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Analysis of validity and practicality test of physics enrichment e-book based on CTL and enviromental factor

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Abstract. Teaching in the 21st century should have context, use multiple learning resources, and use ICT. This teaching will support the attention, involvement, and motivation of students. However, learning resources for physics enrichment and the use of ICT in physics teaching were still limited. The solution to this problem is to develop a physics enrichment e-book. The research objective was to determine the validity and practicality of the physics enrichment e-book on the theme of motion. This research method can be categorized into research and development. The development model in this research was included in the ADDIE model. The research instrument consisted of two parts, namely the validity assessment questionnaire sheet from the experts and the practicality assessment questionnaire sheet from the physics teachers and students. The research data were analyzed using descriptive statistics. From the results of data analysis, it can be stated that two results from this research. First, the validity of the physics enrichment e-book can be classified into a very good category in the aspects of learning material, presentation, language, graphics, and e-book criteria. Second, the practicality of using physics enrichment e-books based on CTL and environmental factor can be included in the very good category according to both physics teachers and students in the aspects of usability, easy of use, appealing, and clarity. Therefore, physics enrichment e-book based on CTL and environmental factor has met the high generic quality criteria of intervention in the components of validity and practicality.

1. Introduction

The 21st century emphasizes quality education. In facing the challenges of the 21st century, teachers have a role to guide students in finding information on everything they do. In other words, teaching in the 21st century can be related to the real-world context. This means that the learning material being studied needs to be connected to the real life context. This can make the learning material close to the student's life so that the material will be remembered longer by students.

Contextual teaching and learning (CTL) is a concept to help teachers connect learning material to real-world contexts [1]. CTL facilitates the active involvement of students in finding learning material, connecting learning material with real-world contexts and encouraging students to apply it in their lives so that learning becomes effective [2, 3, 4]. This means, learning material is discussed in the classroom close to the daily life of students. In the teaching process students are actively involved in constructing all their abilities.

The 2013 curriculum emphasizes that the use of learning materials in the teaching process must be able to help develop students' attitudes, knowledge, and skills. Learning materials that are following technological developments and the 21st century are electronic-based (e-books). An e-book is a book



published in digital form, which consists of text, images, or both, which can be read on a computer or other electronic device [5]. In its development, e-books have undergone many changes to become more varied [6]. E-books can contain a network of digital information units consisting of text, graphics, video, animation, or sound and questions which are all packaged in the form of flash animation visualizations combined in one program and equipped with color, sound, and music [7]. E-books can help student-centered learning so that they can understand the material more easily and are stored well in students' memory [7].

Based on the 2013 curriculum and 21st-century learning, students have the ability and attitude to care about environmental problems that occur around them. The environment requires human attention and affection so that it is not damaged. Environmental problems occur because of human behavior who is less active in managing environmental resources. This behavior could be due to a lack of knowledge about the relationship between the environment and life. Therefore environmental education is needed, which is expected to be able to change behavior starting from knowledge, preparedness, or behavior, and action [8].

Preliminary research has been carried out at high schools in the Padang city, namely SMAN 2, SMAN 7, and SMAN 13 Padang with the three results of this research. First, the application of CTL from the three schools was still in a sufficient category. Second, the implementation of the REACT strategy was still lacking in physics teaching. This is confirmed by research conducted by Asrizal (2020) which states that REACT in physics teaching was still low [22]. Third, Enrichment books have not been used by physics teachers in their teaching process. This is because learning physics is still focused on the use of reference books and encyclopedias. Fourth, the integration of CTL and environmental factor in physics learning books was still lacking. This is confirmed by Asrizal's research in 2018 which states that integration in teaching was still categorized as low [28]. One solution to overcome this problem is to develop a physics enrichment e-book based on CTL and environmental factor.

Contextual teaching and learning or CTL can affect student achievement and attitudes [9]. Besides, CTL can improve the transfer of learning to students [10]. Seven characteristics can be applied to CTL. First, teaching is applied in a real world context to achieve knowledge and skills of students. Second, teaching process creates opportunities for students to perform meaningful tasks so that meaningful learning can be created. Third, teaching must be able to provide meaningful experiences to students by observing and investigating. Fourth, teaching can facilitate students to discuss, work in groups, and provide mutual correction and reinforcement. Fifth, teaching is able to provide opportunities for students to create a sense of togetherness, group work habits, and deeper understanding of learning material. Sixth, teaching encourages students to learn actively, creatively, and productively by asking question, conducting investigation, and working together. Seventh, teaching must be able to create a pleasant learning atmosphere so that students enjoy in learning [3].

