**Journal of Advanced Sciences and Mathematics Education**
**Volume 5, Issue 1, 197 - 209.**
e_ISSN: 2798-2351
DOI: 10.58524/jasme.v5i1.708

# Development of the climate change investigation (CCI) module to empowering sustainability literacy and global diversity in junior high school students

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**Article Info**

***Article history:***

Received: April 02, 2025
Revised: May 10, 2025
Accepted: June 02, 2025

***Keywords:***

CCI Module;
Global diversity;
Sustainability literacy.

**Abstract**

**Background:** Environmental issues are integral to science education, addressing the causes, impacts, and prevention of environmental damage. Investigative learning is essential to help students better understand these complex topics.
**Aim.** This study aimed to determine the characteristics and feasibility of the Climate Change Investigation (CCI) module in empowering students' sustainability literacy and global diversity.
**Method.** The research employed a Research and Development (R&D) approach using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. Data collection included expert validation and student-teacher response questionnaires.
**Results.** The findings showed that the CCI module is an effective and engaging tool for enhancing students' understanding of environmental issues and cultural awareness. The module also benefits teachers by introducing interactive, low-carbon, and sustainability-based learning media. Validation scores from material, media, and language experts confirmed its high feasibility. Student and teacher responses indicated a high level of satisfaction with the module's clarity, content, and relevance.
**Conclusion.** The CCI module enables students to understand various causes and impacts of environmental degradation, recognize the regional variations in climate effects, appreciate the role of biodiversity, evaluate the influence of eco-friendly technologies, and participate actively in discussions. The module supports independent learning and contributes to shaping environmentally and culturally conscious students aligned with 21st-century educational goals.

**To cite this article:** Buana, C. E., Hudha, M, N., Gunawan, K, D, H., Indriyanti, N, Y., Probosari, R, M., & Mahardiani, L. (2025). Development of the climate change investigation (CCI) module to empowering sustainability literacy and global diversity in junior high school students. *Journal of Advanced Sciences and Mathematics Education, 5*(1), 197 - 209.

## INTRODUCTION

In the 21st century, education has experienced a paradigm shift that emphasizes not only the mastery of thinking skills but also the development of sustainability literacy. This transformation aligns with the global commitment to Sustainable Development Goals (SDGs), which aim to address pressing challenges such as climate change, inequality, and environmental degradation (Adam et al., 2021). Despite these efforts, several studies have shown that awareness of sustainability literacy remains relatively low, particularly among elementary and middle school students (Chen & Li, 2019). For instance, research involving middle school students revealed no significant improvement in students' perceptions and understanding of sustainability before and after the learning process, and in some cases, there was even a decline (Adam et al., 2021). These findings underscore the urgency

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of integrating sustainability literacy into educational practices to ensure that students acquire the competencies necessary to contribute to sustainable development (Putri et al., 2023).

Awareness and knowledge are not only outcomes but also the foundation for students to actively engage in sustainable practices (Décamps et al., 2017). Increasing student awareness is therefore essential in building a sustainable future (Erguvan, 2024). In response to these educational demands, Indonesia's Ministry of Education and Culture has initiated the development of the Pancasila Student Profile in the era of Industrial Revolution 4.0, aiming to shape students who are competent, uphold noble behavior, and embody the values of Pancasila (Kurikulum & Pendidikan, 2022). The Independent Curriculum supports this initiative by encouraging lifelong learning and the development of global competence (Yustitia, 2023). However, a growing challenge among today's youth is their tendency to admire foreign cultures while showing less appreciation for local traditions, which are often viewed as outdated (Irmawati et al., 2024). This phenomenon calls for an educational response that fosters global diversity and prevents further cultural and character erosion among the younger generation (Sabanil et al., 2022).

To actualize the SDGs through education, it is crucial that students possess strong sustainability literacy and an appreciation for global diversity (O'Riordan et al., 2020). Yet, studies have indicated that conventional classroom approaches have failed to significantly improve these attributes. Sustainability literacy serves as a strategy for developing students' awareness and competence in addressing global challenges such as poverty and environmental degradation. Several socio-cultural factors in Indonesia—such as family cultural background, parental values, school systems, and the way teachers evaluate students—present obstacles to fostering this awareness (Warliyah et al., 2023). Schools attempt to instill values of global diversity through subjects like the Pancasila Student Profile Strengthening Project (P5), but field interviews have revealed that students often exhibit disrespectful behavior towards peers, teachers, and even parents. Additionally, interest in learning and preserving local culture appears to be waning (Firdayani et al., 2024). This problem is compounded by the limited readiness of teachers to teach about cultural differences, as well as students' minimal engagement in meaningful and diverse learning experiences (Aprilia et al., 2024).

