



## The Implementation of Interactive E-Books in the TEFA Learning Model to Improve Students' Cognitive Abilities

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### Abstract

Vocational High Schools (SMK) play a crucial role in preparing their graduates to work in both industry and the professional workforce. The learning process is expected to be carried out optimally by teachers to ensure quality education. Based on observations at SMKS Kerabat Kita Bumiayu, it was found that the TEFA learning model being developed has not yet been supported with adequate teaching materials that facilitate students' cognitive understanding in the classroom. This highlights the need for integrating technology in the form of interactive e-books to support the learning process of vocational students. The objective of this study is to analyze the feasibility, effectiveness, and practicality of interactive e-books in learning, as well as to examine whether their implementation can improve students' cognitive learning outcomes. The research design employed the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) as the development framework. Data analysis in this study assessed the feasibility, practicality, and effectiveness of the interactive e-book. The results of media expert validation indicated an average score of 4.54 (highly feasible), while the subject matter expert validation yielded an average score of 4.50 (highly possible). The practicality test conducted by users achieved an average score of 99.5% (highly practical). The effectiveness test, carried out through pretest and posttest, significantly improved students' cognitive scores. This study concludes that the developed interactive e-book is highly feasible, practical, effective, and significantly enhances students' mental abilities, particularly in the elements of basic accounting and banking principles and concepts within the subject of Fundamentals of the Accounting Program.

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## INTRODUCTION

Vocational education must continuously adapt to achieve superior and optimal quality, aligning with the needs of industry and the latest technological developments. Vocational High Schools (SMK) are crucial in preparing human resources (HR) who are ready to work, pursue higher education, and engage in entrepreneurship. According to Mukhlason et al. (2020), SMK is a secondary education institution designed to prepare young generations to work according to their expertise. As outlined in his 16 theorems, Dr. Charles Allen Prosser emphasized the fundamental principles of vocational education, which Yunus et al. (2023) elaborated as the foundation of vocational education concepts. Mastery of the basic accounting and banking concepts through e-books falls into the third category: training students to think and work in ways that are applied in industry. Based on the tenth theorem, the effectiveness of using e-books is reflected in learning outcomes, which indicate that delivering material through internet-based media can strengthen students' understanding more effectively compared to conventional methods.

The fundamental competencies in Fundamentals of Accounting, particularly in the material on basic accounting and banking concepts at SMK Kerabat Kita Bumiayu, have not yet shown optimal results. This is reflected in the average cognitive score of Grade X Accounting students, which only reached 42%, still below the KKTP (Learning Objective Achievement Criteria). Based on classroom observations, the low level of student response to teachers' explanations, the absence of learning media, and the dominance of conventional methods were identified as the main factors hindering students' understanding of the material. Learning media development can be carried out by integrating rapidly growing technology and information into the learning process. Learning media produced through the utilization of technology and information are expected to attract students' interest more effectively, remove limitations of space and time, and thereby facilitate students' mastery of the competencies that must be achieved.

Messages delivered through media, whether in print or electronic/digital form, are understood as part of learning media. In this context, electronic learning media are supported through interactive e-books, which contain materials, images, audio, and video that can be utilized to help the student learning process (Lestari et al., 2018). E-books as interactive learning media are chosen because they are considered practical, easily accessible, and highly durable. As long as electronic devices are provided or carried, e-books can be accessed by students anytime and anywhere (Ruddamayanti, 2019).

Several previous researchers have explored the development of learning media for basic accounting and banking; however, those studies still left room for suggestions and improvements. A survey conducted by Rahmawati & Susanti (2019), entitled *The Development of E-Book Teaching Materials in Contextual-Based Institutional Accounting Practicum Subjects for Vocational High Schools*, suggested the need for further research to understand the effectiveness of e-book teaching material development and its benefits for teaching and learning activities in schools. Similarly, e-book development was also carried out by Fitriani & Rohayati (2019) in their study entitled *The Development of an Android-Based E-Book with a Scientific Approach in the Tax Administration Subject for Grade XII Accounting Students at SMK Negeri 2 Buduran*. Their study recommended that future researchers develop more innovative and engaging teaching materials.

The objectives of this study are as follows (1) to develop an effective e-book for the TEFA learning model that can enhance students' cognitive abilities in the elements of Basic Accounting and Basic Banking principles; (2) to analyze the feasibility of the interactive e-book for the TEFA learning model in improving students' cognitive abilities; (3) to analyze the practicality of the interactive e-book for the TEFA learning model in improving students' cognitive abilities; and (4) to analyze the effectiveness of the interactive e-book for the TEFA learning model in improving students' cognitive abilities.

## METHOD

The research and development (R&D) design was employed in this study to produce a new product developed to assist students. According to Anwariningsih (2013), this method is a research approach accompanied by a development program. The research design applied was a two-group pretest–posttest with a control group design.

