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Green School Oriented Guided Inquiry-Based Science E-Book: Effectiveness Analysis on Increasing Environmental Literacy

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Abstract: The world has entered the era of Industry Revolution 4.0, which is characterized by the advancing development of science. The ease of accessing information is increasing along with the development of science. Education can be a solution to the problems of life. Education can change a person's behavior in a more positive direction. Learning in the 4.0 era utilizes technology to facilitate the learning process. The advantage of using technology is that it makes it easier to access information without boundaries of space and time. The use of technology can be applied to compiling and developing teaching materials in the form of electronic books. Improving the quality of learning is prioritized in core activities so that appropriate learning models are needed to support learning activities. The learning model that can be used is the guided inquiry learning model. Guided inquiry can be used as learning models. This study was aimed to find out the effectiveness of Green School Oriented Guided Inquiry-Based Science E-Book. This research was used Plomp development model. The product in the form of a guided inquiry-based science e-book was tested on 31 class VIII students of Junior high school 17 Padang. Based on the results of the research and the explanation of the discussion, we can conclude that guided research-based e-books with green school orientation are effective in improving the environmental literacy of junior high school students. This is reflected in the value of knowledge, and learners' attitudes towards the environment are increasing.

Keywords: E-book; Effectiveness; Guided inquiry.

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Introduction

The world has entered the era of Industry Revolution 4.0, which is characterized by the advancing development of science (Partoyo, 2020). The ease of accessing information is increasing along with the development of science. Industry Revolution 4.0 requires each individual to be able to adapt to the latest updates (Ghufron, 2018). Industry Revolution 4.0 also requires quality talent and can adapt to the global environment. It can realize this through education (Pangondian et al., 2019; Lase, 2019).

Education can be a solution to the problems of life (Gimah & Bodo, 2019). Education can be used as a benchmark to produce quality human resources (Bae et al., 2021; Kiradoo, 2021). Education can change a person's behavior in a more positive direction (Ramani et al., 2019). Education in the industrial revolution era 4.0 is expected to grow human resources that are qualified and superior and have skills in various fields, especially mastery of technology (Ofosuhene, 2022).

The curriculum being developed in Indonesia is currently the 2013 curriculum (Ikhsan & Hadi, 2018). This curriculum emphasizes character and competence in students, which includes knowledge (Noviana et al., 2019), attitudes (Machali, 1970), and skills (Pulungan et

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al., 2021). The implementation of the 2013 curriculum has been hampered since the start of the COVID-19 pandemic (Puspitasari et al., 2020; Zahrawati & Nurhayati, 2021). The COVID-19 pandemic is indirectly caused by human activities that damage the environment, so it needs to be followed up through *green school* policies (Fatica & Panzica, 2021; Swelum et al., 2020).

The 2013 curriculum regulates every subject at the education unit level, such as cognitive (Setyowati & Sutrisno, 2020). Cognitive learning in the 2013 curriculum is implemented using the science concept (Iyer et al., 2019). The concept is shown in the presentation of scientific material, packaged in a particular theme that discusses the combination of Physics, Chemistry, and Biology material (McPhail, 2020). In addition, in the 2013 curriculum, teaching materials are an indispensable part of learning resources. One type of teaching material that is often used is printed books (Palobo et al., 2020). Permendikbud No. 8 of 2016 concerning books explains that books are the primary learning source to achieve competence, both essential competencies, and core competencies.

Learning in the 4.0 era utilizes technology to facilitate the learning process (Darmaji et al., 2019; Maduretno & Fajri, 2019). The advantage of using technology is that it makes it easier to access information without boundaries of space and time (Tawafak et al., 2018). The use of technology can be applied to compiling and developing teaching materials in the form of electronic books (Adam & Suprapto, 2019). The structure of the arrangement between printed books and e-books is the same, except that e-books are in digital form and are equipped with multimedia features such as images, videos, audio, etc (Tuah et al., 2019). The existence of e-books makes the learning process more effective and efficient (Lin et al., 2018).

Based on preliminary research conducted at three schools in Padang, namely Junior high school 25 Padang, Junior high school 15 Padang, and Junior high school 17 Padang, the value of core activities received the lowest score in the analysis of learning activities. Improving the quality of learning is prioritized in core activities so that appropriate learning models are needed to support learning activities. The learning model that can be used is the guided inquiry learning model. Guided inquiry can be used as learning models (Chandra et al., 2020). The guided inquiry learning model is a model that connects students in finding and using various sources of information to improve student understanding specifically (Wen et al, 2020). Student analysis shows the lowest score is on the learning style of students. E-books are expected to provide various learning styles for students because they contain pictures, audio, and video.

Preliminary research is also carried out through the interview method. The teacher explained that student literacy was only trained through functional literacy. The teacher asks the students to read the material and then presents the material in front of the class. It shows that literacy applied in schools is still limited and has not been implemented properly, so learning resources are needed to train and improve student literacy.

