

DEVELOPMENT OF INTERACTIVE STEAM-BASED FLIPBOOK MEDIA ON NETS OF THREE-DIMENSIONAL SHAPES

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ABSTRACT

Media serves as a tool for delivering information. The advancement of technology is essential to implement so that students can develop competencies in line with 21st-century skills. The purpose of this study is to develop an interactive STEAM-based digital flipbook as a teaching medium for fourth-grade elementary school students to learn about nets of three-dimensional shapes. This research employed the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The validity of the STEAM-based interactive flipbook was measured based on the results of validations by material experts, media experts, and design experts. The study involved 20 fourth-grade students from SD Tambakrigadung 2. The findings indicate that the development of the STEAM-based interactive flipbook can be summarized as follows: 1). The validity of the STEAM-based interactive flipbook as a learning medium received scores of 96%, 92%, and 93% from media experts, designers, and material experts, respectively. 2). The practicality of the STEAM-based interactive flipbook in limited trials and field trials achieved percentages of 89% and 95%, indicating that it is practical for use in the learning process. 3). The effectiveness of the STEAM-based interactive flipbook in limited trials and field trials achieved percentages of 87% and 95%, indicating that it is effective for use in the learning process. It can be concluded that the use of the STEAM-based interactive flipbook is highly valid, practical, and effective for use in the learning process.

Keywords: Interactive Flipbook, STEAM, Nets of Three Dimensional Shapes

ABSTRAK

Media merupakan sarana yang digunakan untuk penyampaian informasi. perkembangan teknologi merupakan suatu hal yang wajib untuk diterapkan, agar siswa mampu berkembang sesuai dengan kompetensi abad 21. Tujuan penelitian ini adalah untuk membuat produk media digital flipbook interaktif berbasis STEAM dalam mengajar siswa jaring-jaring bangun ruang di kelas empat sekolah dasar. Penelitian ini menggunakan model ADDIE (Analysis, Design, Development, Implementation, dan Evaluation). Validitas flipbook interaktif berbasis STEAM diukur berdasarkan hasil validasi ahli materi dan media, validasi ahli desain. Penelitian ini melibatkan 20 siswa kelas IV di SD Tambakrigadung 2. Hasil penelitian menunjukkan bahwa pengembangan flipbook interaktif berbasis STEAM dapat disimpulkan sebagai berikut: (1) Validitas media pembelajaran flipbook interaktif berbasis STEAM digunakan dengan presentase 96%, 92%, dan 93% dari ahli media, desainer, dan ahli materi. (2) Kepraktisan flipbook interaktif berbasis

STEAM pada uji coba terbatas dan uji coba lapangan dengan presentase 89% dan 95% yang dapat dinyatakan bahwa praktis digunakan dalam proses pembelajaran. (3) Keefektifan flipbook interaktif berbasis STEAM pada uji coba terbatas dan uji coba lapangan dengan presentase 87% dan 95% yang dapat dinyatakan bahwa efektif digunakan dalam proses pembelajaran. Dapat disimpulkan bahwa penggunaan media flipbook berbasis STEAM sangat valid, praktis dan efektif digunakan dalam proses pembelajaran.

Kata Kunci: Flipbook Interaktif, STEAM, Jaring-jaring Bangun Ruang

A. Introduction

Education is an essential component that must be prioritized to produce quality human resources. Education can guide individuals toward a better life through the process of learning and applying what they have learned. Learning activities should be interactive, engaging, challenging, and motivating (Humairah, Zativalen, et al., 2022). Learning should also encourage students to actively participate and provide sufficient space for creativity, effort, and independence in alignment with their talents, interests, and physical and psychological development. Media plays a crucial role as a mediator between teachers and students in the learning process (Hendriawan et al., 2023). One of the engaging, interactive, and innovative learning media is the STEAM-based interactive flipbook for mathematics subjects (Siregar et al., 2023; Twiningsih, 2020). Learning media are

the teaching and learning process and convey messages to students, enabling them to achieve their educational goals (Humairah, Chasanah, et al., 2022). The development of learning media makes the learning process more engaging, enhances learning efficiency, fosters students' enthusiasm for learning, provides students with an engaging learning experience, and allows them to actively participate in the learning process (Parniati et al., 2021).