The sustainability of human life is intrinsically linked to the health of the planet. Therefore, the implementation of the SDGs requires urgent action through education, particularly by addressing climate change, conserving oceans, and protecting forests. Climate Change Education (CCE) plays a vital role in shaping the younger generation's attitudes, skills, and behavior to foster a more sustainable world (Asimakopoulou et al., 2021). CCE is especially relevant in contexts of uncertainty and rapid change, as it promotes inquiry-based, creative, reflective, and participatory learning that prepares students to deal with complex, real-world problems. Its importance spans from primary to higher education (Molthan-Hill et al., 2019). Through CCE, students are expected to become agents of change who are capable of addressing the climate crisis with both mitigation and adaptation strategies (Nepraš et al., 2022; Winter et al., 2022). Moreover, climate change learning should extend beyond formal settings, as children and adolescents interact with environmental issues in a variety of contexts such as schools, homes, communities, and media (Rousell & and Cutter-Mackenzie-Knowles, 2020).

Integrating climate issues into school learning activities encourages students to connect these issues with their daily lives and engage in active, collaborative learning (Fahrullisa et al., 2018). In this context, student investigation of climate change phenomena becomes essential in fostering problem-solving abilities (Puspita & Dewi, 2021). To support such experiences, educators must design effective learning tools aligned with 21st-century educational approaches. Learning modules offer one such solution, providing both clarity and flexibility for teachers and students. They support independent learning, allow students to study anytime and anywhere, and offer structured materials that are easy to follow (Muthmainnah et al., 2023; Yuristia et al., 2022). Modules function not only as

instructional resources but also as tools for self-directed learning and skill assessment (Al Azka et al., 2019; Puspitasari, 2019).

While existing research addresses sustainability literacy and climate education, few studies have linked these themes with the Pancasila Student Profile through investigative, module-based learning. This represents a significant gap in the literature. The development of such a module is crucial for fostering sustainable thinking, promoting respect among students, and nurturing environmental awareness that supports long-term development goals.

Aligned with the spirit of 21st-century science education, which emphasizes student-centered and technology-integrated learning (Bogar et al., 2023), the use of instructional modules can optimize students' knowledge and engagement (Rahmawati & Atmojo, 2021; Sari & Atmojo, 2021). Considering the persistent challenges in students' sustainability literacy and global diversity awareness, this study aims to develop a Climate Change Investigation (CCI) learning module. The CCI module is expected to enhance students' understanding of environmental issues, instill values of global diversity, and foster sustainable behavior. This study investigates the feasibility and characteristics of the CCI module as an innovative instructional tool to empower junior high school students to become more globally conscious and environmentally responsible.

## METHOD

### Research Design

This study uses the type of Research & Development (R&D) research. Research & Development is a research used to test and produce the effectiveness of a product. In this study, the Research & Development used is the ADDIE development model. In the ADDIE development model, there are five stages, namely Analysis, Design, Development, Implementation, & Evaluation (Spatioti et al., 2022). The ADDIE development model was chosen because the objective is able to find and identify problems and their detailed nature and select development efforts, in addition, the ADDIE development model includes evaluation and revision to ensure valid final results (Waruwu, 2024). The ADDIE development model can be seen in Figure 1.

### Participants

The participants in the needs analysis stage consisted of one grade IX science teacher and grade IX students who served as respondents for questionnaires, interviews, and initial observations. The study included both small-scale and limited-scale trials. In the small-scale trial, 10 students were selected to evaluate and provide feedback on the initial product prior to broader implementation. During the implementation phase, participants were selected from one class of grade IX students and science teachers at a public junior high school in Surakarta. A convenience sampling method was used, based on accessibility and logistical considerations (Emerson, 2021). The selected students were those studying environmental issues, had access to the internet, were permitted to use mobile phones at school, and were willing to complete the response questionnaire.

