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# Need analysis to develop electronic enrichment book of Physics based on contextual teaching and environmental potential

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**Abstract.** Teaching in the 21st century should be connected to the real world context, focused on students, and conducted in collaboration. The application of contextual teaching and the utilization of the potential environment are relevant to the teaching of this century to create the meaningful learning. But the real condition showed that the learning resources of physics were less supportive to create the meaningful learning. The solution to the problem was to develop a physics enrichment book based on contextual teaching and environment potential. To find problems and potential for developing this book, research needs to be done. The purpose of the research was to describe the problems and potential associated with the development of this enrichment book. This type of research was descriptive research. The instruments for obtaining data were observation sheet, questionnaire sheet, and document analysis. The results of the data analysis show that: the application of both the component and strategy of contextual teaching in physics teaching is grouped into the sufficient category, the characteristics of students are generally good for receiving physics enrichment book, the integration of contextual teaching and environmental aspects is still low in physics textbooks, and physics teachers haven't used enrichment books to improve knowledge of students. Therefore, the results of this research can be used as a basis for designing and developing an electronic physics enrichment book needed to improve knowledge of students.

## 1. Introduction

Information technology has supported development in various fields of human life. Progress in information technology has made communication between countries more easily providing great opportunities to work together. Sophisticated information technology provides opportunities for people to access various information wherever and whenever. Interpersonal communication can be done easily, cheaply anytime and anywhere. There are several characteristics of society in the 21st century. First, society has high innovation that encourages rapid life changes in society. Second, people have an awareness and apply healthy life in their daily lives. Third, free life is open and with relationships between citizens is very easy to do. Fourth, people have a high degree of flexibility and adaptation in their lives. Fifth, community members have links between life, study, work and fun [1]. Education plays an important role in preparation for being able to challenge the 21st century. Educational graduates who have high competence are able to compete in a healthy manner. Education should be able to prepare and help graduates to compete in this century. Therefore, education needs to develop the four skills of students in the 21st century, namely how to think, how to work, tools to work, and skills to live in the world [2].



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The 21st century learning paradigm has emphasized various abilities of students. They must be able to apply the critical and creative thinking, connect science with the real world, apply technology and information, work together, and communicate effectively. This skill can be created by applying appropriate teaching methods in terms of mastery of the material and skills. There are at least four principles that need to be applied in 21st century learning. First, the development of teaching should use a student-centered teaching approach. Students are placed as teaching subjects who actively develop their interests and potential. They try to construct their knowledge and skills, according to their capacity and level of thought development, while being invited to contribute to solving real problems that occur in society. Second, teaching should be collaborative. Students must be taught to be able to collaborate with others. Third, teaching should have context. Educators develop teaching methods that allow students to connect with the real world. Fourth, schools should be integrated with the community. In an effort to prepare students to become responsible citizens, schools should be able to facilitate students to be involved in their social environment [1, 2].

Information Technology (IT) is currently something that attracts the attention of people engaged in education and teaching. By knowing and utilizing IT, it is hoped that educators and education staff will be more capable and willing to make efforts to improve continuously, correctly and objectively. If this is accustomed to teaching, it is hoped that educators and education staff will be able to grow and develop as professional and competent educators and education personnel, who are always able to make improvements based on the real problems encountered in carrying out their educational and teaching tasks. The main characteristic of teaching that utilizes IT is integrating various forms of material such as: text, images, graphics, and sound that is operated by computer. Teaching that is well designed and creative by utilizing teaching technology, within certain limits will be able to increase the likelihood of students to learn more, keep in mind what they have learned better, and improve the quality of teaching and achievement of competence [3].

Improvement of the education quality in aspects of knowledge, skills, attitudes, and values can be done in various ways. The development of these aspects is done to improve and develop life skills through a set of competencies, so students can survive, adjust, and succeed in the future. The implementation of education in Indonesia functions to develop to develop capabilities and shape the character and civilization of a dignified nation in the context of intellectual life of the nation. One of them is by preparing contextual teaching [4]. Contextual teaching is basically a teaching concept that aims to equip students with knowledge that can later be flexibly applied from one problem or from one context to another, so that students' understanding is expected to learn through experience rather than memorization [5].

