



## Teacher Needs Analysis as a Basis for Developing CPS-EIS Based E-Module in Environmental Change Learning

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### ABSTRACT

The global environmental crisis positions the education sector as a strategic actor in mitigation and adaptation efforts. This study analyzes biology teacher needs to establish a foundation for developing an e-module based on the Collaborative Problem Solving Environmental Issue-Based Socio-Scientific Issues (CPS-EIS) framework. Through a descriptive research design, data were obtained from practitioners using a validated five-level Likert scale instrument. Evidence indicates a high priority for digital media that integrates authentic environmental cases and guides systematic collaborative thinking processes over simple information delivery. The integration of the CPS-EIS model offers a novel solution by aligning collaborative group work with the analysis of controversial socio-scientific issues to address the disparity between curriculum objectives and field realities. These results serve as the primary guideline for the instructional design of adaptive tools intended to improve environmental literacy and student collaboration in high school settings.

## 1. Introduction

The development of global environmental issues shows an increasingly complex and multidimensional trend. The current global environmental crisis, ranging from extreme climate change to biodiversity degradation, has positioned the education sector as a strategic actor in mitigation and adaptation efforts. Environmental changes are an important topic in science education because they are closely related to increasingly complex global issues, such as environmental pollution, climate change, ecosystem degradation, and unsustainable natural resource exploitation. This phenomenon shows that the relationship between human behavior and nature can have a significant impact on ecosystem stability (Fitriandhini & Putra, 2022).

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In this context, Education for Sustainable Development (ESD) emphasizes that environmental learning should not only focus on theoretical understanding, but also equip students with problem-solving and critical thinking skills (UNESCO, 2021; Ariadila, 2023).

In Indonesia, the urgency of strengthening sustainability literacy thru biology materials has become a priority to achieve the Sustainable Development Goals (SDGs), especially in the areas of quality education and climate action (Radha & Arumugam, 2023). The topic of Environmental Change is a very strategic subject for contextualizing global issues because it is directly related to daily human activities (Azaly, 2022). The shift in educational approaches in the 21st century now places greater emphasis on mastering non-technical skills, one of which is collaborative problem solving (CPS). The ability to collaborate in teams to solve problems has become very important, especially in facing complex environmental issues that involve various sectors (OECD, 2023). However, the implementation of Collaborative Problem Solving (CPS) in learning still faces various obstacles, primarily due to the continued reliance on conventional learning media. To address these limitations, the digital transformation in education has fostered the use of e-modules as an innovative alternative to enhance both the quality and interactivity of the learning process (Dipuja & Wahyuni, 2025).

Research conducted by Thaib (2026), shows that learning in Indonesia is still dominated by the lecture method, resulting in suboptimal interaction and cooperation among students. Additionally, the ability to solve problems collaboratively also receives less attention, as the learning instruments used are more focused on assessing individual abilities rather than teamwork (Lucas, 2022). The integration of socio-scientific issues in the environmental context, known as Environmental Issue-Based Socio-Scientific Issues (EIS), is a learning approach that places students in authentic problem situations involving the analysis of scientific evidence and ethical considerations. Through this approach, students are encouraged to develop scientific argumentation skills and critical thinking abilities more deeply (Tian et al., 2025). Although the EIS (Environmental Issue-Based Socio-Scientific Issues) approach has significant potential in enhancing environmental awareness and literacy, the availability of teaching materials that systematically integrate the Collaborative Problem Solving Environmental Issue-Based Socio-Scientific Issues (CPS-EIS) framework is still relatively limited. In practice, educators often face difficulties in accessing or developing learning resources that can accommodate the integration of scientific dimensions and the social, economic, and political complexities inherent in environmental issues (Kumar et al., 2024). This condition results in low active participation of students in the discussion and decision-making processes related to environmental problem-solving in their surroundings.

