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The Effectiveness of the *Case Method* Module in Improving the 21st Century Students' Ability to Manage Disasters

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A B S T R A C T

Indonesia is a disaster-prone country that requires people to have disaster management skills. Disaster education is carried out through learning Environmental Science and Disaster Mitigation using case method-based modules. The purpose of the research is to evaluate the effectiveness of case-based modules in improving students' 21st century abilities including critical thinking, communication, collaboration, and creativity. This study used a pre-experimental design using a single-shot case study approach, which was conducted in two experimental classes without a control group. Data were collected using structured observation sheets based on standardized 4C skill indicators. The results of the study showed that the use of case-based modules improved students' 4C skills, including critical thinking, with an average score of 84.27 (class A) and 84 (class B) categorized as competent. Student communication class has an average score of 85.20 and class B 82.87 is categorized as competent. The collaboration of students is categorized as very competent with a grade A score of 85.67 and class B of 83.4. Students' creative abilities are categorized as competent in class A with an average of 85.13 and categorized as very competent in class B with an average of 83.27. Overall, the application of disaster management learning modules with case study methods is effective in improving students' 21st century competencies, especially in critical thinking, communication, collaboration, and creativity (4C).

1. Introduction

Indonesia is geographically and geologically located within the "ring of fire and the equator; as well as the confluence of 3 Pacific, Eurasian and Indo-Australian tectonic plates, resulting in Indonesia being vulnerable to natural disasters. One of the efforts in dealing with disaster risk is the need for an understanding of disaster management. Education plays a crucial role in shaping students' awareness and understanding of disaster management. Disaster management education is part of the education unit by integrating learning with problems in the surrounding environment into learning materials (Rahmat et al., 2024). Students who are not

given education about disaster management are less prepared to deal with disasters (Ayu & Ratriwardhani, 2021).

The University of Riau presents disaster management learning in mandatory courses, namely Environmental Science and Disaster Mitigation (ILMB). The lack of evaluation of learning methods and media makes learning related to disaster management less optimal. The lecture method is the main method used in lectures. This method is still not appropriate to be used in disaster management materials that require in-depth analysis. Learning using the case method allows students to analyze cases, collaborate, and design solutions (Andayani et al., 2021).

The case method is a participatory discussion-based learning method to solve a problem case. Widiastuti et al., (2022) revealed that the case method is an alternative method of learning activities with a case study implementation pattern from real problems that can be applied to lecture materials. The application of this case method emphasizes the selection of teaching materials that have cases that can be solved(Rosidah & Pramulia, 2021). The use of the case method is expected to be able to reduce the gap between theory and practice and provide a complex and contextual learning experience. Students not only memorize the content but can also know, as well as understand the meaning of the relationship between the material taught and real-world situations (Andayani et al., 2021).

Case-based learning provides opportunities for students to develop their potential, innovate, and find solutions from the cases presented (Widiastuti et al., 2022). Students have basic skills in receiving information, analyzing information, and interpreting knowledge about disaster mitigation in their daily lives (Nurjanah & Mursalin, 2021). The learning method using cases has been proven to be able to improve learning outcomes (Nestiadi et al., 2024). The Case Method is able to improve students' 21st Century skills in the 4Cs (creativity, critical thinking, communication, and collaboration), and improve the quality of graduates (Andayani et al., 2021). The application of learning with this case method is able to hone critical thinking skills for case solving, students' ability to communicate, collaborate, and creativity (Fauzi et al., 2023). This method encourages students to be able to improve their 4C skills and connect them to natural disaster management.

4C skills are very important in the 21st century to produce students who are ready to face various complex challenges (Pramudita et al., 2021). The 4C skills in students can have a positive effect on disaster management in Indonesia. The ability to analyze, collaborate, communicate, and be creative trains individuals to have social skills and have a global perspective (Nurhayati et al., 2024).

