Development of Scrapbook Environmental Change Material Based on Entrepreneurship for Senior High School Students

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Abstract. This study aimed to develop and evaluate entrepreneurship-based scrapbook learning media on environmental change for senior high school students in alignment with the Merdeka Curriculum and Pancasila Student Profile. Using the ADDIE development model, the media was created with print and digital formats, incorporating local environmental issues—specifically tofu dregs waste—and entrepreneurship-based learning activities. The validity tests by media and material experts yielded scores of 85% and 97%, respectively, indicating high content quality. Practicality testing through student response questionnaires scored 81%, reflecting the media's ease of use and student engagement. Effectiveness was evaluated through student learning interest, with scores of 81% in small-scale trials and 86% in large-scale implementation—both categorized as very high. The results demonstrate that the developed scrapbook effectively increases learning interest, supports contextual and sustainable education, and promotes entrepreneurial awareness. This media provides a promising instructional tool for integrating environmental education and entrepreneurship in science learning.

Keywords: environmental change, entrepreneurship, scrapbook, Merdeka Curriculum, student learning interest.

1 Introduction

Implementing the Merdeka Curriculum represents a strategic response to the growing demand for an education system that is more adaptive and aligned with the dynamics of the 21st century. This curriculum grants schools the autonomy to design learning experiences tailored to students' diverse characteristics and the local socio-cultural context[1]. It emphasizes strengthening foundational competencies, provides flexibility in selecting teaching materials, and promotes project-based learning that fosters active student participation and engagement. Furthermore, the Merdeka Curriculum supports the development of essential 21st-century skills, including creativity, collaboration, communication, critical thinking, and problem-solving, equipping students to navigate future challenges with confidence and adaptability[2].

Since its initial rollout, schools across Indonesia have gradually adopted the Merdeka Curriculum, although its implementation has not been without challenges[3]. Many educational institutions are still adjusting to its flexible and student-centered approach[4]. In response, schools have created opportunities for students to think critically, express their

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ideas, and participate meaningfully in learning. Consequently, teachers are increasingly expected to be innovative and resourceful in designing instructional strategies and developing relevant learning media that support the principles of the new curriculum[5].

A madrasa in Jember, Indonesia, began gradually implementing the Merdeka Curriculum (Kurikulum Merdeka) in the first Grade starting in 2023. As with many institutions transitioning to this curriculum, teachers and schools have encountered several challenges, particularly in teaching Biology. Based on interviews with multiple educators, key difficulties include the limited availability of engaging and contextually relevant learning media and a shortage of appropriate textbooks for students. Despite advancements in digital learning, textbooks remain a critical didactic resource in classroom instruction and curriculum delivery[6].

Interviews with the first-grade teachers revealed that the lack of access to textbooks significantly hinders learning effectiveness. When teachers assign textbook-based tasks, many students must borrow materials from peers or rely on mobile phone photographs of assignment pages. This practice compromises the completeness and clarity of learning resources, resulting in lower academic performance during evaluations. Furthermore, the absence of visual aids—such as diagrams and illustrative examples—exacerbates students' difficulty grasping abstract biological concepts. As Biology is a subject that heavily depends on visual representation[7], the lack of sample images makes it more challenging for students to engage with the material meaningfully. Previous research supports that visuals in biology education enhance comprehension and stimulate student engagement, making them an essential component of effective instructional materials[8].

One effective strategy to address these challenges is to design learning experiences using more innovative and engaging media[9]. Among the available options, scrapbooks present a promising alternative for teachers seeking to diversify their instructional materials[10]. Prior studies have shown that using scrapbooks in biology education significantly enhances students' creative thinking skills [11] and increases learning motivation, particularly in fostering initiative and active participation among high school students[12]. A scrapbook is a form of creative media that arranges and decorates photos, recycled materials, and notes into visually engaging formats [13]. It typically includes a combination of images and important textual content, which can be tailored to suit specific learning objectives and subject matter. The visual and interactive nature of scrapbook media facilitates students' understanding of complex topics while increasing their attention, interest, and classroom engagement[14]. In the context of technological advancement, scrapbooks can also be designed digitally using various applications [15], allowing for more attractive and accessible formats that support both offline and online learning across diverse educational settings.

The integration of scrapbook media with an entrepreneurship-oriented learning approach offers an innovative strategy that aligns with the goals of the Pancasila Student Profile Strengthening Program, which aims to cultivate socially responsible and environmentally conscious learners. Embedding entrepreneurship in education is increasingly essential, as it equips future generations with the mindset and skills needed to drive the national economy and respond to the challenges of globalization[16]. In science education, entrepreneurship-based learning encourages students to explore real-world problems—individually or

collaboratively—and identify opportunities for sustainable solutions, particularly in addressing environmental and resource conservation issues within socio-ecological systems[17].

