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Utilization Of Interactive E-Books With Learning Objectives Orientation & Problem-Based Learning In Science Learning

Muhammad Ikhsan Sukaria[1*]

[1]Makassar State University, Makassar, Indonesia

**Corresponding Address*: Muhammad.ikhsan@unm.ac.id

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ABSTRACT

This study aims to develop and test the effectiveness of interactive e-books oriented to learning objectives and based on Problem Based Learning (PBL) in science learning. This interactive e-book is designed to support students in understanding science concepts more deeply through a structured problem-solving approach. The research method used is Research and Development (R&D) with the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). Data collection was done through observation, questionnaire, and learning outcome test. The results showed that the interactive e-book developed had high validity based on the assessment of material experts and media experts. The implementation of this interactive e-book also significantly improved students' concept understanding and problem solving skills compared to conventional learning methods. Therefore, this PBL-based interactive e-book can be used as an effective alternative learning media to improve the quality of science learning in elementary schools. This research makes an important contribution to the development of digital learning media that is innovative and relevant to the needs of education in the digital era.

Keywords: *interactive e-book, Problem Based Learning, learning objectives, science learning, digital learning media*

INTRODUCTION

Technology plays an important role in the development of science. The most fundamental role of technology is the opening of space for innovation (Huda *et al.,* 2015). In education, innovation aims to improve the effectiveness and efficiency of the learning process (Permendikbud No. 56, 2003). This effectiveness is supported by utilizing technology in the teaching and learning process in the classroom (Permen No. 32, 2013). Several studies have proven that the use of technology in *learning* can significantly improve student learning outcomes (Embong*, et al.,* 2012). The use of technology in learning is more commonly referred to as *e-Learning*.

The integration of interactive e-books within educational frameworks, particularly in science learning, has emerged as a significant area of research and practice. This approach not only leverages technological advancements but also aligns with contemporary pedagogical strategies such as Problem-Based Learning (PBL) and learning objectives orientation. The utilization of interactive e-books is particularly relevant in fostering an engaging learning environment that enhances students' critical thinking and problem-solving skills, which are essential competencies in the 21st century. Research indicates that e-books can positively influence students' learning experiences by catering to diverse learning styles and preferences. For instance, a study conducted in Malaysia highlighted the successful adoption of e-books in primary education, demonstrating their effectiveness in improving student engagement and learning outcomes (Roslina et al., 2013). Furthermore, the integration of e-books into the curriculum has been shown to facilitate a more interactive and immersive learning experience,

which is crucial for subjects like science that often require hands-on experimentation and critical analysis (D'Ambra et al., 2012). In conjunction with e-books, the PBL model has been recognized for its effectiveness in enhancing students' critical thinking and problem-solving abilities. Studies have shown that PBL encourages students to engage actively with content, fostering a deeper understanding of scientific concepts through real-world applications (Setyono et al., 2018; Rahmadani, 2017). This pedagogical approach not only promotes collaborative learning but also empowers students to take ownership of their educational journey, thereby improving their academic performance (Suratno et al., 2020; Schmidt et al., 2011). The combination of interactive e-books and PBL creates a dynamic learning environment that supports the development of essential skills necessary for future academic and professional success. Moreover, the alignment of learning objectives with interactive e-books and PBL is crucial for ensuring that educational practices meet the diverse needs of learners. By clearly defining learning objectives, educators can better assess the effectiveness of these tools in achieving desired educational outcomes (Isdaryanti et al., 2018; Wahono et al., 2020). The integration of technology in education, particularly through interactive e-books, presents an opportunity to enhance traditional teaching methods, making learning more relevant and accessible to students in various contexts (D'Ambra et al., 2012). In conclusion, the utilization of interactive e-books, coupled with a focus on learning objectives and the PBL approach, represents a promising avenue for enhancing science education. This integration not only supports the development of critical skills but also prepares students to navigate the complexities of modern scientific challenges effectively

METHODS

This research uses the **Research and Development (R&D)** method with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model approach. The research procedure includes five main stages:

