Jurnal Teknologi Pendidikan, Desember 2025, 27 (3), 842-851
DOI: http://dx.doi.org/10.21009/JTP2001.6
p-ISSN: 1411-2744 e-ISSN: 2620-3081
Accredited by Directorate General of Strengthening for Research and Development
Available online at http://journal.unj.ac.id/unj/index.php/jtp

The Development of Classroom Action Research Teaching Materials Through the Integration of Interactive E-Books with Flipped Learning

Irna Sjafei[1(*)], Dadi Waras Suhardjono[2]
[1,2] Faculty of Teacher Training and Education Universitas Tama Jagakarsa, Jakarta, Indonesia

Received : September 27, 2025
Revised : October 30, 2025
Accepted : December 24, 2025

Abstract

Digital learning materials for Classroom Action Research (CAR) in higher education are generally still presented as passive PDF e-books that provide limited support for self-directed learning. This condition highlights the need to develop more interactive and open-access instructional materials. The purpose of this study is to develop interactive CAR materials that are valid and feasible to support flipped learning. The development process adapted the Hannafin & Peck model, which consists of the stages of needs analysis, design, development, and systematic evaluation and revision. The needs analysis, design, and development phases primarily employed qualitative data, while the product evaluation phase used expert-validated questionnaires to ensure the relevance and validity of each item. The expert evaluation results show that the average score given by material and instructional experts, media experts, and language experts reached 97.45%, which is categorized as "excellent" and feasible for implementation. Based on these key findings, the interactive e-book developed for CAR learning materials through a flipped learning approach received an overall rating of "excellent and highly feasible," indicating that it can be directly implemented in CAR instruction as either a primary or supplementary learning resource. As this study was limited to expert validation, further research is recommended in the form of field testing to examine the product's effectiveness on learning outcomes, motivation, or student competence.

Keywords: Interaktif Learning Media; Technlogy Enhanced Learning; Meterial Development

(*) Corresponding Author: irnasjafei@gmail.com

How to Cite: Sjafei, I., & Suhardjono, D. W. (2025). The Development of Classroom Action Research Teaching Materials Through the Integration of Interactive E-Books with Flipped Learning. *JTP - Jurnal Teknologi Pendidikan*, *27*(3), 842–851. https://doi.org/10.21009/jtp.v27i3.60533

INTRODUCTION

In today's digital era, the integration of technology into higher education has become not only an imperative but also an opportunity to enhance instructional quality. Technological innovations, such as the adoption of interactive e-books, offer new possibilities for enriched learning experiences and increased flexibility in accessing instructional materials. For prospective teachers, such digital media serve as an essential means of cultivating their digital competencies, which have grown increasingly necessary in today's educational contexts. In addition, the development of pedagogical competence can be further strengthened through well designed Classroom Action Research (CAR) teaching materials, which equip

future teachers with the skills necessary to plan, implement, and evaluate classroom-based inquiries.

The availability of CAR teaching materials is currently limited to PDF-based e-books, which are less engaging as learning resources. The urgency of this study is driven by the need for innovative and interactive digital materials that support self-directed learning within a flipped-classroom approach. The implementation of flipped learning strategies has demonstrated positive outcomes in addressing the challenges of online learning (Donald, 2014).

Development of CAR instructional materials in the form of interactive e-books is proposed as an urgent necessity so that they can be directly utilized in coursework. In line with current trends in digital learning, interactive e-books equipped with multimedia features, such as videos, quizzes, simulations, or digital text links and have the potential to enhance student engagement and clarify complex concepts (Chen et al., 2023). Instructional materials refer to the essential subjects, content, or learning resources, whether written, mediated, or teacher-facilitated, that learners use to engage in achieving the intended learning objectives (Dick et al., 2015).

The implementation of flipped learning aims to equip students with prior knowledge before the class session begins, while during the session, they receive reinforcement and practical exercises related to the CAR (Classroom Action Research) materials. In addition, this interactive e-book serves as a learning resource specifically designed to support more practical self-directed learning. The e-book materials are expected to offer an innovative solution for enhancing students' engagement, understanding, and interest in CAR instructional materials. The purpose of this study is to develop CAR instructional materials in the form of an interactive e-book to support flipped learning.