One such environmental issue faced by a madrasa in Jember involves the accumulation of tofu dregs waste produced by nearby tofu processing industries. Interviews with local tofu producers revealed that the waste is typically used as animal feed; however, if not collected by farmers, it accumulates and emits an unpleasant odor, disturbing nearby residents. That presents an opportunity for students to engage in a project-based learning activity by converting tofu dregs into crackers, thereby addressing a real environmental problem while fostering entrepreneurial thinking.

Given this context, developing problem-based, engaging, and contextual learning media is essential to increase students' sensitivity toward local environmental challenges. An entrepreneurship-based scrapbook on environmental change can be a medium to integrate hands-on activities—such as tofu dregs processing—into classroom instruction. This approach enhances student creativity and environmental awareness and promotes sustainability-oriented learning. Ultimately, such media are expected to make learning more meaningful and engaging while increasing student motivation and interest in environmental science.

2 Methods

This study uses the research and development (R&D) method [18], using the ADDIE model consisting of the stages of Analysis, Design, Development, Implementation, and Evaluation [19]. The analysis includes performance gap analysis, learning characteristics, and curriculum. Participants involved in the needs analysis are Biology teachers. The design stage uses the Canva application, the preparation of materials is accompanied by attractive images, and entrepreneurship elements are added with the principle of zero waste. The product developed is a scrapbook learning media on the material of environmental change in high school Biology material. The development stage was carried out by expert validity tests consisting of media experts and material experts, aiming to determine the validity level before general use. The implementation stage is a product trial through learning with class X students. The evaluation stage is carried out to assess and improve the developed product.

The study subjects are experts, validators, and users, namely students. Validators consist of media experts, material experts, and practitioners, and users are grade X students.

The validity and practicality test uses a Likert scale in the form of a score of 1-4; it is said to be valid and practical if it gets an average score of ≥ 60 [20] (Table 1), which is obtained from the formula:

$$Valid/practical\ (\%) = \frac{\text{Total score}}{\text{maximum score}}\ 100$$

Table 1. Validity and practicality criteria

Interval (%)	Criteria
80< P ≤100	Very valid/practical
60< P ≤ 80	Practical

Interval (%)	Criteria
$40 < P \leq 60$	Quite practical
$20 < P \leq 40$	Less practical
$0 < P \leq 20$	Not practical

The effectiveness test also uses a Likert scale based on a learning interest questionnaire with indicators [21]: feelings of pleasure, student interest, student involvement, diligence and enthusiasm in doing assignments, and diligence and discipline in learning. Interpretation of the percentage of learning interest is said to be high when it has a percentage ≥ 61 (Table 2), referring to the formula:

$$Learning\ interest\ (\%) = \frac{\text{Total score}}{\text{maximum score}}\ 100$$

Table 2. Effectiveness criteria based on student learning interests

Interval (%)	Criteria
0-20%	Very low
29 - 40%	Low
41 – 60%	Moderate
61 – 80 %	High
81 -100%	Very high

3 Result

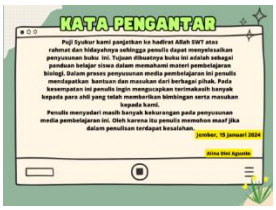
3.1 Analysis

The needs analysis results show that teachers have difficulty developing learning media that are in accordance with the Merdeka curriculum. Students also face difficulties learning biology material due to the lack of sample images for each topic, which is exacerbated by the limited reading books available. The biology learning process has also often been carried out using the lecture method and using PowerPoint media and textbooks. Curriculum analysis shows that environmental change material requires students to be active and think critically, but current learning has not focused on solving problems directly.

3.2. Design

The stages of designing scrapbook media begin with selecting reference materials from various sources, such as books and journal articles, followed by an attractive product design to increase student appeal. In the material display, reminder notes are provided to make it easier for students, and original images of pollution and environmental problems in the surrounding area are added. The procedure for making tofu dregs crackers is also presented to help students in P5 activities as a form of entrepreneurship-based learning. The appearance of the scrapbook design is as in Table 3.

Table 3. Visual Features of the Environmental Scrapbook Design

Design	Information
 	The initial appearance of the scrapbook is designed to be as attractive as possible to attract students' interest. It consists of a cover, author identity, table of contents, instructions for use, and learning objectives.
 	The material not only displays the main material but also contains reminder notes to make it easier for students to remember it. The material is equipped with pictures and a guide to making tofu dregs.
	The final appearance of the scrapbook media contains a bibliography and author biography.