1. **Analysis**: Identifying learning needs, deficiencies in existing learning resources, and the potential of technology to overcome these problems.
2. **Design**: Designing interactive e-books based on Problem-Based Learning (PBL) with learning goal orientation. The initial prototype includes material structure, interface design, and interactive features.
3. **Development**: Creating an interactive e-book with the integration of text, images, videos, simulations, and interactive quizzes using software such as Adobe Reader or Adobe Flash Player.
4. **Implementation**: Implementing e-books in science learning in elementary schools through student trials. This process includes distributing e-books and implementing e-book-based learning.
5. **Evaluation**: Assessing the effectiveness of e-books through observation, questionnaires, and learning outcome tests. Validation is also conducted by material experts and media experts to measure the validity of the e-book.

RESULTS AND DISCUSSION

Impact of e-Learning on Learning

In general, the use of technology in the form of *e-Learning* has several advantages and offers convenience not only for students but also teachers. According to Olson, *et al (*2011), some of the advantages of *e-Learning* based learning process include:

Impact of *e-Learning* Implementation in improving student learning outcomes

- Effectiveness in increasing student engagement in learning which also has an impact on student motivation.
- Technology in learning can make it easier for teachers to evaluate learning
- Many applications such as word can improve students' writing skills

Impact of *e-Learning* implementation for teachers.

- The direction of learning can be changed from *teacher-centered* to *student-centered* with student interaction with technology used in learning.
- The use of *e-Learning* can make it easier for teachers to increase student confidence and motivation.
- The utilization of technology in learning will also encourage teachers to continue to improve their skills.

Weaknesses of Learning Forms Related to Learning Resources

One form of *e-Learning* that is often used in supporting classroom learning is *e-Book.* Simply put, an *e-Book* is defined as an electronic book or digital book (Directorate of SMK Development, Directorate General of Dikmen, Ministry of Education and Culture, 2012). *e-Book* is a technology that utilizes computers or other electronic media to display multimedia information in a concise form without reducing the substance of the material to be delivered to students (Lim & Hew, 2014).

Currently, the use of *e-Books* as learning resources in the classroom is very much. The various models and forms of *e-Books* developed are also very innovative. Of the many *e-Books* in circulation, not a few only copy the material contained in the textbook. They only convert textbooks in the form of sheets of paper into digital text forms such as pdf and other applications (Directorate of Vocational Development, Directorate General of Education, Ministry of Education and Culture, 2012). This form reduces the effectiveness of *e-Books* as a learning resource because learning resources are actually able to stimulate students to be active. The lack of interactive forms of *e-Books* like this is the reason for the author to give a little touch of innovation to *e-Books* so that they become interactive learning resources so that student involvement in learning is maximized (Yulianti *et al.,* 2015).

The problem in learning that is also most often encountered related to learning resources is that the material in the book is presented with examples that are not contextualized. Explanations of a concept sometimes use examples that are far from students' daily lives. As a result, students have difficulty connecting the example with the concept being explained. According to Kuswanto in Maryati (2009), students will find it easier to understand the material explained if it is connected to phenomena they encounter in everyday life, especially those concerning science concepts.

Another weakness encountered regarding learning resources is that information is presented only in the form of text and images so that it seems passive, rigid, and boring. It is not surprising that such a form will make students lazy to read. Information in the form of text and images only accommodates students' visual abilities even though each student has a different way of understanding something so that information in learning must be presented in a more diverse form (Embong *et al, 2012)*.

Solutions to problems related to learning resources

Above, some problems related to learning resources have been presented. The author will follow up on these problems by making some innovations in the parts of the *e-Book* so that its function as a learning resource can be maximized. There are three main problems that we want to provide solutions to, namely *e-Books* that are less interactive, the presentation of material in *e-Books is only* informative, and the form is rigid, passive (no *feedback),* and boring.

For the first problem concerning the lack of interactive *e-Books, the* form of innovation that the author will do is to insert exercise questions at the end of each material. The exercises are not in the form of essay or multiple choice questions that ask students to write the answers on paper, but students directly work on the questions in front of each student's computer device. Unable to answer correctly, then students cannot continue using the *e-Book* on the next page or for the next material. In solving the questions, the author ensured that students would be active at least in moving and clicking on the answers they thought were correct.