On the other hand, digital transformation in the field of education has encouraged the use of e-modules as an innovative alternative to enhance the quality and interactivity of learning. E-modules allow the integration of various multimedia elements that can represent environmental change phenomena in a more visual, contextual, and dynamic manner (Neyarasmı & Mardatillah, 2025). However, the

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development of such digital media is often not based on a comprehensive needs analysis from the perspective of educational practitioners, which potentially reduces its relevance and effectiveness in supporting the learning process (Lysander & Setiawan, 2025). The effectiveness of an electronic module highly depends on the alignment of its content with student characteristics and the ease of use for teachers (Qomariyah & Setiawan, 2022). Without a comprehensive needs analysis, the developed technological innovations risk not being used optimally in the classroom (Tjahyanti & Utama, 2024). Currently, the literature on the development of biology e-modules is widely available, but there is a significant gap that becomes the state of the art in this research. Most previous research has focused more on the development of electronic modules to enhance independent concept understanding thru project-based learning or inquiry models (Mutia et al., 2025). Some other studies have begun to integrate SSI into learning, but few have explicitly combined it with a structured CPS framework for specific environmental issues. The main difference of this research from previous works lies in the use of the CPS-EIS framework, which is designed to build synchronization between collaborative group work and the analysis of controversial environmental socio-scientific issues. In addition, this research positions teachers as the main subjects in determining the parameters for module development to ensure the sustainability of its implementation in schools.

The gap in the field shows that many biology teachers understand the importance of environmental issues, but find it difficult to design systematic collaborative learning scenarios (Fodouop, 2025). This is also influenced by the lack of digital teaching tools that can facilitate group discussions online or offline within the framework of EIS issues. The development of instruments and learning media must be rooted in real problems faced in the classroom to have a significant impact on students' science literacy (Nugroho et al., 2025). Therefore, conducting a teacher needs analysis is essential to bridge the gap between curriculum demands and classroom instructional practices. Overall, this article aims to analyze teachers' needs as the basis for developing CPS-EIS based e-modules on Environmental Change material. It is expected that the results of this analysis can provide a comprehensive overview of the module specifications needed, ranging from content novelty to user-friendly technology functionality. Success in mapping these needs will serve as the foundation for the development of learning media that is not only innovative but also has a high level of acceptability among education practitioners. Thru this approach, the research is expected to contribute to the improvement of biology education quality that is oriented toward collaboratively solving global environmental problems.

## **2. Methodology**

### ***Research Design***

This study employed a descriptive research design with the primary objective of analyzing teachers' needs as the basis for developing a Collaborative Problem Solving Environmental Issue-Based Socio-Scientific Issues (CPS-EIS) based e-

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module in environmental change learning. The descriptive approach was selected because the study did not aim to test the effectiveness of a product or compare experimental treatments, but rather to obtain a comprehensive and factual description of teachers' needs in classroom learning. Through this approach, the study sought to generate detailed information regarding instructional challenges, learning media requirements, and teachers expectations toward innovative digital learning resources. The results of this needs analysis were intended to serve as the foundation for designing a contextual, adaptive, and relevant CPS-EIS based e-module.

### ***Subjects***

The subjects of this study consisted of biology teachers from several senior high schools who teach environmental change materials. Respondents were selected purposively based on their teaching experience, involvement in environmental education, and familiarity with digital learning implementation. Biology teachers were chosen as the main subjects because they are the primary users of the developed e-module and directly understand classroom learning conditions related to environmental change topics.

### ***Instruments***

The main instrument used in this research was a teacher needs analysis questionnaire developed systematically based on theoretical studies related to environmental education, Collaborative Problem Solving (CPS), Environmental Issue-Based Socio-Scientific Issues (EIS), and digital learning media characteristics. The questionnaire consisted of closed-ended statements using a five-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree." The aspects of instrument validation are presented in Table 1.

Table 1. Assessment Aspects and Expert Validation Indicators

No	Validation Aspects	Indicators
<b>A. Content Validity</b>		
1	Conformity with research objectives	The questionnaire items align with the objectives of the needs analysis for developing a CPS-EIS e-module for environmental change.
2	Conformity of indicators with constructs	The indicators reflect aspects of CPS (problem solving, collaboration), EIS (real-life environmental issues), and critical thinking.
3	Representation of needs aspects	The items cover teacher and student needs (material understanding, media, collaboration, problem-solving, multimedia, critical evaluation).
4	Relevance of the material context	The statements align with the context of environmental change learning.
<b>B. Instrument Construction</b>		
5	Clarity of filling instructions	The questionnaire instructions are clear and easy to understand.
6	Suitability of statement format	The statements are structured as closed-ended sentences using a Likert scale.

