Kasuari: Physics Education Journal 8(1) (2025) 246-253
P-ISSN: 2615-2681
E-ISSN: 2615-2673

Kasuari: Physics Education Journal (KPEJ)
Universitas Papua
website: https://journalfkipunipa.org/index.php/kpej

Implementation of Flipbook-Based E-Modules on Particle Kinematics Material for Physics Learning in High Schools

Kistiono* & Ade Fitri
Pendidikan Fisika, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Sriwijaya, Indonesia
*Corresponding author: kistiono@fkip.unsri.ac.id

Abstract: *This research aims to develop a flipbook-based e-module on particle kinematics for high school physics learning. The research employed the Research and Development (R&D) method with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The analysis phase revealed that 58% of students encountered difficulties in learning physics, while 50.7% specifically struggled with force-related materials. The e-module was developed based on student needs and validated by content, design, and language experts. Validation results indicated that the e-module was suitable for use after incorporating suggested revisions. Practicality testing was conducted in two phases: a limited trial involving 18 students and a broader implementation with 35 students. The average practicality level reached 81.2% in the limited trial and 80.6% in the broader implementation, categorizing the e-module as "very practical." This study demonstrates that the flipbook-based e-module effectively addresses students' learning challenges by providing an interactive digital learning resource appropriate for the digital era.*

Keywords: *ADDIE, digital learning resource, e-module, flipbook, kinematics, physics education, interactive learning*

Implementasi E-Modul Berbasis *Flipbook* pada Materi Kinematika Partikel untuk Pembelajaran Fisika di SMA

Abstrak: Penelitian ini bertujuan untuk mengembangkan e-modul berbasis flipbook pada materi kinematika partikel untuk pembelajaran fisika SMA. Penelitian ini menggunakan metode *Research and Development* (R&D) dengan model ADDIE (*Analysis, Design, Development, Implementation, Evaluation*). Hasil analisis menunjukkan bahwa 58% siswa mengalami kesulitan dalam belajar fisika, sementara 50,7% siswa secara khusus mengalami kesulitan pada materi yang berhubungan dengan gaya. E-modul dikembangkan berdasarkan kebutuhan siswa dan divalidasi oleh ahli konten, desain, dan bahasa. Hasil validasi menunjukkan bahwa e-modul layak digunakan setelah dilakukan revisi sesuai dengan saran yang diberikan. Uji kepraktisan dilakukan dalam dua tahap yaitu uji coba terbatas yang melibatkan 18 siswa dan implementasi yang lebih luas dengan 35 siswa. Tingkat kepraktisan rata-rata mencapai 81,2% pada uji coba terbatas dan 80,6% pada uji coba lebih luas, yang mengkategorikan e-modul sebagai “sangat praktis”. Penelitian ini menunjukkan bahwa e-modul berbasis *flipbook* secara efektif menjawab tantangan belajar siswa dengan menyediakan sumber belajar digital interaktif yang sesuai untuk era digital.

Kata kunci: ADDIE, e-modul, *flipbook*, kinematika, pembelajaran interaktif, pendidikan fisika, sumber belajar digital

INTRODUCTION

Education is defined as an ongoing process that aims to improve the quality of students by facilitating the acquisition of knowledge and the achievement of specific goals. The contemporary educational landscape is undergoing a paradigm shift, transitioning from conventional face-to-face learning models to online-based educational approaches (Efgivia, 2020). The learning process requires various supporting components, one of which is learning media. Education is highly dependent on the teaching materials used; teaching materials are considered a very important learning asset, and their existence is indispensable for the success of educational programs. Utilizing the ease of technology in the current era and combining it with learning materials can make the atmosphere during the learning process more enjoyable and less monotonous to students (Hapsari et al., 2024). The success of the learning process depends on the collaboration between educators, students, and the learning resources used in the educational environment(Sudirman et al., 2020). Consequently, educators who possess specific competencies, such as creativity, critical thinking, and metacognitive skills, are well-positioned to effectively implement technology-based learning, a necessity for education in the 21st Century (Boholano, 2017). These competencies empower educators to seamlessly integrate digital technology into teaching practices, adapt to evolving educational paradigms, and facilitate learning experiences that align with the needs of contemporary learners.

