

Development of an Education for Sustainable Development (ESD)-Based Digital Flipbook to Improve Sustainability Literacy Among Fifth-Grade Elementary School Students

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Abstract

This research is motivated by the low continuous literacy of students and the limitations of interactive learning media in the material "*Bumiku Sayang, Bumiku Malang*" in elementary schools. This research aims to develop digital flipbook media based on Education for Sustainable Development (ESD), determine its level of eligibility, and test its effectiveness in improving the sustainable literacy of grade V students. The research subjects consisted of two expert validators and 41 students in grade V of SDN Pangabuan. Data were collected through interviews, expert validation questionnaires, student response questionnaires, and tests (pre-test and post-test), then analyzed using the Shapiro-Wilk normality test, the Paired Samples t-Test hypothesis test, and the N-Gain calculation. The results of the study showed that ESD-based digital flipbook media obtained a feasibility percentage of 98% from media experts and 94% from material experts, both of which were categorized as very feasible. The results of the Paired Samples t-Test showed a significance value of 0.000 (< 0.05), which means that there was a significant difference between the pre-test and post-test scores. The average N-Gain obtained was 0.60 (60%) in the medium category. Thus, ESD-based digital flipbook media was declared valid, practical, and effective to be used to improve the continuous literacy of grade V elementary school students.

Keywords

Digital Flipbook; Elementary School; Education Sustainable Development (ESD); Sustainable Literacy



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INTRODUCTION

The development of information technology in the era of globalization encourages the transformation of the world of education, especially in the use of innovative and interactive digital learning media. Ideally, learning in elementary schools is expected to be able to integrate technology with the Education for Sustainable Development (ESD) approach to instill sustainable awareness that includes knowledge, skills, attitudes, and values in dealing with

global problems. Sustainable education plays a significant role in constructing students' critical reasoning capacity while instilling awareness to take responsible actions for the environmental ecosystem and the social structure of society (Redman & Wiek, 2021). The integration of ESD into the basic education curriculum is a manifestation of a global commitment to realizing the Sustainable Development Goals (SDGs), which requires curriculum reorientation in order to be able to harmoniously connect local content with global issues (UNESCO, 2020).

Sustainable development in the education sector is closely related to SDG 4 on Quality Education, SDG 12 on Responsible Consumption and Production, and SDG 13 on Climate Change Management. Education through the ESD approach plays an important role in equipping students with the knowledge, skills, values, and attitudes needed to understand and deal with various sustainability issues (Zwolińska et al., 2022). SDG 12 is relevant to the formation of awareness and responsible behavior in the use of resources and waste management through the 3R (Reduce, Reuse, Recycle) principle (Kiely et al., 2021), while the integration of climate change issues in learning is considered important to build students' knowledge and concern for the environment (AlQallaf et al., 2024).

At the fifth grade level of elementary school, students are in a transition period to a more abstract mindset but still need concrete representations in understanding natural phenomena. As a digital native generation, students have a tendency to have a high attraction to electronic devices and visual information, so the use of conventional methods that are static has the potential to create a learning gap. A study in the *Journal of Science Education Research* confirms that monotonous instruction patterns are the main trigger for a decrease in students' participation and academic achievement (Pigai & Yulianto, 2024). The material "Bumiku Sayang, Bumiku Malang" in the IPAS subject examines the causal relationship between human activities and changes in natural conditions, so that comprehensive understanding through the right media is the first step in building a society that is resilient to disasters from an early age.

The results of the researcher's interviews with grade V teachers at SDN Pangabuan show that students' reading literacy skills are still relatively low and the learning media used is still limited to one-way printed books. This condition is also reflected in students' low concern for the cleanliness of the school environment. Sustainable literacy, which is the capacity of individuals to criticize and respond to environmental problems and make decisions that are in line with the principles of sustainable development (Murray in Amalia et al., 2025), in fact is still understood by students at a theoretical level without being internalized in real actions.

As an alternative solution, digital flipbook learning media is seen as able to present characteristics such as printed books through page transition effects while still integrating multimedia components. The integration of digital media such as flipbooks is seen as a strategic solution to trigger an increase in students' critical thinking skills (Velinda et al., 2024), and the use of flipbook-based digital teaching materials has proven to be effective in increasing students' mastery of concepts through interactive and persuasive material presentations (Silalahi & Budiono, 2023). This is strengthened by the findings that the implementation of flipbooks is able to optimize students' literacy skills and engagement (Maulida & Zulherman,

2024; Desyandri et al., 2024). However, based on the studies that have been conducted, there has not been a flipbook media that is integrated with the ESD approach in the material "Bumiku Sayang, Bumiku Malang" for elementary school students, so there is a gap between the learning needs of the 21st century and the availability of appropriate media.