The abilities of students can be developed by using various learning resources in the teaching process. Enrichment books are a learning source to enrich the abilities of students at school.. Enrichment books are books that contain material that can enrich elementary, secondary and tertiary education textbooks. The enrichment book is recommended for its use to increase students' knowledge and insight [6]. Enrichment books are defined as books that contain material that can enrich and enhance the mastery of science, technology, and art (science and technology) as well as skills in shaping the personality of students, educators, education managers, and other communities [7, 8]. The knowledge enrichment books are books that can develop students' knowledge development, not science (both for natural and social sciences) which is a field of study. The knowledge enrichment book serves to enrich the insight, understanding, and reasoning of students [7]. The enrichment book has its own characteristics that are different from other enrichment books. Characteristics of knowledge enrichment books, namely, 1) presenting material that is reality, 2) developing reading material that is based on science, and 3) developing a variety of knowledge such as facts, concepts, procedures, and metacognitive of knowledge [9]. Knowledge enrichment books not only benefit the general public and students. But as a prospective high school physics teacher the writer also needs to equip himself with experience and knowledge to develop enrichment material in the field of physics.

Some researchers have developed physics enrichment books to enrich the competencies of students. Knowledge enrichment books have been developed for certain physics topics such as ice and snow [10], optical instruments [11], sound and wave [12], and water rocket [13] Other researchers have tried to connect enrichment books with ethnoscience [14, 15]. However, these researches haven't integrated

contextual teaching and environmental potential yet into enrichment books. Another limitation of these research is the use of information technology in the form of electronic book. Therefore, as the main focus of this research is to develop an electronic physics enrichment book by integrating contextual teaching and environmental potential.

Enrichment books have an important role in learning activities [16]. The development of important enrichment books, in addition to being used to add insight and knowledge, is also used to add to the textbooks used in schools [17]. Enrichment is an effort to help students who have achieved mastery of learning to broaden their knowledge and skills [18]. Enrichment programs can be in the form of activities, experiences, and subject matter that bring students out of the regular curriculum, challenge their abilities and fulfill their curiosity, and fill their time. Enrichment programs mean giving students the opportunity to study material deeper than what is done in class [19]. In addition, offering an enrichment program can also develop students' thinking skills [20]. Enrichment books can be used as learning resources that support the learning process [11]. If the use of enrichment books in schools is optimized, students will be able to follow the development of communication and technology in the present very well [21]. Enrichment books contain material that can enrich and enhance the mastery of science, technology and art and skills, shape the personalities of students, educators, education managers, and other communities. The characteristics of enrichment books are that the material does not have to be tied directly to the curriculum; the target reader is not explicitly limited, although the appearance and content aspects of the reader's readability can be imagined; presentations can be in the form of prose with pictures; generally use popular languages; matter grows and develops cognitive aspects, skills, attitudes, morals, and personality [22]. Content in enrichment books must also be adapted to the environment of students so students are easy to learn because it is related to the environment and everyday life [23]. So based on the description above, the role of enrichment books in the learning process is very important, not only being able to increase students' knowledge but also being able to develop students' affective and psychomotor aspects [24].

One implementation of the 2013 curriculum in teaching is teaching that links real life. Contextual teaching departs from a belief that someone is interested in teaching when he sees the meaning of what he is learning. In contextual teaching the teacher acts as a facilitator who never stops (reinforcing) that helps students find meaning (knowledge) [25]. The seven components of the contextual approach, namely constructivism: building their own understanding and teaching must be packaged into a process of constructing rather than receiving; ask: teacher activities to encourage, guide, and assess students' thinking abilities; found: the process of moving from observation to understanding; learning society: a group of people involved in learning activities and working together with others is better than learning by themselves; modelling: the process of displaying an example so that other people think, work, and learn and do what the teacher wants students to allow; reflection: how to think about what has been learned and record what has been learned with the group; actual assessment: measuring students' knowledge and skills, product or performance appraisal and relevant assignments [26].

Physics teaching should also integrate environmental potential. The reason is the many applications of physics in daily life and the environment. In learning, students need to have sensitivity to the biotic, a biotic, and social environment. Besides that, by integrating physics with various environmental potentials will make physics teaching become meaningful and interesting. Integration of environmental potential in physics teaching can develop student literacy towards the environment [27]. Environmental literacy is related to the ability of humans to understand and interpret the relationship between environmental problems, environmental health, and environmental preservation [28, 29, 27].