The essence of CTL is meaning, meaning, and meaning [11]. The application of CTL is able to create meaningful learning by connecting learning materials with real-world contexts. CTL consists of seven components, namely: constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment [12]. There are three components of CTL that are suitable and The application of these three components in the teaching process can provide benefits in modeling learning ways, constructing knowledge, and understanding learning materials [11].

CTL requires students to be close to their surroundings. Besides that, Asrizal (2018) states that CTL learning is believed to have a significant influence on the ability of knowledge, attitudes, and skills of students [23]. Concerning skills, it will make experiences from interactions with the learning environment and knowledge construction in individuals [13]. The environment can be defined as everything that is around humans then live together and influence each other for the development of human life [11]. The integration of environmental factor into teaching process is intended to develop the environmental literacy of students. This method can encourage students to have good knowledge, attitudes, cognitive skills, and behaviour towards their environment. Thus, they have a good awareness and concern for their environment.

In physics teaching, CTL and environmental factor can be realized through the help of various media and learning resources. One of the learning resources that can realize the CTL approach and

environmental education is books. Maulana (2018) states that books can increase students' knowledge and interviews [25]. In physics learning, learning resources that are often used are textbooks. These textbooks are familiar and widely available in schools. However, in enrichment activities, different learning sources are needed. One of the learning resources needed for enrichment activities is an enrichment book. Enrichment books are reading books for students, educators, education managers, and other communities so that they can enrich and improve their understanding of science and technology and skills and develop personalities [14].

The enrichment book developed is in electronic form. This is done in response to the development in the 21st century which is marked by the use of technology. The main characteristics of the physics enrichment book are the integration of CTL and environmental factors into the e-book. The reason for developing the physics enrichment e-book based on CTL and environmental factor aims to facilitate the integration of environmental factor in physics teaching which has a symbiotic effect on mutualism for both. The purpose of this research is to determine the results of the validity and practicality of the physics enrichment e-book based on CTL and environmental factor for grade X students that have been developed.

2. Research Method

Research methods can be classified into research and development. This method is intended to develop a product and test the effectiveness of the product [15]. In developing a physics enrichment book, the ADDIE model was used, which is an iterative development model, the result of the formative evaluation of each phase was used as a guide for activities in the next phase [16]. ADDIE stands for Analysis, Design, Development, Implementation, and Evaluations [17, 18].

The development of the physics enrichment e-book begins with the analysis stage regarding the application of the CTL, the implementation of the REACT CTL strategy in physics teaching, the use of learning material in physics teaching, and student characteristics. The next step that needs to be done is a development by carrying out activities including: 1) searching and collecting all sources and references needed for material development, 2) making supporting charts or tables, 3) drawing illustrations, 4) typing, 5) layout arrangement and 6) preparation of evaluation instruments [19]. After being developed, the product must be validated first by experts, then revised, so that the physics enrichment e-book can be used to test its practicality and effectiveness [15].

In this research, the product validity was carried out by a physics lecturer at the State University of Padang. Product validity was carried out by providing a test sheet containing five components of the assessment: material, presentation, language, graphics, and e-book criteria. After the validity was done, a revision was carried out to fix the weaknesses based on the suggestions of the experts. After revising the physics enrichment e-book based on the suggestions of the experts, practicality test activity was carried out to determine the feasibility of this product. In testing the practicality of the physics enrichment e-book, it was carried out by three physics teachers and grade X students of SMAN 2 Padang. The practicality of the physics enrichment e-book was carried out using a practicality test sheet that contains four assessment components, namely: usable, easy to use, appealing, and clarity. Each of these components was translated into several more specific indicators aimed at making it easier to analyze the strengths and weaknesses of the enrichment e-book that have been developed.

