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THE DEVELOPMENT OF E-BOOK BASED ON A SCIENTIFIC APPROACH TO TRAIN CRITICAL THINKING ABILITY ON THE STRUCTURE AND FUNCTION OF PLANT TISSUE TOPIC

Pengembangan E-Book Berbasis Pendekatan Saintifik untuk Melatihkan Kemampuan Berpikir Kritis pada Materi Struktur dan Fungsi Jaringan Tumbuhan

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Abstract

Educational demands that must be met in the 21st century are mastery of 4C skills (Critical Thinking, Collaborative, Creativity, and Communicative) and centered on higher-order thinking skills (HOTS). One of the HOTS is the ability to think critically. These critical thinking skills can be realized by applying the right learning approach with the support of appropriate learning media, including through a scientific approach. The goal of this research is to create an e-book based on a scientific approach to train critical thinking skills on the structure and function of plant tissues that are valid, practical, and effective. This study used a 4D development model, which included define, design, develop, and disseminate. The methods used to collect data are questionnaires, readability, pretest and posttest, and observation. Data analysis was performed using a quantitative descriptive technique. The e-book's validity was obtained by the assessment of three validators, resulting in a percentage of 97.50% in the very valid category. The practicality of the e-book was obtained by the results of student responses resulting in a percentage of 94.80% in the very practical category, and the readability test using a fry chart was at level 11. The effectiveness of the e-book was obtained by the results of the students' pretest and posttest gain scores resulting in an average of 0.72 in the high category, and the results of observations obtained a score of 3.80 in the very good category. Therefore, the developed e-book is declared valid, practical, and effective for use in learning.
Keywords: e-book, scientific approach, structure and function of plant tissues, critical thinking skills.

Abstrak

Tuntutan pendidikan yang harus dipenuhi pada abad 21 yaitu, penguasaan keterampilan 4C (Critical Thinking, Collaborative, Creativity, dan Communicative), serta berpusat pada keterampilan berpikir tingkat tinggi (HOTS). Salah satu kemampuan berpikir tingkat tinggi adalah kemampuan berpikir kritis (critical thinking). Keterampilan berpikir kritis ini diharapkan dapat terealisasikan dengan diimplementasikannya pendekatan pembelajaran yang sesuai dan didukung oleh adanya media belajar yang tepat, diantaranya melalui pendekatan saintifik. Penelitian ini bertujuan untuk menghasilkan e-book berbasis pendekatan saintifik untuk melatihkan kemampuan berpikir kritis pada materi struktur dan fungsi jaringan tumbuhan yang valid, praktis, dan efektif. Pada penelitian ini, digunakan model pengembangan 4D yang meliputi define (pendefinisian), design (perancangan), develop (pengembangan), dan disseminate (pendeseminasian). Metode yang digunakan untuk mengumpulkan data adalah metode angket, keterbacaan, pretest dan posttest, dan observasi. Analisis data dilakukan dengan teknik deskriptif kuantitatif. Kevalidan e-book didapatkan dari penilaian tiga validator yang menghasilkan persentase sebesar 97.50% dengan kategori sangat valid. Kepraktisan e-book didapatkan dari hasil respon peserta didik yang menghasilkan persentase sebesar 94.80% dengan kategori sangat praktis serta uji keterbacaan menggunakan grafik fry yang berada pada level 11. Keefektifan e-book didapatkan dari hasil gain score pretest dan posttest peserta didik yang menghasilkan rata-rata sebesar 0.72 dengan kategori tinggi dan hasil observasi mendapatkan skor sebesar 3.80 dengan kategori sangat baik. Maka dari itu, e-book yang dikembangkan dinyatakan valid, praktis, dan efektif untuk digunakan dalam aktivitas belajar mengajar.
Kata Kunci: *e-book, pendekatan saintifik, struktur dan fungsi jaringan tumbuhan, kemampuan berpikir kritis.*

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INTRODUCTION

In the 21st century, competition between individuals is getting tougher, including in the field of education (Fauziah, dkk., 2023). Educational demands that must be met in the 21st century are mastery of 4C skills (Critical Thinking, Collaborative, Creativity, and Communicative) and centered on HOTS (Kemendikbud, 2017). One of the higher-order thinking skills is the ability to think critically (Girsang, dkk., 2022). Critical thinking is a student's skill in processing information, analyzing and interpreting the results of observations, reasoning, experience, and even communication to decide whether the information obtained can be trusted and whether the truth is real (Purwati, dkk., 2016).

According to the results of a survey regarding the secondary education system in the world in 2018 issued by PISA (Program for International Student Assessment) in December 2019, Indonesia was in a low position, namely 74 out of 79 participating countries (Kurniawati, 2022). From this data, Lestari & Annizar (2020) concluded that Indonesian students' ability to reason, especially critical thinking, is still deficient. Based on these data, it is known that the low critical thinking skills of students in Indonesia are a reference that there is an urgency to train critical thinking skills in the current education system. The indicators of critical thinking used in this study are the indicators described by Ennis (1985), namely: elementary clarification (sub-indicators analyzing arguments and asking & answering explanation or challenge), basic support (sub-indicators match with the sources and observing & considering the results of observations), inference (sub-indicators induce & consider the results of induction), advanced clarification (sub-indicators identify assumptions), and strategy and tactic (sub-indicators interact with others). These critical thinking skills can be realized by carrying out teaching and learning activities using appropriate learning models and learning media (Fitri & Rahayu, 2022).

The approach to be used in this study is a scientific approach. The scientific approach to learning is an approach based on scientific processes by carrying out logical (according to reason) and empirical (obtained from the senses) steps, and the essence of the scientific approach is to provide learning experiences to students and educators so that they can positions themselves as a facilitator, motivator, mediator and others (Mujahidin, 2017). Based on Permendikbud Number 103 Tahun 2014, the scientific approach is carried out through the following process: observing, questioning, experimenting, associating, and communicating. This scientific activity shows that learning natural sciences does not only use cognitive skills, but activities for students in building knowledge from the information and facts that have been presented are also needed (Windari, dkk., 2022).