In learning mathematics, students often face difficulties in understanding the material being taught. Therefore, teachers are expected to deliver the content effectively. Mathematics learning requires students' comprehension as it involves numerous concepts. Mathematics is a field of study that influences human thinking abilities. Mathematics itself plays a role in students' lives, both in the present and in the future (Adolphus, 2011).

Learning media continue to evolve, ranging from conventional tools like books and teaching aids to technology-based media such as social media and popular applications or software today (Ahsanah & Utomo, 2020; MZ, 2021). Therefore, the development of engaging learning media, both in terms of appearance and content, with a technology-based approach, is necessary. A flipbook is an electronic book that serves as a teaching material utilizing modern tools and technology, aligned with advancements in science and technology (IPTEK) and the increasingly progressive era (Nariswari et al., 2022).

Preliminary observations of the teachers at SDN Tambakrigadung 2 revealed that mathematics teachers find it challenging to use technology, resulting in learning media that appear monotonous and unengaging. The learning media currently used include PowerPoint presentations containing text or student textbooks. Teachers believe that mathematics learning media should be engaging and easy to use. Therefore, the researcher sought to create something new that is not only engaging but also incorporates technology, is feasible, practical, and cost-effective. This would enable

teachers and students to easily understand mathematics material, particularly the topic of nets of three-dimensional shapes.

Flipbook media is an easy way to present learning materials and attract students' interest in learning. According to a study conducted by Santi & Prasetya (2022), the development of e-module learning media using FlipbookMaker for the topic of Force and Motion in Grade IV at SDN Bahagia 04 achieved material feasibility test results with a score of 96%, media feasibility with a score of 94%, and linguistic validation with a score of 86%. This indicates that the e-module learning media based on FlipbookMaker is highly suitable for use in science lessons on the topic of Force and Motion.

B. Method

The purpose of this research is to create and develop a product; therefore, the research employs the Research and Development (R&D) method. The goal of R&D is to produce a specific product and determine its effectiveness. One of the development models within the R&D method is the ADDIE model, which will be used by the author in developing the STEAM-based interactive flipbook learning

media. ADDIE stands for **Analysis, Design, Development, Implementation, and Evaluation**. This model was chosen because it is systematic and easy to understand, making it suitable for development research.

The subjects of this study are 20 fourth-grade students from SDN Tambakrigadung 2. The data collection tools used in this study are questionnaires and validation sheets. The media validation sheet was validated by media experts, design experts, and material experts. To calculate the validation sheet, the following formula is used:

$$V - au = \frac{Tse}{Tsh} \times 100\%$$

Fourth-grade students from SDN Tambakrigadung 2 were involved in this study. Ten fourth-grade students participated in the limited trial of the STEAM-based interactive flipbook learning media, while twenty fourth-grade students took part in the field trial. The data used in this study comes from three sources: data from the validation of the STEAM-based interactive flipbook media, student response questionnaires after testing the STEAM-based interactive flipbook media, which were completed by the students, and activity questionnaires filled out by peers and teachers to assess the effectiveness of the STEAM-based interactive flipbook media.

Table 1. Expert Validation Criteria

Validity Percentage	Validity Level
81% - 100%	Highly Valid, or can be used without revision
61% - 80%	Valid, can be used but requires minor revisions
41% - 60%	Fairly recommended to use, valid but requires major revisions
21% - 40%	Not recommended to use, invalid, should not be used
0% - 20%	Highly Invalid, or should not be use

C. Result and Discussion

Results of the Development of STEAM-Based Interactive Flipbook

Below is the design of the STEAM-based interactive flipbook learning media that has been developed by the researcher.

a. Initial Display of the STEAM-Based Interactive Flipbook Media

This media contains a barcode that can be scanned using a smartphone or other devices to

access the STEAM-based interactive flipbook media.



Figure 1: Barcode and Media Initial Display

b. The Display of Learning Objectives

In this part consist of Learning Objectives so that the students can comprehend the learning outcome that need to be achieved.



Figure 2: Learning Objectives Display

c. Content Display of the STEAM-Based Interactive Flipbook Media.

The content of the developed STEAM-based interactive flipbook media is for the fourth-grade Mathematics subject, focusing on the topic of nets of three-dimensional shapes. Below are some examples of the content from the interactive flipbook media:



Figure 3: Content Display of the STEAM-Based Interactive Flipbook Media.