7	Clarity of indicators to statements	Each indicator has a specific, non-overlapping statement.
8	Suitability to respondent characteristics	The statements are aligned with the characteristics of teachers and students.
<b>C. Language and Writing</b>		
9	Conformity to language rules	The language conforms to the rules of good and correct Indonesian.
10	Clarity of meaning	Statements are not open to multiple interpretations.
11	Simplicity of language	The language used is simple and easy to understand.
<b>D. Compliance with the CPS-EIS Model</b>		
12	CPS Representation	The instrument covers aspects of problem solving, problem-solving steps, and collaboration.
13	Measurement of critical thinking	The instrument covers the need for critical thinking practice and evaluation.

The questionnaire was designed to identify teachers' needs in environmental change learning. This instrument covered various aspects, such as the use of teaching materials, difficulties in explaining environmental change concepts, the need to integrate real-world environmental issues, and the implementation of Collaborative Problem Solving (CPS) based learning. Furthermore, the questionnaire explored teachers' perceptions of the use of digital e-modules, the availability of technological resources in schools, and the need for interactive and innovative learning media. The low level of critical thinking skills necessitates that teachers be capable of providing innovative learning activities and digital teaching materials (Rosiana et al., 2023). Indicators or aspects of teacher needs are presented in Table 2 below.

Table 2. Indicators or aspects of teacher needs

No	Aspects Analyzed
1	Use of conventional teaching materials (printed textbooks/worksheets)
2	Difficulty in explaining the concept of environmental change
3	Need for contextual learning based on environmental issues
4	Implementation of Collaborative Problem Solving (CPS) in learning
5	Difficulty in developing learning media independently
6	Need for digital and interactive e-modules
7	Availability of digital facilities and infrastructure in schools
8	Need for user-friendly media
9	Teachers' interest in CPS-EIS-based e-modules
10	Perceptions of the effectiveness and efficiency of digital learning media

### **Data Collection**

Data collection was conducted using an online questionnaire distributed through digital forms to facilitate accessibility and efficiency. The use of digital forms enabled respondents from different schools to participate more easily and ensured systematic data recording. Quantitative data were obtained from respondents' Likert-scale responses, while qualitative information was collected from teachers' additional comments and suggestions regarding environmental change learning and digital media needs.

### **Data Analysis**

All questionnaire items were closed-ended questions structured based on teacher needs indicators for the development of the CPS-EIS e-module. The data analysis technique used was quantitative descriptive analysis, which assigned a score to each respondent's answer according to the Likert scale. Next, the average score for each aspect was calculated to determine the priority level of needs in the development of the CPS-EIS based e-module. According to Sugiyono (2022), the criteria for interpreting the average Likert scale score are presented in Table 3 below.

Table 3. Average Score Interpretation Criteria

Average Score Range	Criteria	Description
4.21-5.00	Strongly Agree	The majority of respondents indicated very high needs.
3.41-4.20	Agree	The majority of respondents indicated high needs.
2.61-3.40	Neutral	Respondents tended to be neutral or had moderate needs.
1.81-2.60	Disagree	The majority of respondents indicated low needs.
1.00-1.80	Strongly Disagree	The majority of respondents indicated very low needs.

These criteria were used as a reference to determine the level of teacher needs for each aspect analyzed. Through, the researchers were able to systematically identify priority needs as a basis for developing CPS-EIS-based e-modules for environmental change learning. The analysis results were then presented descriptively to provide a clear picture of teacher needs and support the development of relevant and effective learning media. These aspects had an average score above 4.21. It indicated that the majority of respondents indicated very high needs. This finding indicated that e-module development should not simply focus on presenting material but must be designed as a learning tool capable of presenting authentic problems while facilitating higher-order thinking processes (Setyarini et al., 2023). In other words, e-modules need to function as learning environments, not simply sources of information. Meanwhile, the aspects, such as interactive multimedia, group discussions, and teacher understanding of CPS, were categorized as priorities. It indicated high but less urgent needs than other aspects. This suggests that although infrastructure and basic understanding are adequate, their optimal use still requires the support of structured learning media.

### **3. Results and Discussion**

The results of the biology teachers' needs analysis confirm that the development of e-modules based on Collaborative Problem Solving Environmental Issue Based Socio Scientific Issues (CPS-EIS) is a primary urgency in environmental change education. The data in Table 4 shows that all analyzed aspects fall within the "Agree" to "Strongly Agree" categories, indicating a significant gap between the ideal learning conditions and the reality in the classroom. This finding also reflects

the indicators of teacher needs presented in Table 2, particularly regarding the need for CPS implementation, contextual environmental issues, multimedia integration, readiness for digital learning, and the development of critical thinking skills.