The development of teaching materials that are easily comprehensible by students is a crucial aspect of introducing information technology-based teaching materials. In the current digital era, electronic media have emerged as a prominent learning resource. An exemplar of this is the E-Module, which is based on the flipbook application. This application can also be accessed through several electronic devices, facilitating portability (Talitha et al., 2023). This approach enables students to learn according to their own pace and in a flexible manner, independent of time and place. In order to enhance the appeal and relevance of the Physics subject, it is essential to integrate more interactive and contextualized learning innovations, thereby ensuring that education remains engaging and meaningful for students (Maulida et al., 2024). Physics as a scientific discipline includes interrelated facts, concepts, laws, equations, and theories. (Fitri & Fathurohman, 2025) stated that physics concepts are both abstract and concrete, both being the foundation of scientific inquiry. This complexity causes students to often consider physics as a challenging subject, especially in the topic of particle kinematics.

Kinematics is one of the sciences that studies motion without regard to the cause of the motion (Syuhendri et al., 2021). The challenge students encounter in comprehending particle kinematics material frequently impedes their engagement and success in physics learning. National exam data from the Ministry of Education and Culture in 2019 revealed that the average score on the physics national exam (46.47) placed it in the penultimate position among all subjects, following mathematics. This finding underscores the necessity for the implementation of more effective and interactive learning media, particularly in the context of particle kinematics material.

METHOD

The research method used is Research and Development (R&D) with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model developed by Dick and Carry in 1996 (Umami et al., 2021). This research will be conducted at SMAN 20 Palembang. The research was conducted in the odd semester of the 2024/2025 academic year. The subjects of this research are material expert validators and media experts for the validation process, and class XI students of SMAN 20

Palembang in the academic year 2024/2025. There were 18 students for limited test and 32 students for broad test.

This study used an expert judgment analysis technique to validate the content, design, and language aspects of the developed E-module. The experts gave an assessment of the draft E-module with the status of "feasible with revision," then the researcher analyzed the input and made improvements according to the suggestions given. The validation process was carried out iteratively until it reached an instrument that met the quality standards. After validation by experts, the analysis continued with testing the practicality of the product through student assessment. This assessment used a Likert scale instrument with five response categories as shown in Table 1.

Table 1. Practicality Calculation Scale

Criteria	Scale
Strongly agree	5
Agree	4
Less agree	3
Disagree	2
Strongly Disagree	1

(Siahaan et al., 2022)

Calculate the percentage of each learner's total response value for all statements. By using the formula (1).

$$\text{Practicality score} = \frac{Total\ Score}{Maximum\ Total\ Score} \times 100\% \quad (1)$$

The percentage results of practicality are then interpreted in qualitative terms based on Table 2.