Based on this description, this study aims to: (1) produce ESD-based digital flipbook learning media on the material "Bumiku Sayang, Bumiku Malang"; (2) analyze the feasibility level of the media developed based on the assessment of media experts and subject matter experts; and (3) determine the effectiveness of these media in improving the sustainable literacy of grade V elementary school students.

METHODS

This research uses the Research and Development (R&D) method, which is a scientific process to examine, design, manufacture, and test the effectiveness of a product (Sugiyono, 2023). The development procedure follows the ADDIE model which consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation (Siregar & Rhamayanti, 2025). In the Analysis stage, the researcher identifies the needs, characteristics of students, curriculum, and learning materials through interviews with class V teachers. The Development stage produces ESD-based digital flipbook products created using the Canva application with the help of the Heyzine Flipbook platform, then validated by media experts and subject matter experts. The Implementation stage is applied to grade V students through two learning meetings, while the Evaluation stage is carried out through formative and summative evaluations to assess the overall quality of the product.

The subjects of this study consisted of two expert validators (media experts and material experts) and 41 grade V students of SDN Pangabuan as field trial subjects. Primary data were obtained from expert validation sheets and student response questionnaires, while secondary data were obtained from literature studies in the form of books, scientific articles, and relevant journals. The research instruments include teacher interview guidelines, media expert validation questionnaires (10 items) and material experts (10 items) which were measured using a five-point likert scale, student response questionnaires, and test instruments in the form of 8 pre-test and post-test description questions prepared based on seven indicators of sustainable literacy adapted from Décamps et al. (in Amalia et al., 2025), namely knowledge about humanity and sustainable ecosystems, knowledge of sustainable transition, knowledge about the role of self in individual and system change, individual skills, systematic thinking and acting skills, cooperative skills, and mindset towards sustainability.

Media feasibility data was analyzed using a percentage descriptive technique with the formula $NP = (R/SM) \times 100$, with NP being the percentage value, R being the respondent's answer score, and SM being the maximum score (Purwanto in Widiastika et al., 2020), which was then interpreted into five feasibility categories ranging from "not feasible" (0–20%) to "very feasible" (81–100%) (Kamilah et al., 2023). The data from the pre-test and post-test

results were first tested for normality using the Shapiro-Wilk test at a significance level of 0.05, considering that the number of samples was less than 50 (Sianturi, 2025); the data was declared to be normally distributed if the significance value > 0.05 . Furthermore, hypothesis testing was carried out using the Paired Samples t-Test assisted by SPSS 25 with the criteria H_0 rejected and H_a accepted if the significance value was < 0.05 (Ginting, 2019). The effectiveness of continuous literacy improvement was analyzed using the normalized N-Gain formula, namely $g = (\text{Spost} - \text{Spre}) / (100 - \text{Spre})$, with the high ($g \geq 0.70$), medium ($0.30 \leq g < 0.70$), and low ($g \leq 0.30$) categories (Harianja et al., 2024).

RESULTS AND DISCUSSION

Media Development Results

ESD-based digital flipbook media is developed through five stages of the ADDIE model. The product contains three main topics, namely changes in earth conditions, environmental damage due to human activities, and environmental problems that threaten life, and is equipped with illustrations, learning videos, student worksheets, and reflection activities that integrate the three domains of ESD, namely environmental, social, and economic.

Media Eligibility

Media feasibility is measured through a validation questionnaire by media experts and material experts. The recapitulation of the validation results is presented in table 1.

Table 1. Results of Validation of ESD-Based Digital Flipbook Media Feasibility

Validation Aspects	Acquisition Score	Percentage	Category
Media Expert (10 items, maximum score of 50)	49	98%	Highly Worth It
Subject Matter Expert (10 items, maximum score of 50)	47	94%	Highly Worth It

The media expert stated that the appearance, layout, color selection, use of images and videos, and the ease of operation of the media were very feasible without any suggestions for further improvement. The material expert gave a score of 94% with a very feasible category, accompanied by input so that the concept of ESD in the three domains — especially the economic realm which is still less visible — was raised more explicitly. Based on these inputs, the researcher added material on the role of the family in managing organic waste into compost and the application of ESD through the use of tumblers, which reflected the relationship between the environmental, social, and economic domains more clearly. The media was then declared valid and ready to be tested to students without the need for further revision on the media aspect.

Prerequisite Test and Hypothesis Test

Before hypothesis testing, normality tests were carried out on pre-test and post-test data. The recapitulation of the results of prerequisite tests and hypothesis tests is presented in Table 2.