Expert Validation Results

Media, design, and content experts conducted a validation test on the developed STEAM-based Interactive Flipbook Media to assess and evaluate the content of the product before it was tested with students.

Table 2. Media Expert Validation Results

Assessment Aspects	Expert Score		Total Average
	1	2	
Visual Quality	3,75	3,75	3,75
Software	4	3,6	3,8
Engineering			
Feasibility	3,6	3,6	3,6
Total Average			3,71

$$V - au = \frac{3,71}{4} \times 100\% = 92\%$$

Based on Table 2 and the calculation of the media feasibility results according to media experts, with a percentage of 92%, it falls into the "Highly Valid" category.

Table 3. Design Expert Validation Results

Assessment Aspects	Expert Score		Total Average
	1	2	
Display Desain	3,8	3,7	3,75
Total Average			3,75

$$V - au = \frac{3,75}{4} \times 100\% = 93\%$$

Based on Table 3 and the calculation of the media feasibility results according to design experts, with a percentage of 93%, it falls into the "Highly Valid" category.

Table 4. Material Validation Results

Assessment Aspects	Expert Score		Total Average
	1	2	
Curriculum	4	4	4
Material	4	3,71	3,85
grammatical	4	3,5	3,86
Total Average			3,86

$$V - au = \frac{3,86}{4} \times 100\% = 96\%$$

Based on the data in Table 4 and the opinion of the subject matter expert, the learning media is deemed feasible at 96%, placing it in the "Highly Valid" category. The STEAM-based interactive flipbook media is considered valid for use based on the findings from the validation tests by media experts, design experts, and subject matter experts.

Practicality Results of the Interactive Flipbook Media

The testing phase was conducted in two stages: limited trials

and field trials. Students filled out a questionnaire about the practicality of the media. After the students completed the questionnaire, the researcher will analyze the data to determine whether the STEAM-based interactive flipbook learning media is highly beneficial. Table 5 presents the findings from the student response questionnaires in the field trial class (20 participants) and the limited trial class (10 participants).

Table 5: Practicality Test Results of Limited Trials and Field Trials

Aspects	Frequency	Score	Percentage
Limited Trial	10	89	81%
Field Trial	20	200	95%

As shown in Table 5, the results of the student response questionnaire in the limited trial were 89 points, or 81% of the total. Additionally, the student response questionnaire in the field trial resulted in a score of 210, or 95% of the total. The results of this study fall into the "Highly Practical" category. Therefore, it can be concluded that the STEAM-based interactive flipbook media is practical to use.

Effectiveness Results of Interactive Video Media

The researchers demonstrated the effectiveness of the media through its application, as proven by administering an activity questionnaire to students in both controlled and uncontrolled conditions. After reviewing the survey responses, we need to find evidence that the interactive video media is beneficial. Table 6 presents the findings from the student activity questionnaires completed by the fourth-grade teacher and peers.

The researchers demonstrated the media's effectiveness by providing activity questionnaires to students in both controlled and uncontrolled settings. We should find evidence that the interactive flipbook media is beneficial after reviewing the survey results. The student activity questionnaires completed by the fourth-grade teacher and peers can be seen in Table 6.

Table 6. Students' Questionnaire Responses for Limited and Field Trial

Name	Tria Types		Total
	Limited	Field	Average
IN	10	12	87%
AND	11	13	95%

The results of the limited trial and field trial show the student activity

throughout the learning process using interactive video media, as presented in Table 6. The limited trial was "Highly Effective" with a percentage of 87%, while the field trial had a percentage of 95%. Therefore, it can be concluded that the STEAM-based interactive flipbook media is effective for use.

The results of the limited trial and field trial show the student activity throughout the learning process using interactive video media, as presented in Table 6. The limited trial was "Highly Effective" with a percentage of 87%, while the field trial had a percentage of 95%. Therefore, it can be concluded that the STEAM-based interactive flipbook media is effective for use.