The second problem is that most *e-Book* materials are only informative (Yulianti *et al.,* 2015). Against this problem, the author will give a little touch of innovation in the form of selecting contextual examples in explaining the material. It is expected that with examples that are close to everyday life, students understand more easily and connect what they learn and encounter everyday so that the learning process becomes much more meaningful. They not only have information but with that information, they can apply it in everyday life.

Third is the problem of presenting material that only copies text and images as in a plain text book. Against this problem, the form of innovation that the author will do is to rearrange the material that will be included in the *e-Book* The rearrangement in question includes aspects of language and appearance. From the linguistic aspect, the material is presented in very simple language so that it is easy for students to understand. So the choice of language in explaining the material is made as simple as possible. From the display aspect, the author will include not only pictures but also insert videos and simulations in explaining examples of the concepts described.

Benefits of Interactive *e-Books*

There are several features in the *e-Book* that can facilitate students in accessing information about learning materials. One of these features is a search feature that allows students to write a word that represents the concept of a material and this *e-Book* will display the word in question. Another feature that makes *e-Books* an effective learning resource option is the combination or blend of images, text, and video so that students are offered information in many forms both audio and visual. The language used in *e-Books* is also very simple and easily understood by students. The language factor is very important in books.

In addition to offering convenience for students, this interactive *e-Book* also provides convenience for teachers in explaining the material, especially for abstract materials such as materials that use chemical concepts. In this interactive *e-Book*, the material to be explained is about electrochemistry. Of course, this electrochemical material uses a lot of symbols so that various representation models are used to provide many references to students ranging from text, images, and videos.

Another benefit obtained from the use of this interactive *e-Book* is the formation of two-way communication between students and *e-Books.* The *e-Book* provides questions with answers so that students can correct or evaluate their own work. There are also several quizzes

that will be completed by students at the end of each material. In this section students cannot move to the next page before correctly answering the quiz given. The quiz is intended as a prerequisite to ensure students understand the basic material before moving on to the next material. Giving these questions and quizzes will indirectly force students to be active in learning.

The last benefit of using this interactive *e-Book* is to eliminate student boredom in learning. Each page of this *e-Book* not only displays information in the form of text but is also equipped with information in the form of images and videos. Especially for videos, the information provided contains explanations of electrochemical concepts such as equalization of redox reactions, the process of corrosion, events in everyday life which are electrochemical processes. Through this video, students are presented with an explanation as if the material is explained by the teacher himself so that the learning process becomes more interesting and interactive.

Interactive *e-Book* Innovation Design

This interactive *E-Book* contains material about electrochemistry. In electrochemistry material, there are several concepts that must be mastered by students referring to the core competencies and basic competencies described through indicators. The material structure of this interactive *e-Book* consists of four parts, namely redox reactions, electrochemical cells, corrosion, and electrolysis cells. The description of the material can be seen in the Table 1 below.

Tabel 1. Description Of The Material

Section	Subject matter	Subject Matter
1	Redox Reactions	Equalization of reactions through the half-recitation method
		Equalizing reactions through the oxidation number method
2	Electrochemical Cell	Positive electrode (cathode) and negative electrode (anode)
		Salt bridges and their functions
		Cell notation
3	Corrosion	The process of corrosion
		Reactions in corrosion
		How to deal with corrosion
4	Electrolysis Cell	Electrolysis of molten sodium chloride
		Electrolysis of salt solution
		Electrolysis cell in daily life
		Faraday's Law I and II

This interactive *e-Book* also provides a concept map that describes the overall material about electrochemistry. The location of the concept map in the *e- Book* is tucked away on the initial page along with core competencies, basic competencies and indicators. So before students read material about electrochemistry, they will first read the indicators which are the goals to be achieved in learning so that students will evaluate whether or not they have succeeded after reading this *e-Book*. Broadly speaking, the appearance of this *e-Book* design is divided based on the amount of material described above. The only addition is the initial

homepage which contains basic competencies, core competencies, indicators, and concept maps.