Table 1. Validity and Practicality

Intervals	Category
30 – 39	Failed
40 – 55	Less
56 – 65	Enough
66 – 80	Good
81 – 100	Very good

The validity and practicality questionnaire sheet use a modified Likert scale with four alternative answers. The alternative answers are 4 = strongly agree, 3 = agree, 2 = disagree

and 1 = strongly disagree. The data analysis technique used is descriptive statistics. The data from the validity and practicality test results are presented in graphical form. The criteria used to determine the validity and practicality of the physics enrichment e-book are as shown in Table 1 [20].

3. Result and Discussion

The research data were obtained from validity questionnaire sheets from experts and practicality questionnaire sheets from physics teachers and students. The main results of the research relate to the validity and practicality of the physics enrichment e-book based on CTL and environmental factor.

3.1. Validity of Physics Enrichment E-Book

The result of the validity test of the physics enrichment book based on CTL and environmental factor was obtained from the questionnaire sheets of the experts. The questionnaire instrument in the validity test consists of five indicators, namely material is based on facts (MBF), facts related to Physics (FRP), material development in accordance with Physics (MAP), pictures and videos match facts (PVMF), material is implemented in a popular manner (MIP). The average value of the CTL indicators can be displayed in Figure 1

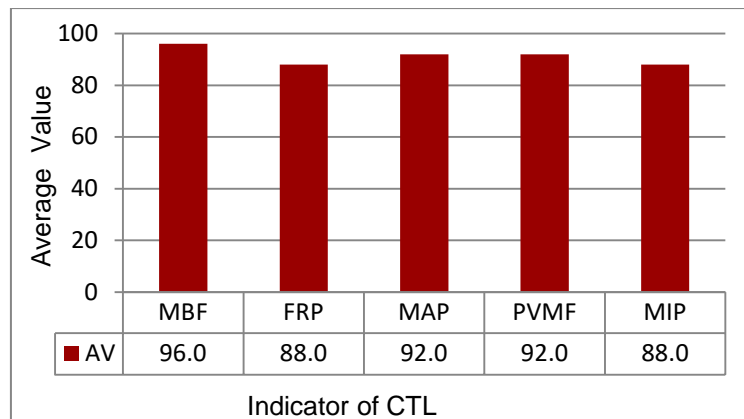


Figure 1. Average Value of Each Validity Indicators of the CTL

Based on Figure 1, it can be stated that the average value of each validity indicator ranges from 88.00 to 96.00. After analyzing each indicator value, the mean value of the integration validity of the CTL in the physics enrichment e-book is 91.20. Based on this average value, the validity of the integration of the CTL in the physics enrichment e-book is in a very good category. Thus, this physics enrichment e-book can be declared valid.

3.2. Validity of the Integration of Environmental Factor in the Enrichment E-Book

The result of the validity test for the integration of environmental factor in the physics enrichment E-book used a validity instrument containing five assessment indicators, namely: potential of the biotic environment (PBE), potential of the a biotic environment (PAE), potential of the social environment (PSE), problem of living environment (PLE), solution of living environment (SLE). Consecutively the value of the five indicators can be displayed in Figure 2.

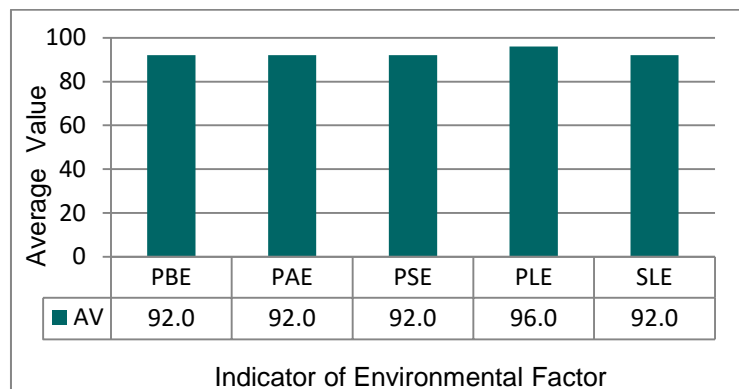


Figure 2. Average Value of Validity Indicators of Environmental Factor

Based on Figure 2, it can be described that the average value of each validity indicator ranges from 92.00 to 96.00. After analyzing each indicator value, the average value of the integration validity of environmental factor in the physics enrichment e-book is 92.80. Based on this average value, the validity of the integration of environmental factor in the physics enrichment e-book is in the very good category. This result indicates that the experts view that the integration of environmental factor into the physics enrichment e-book is included in the very good category on the indicators such as potential of the biotic environment, potential of the a biotic environment, potential of the social environment, problem of living environment, solution of living environment. Thus, this physics enrichment e-book can be declared valid.

