



Analysis of Students' Needs for Game-Based Learning Flashcards on Climate Change Material at SMAN 8 Padang

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ABSTRACT

Biology learning on climate change requires media that can present concepts visually, interactively, and meaningfully. Initial observations at SMAN 8 Padang showed that learning was still dominated by lecture and question and answer methods with the use of LKPD and PowerPoint. In addition, as many as 60.56% of students experienced difficulties in understanding climate change material. This study aims to analyze students' needs for the development of Game Based Learning-based flashcards on climate change material. The study used a descriptive method with a quantitative and qualitative approach through interviews with one Biology teacher and questionnaires to 35 Phase E students of SMAN 8 Padang. The results of the analysis showed that 32.88% of students understood the material through teacher explanations, 25.72% through images and videos, 21.42% through books and PPT, 12.85% through observation activities, and 7.13% through direct practice. Flashcards have the advantage of presenting images, information, and questions concisely and encouraging students to remember, identify, explain, discuss, and test understanding through game activities. The use of flashcards is designed through three stages: Memorize to observe and understand information, recall to recall concepts through questions, and examine to check and analyze answers. The analysis shows that Game-Based Learning flashcards are relevant for development as a learning medium that can support active, interactive, and meaningful understanding of climate change concepts.

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INTRODUCTION

Learning in Indonesia currently adheres to the Independent Curriculum, which provides students with greater freedom to learn independently by emphasizing relevant and contextual learning. According to the Education Curriculum and Assessment Standards Agency (2024), biology instruction in Phase E of high school is directed at developing students' abilities to understand and respond to various issues related to climate change, including playing an active role in finding solutions to environmental issues at the local and global levels (Fante et al., 2024). This achievement is crucial

because climate change is a complex environmental problem that requires understanding and appropriate action, especially from the younger generation.

In its implementation, learning is no longer directed at a one-way information delivery process, but needs to be designed to provide a mindful, meaningful, and joyful learning experience. These three characteristics are interconnected in supporting the creation of learning that can optimize student engagement, motivation, and understanding of the material being studied (Rahmawati et al., 2025). This approach not only emphasizes cognitive aspects but also integrates affective and psychomotor dimensions so that students are able to understand, apply, and reflect on knowledge in real-life contexts. This principle aligns with the objectives of the Independent Curriculum, which emphasizes contextual, collaborative, and differentiated learning (Damayanti et al., 2022).

Mindful learning is a learning approach that emphasizes conscious, attentive, and active student involvement during the learning process. Meanwhile, meaningful learning directs students to connect new knowledge with existing experiences and knowledge, making the concepts learned easier to understand, remember, and apply in everyday life. Joyful learning, on the other hand, creates a pleasant learning atmosphere that can encourage student motivation and enthusiasm in participating in learning (Andayanie et al., 2025). These three approaches have interrelated roles: a pleasant learning atmosphere can increase motivation, directed play activities can encourage active participation, and meaningful learning can strengthen understanding of the concepts being studied (Harjun et al., 2026). Therefore, the implementation of the Independent Curriculum needs to be supported by learning strategies and media that can optimally integrate aspects of mindful learning, meaningful learning, and joyful learning to achieve the goals of 21st-century learning.

The need for a fun, play-based, and meaningful learning approach is becoming increasingly relevant to the characteristics of today's students, most of whom are from Generation Z and Generation Alpha. Both generations grew up in environments close to technology and tend to enjoy challenges, receive rapid feedback, collaborate, and engage in interactive activities (Fernando et al., 2024). One alternative that can be implemented to meet these characteristics is game-based learning, an approach that utilizes game elements as part of the learning process to help students understand the material being studied (Wau & Fadilah, 2024). The application of game-based learning can provide a more concrete, meaningful, and enjoyable learning experience. In addition to potentially improving academic achievement, this approach can also develop the skills students need to face various demands and situations outside the classroom environment (Ulimaz et al., 2024).

One learning approach relevant to student characteristics in the implementation of the Independent Curriculum is Game-Based Learning (GBL). This approach places games as a central part of the learning process, designed to achieve specific learning objectives. The implementation of GBL can create a more joyful learning atmosphere through enjoyable activities, mindful because students are actively and purposefully involved during the game, and meaningful because each activity in the game is designed to support

understanding of learning concepts, not just oriented towards achieving victory (Islam et al., 2024). The effectiveness of Game-Based Learning implementation is also inseparable from the choice of learning media used. One media that has characteristics in accordance with GBL principles is flashcards, which can be developed as interactive media to support game-based learning activities (Syafi'i & Darnaningsih, 2025).

Flashcards are learning aids in the form of cards containing images, numbers, or information as learning materials that can remind or guide students to something related to the image so that students can easily understand the message contained in the image and text well (Wati, 2025). The use of flashcards is not limited to memorizing information, but can encourage interaction between students through activities of identifying, explaining, solving problems, and discussing in an educational game (Cahyanti et al., 2025). These characteristics make flashcards a medium that can create a fun learning atmosphere, encourage active student involvement, and support the formation of conceptual understanding through concrete and direct learning experiences (Aprilianti et al., 2023).