The reason for applying a scientific approach to this study is because the structure and function of plant tissues were used in this study. Based on research conducted by Andriyani, dkk. (2020) from the results of students' daily tests, it was revealed that the structure and function of plant tissue was found to be one of the biology topics that students struggled to comprehend, this was because students could not see directly with their senses, requiring the help of a microscope available at school to view. In line with the findings from Gusti & Syamsurizal (2021) research, from the observations it was revealed that students had difficulty learning biology in the structure and function of plant tissue, because the average daily test score of students at Adabiah Padang High School is 55.8% under the KKM, and at Adabiah 2 Padang High School, the daily test scores of students below the KKM were 85.8%; students also revealed that based on the observation questionnaire given that out of 124 students, 71% of them had trouble comprehending the material structure and function of plant tissues, because there are many foreign terms, too much material and objects that cannot be seen directly. The meaning of an object that cannot be observed directly is its anatomical aspect. According to Kusumawati (2016), direct (actual) observation or direct viewing of plant tissue is crucial in understanding the material structure and function of plant tissue. This follows the implementation of a scientific approach in learning because, according to Munawaroh & Retyanto (2016), taking a scientific approach to learning involves students directly in the process of studying and provides full opportunities for students to try and discover their own knowledge.

The term "e-book" refers to a book that can be open electronically on a laptop screen or other portable device and includes elements like photos, video, audio, and hyperlinks to enable interaction between students and teachers (Muhammad, dkk., 2017). Along with technological developments, various innovations continue to occur in the world of education (Agustina, dkk., 2023). The existence of an e-book can help students learn the structure and function of plant tissue material because it contains visualizations that make it

simpler for students to understand the topic. Especially e-books based upon a scientific approach because they also include activities that can instruct critical thinking skills. The development of e-books is also because e-books are closely connected to digital literacy because their use involves technology. In their research, Wahyuni & Rahayu (2021) stated that the education paradigm in the 21st century demands an education that ensures students have high-level thinking skills, which implies reasoning, systematic, critical, and creative abilities in solving problems so that students can answer educational challenges in the future. This can be fulfilled through digital literacy because, according to Masitoh (2018), the aim of digital literacy is to develop critical thinking, self-expression, and participation in digital media.

The advantages of e-books developed with other e-books are that there are features that can train critical thinking skills through scientific approach steps. Some features involve students actively in learning activities as well, one of which is practical practicum activities because research conducted by Andriyani, dkk., (2020) and Gusti & Syamsurizal (2021) shows that students have difficulty learning this material because they cannot see objects directly with the senses, as well as the material applied requires active and independent involvement of students (Hikmah, dkk., 2021). There is also a glossary feature that contains essential and difficult terms complemented by definitions of these terms, which can overcome students' learning difficulties in the material on the structure and function of plant tissues because there are many complicated terms. E-books can be accessed by mobile phones, tablets, and computers.

Therefore, it is hoped that this research can provide information in the form of field data regarding the development of an e-book based on a scientific approach to train critical thinking skills on the structure and function of plant tissues. Based upon the explanation above, this development research aims to produce an e-book based upon a scientific approach that is valid, practical, and effective to use to train critical thinking skills on the structure and function of plant tissues.

METHODS

This study used the 4D development model, which included define, design, develop, and disseminate. This research was hold in the even semester of the 2022/2023 school year at UNESA FMIPA and SMA Negeri 1 Taman. The population in this study is SMA Negeri 1 Taman, with major science students who have gotten the structure and function of plant tissue material. The sample of this research was one class at SMA Negeri 1 Taman majoring in Science, totaling 30 students who have received structure and function of plant tissues topic.

Curriculum, student, concepts, task analysis, and goal-setting education do the define phase. The design stage is carried out by making an attractive e-book display design that contains cover pages, constituent pages, preface, table of contents, e-book operating instructions, e-book features, e-book characteristics, basic competencies and indicators, maps concepts, learning objectives, materials and features, and bibliography. The develop stage is carried out with the review and revision of products in accordance with the suggestions and input given validator until a final revision is produced. Stage disseminate is done with article publication.

In this study, the parameters measured were the validity, practicality, and effectiveness. The first aspect is the validity, where data collection uses a questionnaire method. The validity aspect was assessed by one biology teacher at SMA Negeri 1 Taman and two lecturers at the Department of Biology, FMIPA, Unesa using a validation sheet instrument. Assessment indicators on the validity aspect are in content, presentation, language, and graphics (BSNP, 2017). In addition, some aspects show that the e-book developed is in line with a scientific approach and can train critical thinking skills. In each aspect described in the validity variable, there are favorable (positive) statement items. This validity aspect scale has four answer choices, namely: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). How to assess this validity scale using the likert scale model adapted from Sugiyono's book (2015). The final validity result is calculated using the formula used to

$$\text{Validation (\%)} = \frac{\text{Obtained score}}{\text{Maximum score}} \text{ x } 100\% \text{.....} \quad (1)$$

determine the percentage of the average validity score as written below:

The validation score results are then interpreted based on Table 1 namely the validity criteria. The developed e-book is considered valid if it obtains a value of ≥ 63% (Sugiyono, 2016).

Table 1. Validity Criteria

Percentage (%)	Criteria
82 – 100	Very valid
63 – 81	Valid
44 – 62	Less valid
25 – 43	Invalid

(Source: Sugiyono, 2016)

The second aspect is the practicality of e-book, where data collection uses the questionnaire method and the legibility method. The questionnaire given contain statements in the form of favorable (positive) items. This practicality aspect scale has two answer choices: "Yes" and "No." Assessing this practicality scale uses the guttman scale model adapted from the book (Sugiyono, 2016). The score in each item is 1 for the answer "Yes" and 0 for the answer "No." The final practicality result is calculated using the formulation to determine the percentage of the average practicality score.

$$\text{Practicality (\%)} = \frac{\text{Obtained score}}{\text{Maximum score}} \text{ x } 100\% \text{.....} \quad (2)$$

The practicality score results are then interpreted based on the Table 2 namely the practicality criteria. The developed e-book is considered practical if it obtains a value of ≥ 63% (Sugiyono, 2016).

Table 2. Practicality Criteria

Percentage (%)	Criteria
82 – 100	Very practical
63 – 81	Practical
44 – 62	Less practical
25 – 43	Not practical

(Source: Sugiyono, 2016)

The practicality assessment is also reviewed from the readability test results using the fry chart. In their research, Febriarti & Rahayu (2022) stated that the readability method was carried out by selecting readings in an e-book totaling 100 words. Sample readings are taken from four different pages of the e-book. How many sentences there are and how many syllables there are on the fry chart were multiplied by 0.6 to determine the readability test score. The results of the meeting are located between the numbers 1 – 15, which indicate the level of legibility according to the level.