Based on this description, this study aims to determine the effectiveness of a guided inquiry-based science e-book with a green school orientation in improving students' environmental literacy.

Method

This research is research and development (R & D) using Plomp's development model. The Plomp model consists of three phases: preliminary investigation (preliminary analysis phase), prototyping phase (design phase), and verification phase (evaluation phase). Preliminary research was conducted by analyzing problems and reviewing the literature, and the results were a framework for intervention. The prototype phase is a prototype development that will be tested and revised based on the evaluation. The assessment phase is an assessment of the effectiveness of the product used.

The product in the form of a guided inquiry-based science e-book was tested on 31 class VIII students of Junior high school 17 Padang. The instruments used to collect the products are questionnaires and interviews for the preliminary research stage and effectiveness instruments which include knowledge and attitude assessment. Knowledge assessment is measured through pretest and posttest, while attitude assessment is based on student attitude observations.

The effectiveness of the e-book can be seen from the analysis of the achievement of the learning competencies of students. The competence of students includes knowledge, attitudes, and skills. Analysis of student competency data uses descriptive analysis.

The category of completeness of student learning outcomes is categorized based on Permendikbud No. 23 of 2016 which stipulates the completeness of learning for knowledge expressed on a scale of 0-100. The data from the test were analyzed and measured using the N-Gain analysis with Formula 1.

$$< g > = \frac{\%<Spost> - \%<Spre>}{100 - \%<Spre>} \quad (1)$$

<g> =Improvement of knowledge competence
< Spre> = Average pretest value
<Spost> = Average *posttest* value

The obtained N-Gain values are converted into categories as shown in Table 1.

Table 1. N-Gain Value Categories

N-Gain	Category
(<g>) > 70.00%	Tall
30.00% ≤ (<g>) ≤ 70.00%	Keep
(<g>) < 30.00%	Low

(Hake, 1999)

The student's attitude value is obtained from the score obtained from the attitude indicator divided by the maximum score and then multiplied by 100 by Formula 2:

$$lue = \frac{Number\ of\ Student\ attitude\ scores}{Maximum\ number\ of\ student\ attitude\ scores}\ x\ 100 \quad (2)$$

The attitude values obtained are converted into categories as found in Table 2.

Table 2. Attitude Value Categories

Score	Category
80 – 100	Excellent
61 – 80	Good
41 – 60	Good Enough
21 – 40	Not Good Enough
0 – 20	Bad

(Riduwan, 2010)

The learner's skill value is obtained from the score obtained from the skill indicator divided by the maximum score and then multiplied by 100 by Formula 3:

$$Value = \frac{Number\ of\ Student\ attitude\ scores}{Maximum\ number\ of\ student\ attitude\ scores}\ x\ 100 \quad (3)$$

The skill values obtained are converted into categories as shown in Table 3.

Table 3. Skill Value Categories

Score	Category
80 – 100	Excellent
61 – 80	Good
41 – 60	Good Enough
21 – 40	Not Good Enough
0 – 20	Bad

(Riduwan, 2010)

Result and Discussion

The environmental literacy of students is measured based on students' knowledge and attitudes. This is in line with the opinion of Pratama (2020), which suggests that environmental literacy consists of several parts, two of which are knowledge and attitudes. The instruments used in the knowledge and attitude competencies were designed based on environmental literacy indicators. The results of knowledge competence were obtained from the results of the pretest and posttest, which were carried out before and after using the science e-book product. The test given is in the form of 25 objective questions. The test is designed according to environmental literacy indicators. This test aims to see the increase in environmental literacy of students before and after using the science e-book based on knowledge competence.

The environmental literacy of students in terms of knowledge competence has increased significantly (Table 4). This can be seen from the Gain Score obtained of 0.9 in the high category. At the beginning of learning before using the e-book, none of the students had achieved completeness, but after using the e-book, all the students had achieved completeness scores. Classical that exceeds 85% that is 100%. Thus, the green school-oriented science e-book based on guided inquiry is declared to be effective in increasing the environmental literacy of students from the aspect of knowledge competence.

Table 4. Cognitive Results

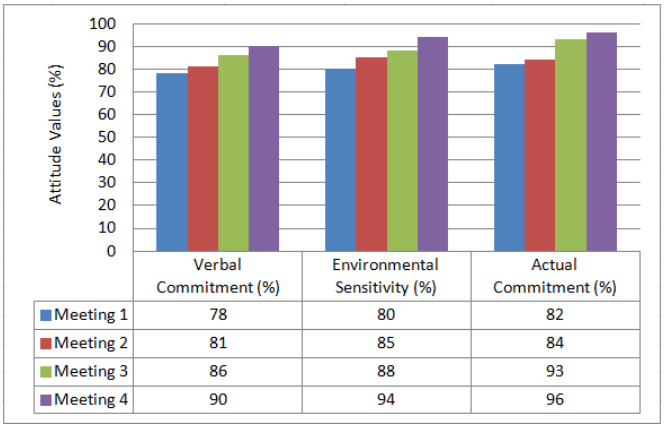
Test	Min	Max	Mean	<g>	Category
Pretest	24	60	48.4	0.9	High
Posttest	80	96	92.4		

In the knowledge competence, an effectiveness test was carried out in terms of the students' pretest and posttest scores. Increased knowledge competence based on classical completeness and the value of N-Gain. The classical completeness results obtained are 100%, and the N-Gain value obtained is in the high category. Safitri et al. (2020) states that through knowledge, students can solve current environmental problems and prevent problems that will occur in the future. This shows that the science e-book is effective in increasing the environmental literacy of students in the knowledge aspect.