Table 4. Results of the Teacher Needs Analysis Based on Average Scores

Aspects Analyzed	Mean	Category	Descriptions
Students' difficulty understanding concepts	3.60	Agree	The majority of respondents indicated a high need
Limited learning resources on environmental issues	3.70	Agree	The majority of respondents indicated a high need
Group discussion-based learning	3.90	Agree	The majority of respondents indicated a high need
Structured problem-solving exercises	4.10	Agree	The majority of respondents indicated a high need
Providing real-world environmental cases	4.80	Strongly Agree	The majority of respondents indicated a very high need
Facilitating Collaborative Problem Solving (CPS)	4.40	Strongly Agree	The majority of respondents indicated a very high need
Systematic problem-solving steps	4.30	Strongly Agree	The majority of respondents indicated a very high need
Multimedia needs (video, graphics, images)	4.20	Agree	The majority of respondents indicated a high need
Critical thinking questions	4.30	Strongly Agree	The majority of respondents indicated a very high need
Teacher understanding of CPS	3.80	Agree	The majority of respondents indicated a high need
Readiness for implementing the CPS-EIS e-module	4.50	Strongly Agree	The majority of respondents indicated a very high need

Research findings indicate that students' difficulties in understanding the concept of environmental change stem from the reliance on conventional teaching materials that are descriptive and decontextualized. This condition is closely related to Indicator 1 in Table 2 regarding the continued use of printed textbooks and worksheets, which tend to emphasize memorization rather than conceptual understanding. Although teachers are aware of these obstacles, time constraints and the availability of learning resources often force the simplification of materials, sacrificing conceptual depth. The score on this aspect also supports Indicator 2, which highlights the need for learning media capable of explaining environmental change concepts in a more interactive and meaningful way. In this context, the high demand for real-world environmental cases emphasizes that the Socio-Scientific Issues (SSI) approach is not merely an additional material, but rather a pedagogical anchor. The very high score for providing real-world environmental cases ( $M=4.80$ ) strongly corresponds to Indicator 3 in Table 2 concerning the need for contextual issue-based learning. The EIS approach in this e-module serves to bridge abstract theory with controversial realities such as the dilemma between economic development and biodiversity conservation. By integrating environmental issues that are alive in society, learning transforms from mere fact transfer into a process of analyzing scientific evidence that intersects with ethical and social implications. Student engagement with real-world issues significantly enhances conceptual retention compared to textual learning (Amiro, 2023). This approach forces students to engage with scientific evidence while considering ethical and social implications,

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thereby addressing the lack of contextual teaching tools identified in recent studies (Hatibu & Pada, 2025).

Further analysis reveals an interesting phenomenon, although group discussion activities have been commonly conducted, they have not positively correlated with students problem-solving abilities. The low effectiveness of this discussion indicates that classroom interactions tend to be merely procedural or task completion without deep cognitive engagement. This finding aligns with Indicator 4 regarding the implementation of Collaborative Problem Solving (CPS) in learning. The Collaborative Problem Solving (CPS) framework embedded in the e-module serves as a structured solution to address the dysfunction of collaboration. Unlike free discussions, CPS provides synchronization stages starting from a shared understanding of the problem, collective reasoning, to solution reflection. Through these systematic steps, the role of the teacher transforms from the primary source of information to a facilitator of higher-order thinking. This e-module ensures that every interaction among students is directed toward building scientific consensus in solving complex environmental problems (Bogaart & Ginkel, 2026). Unlike procedural task completion, CPS synchronization ensures that students interact cognitively to solve complex problems. By embedding systematic steps within the e-module, the teacher's role shifts from a primary information source to a facilitator of higher-order thinking, aligning with the necessity for media that guides thinking processes rather than just presenting material (Huda et al., 2026).