Table 2. Results of Normality Test and Hypothesis Test (Paired Samples t-Test)

Indicator Statistics	Pre-test	Post-test
N	41	41
Average	55	82
Sig. Normality Test (Shapiro-Wilk)	0,172	0,233
t-hitung (Paired Samples t-Test)	-19,251	
df	40	
Sig. (2-tailed)	0,000	

The results of the Shapiro-Wilk test showed a significance value of 0.172 for the pre-test data and 0.233 for the post-test data, both of which were greater than 0.05 so that both data groups were declared to be normally distributed. Since the assumption of normality was met, hypothesis testing was continued using the Paired Samples t-Test parametric test. The test results showed a t-count value of -19.251 with a degree of freedom (df) of 40 and a significance value (2-tailed) of 0.000. Because the significance value was smaller than the significance level of 0.05, H_0 was rejected and H_a was accepted, which means that there was a significant difference between the pre-test scores (average 55) and post-test (average 82) of students after the use of ESD-based digital flipbook media.

Effectiveness of Continuous Literacy Improvement (N-Gain)

The effectiveness of media in improving students' continuous literacy was analyzed using a normalized N-Gain test. The recapitulation of results is presented in Table 3.

Table 3. Recapitulation of N-Gain Test Results

Category N-Gain	Range	Number of Students	Percentage
Height	$g > 0,70$	12	29,27%
Medium	$0.30 \leq g < 0.70$	28	68,29%
Low	$g \leq 0,30$	1	2,44%
Rat-rata n-gain	0.60 (60%) — Category Sedang		

Of the 41 students, 12 students (29.27%) obtained N-Gain in the high category, 28 students (68.29%) in the medium category, and 1 student (2.44%) in the low category, with an overall average N-Gain of 0.60 or 60% classified as the medium category. Further analysis per continuous literacy indicator is presented in Table 4.

Table 4. N-Gain Results per Sustainable Literacy Indicator

No	Sustainable Literacy Indicators	N-Gain (%)	Category
1	Knowledge about humanity and sustainable	72,31%	Height

No	Sustainable Literacy Indicators	N-Gain (%)	Category
	ecosystems on planet earth		
2	Knowledge of sustainable transition	41,49%	Medium
3	Knowledge of the role of the self to shape and sustain individual and system change	70,97%	Height
4	Individual skills	46,91%	Medium
5	Systematic thinking and acting skills	96,36%	Height
6	Skills of working with others	59,72%	Medium
7	Mindset in the matter towards sustainability	53,80%	Medium
Average		63,08%	Medium

Of the seven indicators of sustainable literacy measured, three indicators were in the high category namely knowledge about humanity and sustainable ecosystems (72.31%), knowledge about the role of self in individual and system change (70.97%), and systematic thinking and acting skills (96.36%) while the other four indicators were in the medium category. These findings show that ESD-based digital flipbook media has a fairly even impact on various dimensions of sustainable literacy, although improvements in the aspects of knowledge about sustainable transition and individual skills still have the opportunity to be further optimized.

Discussion

It should be noted that the sustainable literacy measured in this study is focused on the knowledge aspect, because the test instrument used is designed to measure students' understanding of the concept of sustainability, human relations with the environment, and the role of individuals in maintaining environmental sustainability. Thus, the results of this study illustrate an improvement in the cognitive realm and do not fully cover aspects of skills and sustainable mindset as a whole.

The results of this study are consistent with a number of previous studies that show that flipbook-based learning media is able to improve the quality of learning processes and outcomes. Novtiana and Wulandari (2022) found that science literacy-based flipbook electronic teaching materials are suitable for use and effective in improving student learning outcomes in the medium N-Gain category, in line with the findings of this study which produced an average N-Gain of 0.60 in the same category. Other support comes from Halim et al. (2025), Putri et al. (2025), and Annisa et al. (2024), who reported an excellent level of validity and practicality of flipbooks based on expert validation and user responses, in line with the results of media (98%) and material (94%) validation obtained in this study. Chaeratunnisa et al. (2025) also emphasized that flipbook-based digital teaching materials

are effective in increasing learners' learning independence, reinforcing the finding that digital flipbooks create more interactive, interesting, and student-centered learning.

On the other hand, Putri et al. (2025) reported that the sustainable literacy ability of students at other levels of education is also still relatively low, so learning innovations that explicitly integrate the concept of sustainability are needed. These findings are one of the cornerstones of media development in this study, and the results of its implementation show that the integration of ESD principles into digital flipbooks is able to contribute positively to the improvement of students' sustainable literacy, although the categories of improvement obtained are still at a moderate level so that there is room for improvement in the aspects of skills and sustainability mindsets. Overall, the combination of very high feasibility scores from both validators and significant hypothesis test results shows that the ESD-based digital flipbook media developed has proven to be valid, practical, and effective as an alternative learning media that supports the instillation of sustainability values in elementary schools.