METHODS

The type of research employed in this study is research and development (R&D). Borg, Gall, and Gall (2003) state that developmental research is "a process used to develop and validate educational products." This approach is highly relevant to the creation of instructional materials, as it offers a systematic framework for designing, refining, and evaluating products to ensure their effectiveness and alignment with learners' needs (Gall et al., 2003). According to Richey and Klein (2007), design and development research is a systematic study of how to design, develop, and evaluate the performance of a product, to generate empirical data that serves as the foundation for creating products, tools, or models intended for instructional or non-instructional purpose (Richey & Klein, 2007).

In this study, the Hannafin and Peck model was employed as the approach for developing the computer-assisted instructional system. The Hannafin and Peck model is relatively straightforward, consisting of four phases: (1) needs analysis, (2) design, (3) development and implementation, and (4) evaluation and revision. This model provides a clear, interactive structure that supports continuous refinement of the product throughout the development process (Hannafin & Peck, 1988). The Hannafin and Peck model is relevant and well-suited for developing

interactive e-books. The characteristics of this model are designed to integrate educators and computer-based systems as a unified team, thereby creating an efficient and effective learning system (Hannafin & Peck, 1988)(Hill & Hannafin, 2001).

The data analysis technique refers to Suparman's perspective on analyzing data and revising instructional products. Data collected through interviews and questionnaires were analyzed to improve the instructional product (Suparman, 2014). Quantitative data obtained from the questionnaires were calculated based on the mean score of each aspect, followed by computing the total score and classifying it according to Table 1 below.

Table 1. Classification of Expert Assessment Results

Score	Category	Interpretation
3,5 - 4	Excellent	Excellent quality, highly usable
2,5 - 3,4	Good	Good quality; usable
1,5 - 2,4	Fair	Fair quality; requires minor revisions
≤ 1,4	Poor	Poor quality; requires major revisions

Qualitative data obtained from interviews were interpreted to ensure the accuracy and validity of the necessary improvements. Ultimately, the teaching material in the form of an interactive e-book designed to support flipped learning was determined to meet the required quality standards and was classified as feasible for use.

RESULTS & DISCUSSION

a. Results

The development of the interactive e-book teaching material began with a needs analysis. The results of the needs analysis involving prospective teacher students led to the decision to develop an interactive e-book to address the limited variety of available learning resources. During the design stage, a prototype of the interactive e-book was created, consisting of key elements such as the cover, user instructions, and the integration of flipped learning strategies and feedback features.

In the development stage, the process was supported by a book design specialist and a video development team, including a voice-over contributor for the video content. In the evaluation stage, the product was validated by experts in subject matter and instruction, instructional media, and language. These experts also provided recommendations during the evaluation process, which were subsequently used to revise and refine the product.

1). Cover and Front Page

The cover and title page serve as the initial display when opening the interactive e-book and are equipped with user information, as shown in Figure 1.

Figure 1. Cover and Front Page

2). Interactive E-Book User Guide

The instruction page in the e-book serves as a guide for both students and lecturers to optimally utilize the digital features and learning materials. The user guide section is presented in simple language and is accompanied by illustrations or menu icons along with their navigation flow. The multimedia icons illustrate how to access videos, digital text materials, and other information. This is illustrated in Figure 2 below.

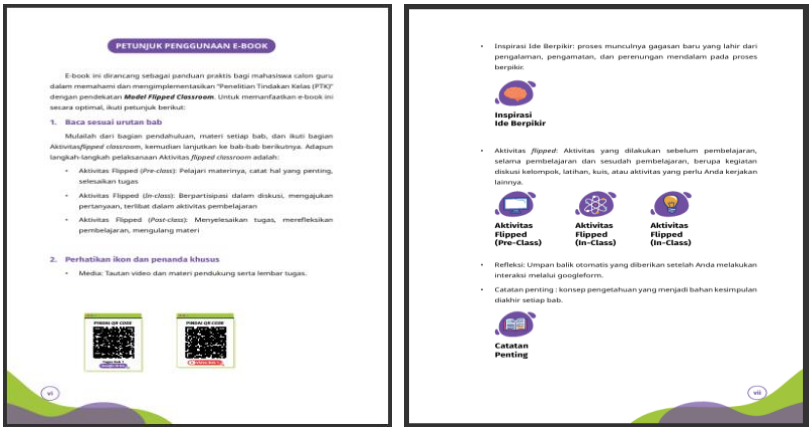

Figure 2. Interactive E-Book User Guide

3). Integration of the Flipped Learning Strategy

The flipped learning activities in the e-book are designed to support students' self-directed learning prior to face-to-face sessions (pre-class). During the pre-class phase, students are guided to study the core material through digital texts, videos, and interactive quizzes provided in the e-book. The aim is for students to gain a foundational understanding independently, so that in-class time is no longer occupied by the delivery of theoretical content.