3.3 Development

This stage is the process of developing products and conducting validity tests. The results of the validity test by media experts showed a value of 85% (very valid) based on aspects of quality, appearance, and content. The results of the validity test by material experts showed a value of 97.7% (very valid) based on aspects of content, language, and presentation feasibility,

and the validity test by practitioners was 93.7% (very valid) based on aspects of quality, appearance, content, and presentation. Based on the validation results, the learning media scrapbook material on environmental change is declared valid for learning.

3.4 Implementation

The implementation stage involves product trials through learning, using scrapbook media in the form of printed books and digital scrapbooks created with the Sidebook application. The sidebook can be downloaded from the Play Store, and then the scrapbook file is saved and used online and offline. In the files contained in Sidebook, personal notes can be added to the material, and the appearance is similar to a flipbook and allows access to internet links.

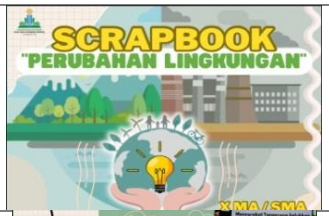
The average student response test results reached 81% (very practical), which shows that scrapbook media is easy to use in learning. Scrapbook media was implemented in small-scale classes (8 students) and large-scale classes (36 students). The effectiveness test was seen based on the student learning interest questionnaire; the average student learning interest on a small scale showed a value of 81% (Very High), so the trial could be continued on a large scale. The average student learning interest in the large-scale trial was 86% (Very High). That confirms that scrapbook media is effective in increasing student learning interest.

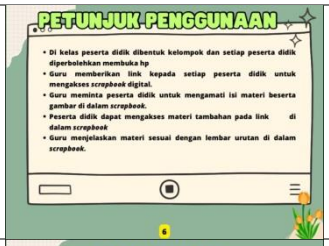
According to students, scrapbook media is very helpful in overcoming difficulties in obtaining learning resources, and the images presented make it easier for them to understand and remember the material. In addition, the entrepreneurship content in the P5 project in the scrapbook improves students' understanding and encourages them to care about the surrounding environment. Making crackers from tofu dregs received a good response from students because learning is more fun and varied.

3.4 Evaluation

Some notes on improving scrapbook media in terms of media appearance and material aspects are in Table 4.

Table 4. Evaluation of scrapbook media in terms of media appearance and material aspects

No.	Evaluation	Before	After
1.	The front (cover) does not show the media type and class name.		
2.	The image display is less varied and not large enough.		

No.	Evaluation	Before	After
3.	Instructions for using the scrapbook are not included.		
4.	The color combination is not very attractive.		
5.	Sample image and caption layout		
6.	The definition of environmental balance is not quite right.		
7.	The definition of environmental pollution is not quite right.		

No.	Evaluation	Before	After
8.	The definition of waste is not quite right.		
9.	There is no information about the sound threshold in the definition of noise pollution.		

At this evaluation stage, product evaluation is carried out on both the material and the appearance of the book, in the next development, evaluation should be carried out in every development process. This study designs the development of entrepreneurship-based media with waste processing around the school. Cooperation with industry requires further initiation in order to provide a real impact on environmental change. Through this process, students are expected to be more sensitive so that environmental awareness and sustainability will increase.

4 Discussion

Using the Canva application to design scrapbook learning media offers significant advantages regarding creativity enhancement and design efficiency. Canva provides a wide selection of templates, graphics, and design tools, enabling users—including teachers and students—to easily create visually engaging materials [22]. The scrapbook media developed in this study is designed to be flexible in format, allowing it to be distributed in printed and digital versions, thus supporting hybrid learning environments. This adaptability makes the media accessible for students in various learning situations, whether online or offline.

Moreover, integrating digital scrapbook media introduces a novel approach in educational settings, offering an innovative and efficient alternative to traditional instructional resources[23]. Its novelty and visual appeal can enhance student motivation and engagement while providing teachers with a dynamic platform for delivering content[24]. Given the growing demand for technology-enhanced learning tools, digital scrapbooks are a promising medium that aligns with current educational trends[25], [26], particularly in supporting creative, student-centered, and visually enriched learning experiences.

Meanwhile, the implementation stage of this study involved classroom-based product trials using scrapbook media, presented in both printed and digital formats through the Sidebook application. Sidebook, which can be downloaded via the Play Store, offers flexibility as it

supports online and offline access, making it suitable for diverse learning environments. The digital scrapbook format provides an interactive user experience[27] similar to a flipbook, allowing students to navigate material seamlessly[27], add personal annotations, and access external internet links embedded within the content[14]. These features contribute to a more personalized and connected learning experience, in line with previous studies that emphasize the value of digital interactivity in promoting engagement and knowledge retention [28], [29], [30].