Development of electronic physics enrichment books needs to be done to enrich student knowledge. Integration of contextual teaching can be done to link learning material with real world contexts and motivate student learning. On the other hand, the integration of environmental aspects is done to enrich student literacy in the environment. Preliminary research was carried out as a basis for designing and developing physics enrichment textbook by integrating contextual teaching and environmental potential. Therefore, the purpose of this research is to describe the application of component and strategy of contextual teaching in physics teaching, characteristics of students in receiving electronic physics enrichment books, integration of contextual teaching and environmental aspects in physics textbooks, and the use of learning materials especially physics enrichment books in physics teaching.

## 2. Research Method

This research can be classified into descriptive research. A group of data from a research is described to state the results of the research. In general, there were four data that are described in this research. First, data on the application of component and strategy of contextual teaching in physics teaching at three schools in the Padang City. Second, data on characteristics of students in terms of background, interests, motivation, attitudes, and learning styles. Third, data integration on contextual teaching and environmental aspects in physics textbooks. Finally, data on the use of physics learning materials in physics teaching.

The research objects in this preliminary research were high school teachers, class X students, and high school physics textbooks. Class X Physics teachers are used to get information about the application of contextual teaching and the potential of the environment in schools. There are six Physics teachers from three state high schools in Padang who were given a questionnaire to get this information. Information about student characteristics is obtained from high school students who are the object of research. The number of students involved in gathering this information is 27 people in SMA Negeri 2 Padang, 34 people in SMA Negeri 7 Padang, and 25 people in SMA Negeri 13 Padang.

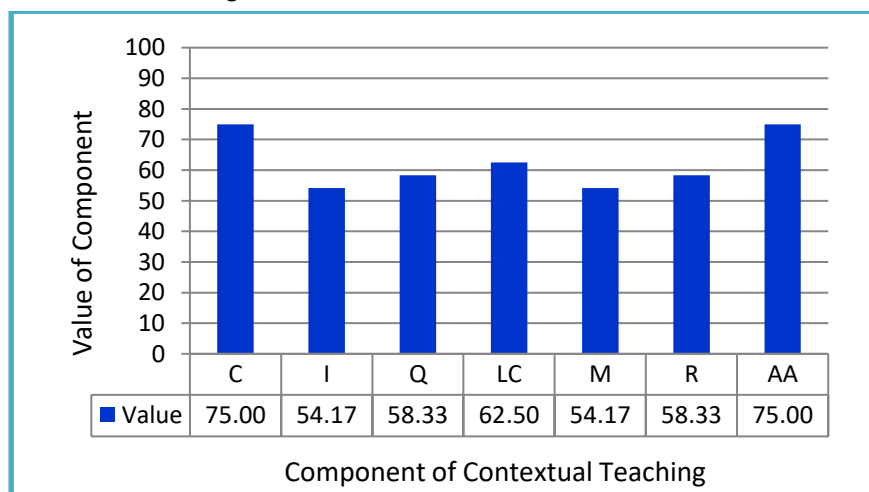
Data collection techniques used were questionnaire distribution and book analysis. The questionnaire was distributed to get data about the implementation of contextual teaching and environmental potential. Book analysis is performed on Physics textbooks used in schools that aim to see the application of contextual teaching and environmental potential. The instruments used were Physics teaching observation questionnaire sheets based on contextual teaching and environmental potential and Physics textbook analysis sheets.

Descriptive statistics was used to analyze data. Research data were analyzed in graphical form. Graph analysis describes a group of research data. In this research, graph was used to describe a group of data from the application of contextual teaching components, REACT strategy from contextual teaching, characteristics of students, integration of contextual teaching and environmental aspects in physics textbooks, and the use of physics learning materials in physics teaching. By analyzing graphs, group of data from the five aspects of this research can be well described.

## 3. Result and Discussion

### 3.1 Analysis of the Application of Contextual Learning Components

Data from the observation of the application of contextual teaching were obtained from three state high schools in the city of Padang. The indicator of observation of contextual teaching components consists of seven which include: constructivism (C), inquiry (I), asking questions (Q), learning community (LC), modeling (M), reflection (R), and authentic assessment (AA). Data were obtained from six teachers from three Padang City Public High Schools. The results of the analysis of contextual teaching components can be seen in Figure 1.