In the face-to-face phase (in-class), lecturers facilitate meaningful learning activities such as group discussions, practical exercises in developing Classroom Action Research instruments, simulations, case studies, and reflection. These activities emphasize the application of concepts learned independently, thereby promoting active, critical, and collaborative learning.

In the post-class phase, students complete extended exercises, work on individual or group assignments, and revise their work based on feedback from lecturers and peers. The following figure illustrates classroom activities implemented using the flipped learning.

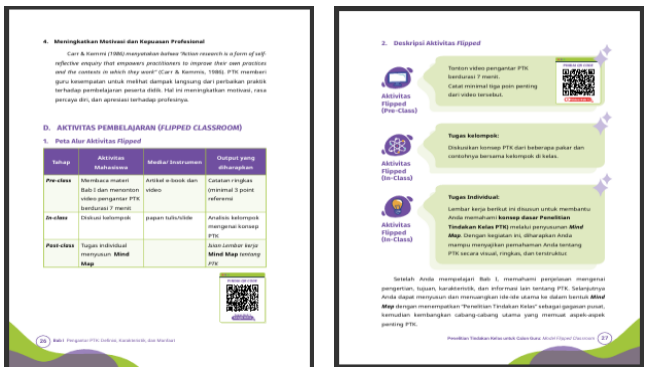

Figure 3. Flipped Learning Activities

4). Reflection Page in the Interactive E-Book.

The-book also provides reflection and evaluation features that allow students to record their understanding, respond to guiding questions, and conduct self-assessment. Thus, the flipped learning activities embedded in the e-book function not only as a medium for mastering the content but also as a platform for developing higher-order thinking skills. The following figure illustrates the reflection activities available to e-book users.

Figure 4. Reflection in the Interactive E-Book

5). User Feedback Page of the Interactive E-Book

The feedback page is provided as a medium for interaction between students and the system, as well as with the lecturer. Its primary purpose is to offer a space for reflection, assess understanding, and provide responses related to the use of the e-book. Feedback is facilitated through a Google Form link. The following figure illustrates the components of this feedback page.

Figure 5. E-Book User Feedback Page

The feasibility test was conducted by three experts, who provided assessments using an instrument previously validated by an expert. The aspects evaluated by the instructional media expert included the structure and the interactive e-book–based flipped learning material, assessed through the following criteria: (1) e-book design layout, (2) navigation and interactivity, (3) coherence of elements within the e-book, and (4) ease of use. The feasibility test conducted by the instructional media expert an average score of 3.86 or 96.84. This score falls into the category of "very good" and "feasible with minor revisions." The results of the feasibility test by the instructional media expert are presented in the following table:

Table 2. Results of the Feasibility Assessment by Instructional Media Experts

No	Rated aspect	Rating Scale				Amount	Score
		1	2	3	4		
1	Front matter of the e-book	-	-	-	16	16	100,00
2	Content Structure of the e-book	-	-	-	20	20	100,00
3	Back Matter of the e-book	-	-	-	16	16	100,00
4	E-book layout Design	-	-	6	20	26	92,85
5	Navigation and Interactivity	-	-	9	8	17	85,00
6	Appropriateness of e-book element	-	-	-	20	20	100,00
7	Ease of use	-	-	-	20	20	100,00
Average Score Value							96,84

The feasibility assessment of the interactive e-book was also conducted by experts in learning materials and instruction. The aspects evaluated for the feasibility of the learning materials and instructional quality included: (1) the relevance and depth of the content; (2) the accuracy of the material; (3) the flipped learning strategy and instructional design; and (4) the implementation and effectiveness of flipped learning.