CONCLUSION

Based on the results of research and development, three main things can be concluded. First, the digital flipbook learning media based on Education for Sustainable Development (ESD) on the material "Bumiku Sayang, Bumiku Malang" has been successfully developed through the ADDIE model, starting from needs analysis, storyboard and material design, product development using Canva and Heyzine Flipbook, implementation in 41 grade V students, to formative and summative evaluation. Second, the media is stated to be very suitable for use in the learning process, with a feasibility percentage of 98% from media experts and 94% from material experts. Third, the media has proven to be effective in improving students' sustainable literacy, as shown by the results of the Paired Samples t-Test with a significance value of 0.000 (< 0.05) and an average N-Gain of 0.60 (60%) in the medium category, with three of the seven indicators of sustainable literacy reaching the high category.

Teachers are advised to use this media as an alternative to learning in the material "Bumiku Sayang, Bumiku Malang", while schools need to provide support for the wider application of ESD-based digital learning media. Further research is suggested to test the effectiveness of media on a larger number of subjects, different school levels, and longer duration of implementation, as well as combine media with other innovative learning models to optimize achievement in aspects of students' skills and sustainable mindset.

REFERENCES

- AlQallaf, N., Elnagar, D. W., Aly, S. G., Elkhodary, K. I., & Ghannam, R. (2024). *Empathy, Education, and Awareness: A VR Hackathon's Approach to Tackling Climate Change. Sustainability*, 16(2461), 1–16. <https://doi.org/10.3390/su16062461>
- Amalia, I., Diana, S., & Riandi. (2025). Analisis Literasi Keberlanjutan Awal Siswa SMA pada Materi Pencemaran Lingkungan Terintegrasi SDGs Poin 6. *Proceeding Biology Education Conference*, 22(1), 175–180.

- Annisa, Z., & Husnita, L. (2024). Pengembangan E-Book Berbantuan Flipbook Pada Mata Pelajaran Sejarah di SMA Negeri 1 Basa Ampek Balai. *Jurnal Pendidikan Tambusai*, 8(2), 25883–25891.
- Chaeratunnisa, E., Utari, E., & Lestari, I. D. (2025). *Development of Environment-Based Digital Flipbook Teaching Materials to Enhance Learning Independence among Elementary School Students*. *Jurnal Pedagogy: Jurnal Penelitian Dan Pengembangan Pendidikan*, 12(3), 775–785. <https://doi.org/10.33394/jp.v12i3.16390>
- Desyandri, D., Kharisna, F., Amini, R., & Erita, Y. (2024). *E-book Based on Project Based Learning Assisted by Kvisoft Flipbook Maker Blended Learning in Elementary Schools*. *Jurnal Ilmiah Sekolah Dasar*, 8(1), 148–155. <https://doi.org/10.23887/jisd.v8i1.68407>
- Ginting, M. C. S. I. (2019). Pengaruh Pendanaan Dari Luar Perusahaan dan Modal Sendiri Terhadap Tingkat Profitabilitas Pada Perusahaan *Property and Real Estate* yang Terdaftar di Bursa Efek Indonesia. *Jurnal Manajemen*, 5(2).
- Halim, A. A., Nurhidayah, & Riyanti, R. (2025). Pengembangan Media Pembelajaran Flipbook Sebagai Sarana Literasi Digital di Madrasah Aliyah DDI Cambalagi. *Jurnal Pendidikan Biologi*, 8(2), 111–124.
- Harianja, M. R., Yusup, M., & Siahaan, S. M. (2024). Uji N-Gain pada Efektivitas Penggunaan Game dengan Strategi SGQ untuk Meningkatkan Berpikir Komputasi dalam Literasi Energi. *Jurnal Intelektualita: Keislaman, Sosial, Dan Sains*, 13(2). <https://doi.org/10.19109/intelektualita.v13i2.25168>
- Kamilah, S. F., Wahyuni, I., & Ratnasari, D. (2023). Pengembangan Media Pembelajaran Interaktif Berbasis Website Menggunakan Google Sites Pada Materi Ekosistem Kelas X SMA. *Jurnal Ilmiah Pendidikan Biologi*, 9(3), 169–181. <https://doi.org/10.22437/biodik.v9i3.25523>
- Kiely, L., Parajuly, K., Green, J. A., & Fitzpatrick, C. (2021). *Education for UN Sustainable Development Goal 12: A Cross-Curricular Program for Secondary Level Students*. *Frontiers in Sustainability*, 2 (March), 1–10. <https://doi.org/10.3389/frsus.2021.638294>
- Maulida, P. E., & Zulherman. (2024). Pengembangan E-Book Berbantuan Flip Pdf Professional Materi Harmoni Dalam Ekosistem. *Research and Development Journal of Education*, 10(2), 900–909.
- Novtiana, I., & Wulandari, D. (2022). Pengembangan Bahan Ajar Elektronik Flipbook Berbasis Literasi Sains Pembelajaran IPA Kelas V. *Jurnal Kependidikan Dasar*, 13(2), 0–5.
- Pigai, F. Y. P., & Yulianto, S. (2024). *Development of Flipbook Learning Media to Improve Learning Outcomes IPAS*. *Jurnal Penelitian Pendidikan IPA*, 10(8), 5775–5781. <https://doi.org/10.29303/jppipa.v10i8.7937>
- Prasetyo, D., & Zulherman, Z. (2023). Pengembangan E-Book Berbantuan Flip Pdf Profesional Pada Materi Tumbuhan dan Hewan Untuk Siswa Kelas IV Sekolah Dasar. *Jurnal Education FKIP UNMA*, 9(4), 1709–1718. <https://doi.org/10.31949/educatio.v9i4.5826>
- Purnamasari, S., & Hanifah, A. N. (2021). *Education for Sustainable Development (ESD) dalam Pembelajaran IPA*. JKPI: *Jurnal Kajian Pendidikan IPA*, 1(2), 69–75.