The third aspect is effectiveness, where the data collection uses the pretest, posttest, and observation methods. Score pretest and posttest obtained based on the formula:

$$\text{Score} = \frac{\text{Student's score}}{\text{Maximum score}} \text{ x } 100\% \text{.....} \quad (3)$$

From the test values obtained, the increase is then calculated based on the formula from Sundayana (2014), namely:

$$\text{N-Gain} = \frac{\text{Posttest score - Pretest score}}{\text{Maximum score - Pretest score}} \text{ x } 100\% \text{.....} \quad (4)$$

In this study, the gain score is utilized to discover the development of critical thinking abilities, which is characterized by an increase in learning outcomes before and after the use of e-books based on a scientific approach. From the value of increasing critical thinking skills that obtained, the interpretation of the gain score is carried out based on the gain index interpretation table to determine critical thinking skills as in this Table 3.

Table 3. Gain Index Interpretation

N-Gain Score	Interpretation
-1.00 < g < 0,0	There was a decline
g = 0,0	No increase
0,0 < g < 0,30	Low
0,30 < g < 0,70	Medium
0,70 < g < 1.00	High

(Source: Sundayana, 2014)

In addition to interpreting the gain index, the average pretest and posttest of students by number of questions was also calculated. From the average pretest and posttest the number of questions obtained is then categorized as completeness based on the minimum completeness criteria (KKM) determined by the school, namely 75. Question numbers that get a value of ≥75 are categorized as complete, while those that get a value of <75 are categorized as incomplete.

The observation method is assessed when the practicum activity takes place. Assessment is built upon this scale below:

Table 4. Likert Scale

Category	Score
Very good	4
Good	3
Good enough	2
Not good	1

(Source: Riduwan, 2015)

Furthermore, from these scores the average is calculated then the average results are converted using the formula below:

Table 5. Scale Conversion

Score	Category
X ≥ 3,25	Very good
3,25>X ≥ 2,5	Good
2,5 >X ≥ 1,75	Less good
1,75 > X	Not good

(Source: Mardapi, 2015)

In this study, observations were made by observing students' practicum activities to assess the outcome of students' critical thinking skills on aspects that could not be measured by pretest and posttest.

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RESULT AND DISCUSSION

E-book development research produces e-books based upon a scientific approach to training critical thinking skills on the structure and function of plant tissues. The characteristic of this e-book is it is oriented towards the phase of a scientific approach and aims to instruct critical thinking skills. The developed e-book has three section: introduction, contents, and closing. The introductory part includes a cover, preface, list of contents, e-book operating instructions, e-book features, e-book characteristics, basic competencies and indicators, concept maps, and learning objectives. The content section covers the entire material structure and function of plant tissues, consisting of three sub-materials: plant tissue and meristem tissue, mature (permanent) tissue, and plant organs. In addition, each material contains features. These features include E-Ask, E-Sum, E-Lit, E-Think, E-Lab, E-Reflection, E-Val, and E-Glossary. The closing section consists of a list of references.

The following are the views and features of the e-book being developed:

Figure 1. Front and Back Covers of E-Book

Covers contain basic information about the e-book title, material title, class level, Unesa's logo, K-13 logo, author's name, and supervisor's name to make it easier for students to know an overview of the contents of the e-book.

Table 6. E-Book Features

No.	E-book Feature	Information
1.		The E-Ask feature presents apperception questions to link what is known or experienced with what students will learn.
2.		The E-Sum feature provides a means of making a summary without reference to the content already examined.
3.		The E-Lit feature presents journals relevant to the material that has been studied. Students conduct a literature study, make a brief summary based on the journal, and make conclusions from the summary that has been made.
4.		The E-Think feature facilitates students to interpret graphs in journals and concludes readings from journals (E-Think 1) or create and answer questions based on journals that have been studied and conduct literature studies independently by seeking new information from other sources (E- Think 2).
5.		The E-Reflection feature presents questions as a means of self-reflection after learning by communicating them in groups and training students in making conclusions.
6.		The E-Lab feature presents the arrangement of student practicum activities, including the report preparation format.
7.		The E-Val feature presents a matter of evaluating the content that has been learned.
8.		The E-Glossary feature presents terms regarding related material accompanied by definitions of these terms.

The eight features are arranged based upon needs, scientific approach, and critical thinking indicators.

From the outcome of the validity assessment showed very valid results. The recap of e-book validation results presented below.

Table 7. Recapitulation of E-Book Validation Results

No	Rated aspect	Average Score			Average
		V1	V2	V3	
A.	Fill				
1	Coverage and accuracy of e-book content/material	4	3.67	4	3.89
2	Up to date	3.50	4	4	3.83
3	Develop skills and stimulate curiosity	3.67	4	3.67	3.78
Content Aspect Average		3.83			
Content Aspect		95.75			

No	Rated aspect	Average Score			Average
		V1	V2	V3	
Percentage (%)					
Content Aspect Category		Very Valid			
B. Eligibility of Presentation					
4	E-book presentation techniques	3.67	4	4	3.89
5	Supporting the presentation of material from e-book	4	4	4	4
6	Font Selection	3.33	4	4	3.77
Average Aspects of Presentation		3.88			
Presentation Aspect Percentage (%)		97			
Presentation Aspect Category		Very Valid			
C. Language					
7	E-book presentation techniques	4	4	4	4
8	Presentation support	4	4	4	4
Average Language Aspect		4.00			
Percentage of Language Aspect (%)		100			
Language Aspect Category		Very Valid			
D. Graphics					
9	Model size	4	4	4	4
10	Content design	4	4	4	4
Graphic Aspect Average		4.00			
Graphic Aspect Percentage (%)		100			
Graphical Aspect Category		Very Valid			
E. Compatibility of E-Books with a Scientific Approach					
11	Observe	4	4	4	4
12	Ask	3	4	3.5	3.5
13	Trying / collecting data	4	4	4	4
14	Reasoning / associating	4	4	4	4
15	Communicating	3.5	4	4	3.83
Compatibility of E-Books with A Scientific Approach Aspect Average		3.88			
Compatibility of E-Books with A Scientific Approach Aspect Percentage (%)		97			
Compatibility of E-Books with A Scientific Approach Aspect Average		Very Valid			
F. Compatibility of E-Books with Critical Thinking Indicators					
16	Elementary clarification	4	4	4	4
17	Basic support	4	4	4	4
18	Inference	3.5	4	4	3.83
19	Advanced clarification	2.5	4	4	3.5
20	Strategy and tactic	4	4	3	3.67
Compatibility of E-Books Critical Thinking Indicators Aspect Average		3.83			
Compatibility of E-Books with Critical Thinking Indicators Aspect Percentage (%)		95.75			
Compatibility of E-Books with Critical Thinking Indicators Aspect Category		Very Valid			
Overall Average		3.90			
Percentage of Overall Validity Score (%)		97.50			
Overall Category		Very Valid			