The evaluation conducted by the learning materials and instructional experts resulted in a score of 3.90 or 97.19%, which falls into the "excellent" category and is considered feasible without revision. The results of the feasibility assessment by the learning materials experts are presented in the following table:

Table 3. Results of the Feasibility Assessment by Learning Materials Experts

No	Rated aspect	Rating Scale				Amount	Score
		1	2	3	4		
1	Relevance and Depth of Material	-	-	3	16	19	95,00
2	Accuracy of Material	-	-	-	20	20	100,00
3	Flipped Learning Strategy and Design	-	-	-	24	24	100,00
4	Implementation and Effectiveness of Flipped Learning	-	-	3	12	15	93,75
Average Score							97,19

The feasibility assessment of the learning materials in the form of an interactive e-book was conducted by Indonesian language experts. The aspects evaluated for the language suitability of the learning materials included: (1) language rules; (2) vocabulary and style; and (3) readability and coherence.

The average score from the language experts was 3.93 or 98.33%, which falls into the "excellent" category and is considered feasible with minor revisions. The results of the feasibility assessment are presented in the following table:

Table 3. Results of the Feasibility Assessment by Language Experts

No	Rated aspect	Rating Scale				Amount	Score
		1	2	3	4		
1	Language Rules	-	-	3	16	19	95,00
2	Vocabulary and Style	-	-	-	20	20	100,00
3	Readability and Coherence	-	-		20	20	100,00
Average Score							98,33

The feasibility assessment of the interactive e-book conducted by three experts yielded average scores ranging from 3.86 to 3.93, equivalent to a feasibility percentage of 96.84%–98.33%, with an overall average of 97.45%. This indicates that the developed interactive e-book meets the standards for learning materials and instructional quality, the standards for the use of the Indonesian language, and the standards for instructional media.

Ultimately, the developed Classroom Action Research (CAR) learning materials include videos, digital texts, Google Forms, email, and Google Drive, which can support flipped learning in the form of interactive e-book.

b. Discussion

The results of this study indicate that the interactive e-book developed to support Classroom Action Research (CAR) learning based on flipped learning is highly feasible for use. Expert evaluations showed high average scores, suggesting that the media meets the criteria for design, navigation, interactivity, and alignment with learning objectives. These findings are consistent with

previous studies, which reported that interactive e-books can enhance students' learning motivation and facilitate access to materials in a practical, effective, and enjoyable manner (Shao et al., 2025); (Setiadi et al., 2021); (Mutiara et al., 2024).

The integration of flipped learning in the development of the e-book also supports autonomous pre-class learning and optimizes in-class time for discussion, practice, and peer interaction (Love et al., 2014); (O'Flaherty & Phillips, 2015). By providing flexible access to content, students can learn at their own pace and according to their learning preferences, which reflects the Flexible Environment pillar of flipped learning (Fisher et al., 2021)(Yarbro, J., Arfstrom, K.M., McKnight, K., McKnight, 2014); (Kim et al., 2013). This indicates that the interactive e-book functions not only as a content delivery medium but also as a tool to foster an active and responsible learning culture, in line with the Learning Culture pillar.

Moreover, the use of digital technology in the interactive e-book allows for the implementation of Intentional Content, whereby learning materials are deliberately structured to achieve specific CAR learning objectives. This aligns with literature emphasizing the importance of digital literacy for pre-service teachers to effectively utilize technology in teaching and learning processes ((Atmazaki & Indriyani, 2019). Consequently, the media contributes to the development of pre-service teachers' pedagogical competence, particularly in designing and implementing classroom action research using digital tools.

However, the implementation of flipped learning-based interactive e-books also presents some limitations. Some students may require adaptation time to fully utilize digital media, while institutional technological infrastructure can influence the effectiveness of learning (Falloon, 2020). Therefore, guidance from professional educators remains essential, consistent with the Professional Educator pillar of flipped learning, to ensure optimal learning outcomes.

Overall, this study confirms that the development of interactive e-books integrated with flipped learning significantly enhances the quality of CAR learning. The media not only facilitates access to learning materials and increases student motivation but also equips pre-service teachers with relevant digital and pedagogical competencies necessary for 21st-century education

CONCLUSION

The interactive e-book developed for Classroom Action Research (CAR) based on the flipped learning approach is highly feasible, as indicated by evaluations from material, language, and media experts, with an overall average score of 97.45%. The findings suggest that the e-book effectively supports pre-class learning, enabling students to study independently before face-to-face sessions, while enhancing comprehension during in-class activities. To further ensure its effectiveness, field testing is recommended to optimize the use of the e-book within the flipped learning context.