### Instrument

This study consisted of 6 expert validators and several teams from FGD activities. The six validators consisted of 2 expert material validators from the lecturers of the Science Education Study Program at Sebelas Maret University, 2 expert media validators from the lecturers of the Science Education Study Program at Sebelas Maret University who had competence in the field of learning media, and 2 expert language validators who were teachers from two State Junior High Schools in Surakarta and Karanganyar.

### Data Collection

Data analysis began with the evaluation of Likert-scale questionnaire responses to gather expert and student opinions on the textbook's content and usability. Content validity for each

instrument was calculated using Aiken's Validity Index, and inter-rater reliability among expert reviewers was measured with Cohen's Kappa to ensure consistency in judgments. To assess learning improvement, students' pre-test and post-test scores were used to compute the N-Gain index (g).

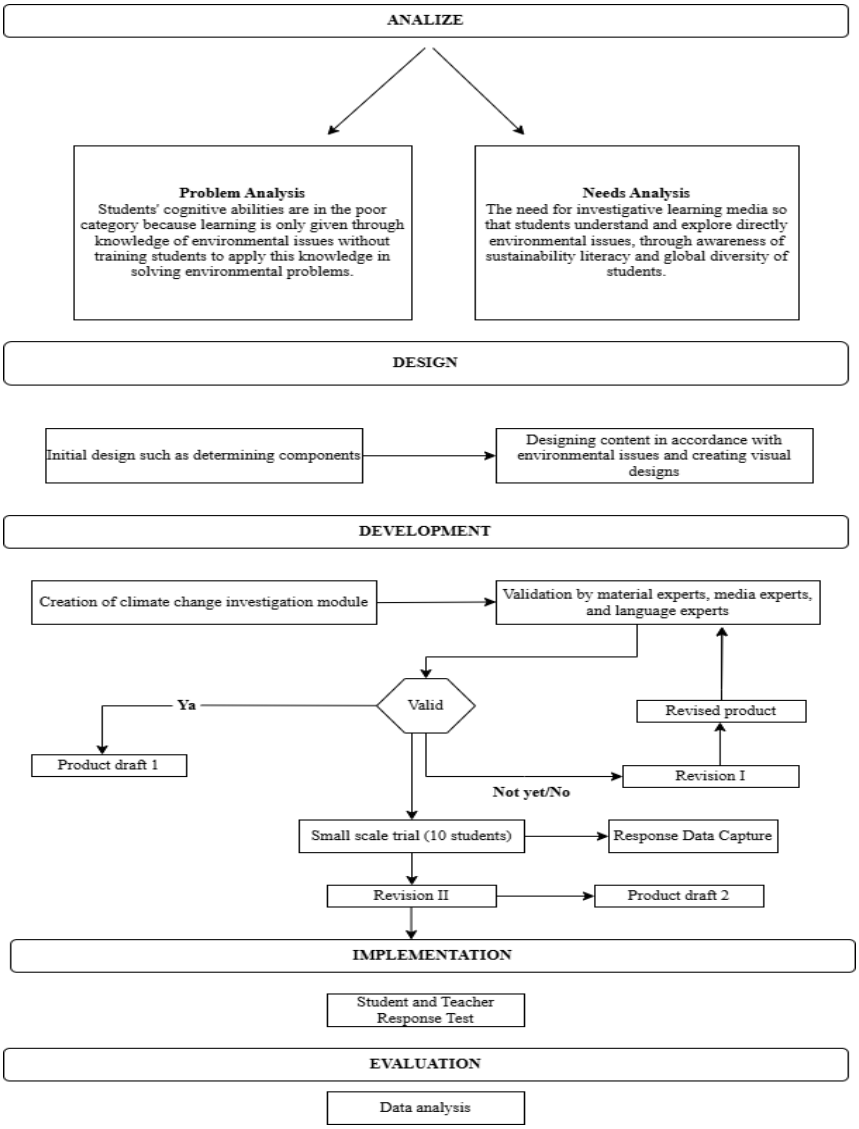


**Figure 1.** CCI Module Development Based on the ADDIE Model

## Data Analysis

The data analysis techniques used in this study are qualitative and quantitative analysis. This data analysis technique is a mixed method research approach, namely a combined research between the process and techniques of qualitative and quantitative data analysis. Before being analyzed, the data from the questionnaire was first quantified and then analyzed using descriptive statistics.