3.3. Validity of the Physics Enrichment E-Book

The result of the validity test of the physics enrichment e-book based on CTL and environmental factor was obtained from the validity sheet instrument filled in by five experts, namely the physics lecturer of FMIPA UNP. The result of this validity was used to determine the feasibility of the physics enrichment e-book based on CTL and environmental factor as well as guidelines for revising the products that have been made. In the validity assessment instrument, there was five assessment components in the physics enrichment e-book based on CTL and environmental factor including material component (MT), presentation component (PC), language component (LC), graphic component (GC), and criteria e-book component (CC). The average value of validity components can be seen in Figure 3.

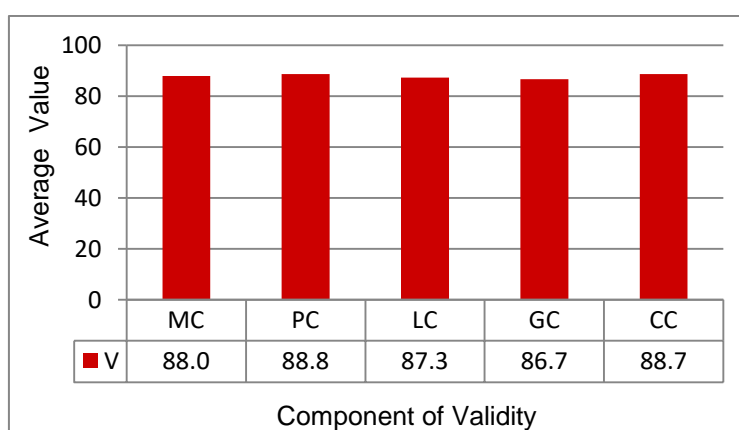


Figure 3. The Average Value of Each Validity Components of the Physics Enrichment E-Book

Based on Figure 3, it can be concluded that the average value of each validity component ranges from 86.70 to 88.78. After analyzing each component value, the mean value of the components of the physics enrichment e-book validity was 87.90. Based on this average value, the validity of the e-book is in the excellent category. This means that the physics enrichment e-book based on CTL and environmental factor is valid but still requires revision. One of the objectives of the revision is so that

the material in the physics enrichment e-book can be presented more meaningfully and systematically. Learning materials should be arranged systematically starting from simple material to more complex material [21]. The revision is adjusted to the suggestions and comments provided by the validator as an expert. With this revision, a better physics enrichment e-book will be obtained so that its practicality and effectiveness can be tested [15].

3.4. Practicality of Physics Enrichment E-Book According to Physics Teacher

The teachers involved in this research were three physics teachers at SMAN 2 Padang. The results of the practicality test according to the physics teachers were obtained from the teacher practicality instrument which contained four assessment components, namely: usable component (UC), easy to use component (EC), appealing component (AC), and clarity component (CC). The average value of practicality components according the teachers can be seen in Figure 4.

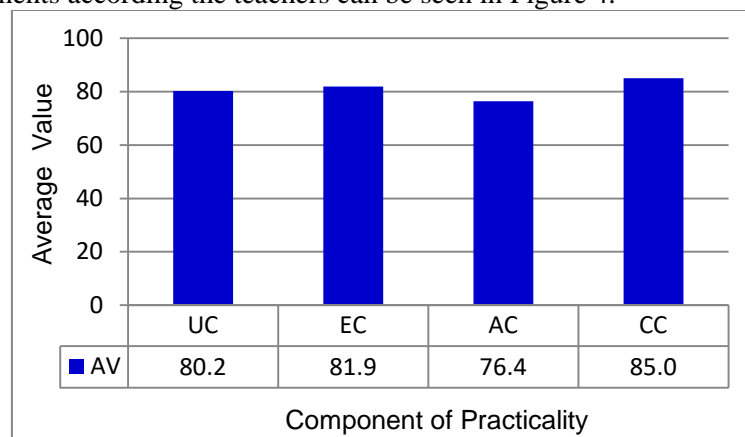


Figure 4. Average Value of Practicality According to the Teacher

Based on Figure 4, it can be described that the average value of each practicality component according to the teacher ranges from 76.39 to 85.00. This means that the practicality value according to the teacher from the components of usable, easy to use, appealing, and clarity is in the good and very good categories. After analyzing each component value, the average value of the practicality component of the physics enrichment e-book according to the physics teachers as a whole was 80.89 with a very good category.

