values to evaluate the suitability of I-DECOBEST Module activities based on weeks and sessions

Week	Session	E1	E2	E3	E4	E5	E6	E7	Sum
1	Session 1	9	8	9	8	10	10	9	63
	Session 2	10	9	9	8	10	9	9	64
2	Session 1	10	8	10	8	10	9	9	64
	Session 2	10	8	9	9	9	10	9	64
3	Session 1	10	8	9	8	9	9	9	62
	Session 2	9	8	10	8	10	10	9	64
4	Session 1	10	8	10	8	10	9	9	64
	Session 2	9	8	10	8	10	9	9	63
5	Session 1	9	8	10	8	9	10	9	63
	Session 2	10	8	9	8	9	9	9	62
6	Session 1	10	8	9	8	9	9	9	62
	Session 2	10	7	10	8	9	9	9	62
7	Session 1	9	7	9	8	10	9	9	61
	Session 2	10	8	9	8	9	9	9	62
8	Session 1	10	8	9	9	10	9	10	65
	Session 2	10	8	9	9	10	9	10	65

In Week 7, Session 1 received the lowest score of 61. Experts noted the activities were relevant and practical but suggested improvements in engagement and clarity to better align with learning outcomes. Week 3, Session 1, and Week 5, Session 2, also had slightly lower scores, indicating a need for clearer instructions and stronger connections between activities and objectives. Overall, the module exhibited exceptional relevance, clarity, and engagement, earning impressive marks in sustainability and innovation. This clearly establishes the I-DECOBEST Module as a highly effective educational tool that significantly enhances energy literacy, scientific process skills, and cultivates positive student attitudes. Enhancing clarity and engagement in specific sessions will undoubtedly strengthen its implementation and maximise its impact. Refer to Table 3, which clearly illustrates the calculation aspect of CVP.

Table 3: CVP Findings

Week	Session	Actual Score	Maximum Score	Validity Percentage (%)
1st	1	63	70	90.0
	2	64	70	91.4
2nd	1	64	70	91.4
	2	64	70	91.4
3rd	1	62	70	88.6
	2	64	70	91.4
4th	1	64	70	91.4
	2	63	70	90.0
5th	1	63	70	90.0
	2	62	70	88.6
6th	1	62	70	88.6
	2	62	70	88.6

7th	1	61	70	87.1
	2	62	70	88.6
8th	1	64	70	91.4
	2	64	70	91.4

The Content Validation Percentage (CVP) analysis for the I-DECOBEST Module indicated consistently high validity, with percentages ranging from 87.1% to 91.4%. This demonstrates strong alignment with educational objectives, showing the module's relevance, engagement, and classroom effectiveness. The highest CVP scores of 91.4% were consistently achieved in multiple sessions, specifically in Weeks 2, 4, and 8, which were characterised by innovative activities, a strong sustainability focus, and outstanding student engagement. Week 8 sessions notably aligned well with module goals, providing an impactful program conclusion. While most sessions scored above 90%, a few, including Week 7, Session 1, scored slightly lower (87.1% to 88.6%). Expert feedback suggested improved clarity and engagement for these sessions to better meet learning outcomes. Overall, the CVP findings affirm the I-DECOBEST Module's high validity and suitability as an educational tool. Strong session scores highlight its objective alignment, and feedback offers opportunities for minor refinements to enhance impact in fostering energy literacy, science process skills, and positive attitudes among Standard 5 pupils.

4.1 Qualitative analysis

Experts conducted a detailed review of the I-DECOBEST Module, providing session-specific and overall feedback on its activities. They assessed the module's alignment with curriculum objectives, relevance, engagement, innovation, and classroom practicality. Each activity conducted over the eight weeks was assessed, emphasising both strengths and areas that need improvement. This comprehensive assessment aims to refine the module, ensuring its effectiveness in promoting energy literacy, science process skills, and positive student attitudes. Below is a detailed report of the findings based on experts' comments.

Session Specific Feedback

The expert evaluation of the I-DECOBEST Module provided comprehensive feedback on the activities across all eight weeks as shown in Table 4, offering detailed insights into their strengths and areas for improvement:

Table 4: Specific Activities Comment by Expert

Week	Session	Expert Code	Expert Opinion
One	1	E1	Video presentation and discussion of the impact of fossil fuel consumption, global warming.
		E2	Can be added for students' attitude elements
		E4	Focus on changing energy sources to electricity with video presentation
		E6	The video should be about energy sources in Malaysia and subsequently energy sources abroad such as nuclear.
	2	E1	Competitive elements between groups for the brightest bulb.
		E2	Interesting.
		E4	Add a description of the function of the components and the basics of energy change before the activity
		E6	Gather smaller pupils so that pupils can carry out hands-on activities.
Two	1	E1	Peer evaluation/feedback to choose the best design.
		E2	Interesting activities.