Based on the table above, V1 is an education expert, V2 is a material expert, and V3 is a biology teacher and from the table above it is notable that the average result of validity for all aspects is 3.90, and the percentage of the overall validity score is 97.50%, with a very valid category. This shows that the e-book is valid for use in teaching and learning activities and meets the standards for preparing textbooks.

The E-books can obtain very valid results; where these results are very good results because their preparation, it follows the rules or standards for preparing textbooks by BSNP (2017). A textbook is said to be good if it meets the standards for preparing textbooks which include content feasibility, presentation, language, and graphics (BSNP, 2017). In addition, the developed e-book is based on a scientific approach and aims to train critical thinking skills so that the preparation is based on steps from a scientific approach and indicators and sub-indicators of critical thinking.

Regarding the outcome of the validation, the first aspect to be assessed is the content aspect. The components of the content aspect include coverage and accuracy of e-book content/material, up-to-date development skills & stimulate curiosity. The average content aspect score obtained was 3.83 and the content percentage was 95.75%, in a very valid category. This

indicate that the developed e-book is in accordance with the component aspects of the content.

The e-book developed aims to convey material in depth that is tailored to learning objectives, ease of understanding, correct concepts, and developments in biology, content updates, supporting features, encouraging students to seek information independently and further, and ease of students in obtaining tools and materials in learning. All of these things aim to train students' critical thinking skills. As previously stated, the e-books content are developed in line with the learning goals, the correctness of concepts, theories, and the development of biology. This shows that the e-book is developed in line with one of the principles of developing teaching materials presented by Hayati (2014) namely relevance or suitability. In addition, one of the points in increasing students' critical thinking is learning independence which in this e-book is demonstrated by encouraging students to seek information independently and further. Based on research by Siagian, dkk. (2021) known that learning independence has a strong influence on critical thinking skills; the higher the learning independence, the better critical thinking skills.

E-book presentation techniques, assisting the presentation of material from the e-book, and selecting letters. The average presentation aspect score obtained was 3.88 and the presentation aspect score percentage was 97% in a very valid category. This shows that the e-book is in line with the presentation aspect components. These results specify that the developed e-book already has appearance and features conformity to the material, content/features in line with learning goals to be achieved, images or layout do not interfere with the presentation, layout is simple and clear in terms of images/tables and clear text selected, there are numbering/naming on existing pictures/tables, the selected font size and type can be read clearly, and the combination of letters and background is clear and the letters are not covered.

The third aspect is the linguistic aspect which includes: e-book presentation techniques and presentation support. The average presentation aspect score obtained is 4.00 and the presentation aspect score percentage is 100% with a very valid category. This shows that the e-book is in accordance with the linguistic aspects of the component. These results specify that the developed e-book already has a coherent presentation according to the latest facts, uses simply-to-understand biological terms, the choice of language used is informative and easy to understand, written with the correct rules, scientific names/foreign terms are italicized, the language used according to the tier of thinking of students. One aspect of linguistics is the language used according to the tier of thinking of students where this is in accordance with the principle of developing teaching materials conveyed by Mulyasa (2013), namely relevance to the ability level of students. This means that the language used is not too difficult or too easy for students.

The fourth aspect is the graphic aspect which includes: model size and content design. The average presentation aspect score obtained is 4.00 and the presentation aspect score percentage is 100% with a very valid category. This shows that the e-book is in accordance with the graphical aspect components. These results specify that the developed e-book already has content size conformity with ISO standards, size conformity with content material, placement of layout elements is consistent, separation between paragraphs is clear, spacing between text and illustrations is appropriate, and does not use too many fonts.

The next aspect is the compatibility of e-books with a scientific approach. The average score for the compatibility of e-books with a scientific approach obtained is 3.88, and the percentage score for this aspect is 97% with a very valid criteria. This aspect is adapted to the five steps of the scientific approach, which include: observing, asking, trying/collecting data, reasoning/associating, and communicating. This shows that the developed e-book is in line with the steps of the scientific approach.

The last aspect is the compatibility of e-book with critical thinking indicators. The average score for the compatibility of e-book with critical thinking indicators obtained is 3.83 and the percentage score for this aspect is 95% with a very valid category. This shows that the e-book is in accordance with indicators of critical thinking and can train critical thinking skills. This aspect is adapted to the indicators and sub-indicators of critical thinking which include: elementary clarification (sub-indicators analyzing arguments and asking & answering explanation or challenge), basic support (sub-indicators match with the sources and observing & considering the results of observations), inference (sub-indicators induce & consider the results of induction), advanced clarification (sub-indicators identify assumptions), and strategy and tactic (sub-indicators interact with others).

The practicality of the e-book is obtained from the results of the survey of student opinions and the readability test using the fry chart. The method used to determine the practicality of the first e-book is the result

of the survey of student opinions. The results of student responses to the e-book are described in Table 8.