# RESULTS AND DISCUSSION

## Results

The research and development results produced the Climate Change Investigation (CCI) module to empower students' sustainability literacy and global diversity. The research was conducted using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The first stage is the analysis stage. At this stage, the researcher

analyzes the problems and needs of students for learning media and students' awareness of sustainability. Based on the results of the distribution of the needs questionnaire, it shows that the learning methods most widely used by teachers to support learning activities in the classroom are lectures and questions and answers. The media and teaching materials most widely used in learning activities are textbooks and power points. Some students admit that teachers often use technological assistance when teaching in carrying out science learning activities. Then students have personal cellphones so that they can support their learning activities, but some still use cellphones with their parents. Furthermore, the researcher conducted the stage of analyzing students' needs for learning media, it was found that most students were interested in or liked interactive learning media, students felt that the investigative learning process made it easier for students to understand the learning material, and students agreed if a learning module was developed which included investigative activities to support science learning activities. Investigative activities provide opportunities for students to solve problems in a way that students determine themselves (Puspita & Dewi, 2021). So that students are directly involved in the environment to identify existing problems and develop analytical thinking skills and create various creative ideas to solve problems given by the teacher(Butar-Butar et al., 2022). The detailed results of the student needs analysis can be seen in Table 1.

**Table 1.** Analysis of Student Needs at SMP Negeri 2 Surakarta

| Category | Sub Category | Result |
|---|---|---|
| Learning methods and resources | Learning methods applied by teachers in class | 70,6% Lecture<br>80,4% Question and answer<br>45,1% Discussion<br>7,8% Demonstration<br>5,9% Outdoor |
| | Media and teaching materials | 56,9% Microsoft PowerPoint<br>27,5% Image Media<br>39,2% Learning videos<br>13,7% Replica/tool<br>82,4% Book<br>13,7% Students Worksheet<br>3,9% Electronic teaching materials |
| Use of technology | Use of technology for learning | 54,9% Using technology in learning<br>45,1% Do not use |
| | Ownership of mobile phones to support learning | 86,3% have a mobile phone to support learning<br>13,7% don't have a personal mobile phone |
| Student interest in CCI module development | Student interest in interactive learning media | 94,1% Interest<br>5,9% Not Interest |
| | Interest in the investigative learning process to make it easier for students to understand learning materials | 90,2% Yes helpful<br>9,8% Not helpful |
| | Student interest in developing climate change investigation modules | 90,2% Strongly agree<br>9,8% Disagree |

The second stage is the design stage. This media selection is based on the demands of science learning, particularly environmental issues, which require investigative activities outside the classroom, aligning with students' interest in outdoor learning. Additionally, the module is designed as an online resource accessible via mobile phones, allowing flexible learning without time constraints. This approach accommodates students' reliance on technology, such as laptops and smartphones, ensuring that the CCI module remains an accessible and engaging learning tool. The

CCI module is not limited to practice exercises but integrates individual and group investigative activities, fostering greater student engagement. Its selection is based on various advantages, including interactivity and flexibility, enabling unrestricted learning. Moreover, investigative activities empower students to solve problems independently (Puspita & Dewi, 2021). This allows students to engage directly with their environment to identify existing problems, develop analytical thinking skills, and generate various creative ideas to solve the challenges presented by the teacher (Butar-Butar et al., 2022). In developing an electronic learning module that can be accessed via gadgets, supporting software is required for creating the CCI module. The chosen software is Canva, as it offers a vast collection of templates, animations, icons, and attractive fonts, making the presentation of information more manageable for students to understand. Additionally, Canva can be used anytime and anywhere, allowing researchers to edit the module conveniently.