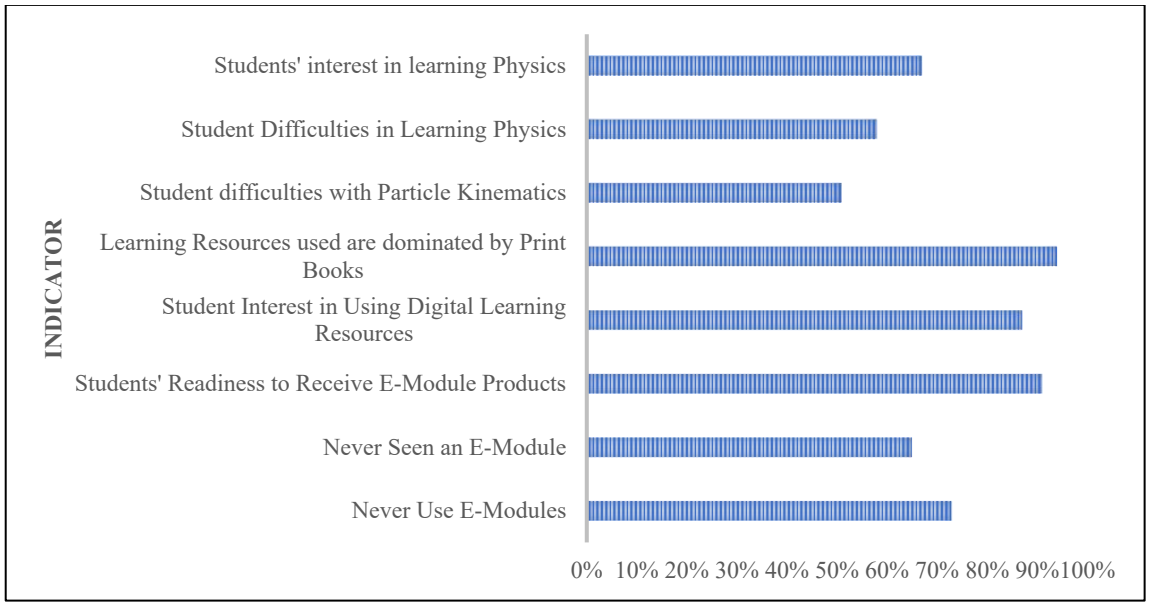
Table 2. Criteria for Practicality

Presentase (%)	Criteria
$80 < \leq 100$	Sangat Praktis
$60 \leq P \leq 80$	Practical
$40 \leq P \leq 60$	Practical enough
$20 \leq P \leq 40$	Less Practical
$0 \leq P \leq 20$	Very Practical

RESULTS AND DISCUSSION

Analysis

Data collection for student needs analysis was conducted using a questionnaire. It was given via Google form, which was sent to 69 students as respondents in this needs analysis. The results and discussion can be presented in tables or graphs to clarify the results verbally.



Gambar 2. Results of Student Needs Analysis

The results of the questionnaire analysis indicate that students' interest in learning physics remains substantial, with a response rate of 66.7%. Concerning the challenges encountered during the learning process, 58% of students reported difficulties in comprehending Physics in general, while 50.7% indicated challenges in understanding force materials within the academic environment. The prevailing teaching materials are predominantly print-based, with a 78% utilization of printed books. Furthermore, 80% of students have never used e-modules, and 70% have never seen e-modules before. Notably, a significant proportion of 91.3% of students have expressed their readiness to receive e-module products.

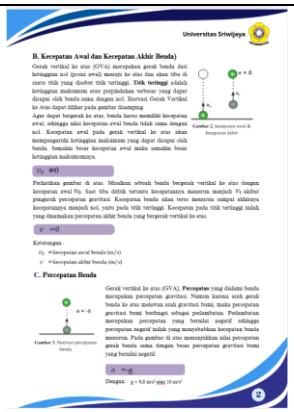
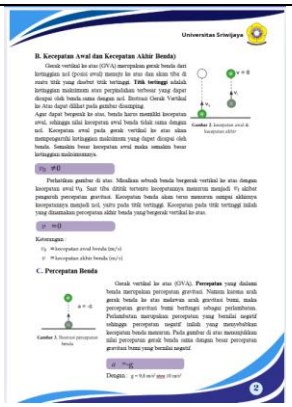
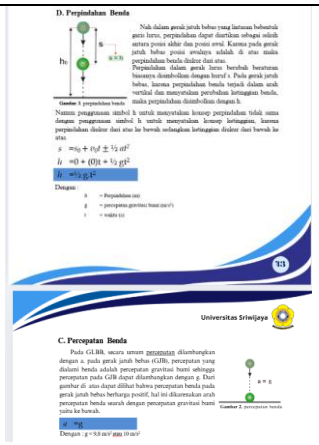
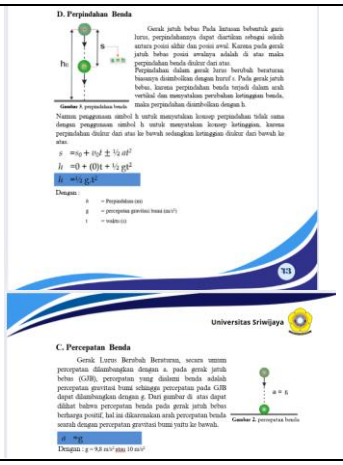
Design

The design stage entails the formulation of a preliminary E-module, which is intended to conceptualize the product under development. This module encompasses the following components: (1) The opening section consists of a title, table of contents, list of images, and list of tables. (2) The Core Section consists of: (a) an introduction or overview of the material, which includes a description of the learning objectives, prerequisites for using the module, instructions for using the module, final objectives, competency standards, and basic competencies, as well as initial tests. (b) Relationship to other meters or concept maps. (c) Description of the material which systematically follows: learning activities, competency objectives, material descriptions, formative tests, assignments, summaries, feedback on assessments. The module's closing section may include a glossary or glossary of terms, a final test, and an index.