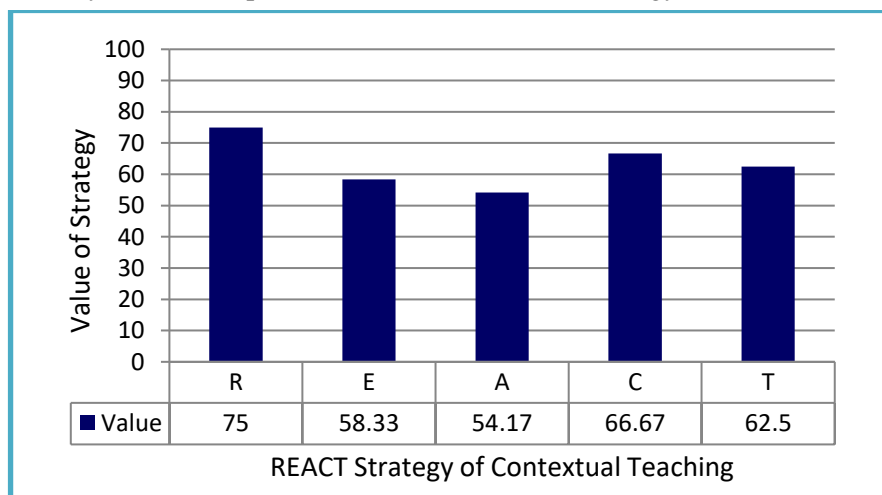


**Figure 1.** Component of Contextual Teaching

From Figure 1, the average value of the constructivism component is 75.00. The average value of the inquiry component is 54.17. The average value of the asking component is 58.33. The average value of the learning community component is 62.50. The average value of the modelling component is 54.17. The average value of the reflection component is 58.33. The average value of the authentic assessment component is 75.00. The average value of the two components of contextual teaching are still in the poor category, namely inquiry and modelling. The average value of the question and reflection components are classified into sufficient category. Meanwhile, the average value of the components of constructivism and authentic assessment is already in the good category. The average value for the component of the application of contextual teaching 62.50. This means that overall the application of contextual teaching is still within a sufficient category and needs to be improved in the learning process so that students can be directly and actively involved.

### 3.2 Analysis of REACT Strategy Implementation

The result of the analysis of the application of the react strategy in physics teaching was obtained from three schools in Padang City, namely SMA Negeri 2, SMA Negeri 7, and SMA Negeri 13 Padang. Data were obtained from observations of physics learning. Indicators of applying react strategies are relating (R), experiencing (E), applying (A), collaborating (C), and transferring (T). The purpose of this analysis is to see the percentage of REACT strategy implementation in the teaching process in schools. The results of the analysis of the implementation of the REACT strategy can be seen in Figure 2.

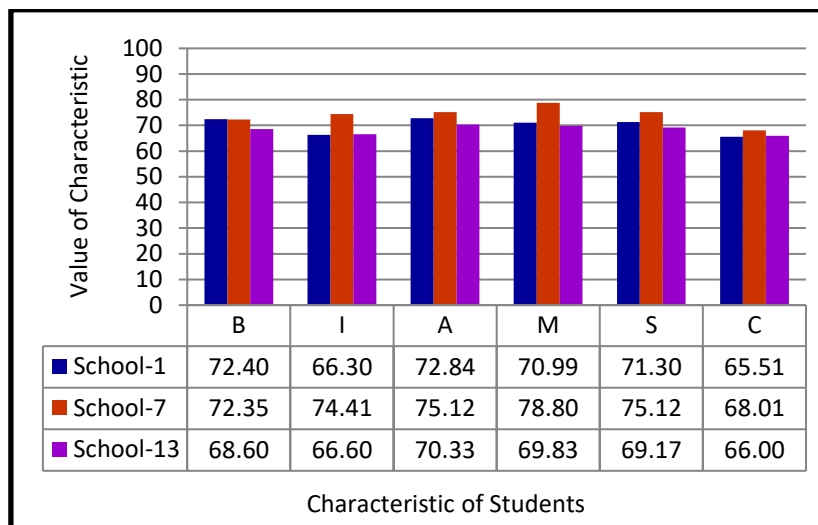


**Figure 2.** REACT Strategy of Contextual Teaching

Figure 2 explains that the average value of relating indicator is 75.00. The average value of experiencing indicator is 58.33. The average value of applying indicator is 54.17. The average value of the collaborating indicator is 66.67. The average value of the transfer indicator is 62.50. The average value of all indicators of the application of contextual learning with react strategies is 63.33. This means that the application of contextual learning with REACT strategy is still lacking in teaching process. In this case, teacher competency is needed in the application so that teaching is created in accordance with REACT strategy of contextual teaching.