The third stage involves development. The media development process is carried out according to the designed plan. Once the media is completed, it undergoes an expert evaluation for validation. After validation, revisions are made based on expert feedback and suggestions. The designed CCI module is then developed into a learning media validated by several experts, including subject matter experts, media experts, and language experts. Product validation by experts using a Likert scale-based questionnaire (Kishore et al., 2021) which was then analyzed using the Gregory matrix (Retnawati, 2016). The Gregory validity test was used because it involved several experts in the fields of materials, media, and language to assess the validity of the developed learning media (Wibisana et al., 2022). The validation process aims to assess the feasibility and characteristics of the developed media. The validation results indicate that the subject matter expert rated the CCI module with a score of 1 (highly valid) which indicates that the material in the CCI module is in accordance with the learning material, namely environmental issues material, the media expert gave a score of 0.94 (highly valid) which indicates that the CCI module media helps students to carry out investigative learning activities, and the language expert assigned a score of 1 (highly valid) which indicates that the language used in the CCI module is in accordance with the KBBI language rules, making it easier for students to understand each material. The validation results of the learning media are presented in Table 2. Based on the feasibility analysis, the CCI module meets the criteria of being highly valid. Furthermore, student and teacher responses were highly positive after using the CCI module.

**Table 2.** Learning Media Validation Results

| Validator | Score | Category |
|---|---|---|
| Subject Matter Expert | 1 | Very Valid |
| Media Expert | 0,94 | Very Valid |
| Linguist | 1 | Very Valid |

After the CCI module product is declared valid by experts, the next stage is that the CCI module will be tested on students to get suggestions and input. Researchers conducted a small-scale trial in class 9 with 10 students taken from 2 students per class (A to E). 10 respondents carried out learning activities using the CCI module. Furthermore, after using the CCI module, students were asked to fill out a questionnaire response sheet for the CCI module.

**Table 3.** Small Scale Student Response Questionnaire Results

| No | Aspect | Percentage | Criteria |
|---|---|---|---|
| 1. | CCI Module View | 85,00% | Very Good |
| 2. | Language | 79,17% | Good |
| 3. | Presentation of Material | 79,00% | Good |
| 4. | Sustainability Literacy | 83% | Very Good |
| 5. | Global Diversity | 85,63% | Very Good |
| | Total | 82,36% | Very Good |

The results of the small-scale trial in Table 3 can be concluded from the results of the questionnaire that the CCI module learning media that has been developed for environmental issues material is considered very good by students with an overall percentage of 82.36%. The percentage indicates that the CCI module that has been developed is included in the very good category and is worthy of being implemented to students on a large scale. In addition, there are several suggestions and input from students such as a summary that is made more concise and there are still several letters that clash with the background and there are still errors/excess letters.

The fourth stage is implementation. The implementation phase involves testing student and teacher responses to evaluate the feasibility of the CCI module. The response test assessed the feasibility of the CCI module covering environmental issues by distributing response questionnaires to 32 ninth-grade students and 4 science teachers.The student response questionnaire results are presented in Table 4.

**Table 4.** Student Response Questionnaire Results

| No. | Aspect | Percentage | Criteria |
|---|---|---|---|
| 1. | CCI Module View | 86,52% | Very Good |
| 2. | Language | 82,81% | Very Good |
| 3. | Presentation of Material | 82,34% | Very Good |
| 4. | Sustainability Literacy | 84,69% | Very Good |
| 5. | Global Diversity | 86,91% | Very Good |
| | Total | 84,65% | Very Good |

Based on Table 4, it can be concluded from the questionnaire results that the CCI module, developed for environmental issue topics, was rated as very good by students, with a percentage score of 84.65%. This percentage was obtained through data analysis of the practicality questionnaire completed by students. The results of the teacher response questionnaire can be seen in Table 5.

**Table 5.** Teacher Response Questionnaire Results

| No. | Respondent | Score | Criteria |
|---|---|---|---|
| 1. | Teacher 1 | 87,92% | Very Good |
| 2. | Teacher 2 | 85,28% | Very Good |
| 3. | Teacher 3 | 90,00% | Very Good |
| 4. | Teacher 4 | 85,53% | Very Good |
| | Total | 87,18% | Very Good |

In Table 5, the questionnaire results indicate that the CCI module, developed for environmental issue topics, was rated very good by teachers, with a percentage score of 87.18%. This percentage was obtained through data analysis of the practicality questionnaire completed by four science teachers.