A digital flipbook is a three-dimensional digital book that can contain images and text. It falls into the category of digital books or e-books. A flipbook is a sheet of paper, usually the size of an album or calendar (Ramadanti & Bektiningsih, 2023). It is then enhanced with animations, particularly moving animations that add value to the flipbook sheet features, which can be opened by clicking an arrow symbol or scrolling (Novelina et al., 2023). A STEAM-based flipbook (Science, Technology,

Engineering, Art, and Mathematics) includes Science: material presented on the nets of solid shapes, Technology: creating a flipbook through the Canva application, Engineering: the process of crafting with recycled materials in the final task of the flipbook, Art: the result of crafting with recycled materials, and Mathematics: the process of crafting, which involves measurement, as well as diagonals and symmetry (Parniati et al., 2021). This media is applied in the classroom through the ADDIE instructional model, and the effectiveness of this development is presented in the form of research results that show the flipbook media is suitable for use by elementary school teachers in mathematics instruction, particularly on the topic of nets of solid shapes, to improve students' understanding of mathematical concepts and creative skills.

Based on the results of the validation tests, which include media validation, design validation, and material validation, the interactive flipbook media is declared valid for use. This is supported by the media expert validation score of 3.71 (92%), the design expert validation score of 3.75 (93%), and the subject matter

expert validation score of 3.86 (96%), all of which fall into the "excellent" category. Therefore, it can be concluded that the interactive flipbook media is valid for teaching the nets of solid shapes in mathematics for fourth-grade students. This is in line with the research conducted by Novelina et al. (2023) and Ramadanti & Bektiningsih (2023), which concluded that the media is valid and suitable for use in the learning process.

The practicality of the interactive flipbook learning media can be seen from the results of the limited trials and field trials. The practicality of the interactive flipbook is seen from students' responses to using the media. The limited trial results showed a percentage of 89%, categorized as highly practical, while the field trial results showed a percentage of 95%, also categorized as highly practical. Based on these results, it can be concluded that the learning process using the interactive flipbook media is practical and helps students understand the material on nets of solid shapes. This is consistent with the research by Wahyuni et al. (2024), which shows that using this interactive flipbook media makes the learning

process more effective, as not only the teacher is active but also the students are involved, creating feedback, which increases students' interest in learning in every subject taught. The effectiveness of the interactive flipbook learning media is also supported by previous researchers, such as Elisya et al. (2023), who stated that the interactive flipbook is practical to use as a learning media.

Based on the discussion presented above, it can be concluded that the development of the interactive flipbook learning media is highly effective and can be used in the learning process for the topic of nets of solid shapes in fourth-grade mathematics at elementary schools.

D. Conclusion

By using the ADDIE development method, this research falls under Development (R&D). The visually appealing and interactive design, complete with captivating images and animations, as well as the ability to access the media via barcode scanning, are all part of the development process of the interactive flipbook learning media. The interactive flipbook is an excellent digital learning tool because it encompasses all the fundamentals as

a learning medium, aligned with the relevant curriculum. The findings fall into the "highly valid" category and are suitable for the learning process, as confirmed by the validation results from media experts, design experts, and subject matter experts. The student response survey results, both in controlled and uncontrolled environments, placed the E-Comic media in the "highly practical" category when evaluating its feasibility. Based on the findings from the student activity surveys, both in the limited trial and field trial, the effectiveness of the interactive flipbook media has proven to be highly beneficial. From these findings, the researchers can conclude that fourth-grade students have benefited from using the interactive flipbook media to master the content on nets of solid shapes.

REFERENCES

- Adolphus, T. (2011). Problems of teaching and learning of geometry in secondary schools in Rivers State, Nigeria. *International Journal of Emerging Sciences*, 1(2), 143–152.
- Ahsanah, F., & Utomo, D. T. P. (2020). The Use of Digital Comic in Developing Student's English Competence. *IDEAS: Journal on English Language Teaching and Learning, Linguistics and*