Table 8. Recapitulation of Student Response Results to E-Books Based on a Scientific Approach

No	Statement	Answer Percentage (%)	
		Yes	No
1.	The e-book helps you understand the structure and function of plant tissues.	100	0.00
2.	The e-book has clear and easy-to-understand material descriptions.	100	0.00
3.	The e-book has a concept map that can help you know the material to be studied.	96.67	3.33
4.	The e-book contains questions that are easy to understand and in line with the material you are studying.	96.67	3.33
5.	E-book supports active and fun learning.	93.33	6.67
6.	The e-book uses Indonesian, according to the refined spelling.	100	0.00
7.	The e-book uses Indonesian, which is easy to understand.	96.67	3.33
8.	The e-book has an interesting presentation.	96.67	3.33
9.	The e-book has the appropriate font/number size and font size and is easy to read.	100	0.00
10.	The e-book has clear and attractive illustrations.	93.33	6.67
11.	The e-book has illustrated pictures that match the material you are studying.	96.67	3.33
12.	The activities in the e-book train you to carry out observational activities.	96.67	3.33
13.	The activities in the e-book train you to ask and answer questions.	90.00	10.00
14.	The activities in the e-book train you to do experiments and collect data.	90.00	10.00
15.	The activities in the e-book train you to do reasoning/associating activities.	96.67	3.33
16.	The activities in the e-book train you to carry out communication activities with other people.	60.00	40.00
17.	Activities in the e-book can train your critical thinking skills.	100	0.00
18.	The E-Lab feature in the e-book facilitates you to do practicum in real terms and compile practicum results reports.	83.33	16.67
19.	The E-Ask feature in the e-book facilitates you to carry out observation, analysis, and answering questions.	100	0.00
20.	The E-Lit feature in e-books facilitates you to study literature through journals that are appropriate to the material you have studied.	96.67	3.33
21.	The E-Think feature in the e-book facilitates you to organize and answer questions from a given journal.	100	0.00
22.	The E-Reflection feature in the e-book facilitates you to reflect after learning and communicate with others.	93.33	6.67
23.	The E-Sum feature in the e-book facilitates you to make a summary independently of the material you have studied.	93.33	6.67
24.	The E-Val feature in the e-book facilitates you to evaluate the material you have studied.	100	0.00
25.	The E-Glossary feature in the e-book makes it simpler for you to understand terms related to the material you have studied.	100	0.00
Average		94.80	5.20

From the results above, an average percentage of 94.80% for positive answers. This shows that e-books are classified as very practical according to the practicality criteria put forward by Sugiyono (2016), supported by the opinion of Rahayu, dkk., (2019), that the practical category obtained point that this learning tool is simple to use, easy to interpret, and useful for the user. The developed e-book can obtain a high average percentage because, in its preparation, it follows the practical aspects as conveyed by Rahayu, dkk., (2019), namely aspects of ease of use and aspects of the presentation of material, for aspects of ease of use, including the ease of understanding the material and the language used. While the presentation aspect focuses on appearance (Agustyaningrum & Gusmania, 2017).

The second method is the readability test using a fry chart. The measurement of e-book readability uses four samples that come from different pages and sub-chapters. Wahyuni & Rahayu (2021) measures readability using samples with four different pages too. The results of the recapitulation of the e-book readability test are written in Table 9. below.

Table 9. E-Book Readability Recapitulation Based on a Scientific Approach based on Fry's Graph

Sa-mple	Page	Σ Sentence	Σ Sylla-bles	Σ Syllable X 0.6	Class Level
1	4	5.25	264	158.4	11
2	6 – 7	6.00	273	163.8	11
3	20	5.71	268	160.8	11
4	55 –	3.88	251	150.6	11

Sa-mple	Page	Σ Senten ce	Σ Sylla-bles	Σ Syllable X 0.6	Class Level
	56				
Average		5.21	265.6	158.4	11

Based on Table 9 above shows that the readability calculation uses four samples. The 1st and 2nd samples were obtained from sub-chapter 1, "Plant Tissue and Meristem Tissue," on pages 4 and 6-7. The 3rd sample was obtained from sub-chapter 2, "Adult Tissue," on page 20. The 4th sample is obtained from sub-chapter 3, "Plant Organs," on pages 55-56. All four are at level 11. The e-book readability test recapitulation conversion on the fry chart is shown in Figure 2.

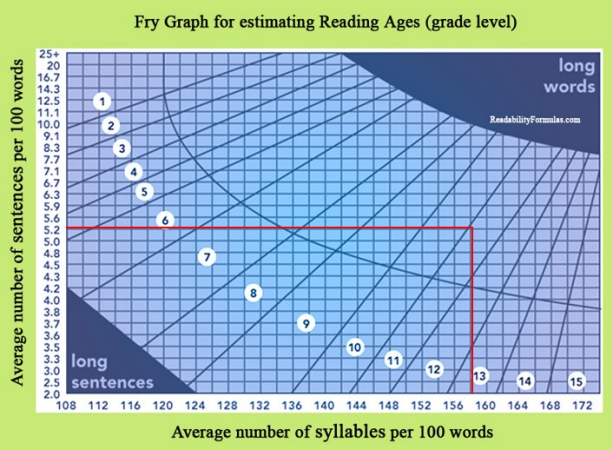

Figure 2. Fry Graph

From Figure 2 above, it is shown that the four samples used in the readability test have a meeting point between the vertical and horizontal lines on the fry chart, which is located in the area that has the number 11 so that the resulting average has a meeting point between the vertical and horizontal lines on the fry chart which is located in an area that has the number 11 as well. This indicate that the developed e-book is practically used by grade 11 students. This is strengthened by the opinion of Imam, dkk., (2018), that the numbers 1 to 15 in the fry chart indicate the level of legibility according to the level. The material in the e-book, namely the structure and function of plant tissue, is taught in grade 11. Readability is important to know because reading with a good readability level will affect readers by increasing their interest in learning and memory, increasing reading speed and efficiency, and maintaining reading habits (Dewi & Arini, 2018).

The effectiveness of the e-book is obtained from the results of the students' pretest and posttest, as well as observations during practicum activities. In the pretest and posttest questions, there are four indicators and six sub-indicators of critical thinking, which means that there is one indicator and sub-indicator of critical thinking that is not present in the pretest and posttest. The critical thinking indicator is strategy and tactic with critical thinking sub-indicators interact with others. This is because the indicators and sub-indicators are related to interactions with other people, consequently, it is inappropriate to use them as a pretest and posttest. Therefore, indicators of critical thinking in strategy and tactic with sub-indicators of critical thinking interact with others are not obtained from the pretest and posttest but from observations of practicum activities.

Judging from the result of the gain score, the average gain score of students is 0.72, which is classified in the high category. This identify that e-books based on scientific approaches are effectively used in learning to train critical thinking skills. This can happen because the pretest and posttest questions used, in addition to being adapted to fundamental competence and competence achievement indicators, are also adapted to critical thinking indicators and critical thinking sub-indicators, besides that the pretest and posttest are also questions that are equivalent and have a C4 – C6 cognitive level, which belongs to the HOTS (higher-order thinking skills) category. The pretest and posttest questions have also been validated by three expert validators before being used in a limited trial with assessment components in the form of material, construction, language, and suitability of the items with critical thinking indicators, and each gets an average percentage of overall validity of 98.10 % and 98.36% with very valid categories.