Deploment

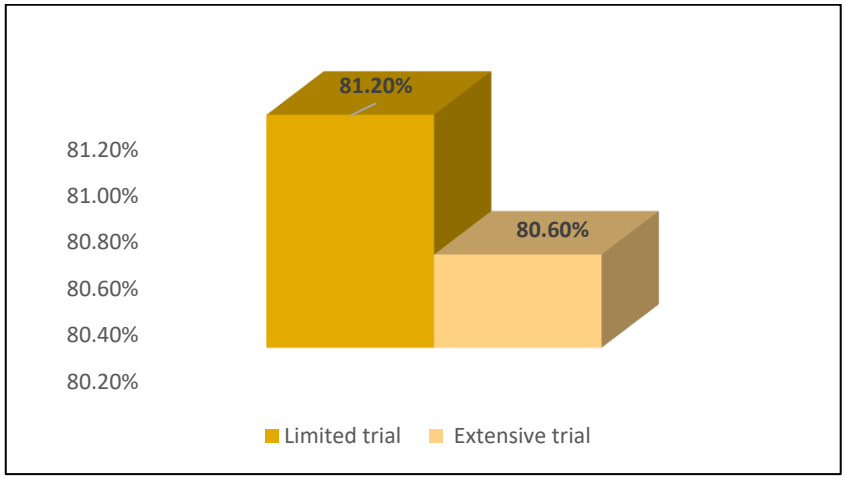
At the Product Validation Development stage, experts evaluate the feasibility of the E-Module using expert judgment. The purpose of this stage is to determine the suitability of the E-Module for use (Sintawati & Margunayasa, 2021). The acceptance of learning media is crucial to support a better physics learning process (Yusuf et al., 2024).The results of the evaluation of the feasibility assessment of content, language, and design are as follows.

Table 3. Correction Results According to Suggestions from the Validator

Statements Suggestions/Revisions	Before Revision	After Revision
Paragraphs are Indented, no prepositions at the beginning of sentences.		
Greeting Words in Paragraphs to Avoid		

Implementation

Following a thorough examination and validation, the developed e-module is deemed suitable for use and acceptable. Subsequently, the implementation stage is initiated. This stage involves the practical evaluation of the e-module's functionality and the application process. Two preliminary trial classes with a total enrollment of 18 participants were conducted, and the application was implemented across 35 students in subsequent trials.



Gambar 3. Practicality Test Result

Evaluation

At this stage, the tool is employed to assess the viability and gauge the responses of students, incorporating suggestions and critiques from teachers, students, and validators. The objective of this stage is to enhance the quality of the product. Consequently, researchers will conclude the outcomes of the developmental process. The results of the student needs analysis indicate that the majority of students maintain a strong interest in learning physics, with 66.7% of respondents expressing a positive inclination towards the subject. However, the analysis also reveals that 58% of students encounter challenges in comprehending physics concepts, suggesting a need for effective pedagogical strategies to enhance their learning experience. Specifically, 50.7% of students reported challenges in comprehending force-related material. This finding served as the foundation for the development of Particle Kinematics E-Modules, designed to address students' identified needs. The validation results from the experts demonstrated that the E-Module product developed met the eligibility criteria in terms of content, language, and design following the revision process (Sintawati et al., 2021). Revisions to the language were made to improve paragraph format, ensuring that sentences begin with a capital letter, prepositions are not used at the beginning of paragraph sentences, and the word "greeting" is omitted. Revisions to the design aspect focused on enhancing the clarity of images and ensuring equitable font size in the equation section. In terms of content, the addition of learning objectives and the alignment of material with the context of everyday life have been implemented to enhance the quality of the E-Module.