		E4	Sustainability was postponed to the end of the module; electrical safety is put first.
		E6	Suggest a way of teaching through posters between classes in school
	2	E1	Use of electrical test pens to detect leakage current in circuits.
		E2	Interesting hands-on activities
		E4	Electrical safety is added immediately after the activity of the circuit.
		E6	Suggest a way of teaching through posters between classes in school
Three	1	E1	Discuss a solar panel installation to save energy
		E2	ZPD for learning from experiences/experimental learning
		E4	A more in-depth discussion of serial and parallel circuit applications.
		E6	Students can carry out hands-on activities to build circuits in this session.
	2	E1	Light bulb competition in series or parallel circuits.
		E2	Activity assessment
		E4	Discuss energy savings in schools through interactive posters.
		E6	Pupils use real appliances to save electricity such as LED lights or sensors.
Four	1	E1	Supply a multimeter to detect electrical current.
		E2	Higher order thinking skills
		E4	Improvements in building circuits with used materials.
		E5	Creative
		E6	Activities that utilize recycled materials are effectively implemented in schools.
	2	E1	Peer evaluation/feedback to choose the best design.
		E2	Focus on how to use electricity safety/dangerous?
		E4	Use a test pen for circuit safety.
		E6	More learning aids are needed to make it easier for students to understand unsafe circuits.
Five	1	E2	Link to session 2
		E4	Creative stories from the circuit should relate to everyday life.
		E5	Suitable
		E6	Murid dapat meningkatkan keterlibatan aktif jika sesi ini dijalankan secara berpasangan atau kumpulan kecil.
	2	E1	Pertimbangan penggunaan litar selari untuk meningkatkan kecerahan nyalaan mentol.
		E2	How to link to the above activity (sesi 1).
		E5	Bersesuaian dengan tahap pelajar.
		E6	Boleh cadangkan tinjauan atau simulasi yang sesuai bagi memastikan murid menguji litar.
Six	1	E2	Provide certain evidence for this element.
		E6	Encourage pupils to run energy-saving campaigns at school or science week.
	2	E1	Use of the Kahoot app for attitude feedback and learning reflection.
		E2	Provide certain evidence for this element.
		E4	Provide electrical learning reflection through digital tools.
		E6	Excellent activities are carried out to help students who are weak in electricity topics.
Seven	1	E1	Learning process Â– try to connect these items.
		E4	Simulation of sustainable energy buildings as the final project.
		E6	In this session, pupils can also be combined with the latest electrical equipment in the market.

	2	E2	Show step on how to overcome reflection.
		E6	Brainstorming activities between students should be assisted by teachers so that students' presentations are clearer.
Eight	1	E2	Show step on how to overcome reflection.
		E6	Suggestions to pupil to conduct a rehearsal before the presentation to the audience.
	2	E1	Peer feedback for the best project improvement.
		E2	Show step on how to overcome reflection.
		E4	Peer feedback for project reflection improvement.
		E6	Teachers should guide students to complete all activities in this session.

Experts praised the I-DECOBEST Module for its effective integration of sustainability concepts, hands-on learning, and real-world applications, aligning with curriculum objectives. They commended the use of videos, engaging activities, and focus on renewable energy and energy-saving practices. Suggestions included incorporating competitive elements, peer feedback, safety reinforcements, in-depth discussions on circuits, interactive posters, and modern electrical technologies. Experts recommended smaller group activities, simulations, evidence-based guidance, and digital tools for assessments and reflections. They emphasized practice sessions, teacher guidance, and scaffolding to enhance clarity and task completion. The module's potential was validated, with actionable insights provided for refinement.

Overall Opinion

Expert feedback (see table 5) on the I-DECOBEST Module underscores its effectiveness as a comprehensive and well-designed educational tool, while also providing constructive improvement suggestions. Experts unanimously commended the module's detailed and structured content, which aligns well with Standard 5 curriculum objectives.

Table 5: Overall Comment From Expert

Expert Code	Expert's Opinion and Suggestion
E1	The course content is detailed and relevant and covers the aspects needed to strengthen the topic of electricity for year five students. The module can be improved by emphasising the negative impact of fossil fuel use (non-renewable energy) and involving elements of competitiveness in group activities such as competitions or peer evaluation/feedback in selecting the best group.
E2	The model is suitable for primary school students but needs improvement in some parts that are proposed to increase the contribution and novelty of this module.
E3	The planned teaching and learning activities need to be explained in detail on how these activities are interconnected with the conceptual framework of the I-DECOBEST module.
E4	Overall, this model is good. I commend this pure effort. I would like to suggest that the activities be reorganized so that they can gradually develop students' interest and focus. Understanding the basic concepts of energy (kinetic, potential, electrical, etc.) needs to be introduced so that students can achieve the level of "energy sustainability" by the end of the course. Then the module continues with the basic concepts of circuits (series, parallel, combination) to help students understand how energy can be transformed and so on. Topics such as energy conservation and energy sustainability can be discussed at the end of the course so that students can encompass the entire topic of energy (electricity) in a more comprehensive manner by integrating various initial pieces of information that have been learned.
E5	The module's planning and implementation are detailed and structured, with clear and easy-to-follow activity execution instructions. The activities planned for an 8-week implementation period are related to process skills, Energy Literacy, and Student Attitudes, to improve fifth-grade students' understanding of electricity.
E6	Overall, this module can increase students' interest in the topic of electricity and indirectly enhance their understanding and knowledge of the topic, along with hands-on activities that are appropriate for the students' level.