### 3.3 Analysis of Student Characteristics

Analysis of student characteristics is needed because to see students' needs in the application of contextual learning and the use of teaching materials in schools. Indicators of analyzing students' characteristics are background (B), interests (I), attitudes (A), learning motivation (M), learning styles (S), and students' creativity (C). Data analysis of student characteristics was obtained from three schools, namely SMAN 2, SMAN 7, and SMAN 13 Padang. The analysis results of the characteristics if students are shown in Figure 3.



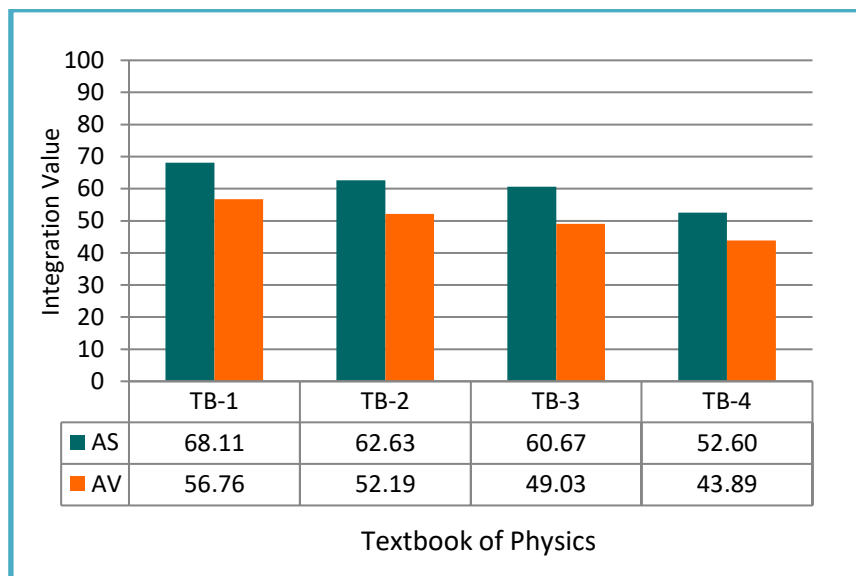
**Figure 3.** Characteristics of Students

Based on Figure 3, it was found that the average value of student background indicators was 72.40 for SMAN 2 Padang, 72.35 for SMAN 7 Padang, and 68, 60 for SMAN 13 Padang. The average value of the three schools for student background indicators is 71.12 with good criteria. Then, the average value of student interest indicators is 66.30 for SMAN 2 Padang, 74.41 for SMAN 7 Padang, and 66, 60 for SMAN 13 Padang. The average value of the three schools for indicators of student interest is 69.10 with quite good criteria. Furthermore, the average value of student attitude indicators is 72.84 for SMAN 2 Padang, 75.12 for SMAN 7 Padang, and 70.33 for SMAN 13 Padang. The average value of the three schools for student attitude indicators is 72.76 with good criteria. Then, the average value for student learning motivation indicators is 70.99 for SMAN 2 Padang, 78.80 for SMAN 7 Padang, and 69.83 for SMAN 13 Padang. The average value of the three schools for indicators of student motivation is 73.21 with good category. The average value of the learning style indicator is 71.30 for SMAN 2 Padang, 75.12 for SMAN 7 Padang, and 69.17 for SMAN 13 Padang. The average value of the three schools for indicators of student motivation is 71.86 with good criteria. Finally, the average value for student creativity indicators is 65.51 for SMAN 2 Padang, 68.01 for SMAN 7 Padang, and 66.00 for SMAN 13 Padang. The average value of the three schools for indicators of student motivation is 66.51 with quite good category. Based on Figure 3 also obtained an average value for all indicators which is 70.76 with quite good category. This means it is necessary to increase students' interest and creativity in learning, especially in contextual teaching.