Students with 4C skills will have critical thinking in solving problems in daily life creatively and innovatively, collaborating and communicating effectively and efficiently so as to minimize the occurrence of miscommunication (Triana et al., 2020). Students' understanding of disaster management is still categorized as low. Many students do not have preparedness in dealing with natural disasters(Pertiwi et al., 2021). According to (Nasution et al., 2025) students' low understanding of

disaster management is caused by a lack of training, limited resources, and limited learning resources.

Modules are one of the learning resources that have the potential to improve 21st century skills (Nesri & Kristanto, 2020). Modules can also motivate students to study the material independently (Awwaliyah et al., 2021). This modules can be an effective alternative learning resource for disaster management learning.

Preliminary studies show that the implementation of the case method model in learning can improve critical thinking skills because it develops problem-solving skills through case studies (Fauzi et al., 2023). The cases given through this model develop logical and critical thinking in case analysis so as to improve students' critical thinking skills (Muhammad Akbar Syafruddin, 2024). The integration of the case method model in the module has been widely developed and is feasible to be applied in learning (I Komang Winatha, Tedi Rusman, Suroto, Fanni Rahmawati, Hadi Wijoyo, Nur Fitriani, 2025; Suningsih & Zulaiha, 2025; Tri et al., 2024). The implementation of the case method model in the module is expected to improve students' 4C skills. However, no studies have been found that examine the effectiveness of modules that integrate case method models on 4C skills.

This study aims to evaluate the effectiveness of the case method module in improving students' 4C skills. This research is useful for educational institutions in designing a more relevant curriculum. Academically, this research can provide empirical evidence that case-based learning methods can develop students' critical thinking, creativity, communication, and collaboration skills, which are essential in understanding and overcoming disaster problems. The results of this research can be an important foundation in the development of disaster management education and 4C skills that are more effective and integrated.

2. Methodology

This research used a pre-experimental design with a one-shot case study approach to measure the effectiveness of a disaster management module using the case method. The research population is the entire environmental science and disaster mitigation class at the University of Riau. The sample was determined through purposive sampling with the criteria of 1) the class was taught by the same lecturer; 2) come from the same study program. The selected sample class was given a case method module, which combines contextual disaster case studies as well as collaborative activities aimed at strengthening students' critical thinking, creativity, communication, and collaboration skills, known as the 4C skills.

In this study, no control group was used. Students' 4C competencies are assessed using structured observation sheets based on performance indicators that have been validated for each skill. The data obtained from these observations were analyzed descriptively to determine the average score across all indicators in each skill domain. This methodology allows for evaluation of student performance as well as the effectiveness of modules in facilitating an in-depth and contextual learning

experience in disaster education through case methods. The 4Cs ability is measured using Observation sheets arranged based on critical thinking, creativity, collaboration, and communication skills. Observations using the likert scale as per Table 1.

Table 1. Skill Observation Scoring Criteria 4C

Alternative Answers	Score Weights
4	Excellent
3	Good
2	Not Good
1	Bad

The results of the observation were then percentaged and analyzed into four levels of competence, namely very competent, competent, less competent, and incompetent. The student skill categories are categorized according to Table 2 below.

Table 2. Categories of Student 4C Skills Assessment

Interval	Predicate	Category
86 – 100	A	Very Competent
81 – 85	B	Competent
76 – 80	C	Less Competent
≤ 75	D	Incompetent

Modified Purnawirawan (2019)

3. Result and Discussion

This case-method-based environmental management module contains the steps of student activities which include deepening the material/concept, presenting cases, forming groups, solving cases, presenting work results, discussions, and at the end there is an assessment of student competency tests in the form of cognitive questions. The design of the disaster management module is based on 4C and *Case method* chose blue as the main design. The module cover can be seen in Figure 1 below.