ACKNOWLEDGEMENT

This research was funded by the *Research Grant Scheme for Early-Career Lecturers* provided by the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia. The authors gratefully acknowledge this support.

REFERENCES

Atmazaki, & Indriyani, V. (2019). *Digital Literacy Competencies for Teacher Education Students*. *335*(ICESSHum), 1010–1018. https://doi.org/10.2991/icesshum-19.2019.156

Chen, C., Jamiat, N., & Mao, Y. (2023). The study on the effects of gamified interactive e-books on students' learning achievements and motivation in a Chinese character learning flipped classroom. *Frontiers in Psychology*, *14*(August), 1–14. https://doi.org/10.3389/fpsyg.2023.1236297

Dick, W., Carey, L., & Carey, J. O. (2015). *The Systematic Design of Instruction* (Eighth). Pearson.

Donald, C. K. (2014). A Study of the Effect the Flipped Classroom Model on Student Self-Efficacy. *Journal of Chemical Information and Modeling*, *53*(9), 1689–1699.

Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational Technology Research and Development*, *68*(5), 2449–2472. https://doi.org/10.1007/s11423-020-09767-4

Fisher, R., Perényi, Á., & Birdthistle, N. (2021). The positive relationship between flipped and blended learning and student engagement, performance and satisfaction. *Active Learning in Higher Education*, *22*(2), 97–113. https://doi.org/10.1177/1469787418801702

Gall, M. D., Gall, J. P., & Borg, W. R. (2003). Educational Research, An Introduction. In A. E. Burvikovs & C. Tridente (Eds.), *Educational Research: An introduction* (Seventh Ed). Pearson Educationa, Inc.

Hannafin, M. J., & Peck, K. L. (1988). The Design Development, and Evaluation of Instructional Software. In *MacMillan Publishing Company* (Issue 503). macmillan Publishing Company.

Hill, J. R., & Hannafin, M. J. (2001). Teaching and Learning in Digital Environments: The Resurgence of Resource-Based Learning. *ETR&D*, *49*(3), 37–52. http://www.speakeasydesigns.com/SDSU/student/SAGE/compsprep/Teaching_and_Learning_in_Digital_Environments.pdf

Kim, Y., Glassman, M., Bartholomew, M., & Hur, E. H. (2013). Creating an educational context for Open Source Intelligence: The development of Internet self-efficacy through a blogcentric course. *Computers and Education*, *69*, 332–342. https://doi.org/10.1016/j.compedu.2013.07.034

Love, B., Hodge, A., Grandgenett, N., & Swift, A. W. (2014). Student learning and perceptions in a flipped linear algebra course. *International Journal of Mathematical Education in Science and Technology*, *45*(3), 317–324. https://doi.org/10.1080/0020739X.2013.822582

Mutiara, E., Anugerah, A. I., Dalimunthe, D. A., Sutanti, S., Sasmita, R. L., Fitria, R., & Akmal, N. (2024). Utilizing interactive media in culinary arts education to enhance student learning outcomes. *Jurnal Pendidikan Vokasi*, *14*(2), 180–193. https://doi.org/10.21831/jpv.v14i2.71230

O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *Internet and Higher Education*, *25*(May), 85–95. https://doi.org/10.1016/j.iheduc.2015.02.002

Richey, R. C., & Klein, J. D. (2007). *Design and Development Research: Methods, Strategies & Issue* (1 st Editi). Lawrence Erlbaum Associates.

Setiadi, M. I., Muksar, M., & Suprianti, D. (2021). Penggunaan Media Pembelajaran Flipbook Untuk Meningkatkan Aktivitas Dan Hasil Belajar Siswa. *JISIP (Jurnal Ilmu Sosial Dan Pendidikan)*, *5*(4), 1067–1075. https://doi.org/10.58258/jisip.v5i4.2542

Shao, J., Abdul Rabu, S. N., & Chen, C. (2025). Gamified interactive e-books for bullying prevention: enhancing knowledge and motivation in Chinese primary schools. *Frontiers in Psychology*, *16*(February), 1–18. https://doi.org/10.3389/fpsyg.2025.1509549

Suparman, M. A. (2014). *Desain Instructional Modern* (Keempat). Erlangga.

Yarbro, J., Arfstrom, K.M., McKnight, K., McKnight, P. (2014). Flipped learning review 2014. *George Mason University*, 20. http://flippedlearning.org/domain/41