The E-Module's practicality, categorized as "very practical" in the limited trial (81.2%) and broad trial (80.6%), signifies its ease of use and acceptance among students as a learning resource. This finding aligns with the observations of (Sudirman et al., 2020).who posited that the efficacy of the learning process is contingent on the collaborative engagement of educators, students, and the utilized learning resources. The Flipbook-based E-Module under consideration offers advantages over conventional teaching materials by providing a more interactive and interesting learning experience by utilizing digital technology (Ramadhan et al., 2023). This addresses the challenges of education in the digital era, as previously outlined (Efgivia, 2020). Additionally, the interactive learning media developed is programmed to incorporate learning elements (Astuti et al., 2020).

As indicated by the findings of previous research (Nurhidayati et al., 2018) the average learning outcomes of students in the knowledge domain of the e-module class were higher than those of the printed teaching material class. In line with this finding, subsequent research by (Romayanti et al., 2020) demonstrated that Flipbook-based E-Modules significantly influenced student learning independence. These findings serve to reinforce the outcomes of research conducted on the development of Particle Kinematics E-Modules, which have been shown to possess a high degree of practicality and have the potential to enhance the quality of physics learning.

CONCLUSION AND SUGGESTIONS

The conclusion contains a brief summary of the research results and discussion. The development of an e-module employing a flipbook approach for the instruction of high school physics students has been successfully executed. This endeavor utilized the ADDIE development model. A comprehensive analysis of the research findings and discussions reveals the following conclusions: The developed Particle Kinematics E-Module has met the eligibility criteria in terms of content, language, and design after undergoing a validation process by experts and undergoing revision according to suggestions. The

practicality test results indicated that the developed E-Module was classified as highly practical, with percentages of 81.2% in the limited trial and 80.6% in the broad trial. The development of this E-Module is designed to address students' challenges in learning Particle Kinematics material by providing interactive digital teaching materials that align with the learning needs of the digital era. It is recommended that physics educators leverage the capabilities of digital technology in the development of interactive teaching materials for other physics concepts.

ACKNOWLEDGMENTS

The author expresses gratitude to their parents and siblings for their support of this research study. Additionally, the students and teachers of SMA Negeri 20 Palembang are acknowledged for their participation as research subjects.

BIBLIOGRAPHY

Astuti, L., Wihardi, Y., & Rochintaniawati, D. (2020). The Development of Web-Based Learning using Interactive Media for Science Learning on Levers in Human Body Topic. *Journal of Science Learning*, *3*(2), 89–98. https://doi.org/10.17509/jsl.v3i2.19366

Boholano, H. (2017). Smart Social Networking: 21st Century Teaching and Learning Skills. *Research in Pedagogy*, *7*(2), 21–29. https://doi.org/10.17810/2015.45

Efgivia, M. G. (2020). Pemanfaatan Big Data dalam Penelitian Teknologi Pendidikan. *Educate: Jurnal Teknologi Pendidikan*, *5*(2), 107–120. https://doi.org/10.32832/educate.v5i2.3381

Fitri, A., & Fathurohman, A. (2025). Eksplorasi Konsep Fisika pada Penggunaan Alat Panen Tradisional Kelapa Sawit. *OPTIKA: Jurnal Pendidikan Fisika*, *9*(1), 16–25. https://doi.org/https://doi.org/10.37478/optika.v9i1.5073

Hapsari, A. N., Risdianto, E., & Medriati, R. (2024). Development of Canva Based Digital Comics on Straight Motion Kinematics Materials For Student's Learning Motivation Orientation. *Kasuari: Physics Education Journal (KPEJ)*, *7*(1), 66–77. https://doi.org/https://doi.org/10.37891/kpej.v7i1.375

Maulida, Q., Lifti Rosyida, Z., Jariyah, I. A., Sunan, U., & Surabaya, A. (2024). Tinjauan Literatur Terhadap Media Pembelajaran Berbasis E-book Interaktif dalam Pembelajaran IPA. *Jurnal Pendidikan dan Kebudayaan*, *1*(2), 145-155. http://dx.doi.org/10.69836/inspirasi-jpk.v1i2.163