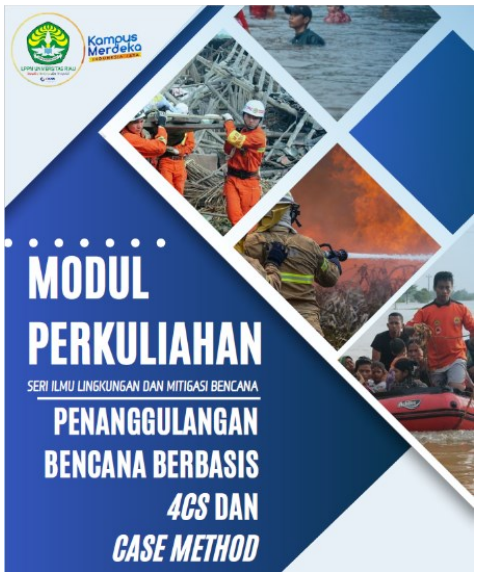
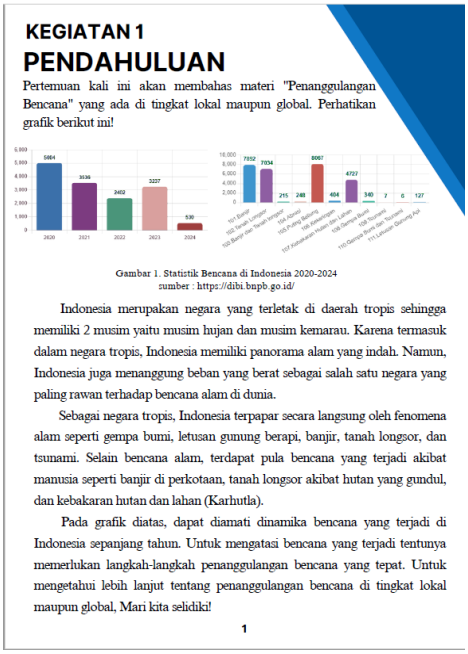


Figure 1. Module Cover Design

This module has a very important case presentation in the syntax of the case method because the case will be a stimulus for students to be able to think critically, give opinions, and find the best solution. This case consists of diagrams and case narratives that will be understood and analyzed by students. The following is a case drawing on the module.



KEGIATAN 1

PENDAHULUAN

Pertemuan kali ini akan membahas materi "Penanggulangan Bencana" yang ada di tingkat lokal maupun global. Perhatikan grafik berikut ini!

Gambar 1. Statistik Bencana di Indonesia 2020-2024
sumber : https://dibi.bnpb.go.id/

Indonesia merupakan negara yang terletak di daerah tropis sehingga memiliki 2 musim yaitu musim hujan dan musim kemarau. Karena termasuk dalam negara tropis, Indonesia memiliki panorama alam yang indah. Namun, Indonesia juga menanggung beban yang berat sebagai salah satu negara yang paling rawan terhadap bencana alam di dunia.

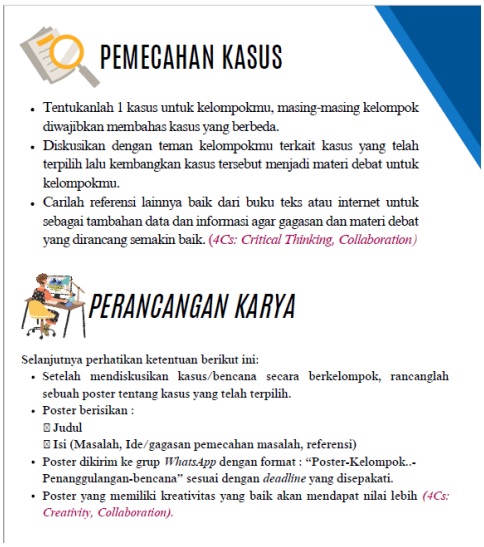
Sebagai negara tropis, Indonesia terpapar secara langsung oleh fenomena alam seperti gempa bumi, letusan gunung berapi, banjir, tanah longsor, dan tsunami. Selain bencana alam, terdapat pula bencana yang terjadi akibat manusia seperti banjir di perkotaan, tanah longsor akibat hutan yang gundul, dan kebakaran hutan dan lahan (Karhutla).

Pada grafik diatas, dapat diamati dinamika bencana yang terjadi di Indonesia sepanjang tahun. Untuk mengatasi bencana yang terjadi tentunya memerlukan langkah-langkah penanggulangan bencana yang tepat. Untuk mengetahui lebih lanjut tentang penanggulangan bencana di tingkat lokal maupun global, Mari kita selidiki!