**Tabel 1.** Pretest Posttest Control Group Design

Group	Pre-Test	Treatment	Post-Test
Eksperimen	O <sub>1</sub>	X	O <sub>2</sub>
Kontrol	O <sub>1</sub>	-	O <sub>2</sub>

Informasi : X= Treatment, - = Without Treatment, O<sub>1</sub>= Pemberian *Pretest*, O<sub>2</sub>= Pemberian *Posttest*

This study involved Grade X Accounting students of SMK Kerabat Kita Bumiayu as the subjects, consisting of two classes, namely AK 1 and AK 2, with a total of 72 students. Of this total, Class AK 1 with 36 students was selected as the experimental group, while Class AK 2, also consisting of 36 students, was designated as the control group.

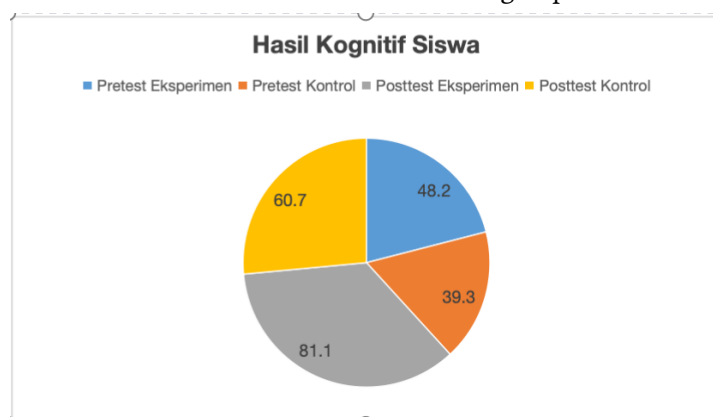
The research data involved validation from subject matter experts, media experts, and practicality instruments assessed by vocational subject teachers. The product's effectiveness was analyzed based on the pretest and posttest results using the t-test and N-Gain calculation. According to Sugiyono (2014), a research instrument is a tool used to measure a natural or social phenomenon observed by the researcher.

## RESEARCH FINDINGS AND DISCUSSION

### Research Results

Based on the data analysis, this study is a development and evaluation research of an interactive e-book aimed at improving students' cognitive abilities in the subject matter of basic accounting and basic banking concepts. The validation results from media and subject matter experts, calculated using the Content Validity Index (CVI), yielded a score of 0.9. In contrast, the reliability test using the Intraclass Correlation Coefficient (ICC) produced a result of 0.383, categorized as “reliable.” Thus, the analysis from both subject matter and media experts indicated that most experts stated the interactive e-book is highly feasible for use in content and media design.

The posttest results were analyzed using descriptive analysis, normality, homogeneity, t-test, and N-Gain tests. The descriptive analysis of the experimental class showed an average posttest score of 77.49, whereas the control class obtained an average posttest score of 35.02. The normality test using the Shapiro–Wilk statistic indicated that the control class scored 0.200 with Sig. = 0.352 > 0.05, and the experimental class scored 0.082 with Sig. = 0.146 > 0.05, thus concluding that the data were normally distributed. The homogeneity test yielded a significance value of 0.905 > 0.05, confirming that the data were homogeneous. The independent sample t-test revealed that the calculated t-value was greater than the critical t-value (10.203 > 1.994), with a significance level (Sig. 2-tailed) of 0.001 < 0.05. These results demonstrate a significant difference in posttest performance between the experimental and control groups.



**Figure 1.** Cognitive Outcome Diagram for Experimental Class and Control Class

The results illustrated in the diagram show a difference in improvement between the experimental and control classes. In the experimental class, the pretest score was 48.2, while the control class obtained a pretest score of 39.3, indicating no significant initial difference between the two groups. The posttest results for the experimental class reached 81.1, whereas the control class reached 60.7. The improvement in cognitive ability for the experimental class was 77.49%, indicating a significant increase through the use of the interactive e-book in the subject matter of basic accounting and basic banking concepts. Meanwhile, the control class achieved an improvement of 35.02%, showing progress in mastering basic accounting and basic banking concepts through the use of conventional methods.

Based on the N-Gain test results, the average posttest score of the experimental class was 77.49%, categorized as “effective,” compared to 35.02% in the control class (classified as “ineffective”). This demonstrates that the implementation of the interactive e-book in basic accounting and basic banking concepts was able to improve students’ cognitive abilities, thereby providing a positive impact on student learning outcomes.

## Discussion

The interactive e-book implemented in this study was designed to improve students’ cognitive abilities in the subject matter of basic accounting and basic banking concepts in Grade X Accounting. The implementation process employed the ADDIE model, consisting of five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation (Alodwan & Almosa, 2020). The analysis stage involved identifying the needs and characteristics of the e-book and conducting curriculum and technology analysis (Priyantama et al., 2024). The observations revealed several issues in learning basic accounting and basic banking concepts, such as low student interest in learning materials, limited use of technology by teachers, and the need for independent learning media for students. In the design stage, a framework for the interactive e-book was developed, including selecting relevant references and an engaging

layout optimized for Android devices. An attractive visual design was expected to enhance student engagement and support more effective comprehension of the subject matter.