3.5. Practicality of Physics Enrichment E-Book Practicality According to Students

Students involved in this research were students of grade X at SMAN 2 Padang. The results of the student practicality test were obtained from the practicality instrument according to the students which consisted of four assessment components. These components consist of usable component (UC), easy to use (EC), appealing (AC), and clarity component (CC). In each component, there are several assessment indicators related to student responses to the physics enrichment e-book. Analysis of the average value of the practicality assessment of physics enrichment e-book based on CTL and environmental factor according to students was determined from each component value. The plot results of the mean value of each component can be seen in Figure 5.

Based on Figure 5, it can be stated that the average value of each practicality component according to students ranges from 80.51 to 81.77. After the analysis was carried out, the practicality average value of the physics enrichment e-book according to the students was 83.53. Based on this average value, the practicality of physics enrichment e-book based on CTL and environmental factor according to students is in the excellent category.

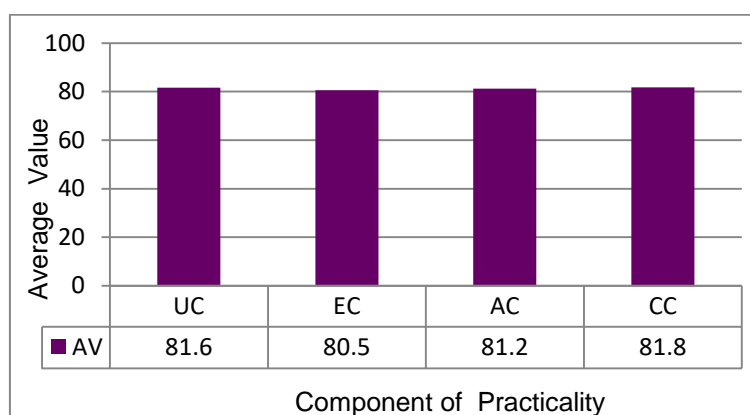


Figure 5. Average Value of Practicality According to Students

The practicality test results of physics enrichment e-book based on CTL and environmental education according to teachers and students were 80.89 and 83.53. Based on the value obtained from the practicality test results according to the teacher and students, the physics enrichment e-book based on CTL and environmental factor is practically used in the physics teaching process for grade X high school students.

The first result of the research is the average value of the validity of the physics enrichment e-book based on CTL and environmental factor can be included in the very good category. This means that experts view that the components of the physics enrichment book are correct according to science and components are consistent in their relationship according to rational thinking. This result indicates that the components of this physics enrichment book have been based on truth according to science and the consistency of the relationship of each components [26,27].

The second result of the research is the average value of the practicality of using physics enrichment e-book based on CTL and environmental factor can be classified into the very good category. From this result, it can be stated that physics teachers and students as practitioners fill that the use of physics enrichment books useful, easy to use, interesting, and clear. A product is said to be practical if practitioners such as teachers and students view that the product has good quality criteria such as useful, easy to use, appealing, and so on in normal conditions [26, 27].

4. Conclusion

The validity of the physics enrichment e-book based on CTL has an average score of 91.20 with a very good category. The validity of the e-book regarding the integration of environmental factor has an average value of 92.80 with categories. For the validity of the physics enrichment e-book, it is in a very good category with an average value of 87.90. Meanwhile, the practicality of physics enrichment e-book based on CTL and environmental factor is in a very good category, this is evidenced by the practicality test results according to teachers and students with an average value of 80.89 and 83.53. Thus the physics enrichment e-book based on CTL environmental factor is valid and practical for use in the physics teaching process for grade X students in senior high school.

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