Based on the results of student responses, it shows that the CCI module attracts students' interest in using it (Khotimah et al., 2019). Then the CCI module language aspect produces student response assessments with good criteria in each indicator. Based on this assessment, the CCI module has a language that is easy for students to understand so that understanding the material is very easy and the sentences in the CCI module are very simple (Mardiani & Noerhodijah, 2015). The CCI module presents structured material so that students find it easy to understand, provides clear examples of environmental issues to help students understand, presents material related to environmental issues that are relevant to everyday life, and presents questions and activities that directly involve environmental issues. The CCI module encourages students to assess the various impacts of environmentally friendly technologies and human actions on environmental safety and makes students understand the various causes and impacts of excessive climate change on the environment. The use of the CCI module also encourages students to take real action in saving the environment and

showing initiative such as taking action to protect the environment in reducing carbon emissions. In addition, the CCI module encourages students to be sensitive to the impacts of environmental damage caused by global warming (Warliyah et al., 2023). The existence of the CCI module makes students understand the different environmental impacts in each area affected by environmental issues, helps students to increase their appreciation for the importance of the role of biodiversity in the environment, makes students actively participate in group discussions, encourages students to explore perspectives between other groups, makes students actively listen to the opinions of fellow group members, makes students respect differences of opinion between groups, encourages students to give opinions according to the problems, makes students dare to express their opinions in groups to find solutions to environmental issues, encourages students to be open to fellow groups, and encourages students to build positive relationships and collaborations between groups (Widhiyanto et al., 2024).

Based on the feasibility validation results from experts and the responses from students and teachers, the CCI module has several key characteristics. It has clear learning objectives, presents illustrations and examples related to the material for easy comprehension, includes practice exercises, uses communicative and straightforward language, provides summaries for each sub-topic, and offers a method for students to assess their mastery of the material independently. These characteristics align with the self-instructional nature of a module, meaning it facilitates independent learning without relying on others (Sirate & Ramadhana, 2017). The CCI module contains one learning chapter on environmental issues for 9th-grade students, consisting of four subtopics: environmental health in Indonesia, global warming, energy crises, and food availability. The material is comprehensively structured as a unified whole, allowing students to understand the subject matter thoroughly. This approach enables students to engage in independent learning, aligning with the self-contained nature of the module (Khoirunnisa et al., 2020).

Additionally, the CCI module does not require supplementary teaching materials, as it already contains comprehensive content that students can study independently. This aligns with the principle that a learning module should be self-sufficient, not reliant on other instructional resources, and usable without additional supporting tools, embodying the stand-alone characteristic (Wulansari et al., 2018). The module is also adaptive, meaning it aligns with technological advancements and can be accessed anytime, anywhere, on various hardware devices. Additionally, the module is user-friendly, featuring clear instructions that assist students in navigating the content. This aligns with the module's structure, where the introduction includes simple, easy-to-understand usage guidelines with commonly used terms, ensuring students can utilize it effectively (Hananingsih & Imran, 2020).

The final stage of this development process is the evaluation phase. After conducting analysis, designing, developing, and implementing the CCI module, the next step is to evaluate its effectiveness. The evaluation phase involved a small-scale trial with 10 students and a limited trial involving 32 students and four science teachers. In the small-scale student trial, feedback was collected, indicating that the CCI module was highly effective and supportive of the learning process. However, some suggestions were provided, such as making the summaries more concise and correcting text misalignments with the background and minor spelling errors. These suggestions were considered for revisions before proceeding with the limited trial. During the implementation phase, teacher feedback was positive, stating that the CCI module was relevant to students' understanding, easy to comprehend, and well-aligned with the environmental issues curriculum.

This study contributes to the development of innovative learning modules based on climate change investigations that can improve literacy desires and strengthen the values of global diversity of junior high school students. The limitation in the CCI module development process is that it only reaches the implementation stage by conducting student and teacher response tests after learning

on the developed media, so that it has not achieved the effectiveness of the learning media. This learning module can be used independently by students or in teaching and learning activities with teacher guidance to strengthen students' understanding of environmental issues and for further researchers it is hoped that they can develop more learning modules by adding investigative activities to make them more interesting, interactive, and innovative.

## Discussion

The development of the Climate Change Investigation (CCI) module through the ADDIE model demonstrated a significant contribution to enhancing students' sustainability literacy and appreciation of global diversity. The analysis stage revealed that conventional learning approaches still dominated classroom instruction, while students expressed high interest in interactive and investigative learning methods. This finding aligns with Puspita and Dewi (2021), who emphasized the effectiveness of investigative learning in engaging students in critical thinking and environmental awareness.