Research conducted by Lailiyah et al. (2024) revealed that students still face difficulties and lack interest in understanding basic accounting and banking concepts, mainly because the learning materials used are limited to printed handouts, which are monotonous in nature. This condition indicates that conventional learning media cannot optimally meet students’ learning needs, particularly in enhancing active engagement and conceptual understanding. Meanwhile, the study by Aprilianto et al. (2025) highlighted that the lack of interactive learning media has also contributed to low student participation in class, as the teaching process tends to be one-way and less stimulating for student activity. In contrast to these studies, the present research focuses on developing an interactive E-book, which not only presents the content of basic accounting and banking in a digital format but is also equipped with evaluative and simulative features. These features encourage students to actively explore concepts while improving their cognitive skills through practice exercises, interactive quizzes, and real-case simulations relevant to the accounting and banking fields. Therefore, this study provides a broader contribution by offering an alternative learning medium and presenting an innovative solution that integrates engagement, interactivity, and the enhancement of critical thinking skills in mastering the subject matter.

Cognitive ability is an essential aspect of the learning domain, encompassing mental processes in acquiring knowledge and understanding. According to Bloom’s Taxonomy, cognitive ability consists of six hierarchical levels: remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). In the context of learning basic accounting and banking concepts, these abilities are necessary not only for enabling students to memorize concepts, but also for helping them apply fundamental accounting principles in real-life situations, analyze stakeholders who require such concepts, and design reliable reports tailored to specific needs.

The e-book developed in this study has several advantages compared to existing learning media. First, the e-book is internet-based, making it easily accessible anytime and anywhere as long as network connectivity is available, which aligns with the current digital habits of students. Second, the e-book has multimedia elements such as images, videos, interactive quizzes, and simulations designed to enhance students' understanding and engagement. With these advantages, the e-book is expected to overcome previous learning barriers and improve the quality of learning in basic accounting and banking. This condition is in line with the characteristics of 21st-century learning, which emphasizes the integration of technology. Moreover, the e-book offers an interactive and engaging learning experience that contributes to improved learning outcomes and the development of students' competencies (Mulia et al., 2024).

According to Ayuardini (2022), one form of e-book learning media that can be applied to enhance students' cognitive abilities is the flipbook learning module. Similarly, Nurrokhman et al. (2025) emphasized that the existence of e-modules is considered both practical and effective, particularly in supporting the improvement of students' cognitive aspects related to the material being studied. This finding is consistent with the research of Depi and Zahmi (2024), who revealed that Android-based modules provide convenience in the classroom learning process quickly, safely, and. In addition, Ismayati (2022) stated that using e-books enhances the practicality of learning and the development of students' cognitive abilities. Therefore, the implementation of interactive e-books is an appropriate alternative solution to address challenges in teaching basic accounting and banking principles at SMK Kerabat Kita Bumiayu. The feedback and evaluation derived from the implementation process are expected to form the basis for continuous improvement, thereby enhancing the overall quality of learning in the future.

The interactive e-book on the concepts of basic accounting and banking has received positive evaluations from experts as a feasible medium to implement in the learning process. This finding is consistent with the study of

Purwismaningsih et al. (2024), which stated that such learning media meet the feasibility criteria. This feasibility indicates that the interactive e-book on basic accounting and basic banking concepts holds significant potential to be applied across various subjects related to the fundamentals of accounting, not limited solely to the concepts of basic accounting and basic banking.

Rosita et al. (2021) explained that validity testing aims to ensure that the instruments used to measure a product meet feasibility standards. Research conducted by Hidayat et al. (2023) revealed that the developed interactive e-book obtained an average expert validation score of 90.54% and an average teacher response score of 95.55%, both of which fall into the category of highly feasible. In line with this, Yuliani and Setiawan (2024) also reported that the feasibility of the developed media received very high evaluations, with a percentage of 92.5%, which is categorized as highly feasible.

Implementing the interactive e-book has proven effective in meeting students' needs to enhance their cognitive abilities in basic accounting and banking concepts. The improvement in cognitive skills related to basic accounting and banking concepts in the experimental class was higher compared to the control class, as indicated by the lower average post-test scores of the control class compared to the experimental class. This improvement is consistent with Charles Prosser's theory, which states that every profession requires a minimum level of competence that individuals must possess to carry out tasks effectively.

## CONCLUSION

Based on the results and discussion of this study, it can be concluded that: the implementation of the interactive e-book in the TEFA learning model for basic accounting and basic banking materials using the ADDIE model has been successfully carried out and tested; the developed interactive e-book is highly feasible for use in the learning process; the interactive e-book is convenient to apply in classroom activities; and the interactive e-book enhances the effectiveness of learning in basic accounting and basic banking.

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