Completeness on each competency achievement indicator, indicators and sub-indicators of critical thinking in the pretest of the six question numbers is in the incomplete category, while in the posttest there is one question number that is in the incomplete category, namely at question number 1, the other four question numbers are at complete category. The number of questions on the posttest that are in the incomplete category is question number one which has an competency achievement indicator in the form of analyzing the concept of plant tissue with questions regarding the location of meristems based on their position in the plant body. This question has an indicator of critical thinking in the form of providing simple explanations and a sub-indicator of critical thinking in the form of asking & answering an explanation or challenge with a posttest average of 6.57. This figure shows that the students did not complete the competency achievement indicator in analyzing the concept of plant

tissue and still had difficulties in giving simple explanations, especially in asking and answering.

In addition to the pretest, posttest, and gain score results from the written test results of 30 students, classifying student scores and gain scores pretest and posttest are carried out per indicator and sub-indicator of critical thinking. This is intended to make it easier to find out which indicators and sub-indicators of critical thinking are still classified as low, medium, or high. The gain score on each critical thinking indicator and sub-indicator are listed on the figure below.

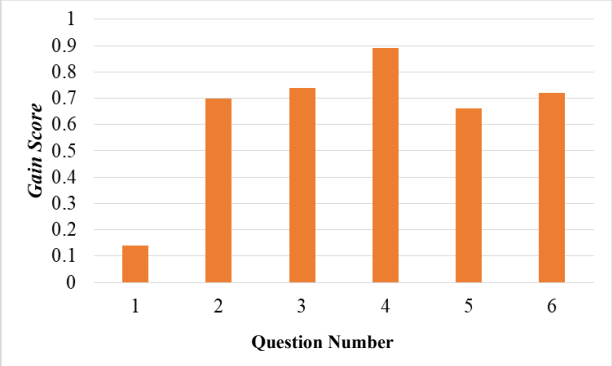

Figure 3. Student Gain Score on Each Indicator and Sub-Indicator of Critical Thinking

Information:

Critical Thinking Indicator (Critical Thinking Sub-indicator) & Competency Achievement Indicator

Question number 1 :
Elementary clarification (asking & answering explanation or challenge) & analyzing the concept of plant tissue

Question number 2 :
Basic support (observing & considering the results of observations) & detailing the structure, characteristic and functions of meristem tissue

Question number 3 :
Elementary clarification (analyzing arguments) & detailing the structure, characteristic and functions of adult (permanent) tissue

Question number 4 :
Basic support (adjust to sources) & detailing the characteristics and functions of plant organs

Question number 5 :
Advanced clarification (identify assumptions) & comparing organs in plants

Question number 6 :
Inference (induce & consider the results of induction)

Gain Index Interpretation

$-1.00 < g < 0.0$: there was a decline
$g = 0.0$: no increase
$0.0 < g < 0.30$: low
$0.30 < g < 0.70$: medium
$0.70 < g < 1.00$: high

From Figure 3 above, it is known that one number of questions resulting from a gain score is in the low criterion, one item number resulting in a gain score is in the medium criterion, and four item numbers resulting in a gain score are in the high criterion. It means that even though the results and categories obtained are different, it still shows that there is an increase in all indicators and sub-indicators of critical thinking.

The question number that gets the lowest gain score is question number one with questions that have competency achievement indicators in the form of analyzing the concept of plant tissue with questions regarding the location of meristems based on their position in the plant body. This question has an indicator of critical thinking in the form of elementary clarification and a sub-indicator of critical thinking in the form of asking & answering explanation or challenge with a gain score of 0.14. This figure shows that students still have difficulty in giving simple explanations, especially in asking and answering. This figure also shows that the students' initial abilities are not much different from their final abilities, so it is concluded that the improvement is low.

The gain score which is in the low category is due to the fact that during the pretest the students were not careful in answering the questions. Some students answered the question by mentioning the difference between the left and right pictures, even though the answers requested were the differences from the pictures numbered 1, 2, and 3 and some students could not tell the difference in the pictures numbered 1, 2, and 3. Likewise during the posttest, students were less thorough in answering the questions. Problem number one has two questions, namely regarding the analysis of meristem division and differences in meristems numbered 1, 2, and 3. Most students did not answer questions regarding the analysis of meristem division and some students could not mention the differences in the pictures numbered 1, 2, and 3.

In addition to the lack of thoroughness of students in answering question number one which causes the gain score on that number to be low, there are other factors that cause the gain score to be low, namely the factor of applying learning methods to daily teaching and learning activities. Class XI IPA 4 students are used to learning with conventional methods or lecture methods. Budiasih (2016) found that students whose learning used a conventional approach had minimal activity, no students asked the teacher, only five students asked friends when experiencing difficulties, three students answered the teacher's questions and five students who answered friends' questions, and only ten students who read reading resources during learning, besides that learning

also took place in one direction, limited to receiving information from the teacher. This also happened to students in class XI IPA 4 who in their teaching and learning activities were only limited to receiving information and listening to explanations from the teacher. So that it causes a low gain score of students on questions that have indicators of critical thinking in the form of giving simple explanations and sub-indicators of critical thinking in the form of asking & answering an explanation or challenge. This can be seen in learning at the questioning stage which is trained by applying the E-Ask feature with activities in the form of apperception where students are asked to answer apperception questions, but in these activities students are less active in answering questions.

The competency achievement indicator on questions that have a low gain score is to analyze the concept of plant tissue. This shows that students still have difficulty understanding the concept of plant tissue, even though the competency achievement indicators are considered basic, because understanding concepts is included in the C2 cognitive level. Halida & Windyariani (2019) said that difficulties in understanding plant tissue structure material coupled with inappropriate learning experiences had an impact on students' low motivation and mastery of students' concepts, besides that the structure and function of plant tissue has a lot of material and is not interesting so that it affects the lack of students' mastery of concepts. Based on this opinion, it is known that inappropriate learning experiences have an impact on students' low mastery of concepts. Inappropriate learning experiences here mean learning activities that are not appropriate with learning materials, such as material on the structure and function of plant tissues that should be taught through direct observation of plant anatomy and morphology. However, students in class XI IPA 4 received material on the structure and function of plant tissues by listening to the teacher's explanation and only observing plant anatomy from preparations. Thus, this affects the learning experience of students which in turn can affect students' lack of mastery of concepts.