- Putri, D. D. N., Rahayu, D., Fadilah, M., & Rahmi, F. O. (2025). Analisis *Sustainability Literacy* (Literasi Keberlanjutan) Peserta Didik Fase E pada Isu Bioteknologi di SMAN 12 Padang. *Jurnal Pengabdian Masyarakat Dan Riset Pendidikan*, 4(1), 2559–2565. <https://doi.org/10.31004/jerkin.v4i1.1832>
- Putri, D. S., Sastrawati, E., & Risdalina. (2025). Pengembangan Bahan Ajar Digital Dalam Bentuk *Flipbook* Berbantuan Aplikasi Canva Pada Materi Harmoni Dalam Ekosistem Kelas V Sekolah Dasar. *Jurnal Ilmiah Pendidikan*, 10(4), 401–406.
- Redman, A., & Wiek, A. (2021). *Competencies for Advancing Transformations Towards Sustainability*. *Frontiers in Education*, 6, 1–11. <https://doi.org/10.3389/educ.2021.785163>
- Sianturi, R. (2025). Uji Normalitas Sebagai Syarat Pengujian Hipotesis. *Jurnal Pembelajaran Dan Matematika Sigma (JPMS)*, 11(1), 1–14. <https://doi.org/10.36987/jpms.v10i2.5881>
- Silalahi, R. B., & Budiono, H. (2023). Pengembangan Bahan Ajar *Flipbook* Berbasis Web pada Muatan IPA di Sekolah Dasar. *Journal of Education Research*, 4(3), 1341–1349. <https://doi.org/10.37985/jer.v4i3.414>
- Siregar, T., & Rhamayanti, Y. (2025). Implementasi Pengembangan Model ADDIE pada Dunia Pendidikan. *Jurnal Hasil Penelitian Dan Pengembangan (JHPP)*, 3(2), 85–100.
- Sugiyono. (2023). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D (Edisi Kedua)*. Alfabeta.
- UNESCO. (2020). *Education for Sustainable Development: A Roadmap*. <https://doi.org/10.54675/YFRE1448>
- Velinda, F., Kurnianti, E. M., & Hasanah, U. (2024). Analisis Kebutuhan Media Digital *Flipbook* Interaktif Berbasis Web untuk Meningkatkan Keterampilan Berpikir Kritis Siswa Sekolah Dasar. *Jurnal Basicedu*, 8(2), 1308–1316.
- Widiastika, A. M., Hendracipta, N., & Syafrudin, A. S. A. (2020). Pengembangan Media Pembelajaran *Mobile Learning* Berbasis Android Pada Konsep Sistem Peredaran Darah di Sekolah Dasar. *Jurnal Basicedu*, 5(1), 47–64. <https://doi.org/10.31004/basicedu.v5il.602>
- Zwolińska, K., Lorenc, S., & Pomykala, R. (2022). *Sustainable Development in Education from Students' Perspective Implementation of Sustainable Development in Curricula*. *Sustainability*, 14(3398), 2–27. <https://doi.org/10.3390/su14063398>