1

Figure 2. Case Presentation on the Module

Furthermore, there are various activities that students can do to direct students in carrying out case study learning. This activity is carried out in groups so that collaboration between students in groups can increase. Through the stages of activities, there is also a process of exchanging ideas that require communication skills. The following is a picture of the activities in the environmental management module.



PEMECAHAN KASUS

- Tentukanlah 1 kasus untuk kelompokmu, masing-masing kelompok diwajibkan membahas kasus yang berbeda.
- Diskusikan dengan teman kelompokmu terkait kasus yang telah terpilih lalu kembangkan kasus tersebut menjadi materi debat untuk kelompokmu.
- Carilah referensi lainnya baik dari buku teks atau internet untuk sebagai tambahan data dan informasi agar gagasan dan materi debat yang dirancang semakin baik. *(4Cs: Critical Thinking, Collaboration)*

PERANCANGAN KARYA

Selanjutnya perhatikan ketentuan berikut ini:

- Setelah mendiskusikan kasus/bencana secara berkelompok, rancanglah sebuah poster tentang kasus yang telah terpilih.
- Poster berisikan :
  - ☑ Judul
  - ☑ Isi (Masalah, Ide/gagasan pemecahan masalah, referensi)
- Poster dikirim ke grup *WhatsApp* dengan format : "Poster-Kelompok..-Penanggulangan-bencana" sesuai dengan *deadline* yang disepakati.
- Poster yang memiliki kreativitas yang baik akan mendapat nilai lebih *(4Cs: Creativity, Collaboration)*.

Figure 3. Student Activities in the Module

The results of validation and practicality tests show that the modules developed are categorized as very valid and very practical (Dipuja & Wahyuni, 2025). Based on the trial use of modules carried out in two classes, it was obtained that there was an increase in students' 4C skills after using this module. The following is presented the results of the observation of students' 4C skills in using the case method environmental management module in Figure 4.

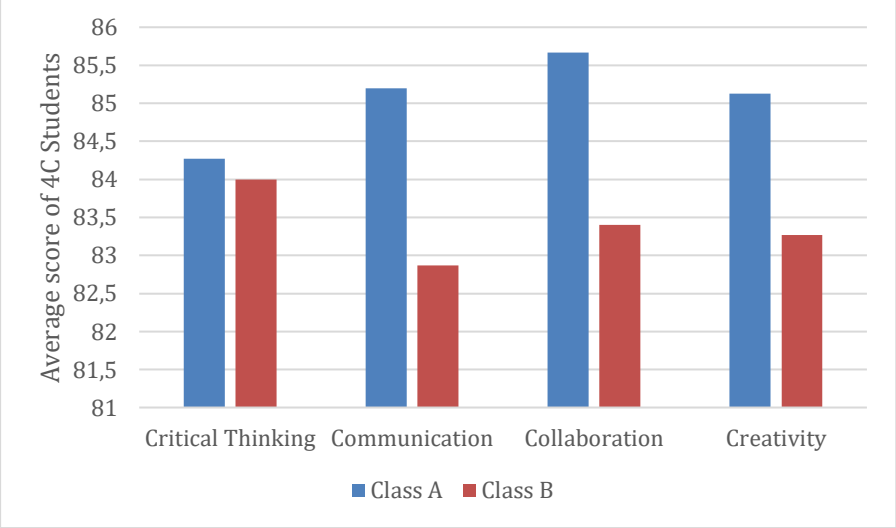


Figure 4. Average Student's 4C Ability

The 4C ability is an important *skill* that must be possessed by students in order to be able to compete in the challenges of the 21st century. These skills include *Critical thinking*, *Communication*, *Collaboration*, and *Creative*. The results of the limited trial conducted in both classes A and B show that students' 4C abilities are categorized as competent to very competent. The following is described in detail about each student's 4C ability.