Overview of Interactive *e-Book* Design

This interactive *e-Book* design at least uses an application that is able to insert text, images, and videos. In addition, it is also able to record the answers given by students when working on quizzes and questions from each material presented. Some possible applications are *Adobe Reader or Adobe Flash Player*. Because the author is not very proficient in using the *Adobe Flash Player* application and in the art of design, then regarding the appearance, the design will be done by those who are experts. The author only provides a design, what this interactive *e-Book* will look like. The display made has a good *interface*. Fast in moving from one menu to another. The images presented in this interactive *e-book* also provide a clear picture of submicroscopic and symbolic representations. The existence of this *e-book* makes it easy to provide explanations for concepts that have submicroscopic representations.

Here's a simple overview of the interactive *e-Book* design

1. **Cover of *e-Book***

   The cover of the *e-Book* displays the big title of the material to be explained, namely electrochemistry. To make it look more attractive, at the bottom of the title several images related to electrochemistry are added. After that, on the cover will appear a column of student names and student identification numbers. An overview of the cover display is more or less like the picture below.

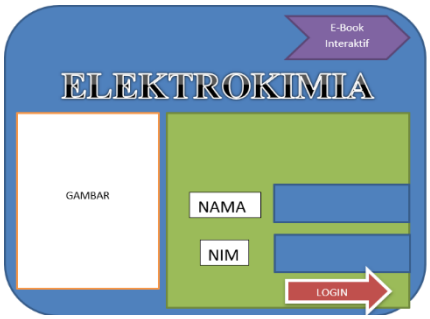

Figure 1. e-Book Cover View

2. General View

After clicking the *login* button on the *e-Book* home page, students will begin to read material about electrochemistry. At the top, there are several toolbars that represent the four materials described above plus *toolbars* related to basic competencies. Here is the design plan.

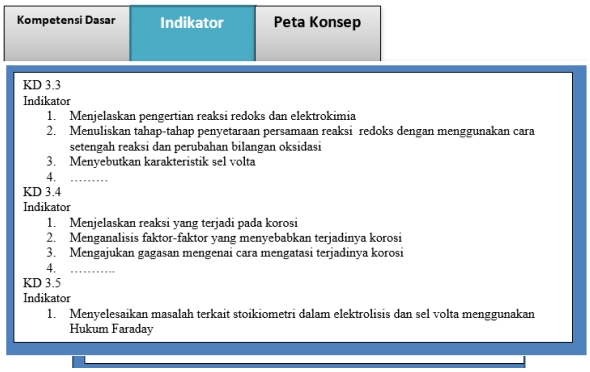

Figure 3. Indicator Display

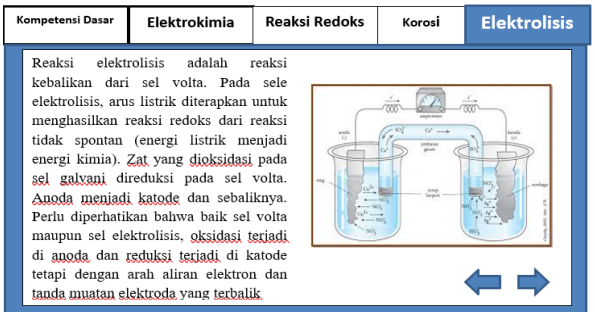

Figure 4. Display of Electrolysis Material

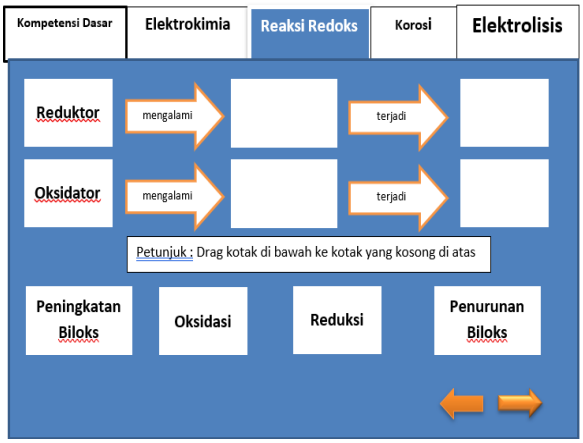

Figure 5. Interactive Quiz Display

CONCLUSION

This study shows that the developed PBL-based interactive e-book has high validity based on the evaluation of material and media experts. Its implementation is able to significantly improve students' concept understanding and problem-solving skills compared to conventional learning methods. This e-book is an effective alternative to improve the quality of science learning, especially in the context of the digital era. This finding reinforces the importance of innovation in the development of digital learning media to meet educational needs that are relevant to technological developments.