#### 3.4 Analysis of Integration of Contextual Teaching and Environmental Aspects in Physics Textbooks

Analysis of the integration of contextual teaching and environmental aspects is seen from four types of Physics textbooks circulating in schools. The physics textbooks are in the form of three school electronic books with different authors. This analysis aims to see the integration of contextual teaching components, REACT strategy of contextual teaching, and environmental potential in the textbooks used in schools. Data analysis of the integration of contextual teaching and environmental aspect seen from four types of Physics textbooks can be seen in Figure 4.



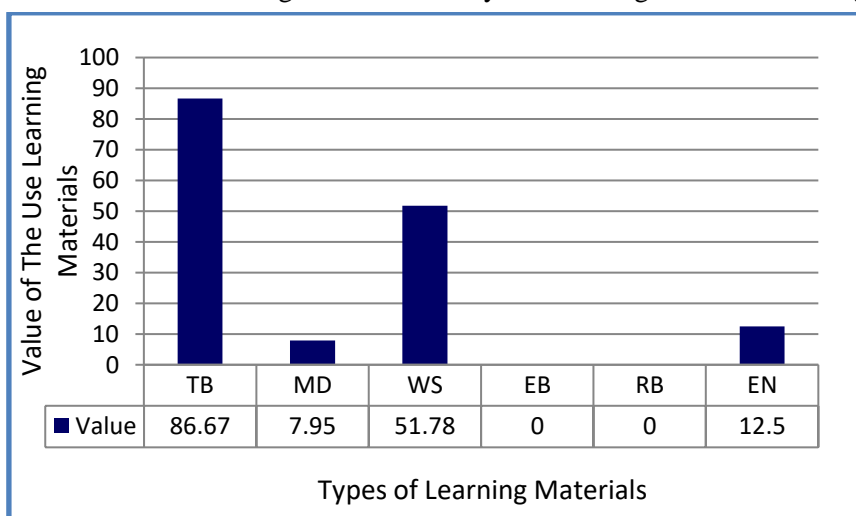


**Figure 4.** Textbook of Physics

From Figure 5, the average value from the integration of contextual teaching and environmental aspects for textbook 1 is 56.76. The average value of textbook 2 is 52.19. The average value of textbook 3 is 49.03. Meanwhile, the average value of textbook 4 is 43.89. This means that the average value of the integration of contextual teaching and environmental aspects in the three physics textbooks are still in the low category, while the average value of one physics textbook is in the sufficient category. The average value for the four physics textbooks is 50.47 with sufficient category. This shows that the integration of contextual teaching and environmental aspects in Physics textbooks is still lacking so it is necessary to develop books that integrate contextual teaching and environmental aspects.

### 3.5 Analysis of the Use of Learning Materials in Physics Teaching

To determine the use of learning materials in physics teaching, an investigation was conducted on the physics teachers. The instrument used in seeing the use of learning materials in Physics teaching was in the form of a questionnaire. The questionnaire on the use of learning materials in Physics teaching was distributed to eight Physics teachers in West Sumatra. Indicators used in the questionnaire are types of teaching materials used in schools. Learning materials analyzed in the form of textbooks (TB), modules (MD), worksheets (WS), enrichment books (EB), reference books (RB) and encyclopedias (EN). Data from the analysis of the use of learning materials in Physics teaching can be seen in Figure 5.



**Figure 5.** Types of Learning Materials



From Figure 5, it is found that the average value of learning materials in the form of textbooks is 86.67. The average value of module learning materials is 7.95. The average value of a worksheet is 51.78. The average value of the enrichment book is zero. The average value for the reference book is also zero. The average value for the encyclopedia is 12.5. This shows that learning materials that are often used are textbooks and followed by student worksheet. Types of enrichment books, reference books and encyclopedias are still rarely used in physics teaching. An important point in this result is the enrichment books are used by physics teachers yet to support their teaching.

#### 4. Conclusion

From the analysis results of the preliminary research, it can be stated the conclusion of the results of this research. First, the application of component and strategy of contextual teaching is still in the sufficient category with an average value of 62.50 and 63.33, respectively. Second, from the characteristics of students, generally students respond well to accept the application of electronic physics enrichment book. Third, the integration of contextual teaching and environmental aspects in physics textbooks can be classified into low category with an average value of 50.47. Fourth, generally physics teachers don't use physics enrichment books to enrich knowledge of students. The results of this research provide a good opportunity to develop an electronic physics enrichment book by integrating contextual teaching and environmental potential.

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