Although the Independent Curriculum directs the learning process to be more active and student-centered, observations at SMAN 8 Padang indicate that the implementation of biology learning still faces several challenges. Based on a questionnaire completed by biology teachers, the learning media used are still dominated by Student Worksheets (LKPD) and PowerPoint (PPT). While the use of LKPD has helped teachers organize learning activities, most LKPD still focuses on presenting text and practice problems, thus not fully providing an engaging and interactive learning experience for students. On the other hand, PPT can increase student enthusiasm during learning, but activities tend to be oriented towards watching and listening to teacher explanations or shared learning videos. As a result, students' attention is more focused on completing the learning process than on understanding the concepts that are the learning objectives. This condition indicates that the learning media used has not optimally integrated elements of fun learning, play activities, and meaningful learning experiences as required by the Independent Curriculum.

Further observations showed that student interest in biology learning reached 100%. However, the methods most frequently applied in the learning process were still dominated by lectures and question-and-answer discussions, so the teacher tended to be the primary source of information in the learning process. This condition resulted in suboptimal student engagement, especially when studying material containing many scientific concepts and terms. Based on the results of the needs analysis, as many as 11.42% of students considered biology learning difficult, while another 52.15% considered biology learning quite difficult. In addition, as many as 60.56% of students admitted to having difficulty understanding the Climate Change material. These findings indicate that the applied learning process was not fully able to support students in building a deep and comprehensive understanding of concepts.

Climate change is a condition characterized by changes in global climate patterns that result in unpredictable weather phenomena (Aryani et al., 2026). Climate change occurs due to changes in climate variables, such as air temperature and rainfall that occur

continuously over a long period of time (Khotimah et al., 2022). In addition, this material also contains various contextual facts and images that need to be understood not only by rote, but also based on the relationship between concepts and events based on existing facts (Ratih et al., 2025). These characteristics indicate the need for learning media that not only help students remember concepts, but also are able to support the process of linking concepts, classifying, discussing, and applying knowledge through meaningful learning activities (Agustina et al., 2025). Based on this description, this article aims to identify students' needs for the development of Game-Based Learning-based flashcard media on Climate Change material at SMAN 8 Padang.

METHOD

This study uses a descriptive method by combining quantitative and qualitative approaches to obtain a comprehensive picture of the need for learning media development. Research data were obtained through interviews with biology teachers and the distribution of questionnaires to Phase E students at SMAN 8 Padang. The instrument used was a questionnaire sheet that aimed to obtain information about student responses to the learning media used in the biology learning process. The research subjects involved one biology teacher and 35 Phase E students of SMAN 8 Padang. Data obtained from the initial research stage were then organized, analyzed and interpreted to determine student needs for Game-Based Learning flashcard media on Climate Change Material.

RESULTS AND DISCUSSION

The results of the needs analysis were conducted to identify the need for developing Game-Based Learning flashcard media for Climate Change at SMAN 8 Padang. Research data was obtained through interviews with teachers and the distribution of student response questionnaires regarding the use of learning media implemented in the school. The collected data were then analyzed by considering student needs in the biology learning process. The results of the needs analysis are presented in Table 1.

Table 1. Students' Ways of Understanding Biology Material

No	How Students Understand Biology Material	Percentage
1	Reading books and PPT	21,42 %
2	Understand and observe	12,85 %
3	Listening to the teacher's explanation	32,88 %
4	Practicing directly	7,13 %
5	Learning using pictures and videos	25,72 %

Based on the needs analysis results in Table 1, there is a variation in how students understand Biology material. The highest percentage was demonstrated by students who understood the material through teacher explanations, at 32.88%. This finding indicates that teacher explanations remain a primary source in helping students understand Biology material. Furthermore, 25.72% of students chose to use images and videos, while 21.42% of students understood the material through reading books and PowerPoint

presentations. This indicates that visual presentations and reading materials still play a role in supporting student understanding.

Meanwhile, 12.85% of students understood the material through observing and understanding objects, while only 7.13% of students understood the material through direct practice. The low percentage of students learning through practice indicates that learning experiences involving students directly are still relatively limited. This situation indicates the need for learning innovations that can increase student engagement through more interactive activities and provide hands-on learning experiences.

The results of this analysis form the basis for the need to develop learning media that can combine visual information, activities, interactions, and games in the biology learning process. One alternative that can be developed is Game-Based Learning flashcards. Flashcards can present material concisely through a combination of images, keywords, and questions, while the application of game elements can encourage students to actively participate, discuss, answer questions, and obtain feedback during the learning process. Thus, the development of Game-Based Learning flashcards is expected to be an alternative learning media that is more interactive and appropriate to students' needs in understanding climate change material.