The validation results from subject matter, media, and language experts confirmed that the CCI module meets the criteria of high validity. This aligns with previous findings by Wibisana et al. (2022), which highlight that well-structured instructional modules can serve as efficient tools to promote conceptual understanding in science education. Moreover, student and teacher responses from both small-scale and limited trials indicated positive acceptance of the module in terms of content clarity, interactivity, and relevance to students' real-world context.

Students' increased ability to analyze environmental issues, evaluate the role of biodiversity, and engage in collaborative problem-solving reflects the module's strength in addressing both cognitive and affective domains. These findings also reinforce the argument by Warliyah et al. (2023) that sustainability education must go beyond theoretical instruction and immerse students in meaningful, action-oriented learning experiences. The module effectively promotes student-centered learning by providing space for self-reflection, investigation, and social interaction, which are key components of 21st-century education.

## Implications

The development and implementation of the CCI module offer meaningful implications for science education, particularly in integrating climate change and global citizenship into classroom practices. For educators, the module provides an innovative and structured alternative to conventional resources, helping them foster student engagement through real-world investigations and digital media.

For curriculum developers and policymakers, the success of the module indicates the importance of embedding sustainability literacy and global diversity into instructional designs aligned with the Pancasila Student Profile. Moreover, the use of accessible platforms such as Canva for module development showcases the potential of low-cost digital tools to support educational innovation and promote low-carbon learning environments.

## Limitations

Despite the positive outcomes, this study has several limitations. First, the research was limited to a single junior high school in Surakarta, thus restricting the generalizability of the findings to other educational settings. Second, the study focused only on the module's feasibility and did not measure its long-term effectiveness or impact on students' environmental behavior over time.

Additionally, the absence of a control group limits the ability to compare the CCI module's impact with other instructional methods. External factors such as school digital readiness, teacher experience, and institutional support, which may influence implementation success, were not controlled in this study.

**Suggestions**

Future research should explore the effectiveness of the CCI module across various regions and educational levels, including its influence on students' long-term attitudes and actions regarding sustainability. Implementing a quasi-experimental design or longitudinal approach is recommended to assess the module's impact more rigorously.

Further development of the module may include the integration of multimedia, augmented reality, or gamified elements to enhance student engagement and interactivity. It is also important to investigate how teachers adapt the module in diverse classroom contexts and how their pedagogical skills evolve when using sustainability-based instructional tools.

Lastly, collaborative efforts among schools, local governments, and teacher training institutions are needed to support the broader adoption of innovative modules like CCI, ensuring that sustainability literacy becomes an integral part of science education nationwide.

## CONCLUSION

The development of the CCI module is adjusted to the needs of students and teachers for the learning process in order to provide investigative activities, empower sustainability literacy, and students' global diversity in environmental issues material. The CCI module enables students to understand various causes and impacts of failing to protect the environment, which affects environmental safety. It also encourages students to assess the effects of environmentally friendly technology and human actions on environmental protection, helps them understand the excessive causes and impacts of climate change on the environment, and allows them to recognize that environmental impacts vary across different regions affected by environmental issues. Additionally, it fosters students' appreciation of the importance of biodiversity in environmental sustainability and encourages their active participation in group discussions. The CCI module on environmental issues includes student competency assessments through exercises based on sustainability literacy indicators and investigative activities developed according to global diversity indicators.

The CCI module is an interesting learning tool for students in empowering sustainability literacy and global diversity of students regarding the concept of environmental issues. In addition, the CCI module provides benefits for teachers in increasing insight in the use of interactive, creative learning media and increasing teacher knowledge related to low carbon education and training sustainability literacy and global diversity to students.

## AUTHOR CONTRIBUTIONS STATEMENT

MNH designed the research framework and coordinated the module development process. CEB conducted the literature review and contributed to the formulation of sustainability literacy indicators. KDHG was responsible for data collection, implementation of the module in the field, and preliminary analysis. NYI jointly analyzed the data and interpreted the findings. MNH, RMP and CEB drafted the manuscript, and LM provided critical revisions. All authors reviewed and approved the final manuscript.

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