- Literature*, 8(2), 373–383.
<https://doi.org/10.24256/ideas.v8i2.1660>
- Elisya, R. N., Wahyuni, S., & Ahmad, N. (2023). Pengembangan Bahan Ajar IPA Berbasis Flipbook untuk Meningkatkan Kemampuan Berpikir Kreatif pada Siswa SMP / MTs. *Jurnal Sainsmat*, 12(1), 62–72.
<http://ojs.unm.ac.id/index.php/sainsmat>
- Hendriawan, W., Yuniarta, T. N. H., & Setyadi, D. (2023). Pengembangan Media Pembelajaran Google Sites Berbasis Steam Untuk Materi Dimensi Tiga. *Pedagogy : Jurnal Pendidikan Matematika*, 8(1), 281–295. <https://www.e-journal.my.id/pedagogy/article/view/2573>
- Humairah, Chasanah, U., & Handoyo, E. (2022). An Evaluation of Students' Readiness to Use E-learning Media in the MBKM Program. *Jurnal Basicedu*, 6(3), 4251–4258.
<https://doi.org/https://jbasic.org/index.php/basicedu/article/view/2388>
- Humairah, H., Zativalen, O., & Nurhasanah, N. (2022). Pengaruh Model Pembelajaran Kooperatif Tipe Picture and Picture Terhadap Hasil Belajar Siswa Matematika MI Muhammadiyah 1 Payaman. *Jurnal Jendela Pendidikan*, 02(01), 82–86.
<https://doi.org/10.57008/jjp.v2i01.136>
- MZ, A. F. S. A. (2021). Pengaruh Penggunaan Media Gambar Seri Terhadap Kemampuan Menulis Karangan Narasi Siswa Kelas V MI Muhammadiyah 1 Payaman. *Jurnal Pendidikan Dan Sains*, 3(April), 142–152.
<https://journal.ikipsiliwangi.ac.id/index.php/collase/article/view/6733>
- Nariswari, N. P., Hidayat, S., & Hariz, A. R. (2022). Pengembangan E-Flipbook Materi Perubahan Lingkungan Berbasis Literasi Lingkungan Sebagai Sumber Belajar Biologi pada Siswa SMA / MA. *NCOINS: National Conference Of Islamic Natural Science*, 2(1), 81–94.
- Novelina, R., Herlinda, Vebrianto, R., Aramudin, & Berlian, M. (2023). Penilaian dan Evaluasi Media Flipbook Digital Berbasis Pendekatan STEAM dengan Instruksional ADDIE pada Materi Keseimbangan Ekosistem. *Jurnal Pendidikan Mipa*, 13(3), 701–707.
<https://doi.org/10.37630/jpm.v13i3.1099>
- Parniati, W., Hadi, Y. A., Hamdi, Z., & Husni, M. (2021). Pengembangan Media Pembelajaran Berbasis STEAM pada Pembelajaran Tematik Integratif di Kelas IV MI NW Ajan Tahun Pelajaran 2021/2022. *Jurnal Pendidikan Tambusai*, 5(2), 6170–6176.
<https://jptam.org/index.php/jptam/article/view/1925/1702>
- Ramadanti, A. R., & Bektiningsih, K. (2023). Flipbook-Based Digital Comic Learning Media in Science Content to Improve Student Learning Outcomes. *Journal for Lesson and Learning Studies*, 6(3), 506–515.
<https://ejournal.undiksha.ac.id/index.php/JLLS/article/view/68053/27908>
- Santi, A. U. P., & Prasetya, G. M. (2022). Pengembangan Media Pembelajaran E-Modul Berbasis Flipbook Maker Pada Materi Gaya Dan Gerak Kelas IV SDN Bahagia 04. *Jurnal Tunas Bangsa*, 9(2), 88–101.
<https://doi.org/10.46244/tunasbangsa.v9i2.2006>

- Siregar, T. E., Santoso, A., & Dewi, R. S. I. (2023). Analisis Penggunaan Bahan Ajar IPAS Berbasis STEAM Untuk Memfasilitasi Literasi Sains Pada Siswa Kelas V Sekolah Dasar. *Jurnal Perseda*, VI(3), 258–267.
- Twiningsih, A. (2020). Pengembangan Media Tak Tik Butarna Berbasis STEAM pada Pembelajaran Tematik Kelas 1 SD. *Jurnal Didaktika Pendidikan Dasar*, 4(3), 741–758.
<https://doi.org/10.26811/didaktika.v4i3.143>
- Wahyuni, F., Surmilasari, N., & Jayanti. (2024). Pengembangan Media Pembelajaran Flipbook Materi Bangun Ruang Kelas V SDN 72 Palembang. *Indonesian Research Journal on Education*, 4(2), 819 – 827.