Attitude assessment is carried out observing by observers of students during the learning process. In the observation process used, instruments in the form of observation sheets. This sheet is designed based on environmental literacy indicators. This assessment aims to measure students' environmental literacy skills. Environmental literacy indicators on attitudes consist of verbal commitment, environmental sensitivity, and actual commitment. Attitude assessment is carried out at each meeting.

Figure 1 shows the attitudes of students based on environmental literacy indicators have increased in each meeting. At the first meeting, a score of 80% was achieved in the Good category. The second meeting was 82% in the very good category. The third meeting was

86%, and the fourth was 93%, with each meeting in the very good category. Each indicator also experienced an increase, both in verbal commitment, environmental sensitivity, and actual commitment.



	Verbal Commitment (%)	Environmental Sensitivity (%)	Actual Commitment (%)
Meeting 1	78	80	82
Meeting 2	81	85	84
Meeting 3	86	88	93
Meeting 4	90	94	96

Figure 1. Affective Results

Each indicator also experienced an increase, both in verbal commitment, environmental sensitivity, and actual commitment. Attitude assessment, in addition to using the observation sheet, also uses a self-assessment sheet. This sheet aims to support the results of the observation sheet assessment. Students fill out the self-assessment sheet according to the environmental literacy indicator reference. The results of the self-assessment can be seen in Figure 2.

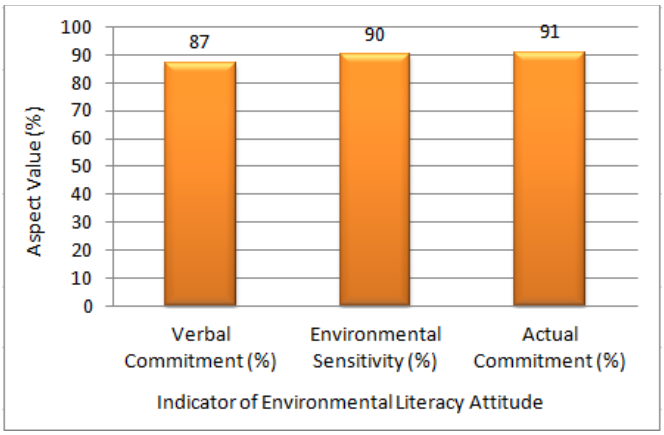


Figure 2. Self Evaluation

Figure 2 shows the results of the attitude assessment based on the student self-assessment sheet. From the figure, it can be seen that the value obtained for each indicator is in a high category. In this way, from the results of attitude evaluation and self-evaluation from the observation sheet, it can be concluded that a green school-oriented science ebook based on a guided survey is effective.

Self-evaluation is the stage carried out by the author to re-examine the product and repair the parts that need to be repaired. The results of the self-evaluation found several things that needed to be corrected, such as typing errors, presenting a concept map, and conforming to the components in the e-book. The improvement results from the self-evaluation were then continued into the validity test stage. This is in line with the opinion of Yuli & Mufit (2021), which suggests that the results of the self-evaluation are the determinants of continuing the validity test stage.

Attitude competence is carried out using observation sheets and is supported by self-assessment sheets for students. According to the results of the recruitment skill analysis, the evaluation of the category was incredible. These results are in line with research by Rokhmah & Fauziah, (2021), which confirms that attitudes have a major influence and become the basis for determining student behavior towards the environment. This shows that the science e-book is effective in increasing the environmental literacy of students in the attitude aspect.

Competence knowledge and attitudes are related to each other. Knowledge has an influence on attitudes which will ultimately improve behavior (Fatmasari et al., 2020). The guided inquiry model contained in the e-book helps improve learning outcomes. Handayani et al. (2020) found that the successful application of the guided inquiry model is characterized by increased learning outcomes in terms of knowledge and attitude. Thus, it can be concluded that the green school-oriented science e-book based on guided inquiry is valid, practical, and effective in improving students' environmental literacy in the aspects of knowledge and attitude competence.

Conclusion

Based on the results of the research and the explanation of the discussion, we can conclude that guided research-based e-books with green school orientation are effective in improving the environmental literacy of junior high school students. This is reflected in the value of knowledge, and learners' attitudes towards the environment are increasing.

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