There is one critical thinking indicator that has a moderate gain score interpretation, namely question number five with questions that have competency achievement indicators in the form of comparing organs in plants with questions regarding comparing dicot and monocot plant organs. The question has critical thinking indicators providing further explanation and critical thinking sub-indicators identifying assumptions with a gain score of 0.66. This figure shows that the students' initial and final abilities have a moderate increase. It also shows that students are sufficiently able to compare the organs of dicot and monocot plants. In addition, there are four indicators of critical thinking that have high gain score interpretations, namely question number two with competency achievement indicators detailing the structure, characteristics and functions of meristem tissue with questions regarding characteristics of meristem tissues which have indicators of critical thinking building basic skills and sub-indicators of critical thinking observing & considering the results of observations with a gain score of 0.70, question number three with competency achievement indicators detailing the structure, characteristics and functions of adult (permanent) tissue with questions regarding the structure, characteristics and functions of adult (permanent) tissues which have critical thinking indicators providing simple explanations and sub-indicators of critical thinking analyze arguments with a gain score of 0.74, question number four with competency achievement indicators detailing the characteristics and functions of plant organs with questions regarding the characteristics and functions of plant organs which have indicators of critical thinking building basic skills and sub-indicators of critical thinking adapting to sources with gain a score of 0.89, and question number six with competency achievement indicators relating the structure of plant tissues and organs to their functions with questions regarding the relationship between features and functions of plant organs which have indicators of critical thinking concluding and sub-indicators of critical thinking induce & consider induction results with a gain score of 0.72.

In addition to measuring the effectiveness of the e-book achieved from the gain score pretest and posttest, effectiveness measurements were also obtained from observation of practicum activities which aimed to discover the average results of students' critical thinking skills taken during practicum activities. During practicum activities, indicators of critical thinking that are evaluated are strategy and tactic with sub-indicators of critical thinking interact with others. This is because the indicators and sub-indicators are related to interactions with other people, so it is not appropriate to put them in the shape of pretest and posttest questions. Therefore, indicators of critical thinking in developing strategies and tactics with sub-indicators of critical thinking to interact with others are obtained from practicum activities. The average result of students' critical thinking skills taken during practicum are 3.80 in the very good category.

The results of the gain score, which measures the increase in critical thinking skills, show good results, as

well as observations of practicum activities that get the average results of students' critical thinking abilities, which are in the very good category. This can happen because learning activities use a scientific approach and use e-books based on a scientific approach. This is supported by the opinion of Susilana & Ihsan (2014), who states that the scientific approach is not only applied to learning activities but also included in teaching materials so that they are able to generate and realize diverse learning experiences because they involve all the functions of the five senses, both physical and psychological. So that the potential of students develops and learning outcomes are maximized. In addition, a study conducted by Hardianti, dkk. (2019) stated that a scientific approach can improve students' critical thinking skills. The existence of features in the developed e-book can also be the cause of the high results on the gain score because the features in the e-book are developed based on needs, scientific approaches, and indicators along with critical thinking sub-indicators, as listed in Table 4.

CLOSING

Conclusion

An e-book based on a scientific approach to train critical thinking skills on the structure and function of plant tissues is declared valid, practical, and effective for use in learning. Validity is classified as very valid in terms of content, presentation, language, and graphics, with a percentage of 97.50%. Practicality is classified as very practical in terms of students' responses regarding practicality with a percentage of 94.80% and the results of the readability test, which shows the e-book is at level 11, which is suitable for use by students in class XI SMA/MA. Also, effectiveness is classified as effective in terms of critical thinking skills, with an average gain score of 0.72 in the high category and the results of observations of practicum activities of 3.80 in the very good category.

Suggestion

It is hoped that there will be a larger scale implementation of this e-book so that this e-book can be useful in effective education on the related material and trains students' critical thinking skills.

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REFERENCES

Agustina, D. W., Rachmadiarti, F., & Kuntjoro, S. (2023). Development of Environmental Pollution Handling Flipbook Based on Surabaya Local Wisdom to Train Students' Ethno-conservation. *IJORER : International Journal of Recent Educational Research*, 4(1), 16 – 30.

Agustyaningrum, N., & Gusmania, Y. (2017). Praktikalitas dan Keefektifan Modul Geometri Analitik Ruang Berbasis Konstruktivisme. *Jurnal Dimensi,* 6(3), 412 – 420.

Alita, K. U., Koeswanti, H. D., & Giarti, S. (2019). Penerapan Model Problem Based Learning untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Kelas V SDN Ledok 5 Tahun Pelajaran 2018/2019. *Jurnal Basicedu*, 3(1), 169–173.

Andriyani, F., Saraswati, R. R., Melasari, D., Putri, A., & Sumardani, D. (2020). Media Pembelajaran Monopoli : Media Edukasi Materi Struktur dan Fungsi Jaringan Tumbuhan. *Jurnal Pendidikan Biologi Nukleus,* 6(1), 81 – 87.

BSNP. (2017). *Panduan Penyusunan Perangkat Pembelajaran dan Bahan Ajar*. Kementerian Riset, Teknologi dan Pendidikan Tinggi Direktorat Jenderal Pembelajaran dan Kemahasiswaan Direktorat Pembelajaran.

Budiasih, D. R. (2016). Penerapan Pendekatan Saintifik untuk Meningkatkan Keaktifan Siswa pada Pembelajaran IPA di Kelas V. *Jurnal Pendidikan Guru Sekolah Dasar,* 1(1), 110 – 121.

Dewi, N. R. & Arini, F. Y. (2018). Uji Keterbacaan pada Pengembangan Buku Ajar Kalkulus Berbantuan Geogebra untuk Meningkatkan Kemampuan Pemecahan Masalah dan Representasi Matematis. *Prosiding Seminar Nasional Matematika, Semarang: 21 Oktober 2017*(hal. 299 – 303). https://journal.unnes.ac.id/sju/index.php/prisma/article/view/19592.

Ennis, R. H. (1985). Critical Thinking and the Curriculum. *National Forum: Phi Kappa Phi Journal*, 65(1), 28-31.