Critical thinking

Critical thinking is the ability to think highly (HOTS) in looking at a problem from various perspectives, then conducting literature studies, analyzing data from various references, until a comprehensive conclusion is produced on the problem (O'Reilly et al., 2022). Critical thinking skills are essential in education that is oriented to process learning and *student-centered learning* (Bahr & Lioyd, 2010). The use of disaster management modules is a case study-based learning process that focuses on student learning. The results of experimental research through the use of disaster management modules on the indicators of students' critical thinking ability showed that overall students received an average score of 83.82 categorized as competent. In the module, there is an initial step in presenting cases about environmental problems that occur in Indonesia. Data and also narratives about problems are presented, then students are asked to independently find new cases from scientific sources and analyze the selected cases. The values on each indicator can be seen in Table 2.

Table 2. Students' Critical Thinking Skills

Yes	Critical Thinking Indicators	Class A	Class B	Average	Category
1	Consider the selection of issues that are relevant to factual learning	83	83.67	83.33	
2	Provide answers with simple explanations of the questions asked logically	82.00	84.33	83.17	
3	Reporting the results of systematic problem observation	84.67	84.33	84.50	**Competent**
4	Evaluate results based on facts	83.17	84.00	83.59	
5	Consider a solution to the problem	85.33	83.67	84.50	

This stage requires students in groups to find cases, then analyze the cases, then in groups provide perspectives on the cases presented and then make an effective solution in handling the case. The results of the group's work are also then presented and analyzed together by other groups in one class, so that with various opinions a solution to environmental problems will be produced.

The data shows that the critical thinking indicators that get the highest average score are reporting the results of systematic observations and solutions from cases with an average of 84.50 categorized as competent. The lowest indicator with a score of 83.17 is to provide answers with simple logical explanations. This shows that the ability of students to give opinions must be improved. Overall, it was found that students had an average score of 84.27 (class A) and 84 (class B) categorized as competent. This shows that the learning process carried out using the case method module contributes greatly to developing students' critical reasoning (Marlina, 2020).

Communicaton

Communication is a person's ability to convey messages/information to others in written form and in the form of delivering sentences directly (Nurlaili, 2020). Communication skills through the use of this module can be seen from students in expressing ideas and opinions about case analysis to other groups in the class. There are five main components that are assessed, namely the attitude of respecting the opinions of others, the attitude of confidence in presenting ideas, the ability to present ideas in public, the ability to use good language according to EYD, and the ability to communicate logically and structured. The average student scores for each communication indicator showed no significant difference. The highest score was found in the indicator of good Indonesian language use with an average of 84.83. The lowest score was found in the indicator of the use of proper intonation in communicating with an average of 83.50. The results of the observations are presented in Table 3 below.

Table 3. Student Communication Skills

Yes	Communication Indicators	Class A	Class B	Average	Category
1	Using Indonesian well in the learning process	86.00	83.67	84.83	Competent
2	Convey your opinion in clear language in the learning process	85.00	83.00	84.00	
3	Use proper intonation in communication	84.67	82.33	83.50	
4	Communicate using a logical and structured mindset	85.33	83.00	84.17	
5	Have a confident attitude in communicating and expressing their ideas	85.00	82.33	83.67	

Overall, the communication skills of students in grades A and B have the same average score of 85.7 categorized as competent. This shows that students have good abilities in communicating ideas, ideas and opinions both in oral and written form.

Collaboration

Collaboration is the ability to collaborate with others to find solutions together based on mutually agreed results (Castañer & Oliveira, 2020). This ability cannot be achieved alone, but involves the thinking and contribution of others as a team for the achievement of a common goal (Wahyuni & Anhar, 2020). The use of disaster management modules can affect students' collaboration skills due to group activities in conducting case analysis, finding problem solving, and finding effective solutions based on various ideas that have been expressed by group members. This activity certainly involves various points of view that affect the conclusion of the solution that will be proposed by the group according to mutual agreement. Observations of student collaboration skills carried out through the use of case method learning modules, can be seen in Table 4.