The practicality of the scrapbook media was confirmed through student response questionnaires, which yielded an average score of 81%, falling into the "very practical" category. This result demonstrates that students found the media easy to use and navigate in print and digital forms. The intuitive interface of the Sidebook application and the scrapbook content's visual and interactive elements contributed to its positive reception. These findings are consistent with literature asserting that when designed with user experience in mind, digital learning media can significantly enhance student satisfaction and learning efficacy[31].

Further, the effectiveness of the media was evaluated based on student interest in learning, using a structured questionnaire administered in both small-scale (8 students) and large-scale (36 students) trials. In the small-scale trial, student interest reached an average of 81% (Very High), providing sufficient justification for scaling up. Notably, the large-scale implementation produced an even higher average score of 86% (Very High), reinforcing the conclusion that scrapbook media is highly effective in increasing student learning interest. These results validate the potential of scrapbook-based learning to foster student motivation, mainly when it incorporates visual, interactive, and contextualized content relevant to students' real-world experiences.

In sum, the findings underscore that scrapbook media, supported by accessible digital platforms like Sidebook, offers a practical and effective pedagogical tool for implementing project-based and entrepreneurship-oriented learning. It enables students to interact with content more actively and develop a greater sense of autonomy, interest, and contextual understanding, especially in topics related to environmental change. That supports broader curriculum goals under the Merdeka Curriculum and the Pancasila Student Profile initiative, which prioritize student-centered, creative, and sustainability-focused education.

The evaluation conducted in this study focused primarily on two aspects of the developed media: content relevance and visual presentation. While this final-stage evaluation provided valuable insights into the overall feasibility of the entrepreneurship-based scrapbook, future development cycles should incorporate formative evaluations at each stage of the development process. Continuous feedback loops throughout the design, implementation, and revision phases can ensure the media's effectiveness[32], alignment with learning objectives, and responsiveness to student needs.

Furthermore, the integration of entrepreneurship and environmental education through locally relevant waste processing activities—specifically, tofu dregs management—represents a promising instructional model[33]. However, strategic partnerships with local industries should be initiated and institutionalized for the learning experience to yield tangible environmental impact and greater authenticity[34], [35]. Collaborating directly with tofu producers and community stakeholders can enhance the real-world relevance of student

projects, transforming learning from a classroom-based simulation into a community-centered sustainability initiative.

The developed media has the potential to foster greater environmental sensitivity and sustainability awareness by engaging students in hands-on, project-based learning rooted in their immediate environment. That aligns with the broader goals of the Pancasila Student Profile, particularly in cultivating students who are socially aware, environmentally responsible, and capable of entrepreneurial thinking. These findings suggest that embedding contextual, real-world problems into instructional design improves learning engagement and nurtures long-term behavioral change toward environmental stewardship[36].

Although the scrapbook aligns with Merdeka and Pancasila profiles, the theoretical underpinnings remain implicit. Articulating how project-based tofu dregs processing activates Kolb's experiential learning cycle[37], [38] or Schlossberg's transition theory would situate the media within a coherent pedagogical paradigm, thereby clarifying the mechanisms by which environmental sensitivity and entrepreneurial skills co-develop.

4 Conclusion

This study aimed to develop and evaluate entrepreneurship-based scrapbook learning media on environmental change for senior high school students. The development followed the ADDIE model, and the resulting product was assessed for validity, practicality, and effectiveness. The validation results from media and material experts were highly positive, with scores of 85% and 97%, respectively, indicating that the media is highly valid for use in instructional settings. Furthermore, the student response test yielded a practicality score of 81%, suggesting that the scrapbook media is easy to use and well-received by students.

Effectiveness testing demonstrated strong outcomes: students' learning interest reached 81% in the small-scale trial and 86% in the large-scale trial, falling into the "very high" category. These results confirm that the scrapbook media effectively enhances students' motivation, engagement, and comprehension of environmental change concepts. Additionally, the incorporation of entrepreneurial elements, such as tofu dregs waste processing, not only supported the objectives of the Pancasila Student Profile but also encouraged students to apply learning to real-world sustainability challenges.

Implementing this media at the madrasa positively impacted student participation and environmental awareness, demonstrating the potential of context-based, student-centered media in supporting the Merdeka Curriculum. Future research is recommended in other educational contexts, particularly in schools near industrial zones, to explore how learning media can be further developed to integrate local environmental problems with project-based, entrepreneurial learning. Such efforts will enrich environmental education and contribute meaningfully to sustainable development goals (SDGs) by fostering responsible, creative, and socially aware future generations.

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