One of the crucial findings is the discrepancy between teachers theoretical understanding of the CPS model and their readiness to implement it. Teachers show much higher enthusiasm for adopting e-modules than their self-mastery level of the CPS syntax. This reflects the reality of teachers' high workload, where innovation is often hindered by the limited time to independently create media. This condition explains why the teacher understanding of CPS indicator obtained a lower score ( $M= 3.80$ ) compared with the readiness for implementing the CPS-EIS e-module ( $M= 4.50$ ). Therefore, the CPS-EIS e-module is positioned as a practical instrument that translates complex pedagogical theories into ready to use classroom applications. The availability of multimedia features such as videos and interactive graphics not only serves as visual appeal but also as tools to visualize the dynamic processes of environmental change that are difficult to explain thru text alone. This finding is closely connected to Indicators 5-7 in Table 2 concerning the need for digital interactive e-modules, adequate technological facilities, and user-friendly learning media. The readiness of technological infrastructure in schools, which is already adequate, should be optimized with intuitive and user-friendly media, so that technical barriers no longer become an obstacle in the adoption of digital learning innovations (Zahro et al., 2024)

The integration of Collaborative Problem Solving (CPS) and Environmental Issue-Based Socio-Scientific Issues (EIS) provides a robust theoretical and pedagogical argument. This approach addresses the need for real-world context while providing the collaborative structure necessary for students to navigate the complexity of these issues. This synergy is considered crucial in enhancing the quality of learning as well as developing students' critical and collaborative skills to face global

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environmental challenges. Referring to the indicator regarding teachers' interest in CPS-EIS based e-modules, the readiness level categorized as very high reflects a great enthusiasm for adopting innovative learning approaches. This finding corresponds to Indicators 8-10 in Table 2 related to teachers' readiness, interest, and perceptions toward the effectiveness of digital learning media. This interest is likely influenced by the increasing awareness of the urgency of developing students critical thinking and collaboration skills. This is further supported by the assessment of critical thinking questions and systematic problem solving steps, which show a very high category. The high score on critical thinking questions indicates that teachers perceive higher-order thinking skills as an essential component in environmental change learning. These findings underscore the importance of facilitating higher order thinking skills in every learning activity. The results of this study align with the views of experts who state that effective learning design must be able to stimulate engagement, conceptual understanding, and thinking skills through interactive and contextual approaches. Meanwhile, the aspects of multimedia use and group discussions fall into the priority category. The condition indicates that although both elements have started to be implemented in classroom practice, their optimization still requires further attention to better support the learning process.

From a theoretical perspective, the integration of the CPS approach with the EIS context reinforces the principles of constructivism, in which knowledge is constructed through students' active engagement in solving problems relevant to real-life situations. The incorporation of environmental issues as a learning context not only enhances the meaningfulness of learning but also encourages students to develop higher order thinking skills, such as analysis, evaluation, and creation. Thus, this model is not solely oriented toward content mastery, but also toward the development of essential 21st-century competencies. From a pedagogical perspective, the findings indicating high scores in critical thinking and systematic problem-solving steps suggest that structured and collaborative learning can improve the quality of the learning process. This finding indicates that learning which involves active student participation through discussion, problem solving, and contextual activities can significantly improve critical thinking skills and support the development of 21st-century competencies (Yudistira et al., 2025). Therefore, the CPS-EIS based e-module can be positioned as a comprehensive and targeted solution that addresses the gaps identified across all indicators. By integrating contextual environmental issues, structured collaborative problem-solving processes, and interactive multimedia features, the e-module is expected to improve conceptual understanding, enhance critical and collaborative skills, and ultimately improve the quality of environmental change learning (Pertwi et al., 2025).

#### **4. Conclusion**

This study successfully mapped the specific needs of biology teachers as a foundational basis for developing a Collaborative Problem Solving Environmental Issue-Based Socio-Scientific Issues (CPS-EIS) e-module in environmental change learning. The findings confirmed that teachers require digital learning media that

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integrate contextual environmental issues, structured collaborative problem-solving processes, interactive multimedia, and activities that support critical thinking skills. The study also demonstrated a high level of teacher readiness toward the implementation of CPS-EIS based digital learning innovations.

The contribution of this research lies in providing empirical evidence and clear instructional directions for the development of CPS-EIS e-modules that are aligned with classroom needs and 21st-century learning demands. The identified needs analysis results serve as an important reference for designing learning media that are not only technologically appropriate but also pedagogically relevant to support meaningful, collaborative, and contextual biology learning. Therefore, this study contributes both theoretically and practically to the development of innovative environmental learning media. Further research is recommended to evaluate the validity, practicality, and effectiveness of the developed e-module in improving students' environmental literacy, critical thinking, and collaborative problem-solving skills.

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