Table. 4 Students' Ability to Collaborate

Yes	Collaboration Indicators	Class A	Class B	Average	Category
1	Have the ability to cooperate or coordinate group members	86.67	83.00	84.83	Competent
2	Motivate each other in a group for a common goal	85.67	83.33	84.50	
3	Share knowledge and *skills* in groups	86.00	82.67	84.33	
4	Have closeness between groups	86.33	83.67	85.00	
5	Appreciate the differences between groups	83.67	84.33	84.00	

The results of observations showed that the collaboration ability of students was categorized as very competent with an average score of 85.6 in class A and 83.4 in class B. The data shows that the average score obtained by class A is slightly higher than that of class B. Class A is very competent in indicators of ability to cooperate or coordinate group members, share knowledge with each other, and have closeness between groups. Overall, the average score of classes A and B on collaboration

ability of 84.5 is categorized as Competent. This shows that the use of disaster management modules can improve students' collaboration skills.

Creative

Environmental problems are a major global issue that needs to be solved immediately. In this case, the ability to be creative to find effective solutions is needed to solve increasingly complex problems (Sigit et al., 2019). Creative is the ability of students to find the latest solutions, different from existing ones, and original (Purwasih, 2019). In disaster management learning, creative skills are needed to solve disasters that occur. In this case, students as the young generation of the nation's successors, must have creative ideas and solutions to be able to help solve disasters in the surrounding environment. Riau Province itself is very unique with peatland forest fire disasters, so logical and creative thinking is needed regarding efforts to prevent and overcome peatland fires in order to reduce disaster risk. Observations made in learning using the case method module are presented in Table 5 below.

Table. 5 Students' Creative Abilities

Yes	Creativity Indicator	Class A	Class B	Average	Category
1	Have a high curiosity about something	85.67	84.33	85.00	**Competent**
2	Be open to new perspectives	84.33	82.33	83.33	
3	Presenting creative ideas conceptually and practically	84.67	83.33	84.00	
4	Have the ability to create novelty based on the initial knowledge they have	85.00	82.67	83.83	
5	Applying creative ideas in poster preparation	86.00	83.67	84.83	

Through the use of this case-based module, it shows that students' creative abilities are categorized as competent in class A with an average of 85.13 and categorized as competent in class B with an average of 83.27. This shows that class A is more creative than class B with an average score difference of 1.86. Class A is very competent in applying ideas in the form of posters. This can be seen from the attractive poster design and the message conveyed on the poster.

Through this approach, it is hoped that a better understanding can be obtained of how the designed modules can play a role in improving students' skills in the field of disaster management. By integrating real-life case studies, students are expected to more easily understand the concepts taught and apply them in relevant situations. In addition, collaborative activities carried out during the learning process are also expected to encourage students to share knowledge and experiences with each other, which in turn can enrich their learning process.

This research provides valuable insights for the development of curriculum and teaching methods in the field of disaster management, with a focus on the importance of case-based learning. Thus, it is hoped that the results of this research

will not only be useful for students and teachers at the University of Riau, but can also be a reference for other educational institutions that want to improve the quality of education in this field.

4. Conclusion

Based on the findings of this study, it can be concluded that the application of disaster management learning modules with case study methods is effective in improving students' 21st century competencies, especially in critical thinking, communication, collaboration, and creativity (4C). A learning process that emphasizes contextual problem analysis, group discussions, and reflective thinking has been shown to encourage students' active involvement and contextual understanding of disaster mitigation issues.

The use of real-world disaster scenarios in the module encourages students to analyze problems from multiple perspectives, communicate clearly, collaborate effectively in teams, and develop creative solutions. Quantitative observations from the two experimental classes showed that most students achieved "competent" to "highly competent" levels in all four skill domains. This shows that the case study method not only improves the understanding of the material but also equips students with essential skills to deal with complex environmental challenges.

Therefore, this research supports the integration of case-based modules in the environmental and disaster education curriculum in higher education. This kind of pedagogical innovation is essential in preparing students to become proactive solution-oriented individuals, able to contribute to disaster risk reduction and sustainable development efforts in their communities.

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