Nurhidayati, A., Putro, S. C., & Widiyaningtyas, T. (2018). Penerapan Model PBL Berbantuan E-Modul berbasis Flipbook Dibandingkan Berbantuan Bahan Ajar Cetak Pengaruhnya terhadap Hasil Belajar Pemrograman Siswa SMK. *Teknologi dan Kejuruan Jurnal Teknologi Kejuruan dan Pengajarannya, 41*(2), 130-138. http://dx.doi.org/10.17977/um031v41i22018p130

Ramadhan, W., Meisya, R., Jannah, R., & Putro, K. Z. (2023). E-modul Pendidikan Pancasila Berbasis Canva Berbantuan Flip PDF Profesional untuk Meningkatkan Hasil Belajar Siswa Sekolah Dasar. *Jurnal Pemikiran dan Pengembangan Sekolah Dasar (JP2SD)*, *11*(2). https://doi.org/10.22219/jp2sd.v11i2.27262

Romayanti, C., Sundaryono, A., & Handayani, D., (2020). Pengembangan E-Modul Kimia berbasis Kemampuan Berpikir Kreatif dengan Menggunakan Kvisoft Flipbook Maker. *Jurnal Pendidikan dan Ilmu Kimia*, *4*(1), 51–58. https://doi.org/https://doi.org/10.33369/atp.v4i1.13709

Siahaan, S. D. N., Aurora Elise Putriku, & Saragih, L. S. (2022). Validity, Practicality, and Effectiveness of Business Introduction Book Based on Theory and Practice. *East*

Asian Journal of Multidisciplinary Research, *1*(10), 2277–2290. https://doi.org/10.55927/eajmr.v1i10.1234

Sintawati, N. P., & Margunayasa, G. (2021). Interactive E-Module for Science Learning Content: Validity and Feasibility. *International Journal of Elementary Education*, *5*(1), 19–29. https://doi.org/10.23887/ijee.v5i1.34281

Sudirman, Kistiono, Akhsan, H., & Ariska, M. (2020). Pengembangan Instrumen Penilaian Pengetahuan, Sikap dan Keterampilan IPA Berbasis Berpikir Kritis pada Konsep Listrik Siswa SMP. *Jurnal Inovasi dan Pembelajaran Fisika*, *7*(1), 28-40. http://dx.doi.org/10.36706/jipf.v7i1.10903

Sukmana, H., Ana, A., & Widiaty, I. (2021). Pengembangan Media Edukasi Boneka Tangan sebagai Stimulasi Moral pada Anak Usia Dini. *Jurnal Pendidikan Kesejahteraan Keluarga*, *7*(1), 9-18. https://ejournal.upi.edu/index.php/familyedu

Syuhendri, S., Sania, L., & Akhsan, H. (2021). Pengembangan Bahan Ajar Teks Perubahan Konseptual Materi Fisika Dasar Topik Kinematika. *Jurnal Kumparan Fisika*, *4*(1), 43–50. https://doi.org/10.33369/jkf.4.1.43-50

Talitha, S., Rosdiana, R., & Hilal Mukhtar, R. (2023). Pengembangan Bahan Ajar Digital Flipbook dalam Meningkatkan Kompetensi Guru MGMP Bahasa Indonesia SMA Kota Bogor. *SWARNA: Jurnal Pengabdian Kepada Masyarakat 2*(1), 169-177. https://doi.org/10.55681/swarna.v2i1.314

Umami, R., Rusdi, M., & Kamid, K. (2021). Pengembangan Instrumen Tes untuk Mengukur Higher Order Thinking Skills (HOTS) Berorientasi Programme For International Student Asessment (PISA) pada Peserta Didik. *JP3M (Jurnal Penelitian Pendidikan Dan Pengajaran Matematika)*, *7*(1), 57–68. https://doi.org/10.37058/jp3m.v7i1.2069

Yusuf, I., Setyosari, P., Kuswandi, D., & Ulfa, S. (2024). The Frontier Areas' Student Acceptance of Physics Fun-based Mobile Application: Incorporating the Process-Oriented Guided-Inquiry Learning (POGIL) Strategy. *Participatory Educational Research*, *11*(6), 152-171. https://doi.org/10.17275/per.24.84.11.6