REFERENCES

Directorate of Vocational Development Directorate General of Education Ministry of Education and Culture with Faculty of Engineering, State University of Yogyakarta. 2012. Development of Interactive *e-Book* from Pedagogical, Software Technology and Media Used. Yogyakarta: UNY *e-Book* Development Study.

Embong, A.M., Noor, A.M., Hashim, H.M., Ali, R.M., Shaari, Z.H. (2012). E-Book as Textbook In The Classroom. *Social and Behavioral Sciences,* 47, 1802-1809.

Ginting, Y. F. B., & Simamora, H. (2021). The Use of E-Books in Learning in Elementary Schools. Edu Cendikia: Scientific Journal of Education, 1(01), 36-39.

Hanikah, H., Faiz, A., Nurhabibah, P., & Wardani, M. A. (2022). The use of ebook-based interactive media in elementary school. Basicedu Journal, 6(4), 7352-7359.

Huda, T.A., & Fadiawati, N., Tania, L. (2015). Development of Interactive E-Book on Thermochemistry Material Based on Chemical Representation. *Journal of Chemical Education and Learning,* 4(2).

Istiqomah, I., Masriani, M., Rasmawan, R., Muharini, R., & Lestari, I. (2022). Development of Problem Based Learning Based Science E-Module Flipbook on Environmental Pollution Material. Basicedu Journal, 6(5), 9156-9169.

Lim, E.L & Hew, K.F. (2013). Student's Perceptions of The Usefulness of An E-Book With Annotative And Sharing Capabilities As A Tool For Learning: A Case Study. *Innovations in Education and Teaching International,* 51(1), 34-35.

Mahmud, D. R., Mahmudi, M., Wahyuni, S., Susilo, H., & Ekawati, R. (2022). Needs Analysis Development of "Hai Si IPA" Digital Book to Improve Science Literacy in Grade V Elementary School: Needs Analysis Development Of "Hai Si IPA" Digital Book To Improve Science Literacy In Class V Elementary School. Journal of Science and Technology, 1(2), 47-57.

Maryati. 2009. Increasing Interest in Learning Natural Sciences through the Application of Contextual Learning to Fifth Grade Students of SD Negeri Sragen 5. *Thesis.* PJJ Program FKIP Sebelas Maret University Surakarta.

Olson, J., Codde, J., deMagged K., Tarkelson, E., Sinclair, J., Yook, S., & Egidio, R. 2011. *An Analysis of e-Learning Impacts & Best Practices In Developing Countries.* Michigan: Michigan State University, East Lansing, MI.

Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 65 of 2013 concerning Process Standards for Primary and Secondary Education. Jakarta: Ministry of Education.

Government Regulation of the Republic of Indonesia Number 32 of 2013 concerning Amendments to Government Regulation Number 19 of 2005 concerning National Education Standards. Jakarta: Ministry of Education.

Silalahi, R. B., & Budiono, H. (2023). Development of Web-based Flipbook Teaching Materials on Science Content in Elementary Schools. Journal of Education Research, 4(3), 1341-1349.

Suwarno, R. N., & Rahmatullah, R. (2021). Interactive e-book integrated with local wisdom karawitan as contextual teaching material for junior high school science: A content analysis. Indonesian Journal of Applied Science and Technology, 2(2), 77-82.

Teapon, W. A., Saprudin, S., Rahman, M. H., & Rizal, R. (2023, December). Interactive E-Book Based on Problem Based Learning to Improve Digital Literacy in Science Learning in Junior High School. In Proceedings of the National Seminar on Orientation of Indonesian Science Educators and Researchers (Vol. 2, pp. 188-192).

Yulianti, E., Fadiawati, N., Tania, L. (2015). Development of Interactive E-Book on Reaction Rate Material Based on Chemical Representation. *Journal of Chemical Education and Learning,* 4(2).