E7	Overall, the module has been well-designed, aligning with the requirements of the teaching and learning process to enhance students' knowledge of understanding and using electricity. The main goal of enhancing students' understanding (theoretical knowledge) and practical application (usage) of electricity in real-world scenarios can be achieved. The module can be improved by adding more content on the environmental impact and future of energy usage, for example: Introducing different energy sources and explaining the differences between renewable energy (solar, wind, hydro) and non-renewable energy. (arang batu, minyak, gas asli). Examining the impact of non-renewable energy sources that contribute to climate change (carbon emissions) and their effects on the environment.

The I-DECOBEST Module effectively fosters energy literacy, science process skills, and positive attitudes toward electricity through practical, hands-on activities that enhance theoretical understanding and real-world applications. Interactive tasks and group activities engage students and align with the Malaysian curriculum's goals, emphasizing sustainability, critical thinking, and problem-solving skills. Experts suggest improvements, such as including more content on environmental impacts and renewable energy sources, restructuring the sequence of activities, enhancing clarity and novelty, and incorporating advanced tools. Addressing these suggestions will further strengthen the module's impact and provide a comprehensive learning experience for Standard 5 pupils.

5. Discussion

The I-DECOBEST Module's quantitative and qualitative findings are synthesized and compared with recent primary school educational interventions. The module's strengths and areas for improvement are critically examined based on expert evaluations, aligning with current trends in content validation and teaching methodologies. The analysis highlights the module's effectiveness in fostering energy literacy, science process skills, and positive student attitudes, while offering recommendations for enhancement. The quantitative analysis showed strong content validity, with Content Validation Percentages (CVP) between 87.1% and 91.4%, surpassing the 70% threshold (Sidek Noah & Jamaluddin, 2005). The highest CVP scores of 91.4% were observed in Weeks 2, 4, and 8, indicating strong alignment with objectives, similar to the Computational Thinking in Science Module's high CVI (0.83) (Firdaus Sidek et al., 2022). The I-DECOBEST Module supports critical educational outcomes through structured, hands-on activities and sustainability-focused learning. However, Weeks 5, 6, and 7 had slightly lower CVP scores (87.1% to 88.6%), indicating areas for refinement, consistent with gaps identified in studies like the Health Education Assessment Module (MoPPK) (Norhidayu et al., 2020). Expert feedback praised the module's comprehensive and structured content, emphasizing its relevance to the Standard 5 curriculum and engagement through innovative and practical activities, aligning with research on modules prioritizing creativity and practical applications (Touchette et al., 2023). The module's integration of sustainability concepts and real-world applications, such as circuit-building and energy-efficient building simulations, effectively engaged students and promoted critical thinking, similar to findings from the Islamic Emotional Regulation Module validation study (Ismail et al., 2021).

Experts suggested restructuring the sequence of activities to introduce foundational energy concepts earlier in the module for progressive knowledge build-up, echoing Lam and Tong (2022), who emphasized the importance of progressive content design to scaffold learning effectively. Additionally, enhanced clarity and teacher support, particularly for complex activities, were identified as critical areas for refinement.

Experts suggested incorporating advanced tools and digital platforms to enhance the learning experience, such as multimeters, circuit testers, and digital reflection tools, to expose students to real-world energy applications. This recommendation aligns with Godaert et al. (2022), who highlighted the role of digital tools in improving student engagement and learning outcomes in primary education. Integrating both quantitative and qualitative findings offers a comprehensive understanding of the I-DECOBEST Module's strengths and areas for improvement. High CVP scores validate the module's alignment with curriculum objectives, while expert feedback provides actionable recommendations for refining activities. For example, introducing more scaffolding and advanced tools could improve engagement in Weeks 6 and 7. The findings also align the module with recent research trends in educational interventions. Studies like the Computational Thinking in Science Module (Firdaus Sidek et al., 2022) and the Health Education Assessment Module (Norhidayu et al., 2020) underscore the importance of content validation and innovative teaching methods. Implementing these expert-recommended improvements can enhance the I-DECOBEST Module's effectiveness, offering a transformative learning experience for students.

Conclusion

The I-DECOBEST Module significantly improves energy literacy, science abilities, and positive attitudes in Standard 5 students. Quantitative assessments show high Content Validation Percentages (87.1% to 91.4%), indicating curriculum alignment and effective engagement in hands-on activities. Experts praise its sustainability focus, real-world relevance, and enhancement of critical thinking and problem-solving skills. Recommendations for improvement include earlier introduction of basic energy concepts, increased clarity, and additional support for complex tasks. Further suggestions involve using multimeters, digital platforms, and incorporating reflective discussions on environmental effects. With these adjustments, the I-DECOBEST Module could establish a new standard in science education, promoting sustainability, energy awareness, and advanced teaching methods, thus preparing students to be insightful global citizens.

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