Tabel 2. Students' Perceptions of Difficulty in Biology Materials

No	Biology Material	Percentage
1	Biodiversity	3%
2	Classification of Living Things	7,40%
3	Viruses	8,22%
4	Bacteria	11,82%
5	Fungi	6,40%
6	Ecosystems	2,60%
7	Climate Change	60,56%

Based on the needs analysis, climate change had the highest difficulty percentage, at 60.56%, compared to Bacteria (11.82%), Viruses (8.22%), Classification of Living Things (7.40%), Fungi (6.40%), Biodiversity (3%), and Ecosystems (2.60%). This high percentage indicates that climate change is one of the most difficult topics for students to understand. This difficulty may be due to the material's complex and interrelated concepts, such as the causes of climate change, the greenhouse effect, impacts on ecosystems, and mitigation and adaptation. Some of these concepts are also abstract, requiring students to visualize and engage in more concrete learning experiences.

This finding aligns with the analysis of how students understand biology: 32.88% learn through teacher explanations and 25.72% through images and videos. This situation demonstrates the need for media that can combine visual presentation with learning activities that actively engage students. Therefore, Game-Based Learning flashcards were developed as an alternative learning medium that presents climate change concepts concisely through images, information, and questions, while also providing game activities such as remembering, answering, discussing, and testing understanding. Thus,

this medium is expected to help overcome students' difficulties in understanding climate change material and create more active and interactive learning.

Game-Based Learning can create a fun learning environment through the implementation of various game elements, such as challenges, interaction, turns, opportunities to experiment, and feedback. These activities can stimulate curiosity and encourage students to actively engage during the learning process. Several studies have shown that the implementation of Game-Based Learning has the potential to positively influence learning motivation, especially when games are designed with clear and easily understood goals, rules, and challenges for students (Islam et al., 2024; Handayani S Febriani, 2025).

Flashcard games consist of three stages: stage 1, called the memorization phase, where the front of the card contains an image or phenomenon, while the back of the card contains an explanation of the image and phenomenon. Stage 2, called the recall phase, where the cards contain questions with point values and time durations adjusted to reflect the challenge and the initial culmination of the game (Indrajita & Martitik, 2025). Then, there is the third stage, called the examine stage, where the cards contain more critical and in-depth questions, such as case studies or analysis questions based on actual events or phenomena.

The memorize stage helps students observe images, understand information, find keywords, and associate terms with their characteristics as the initial step in building understanding. The recall stage encourages students to recall information without looking at the answers through activities such as naming characteristics, grouping images, sequencing reproductions, or answering questions. This recall process can reinforce learning. The examine stage involves checking answers, discussing reasons, and correcting errors by comparing them with the answers or explanations on the cards. This stage provides feedback and helps students determine their level of understanding (Chasanah et al., 2025).

Based on the description of the flashcard content, the objectives of in-depth learning, namely awareness, meaning, and enjoyment, can be optimally achieved and help increase student active engagement in the learning process. Conscious learning is implemented through clear communication of the objectives, rules, and stages of the game, along with reflection to help students identify their understanding and learning difficulties. Meaningful learning is realized through images and examples of climate change that are close to life, accompanied by questions that connect the characteristics, lifestyles, and the role of climate change, not just memorizing scientific names. Enjoyable learning is built through challenges, group interactions, opportunities to try, and feedback. The pleasure comes not only from scores or wins, but also from successfully understanding concepts and correcting mistakes.

The results of the needs analysis served as a reference in determining the material, design, game rules, and product evaluation format. The material was tailored to the learning outcomes and objectives of Phase E Biology. The accuracy of the content, images, terminology, and real-life cases or phenomena related to climate change required validation by subject matter experts, while aspects of appearance, readability, card size,

and game rules were assessed by media and learning experts (Safitri et al., 2025). Furthermore, the product was tested through one-on-one, small group, and field trials to determine the clarity of instructions, card readability, timeliness, gameplay fluency, and user response.

Therefore, the development of Game-Based Learning flashcards for Climate Change is considered relevant to the demands of the Independent Curriculum because it has the potential to integrate game elements, visualization, and interaction that align with the characteristics of the material and the learning needs of students. This situation aligns with recent research showing that interactive learning media designed to meet students' needs can increase their attention, engagement, and the quality of their learning experiences (Truss et al., 2024).

CONCLUSION AND SUGGESTIONS

CONCLUSION

The results of the needs analysis indicate that Biology learning at SMAN 8 Padang still largely uses lecture and question-and-answer methods supported by student worksheets (LKPD) and PowerPoint presentations (PPT). This situation indicates the need for learning media that can present images and concepts concisely while encouraging student engagement through interactive activities. Therefore, Game-Based Learning flashcards on Climate Change have the potential to meet student needs and can be used as an alternative, more interactive and meaningful Biology learning media. The media needs to be designed with clear objectives, rules, challenges, turns, feedback, and gameplay. The stages of memorize, recall, and examine can be used to help students observe information, recall concepts, evaluate answers, and improve understanding in a conscious, meaningful, and enjoyable learning environment.

SUGGESTIONS

Based on the needs analysis, educators are advised to utilize more innovative and student-centered learning media, particularly for the complex and abstract nature of Climate Change. Furthermore, it is necessary to develop educational flashcards tailored to the characteristics of the material and students' learning needs, followed by testing the validity, practicality, and effectiveness of the media before widespread implementation in Biology lessons.

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