Fauziah, I. S., Rahayu, Y. S., & Asri, M. T. (2023). The Validity E-modules of Riau Local Wisdom Based to Enhance Students' Creative Thinking through Research. *International Journal of Social Science And Human Research*, 6(2), 1134 – 1142.

Febriarti, F. D. & Rahayu, Y. S. (2022). Pengembangan E-Book Interaktif pada Materi Pertumbuhan dan Perkembangan Tumbuhan untuk Melatihkan Keterampilan Berpikir Kritis Siswa Kelas XII SMA. *BioEdu,* 11(3), 775 – 784.

Fitri, H. M. M. & Rahayu, Y. S. (2022). Pengembangan E-Book Berbasis Inkuiri Terbimbing pada Materi Pertumbuhan dan Perkembangan Tumbuhan untuk Melatihkan Kemampuan Berpikir Kritis Siswa Kelas XII SMA. *BioEdu,* 11(1), 28 – 38.

Girsang, B., Sinaga, E., Tamba, P. G., Sihombing, D. I., & Siahaan, F. B. (2022). Analisis Kemampuan Berpikir Kritis Siswa Dengan Model Program For International Student Assesment (PISA) Konten Quantitiy pada Materi Himpunan di Kelas VII SMP HKBP Sidorame Medan. *SEPREN: Journal of Mathematics Education and Applied*, 172 - 180.

Gusti, U. A. & Syamsurizal, S. (2021). Uji Kevalidan Booklet Struktur dan Fungsi Jaringan Tumbuhan untuk Peserta Didik Kelas XI SMA/MA. *Bioedusiana: Jurnal Pendidikan Biologi*, 6(1), 70 - 78.

Halida, A. N. & Windyarini, S. (2019). Meningkatkan Motivasi dan Kemampuan Penguasaan Konsep Siswa pada Materi Struktur Jaringan Tumbuhan dan Hewan Melalui Media Biology Quartet Card. *Jurnal Kependidikan*, 5(1) 80 – 85.

Hardianti, T., Pohan, L. A., & Hasanah, S. (2019). Efek Pendekatan Saintifik Terhadap Kemampuan Berpikir Kritis Siswa SMP Taman Pendidikan Islam Medan. *Jurnal Riset Intervensi Pendidikan*, 1(2), 103 - 107.

Hayati, M. (2014). *Desain Pembelajaran: Berbasis Karakter*. Pekanbaru: AlMujtahadah Press.

Hikmah, B. F., Artayasa, I. P., & Rasmi, D. A. (2021). Pengembangan LKPD Berbasis Keterampilan Proses Sains dalam Model Pembelajaran Inkuiri Terbimbing: Struktur dan Fungsi Jaringan Tumbuhan. *Jurnal Pijar MIPA*, 16(3), 345-352.

Imam, M. C., Laksono, K., & Suhartono. (2018). Keterbacaan Teks dalam Buku Siswa Kelas VI Sekolah Dasar. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan dan Hasil Penelitian,* 4(1), 1 – 6.

Kemendikbud. (2017). *Panduan Implementasi Kecakapan Abad 21 Kurikulum 2013 di Sekolah Menengah Atas.* Jakarta: Kementerian Pendidikan dan Kebudayaan Indonesia.

Kurniawati, F. N. (2022). Meninjau Permasalahan Rendahnya Kualitas Pendidikandi Indonesia dan Solusi. *AoEJ: Academy of Education Journal*, 13(1), 1 - 13.

Kusumawati, M. U. (2016). Identifikasi Kesulitan Belajar Materi Struktur - Fungsi Jaringan Tumbuhan pada Siswa SMA Negeri 3 Klaten Kelas XI Tahun Ajaran 2015/2016. *Jurnal Pendidikan Biologi*, 5(7), 19 - 26.

Lestari, A. C. & Annizar, A. M. (2020). Proses Berpikir Kritis Siswa dalam Menyelesaikan Masalah PISA ditinjau dari Kemampuan Berpikir Komputasi. *Jurnal Kiprah*, 8(1), 46-55.

Mardapi, D. (2015). *Pengukuran Penilaian dan Evaluasi Pendidikan.* Yogyakarta: Nuha Litera.

Masitoh, S. (2018). Blended Learning Berwawasan Literasi Digital Suatu Upaya Meningkatkan Kualitas Pembelajaran dan Membangun Generasi Emas 2045. *Proceedings of the ICECRS, Sidoarjo, 17 Maret 2018*(hal. 13 – 34). https://doi.org/10.21070/picecrs.v1i3.1377.

Muhammad, M., Rahadian, D., & Safitri, E.R. (2017). Penggunaan Digital Book Berbasis Android untuk Meningkatkan Motivasi dan Keterampilan Membaca pada Pelajaran Bahasa Arab. Pedagogia: *Jurnal Ilmu Pendidikan*, 15(2), 170 – 182.

Mujahidin, F. (2017). *Strategi Mengelolah Pembelajaran Bermutu. Bandung*: PT Remaja Rosdakarya.

Mulyasa. (2013). *Standar Kompetensi dan Sertifikasi Guru.* Bandung: PT Remaja Rosdakarya.

Munawaroh, H., & Retyanto, B. D. (2016). Implementasi Pendekatan Saintifik pada Pembelajaran Cinta Lingkungan Pendidikan Anak Usia Dini (Paud) di Kabupaten Wonosobo. *Al Athfal: Jurnal Pendidikan Anak*, 2(2), 13–24.

Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 103 Tahun 2014 Tentang Pembelajaran pada Pendidikan Dasar dan Pendidikan Menengah (Indonesia). Diakses tanggal 20 Desember 2022 dari https://akhmadsudrajat.files.wordpress.com/2014/11/permendikbud-no-103-tahun-2014.pdf

Purwati, Hobri, & Fatahillah. (2016). Analisis Kemampuan Berpikir Kritis Siswa dalam Menyelesaikan Masalah Persamaan Kuadrat pada Pembelajaran Model Creative Problem Solving. *Jurnal Kadikma,* 7(1), 84-93.

Rahayu, C., Eliyarti, & Festiyed. (2019). Kepraktisan Perangkat Pembelajaran Berbasis Model Generative Learning dengan Pendekatan Open-ended Problem. *Berkala Ilmiah Pendidikan Fisika*, 7(3), 164 – 176.

Riduwan. (2015). *Dasar-Dasar Statistika*. Bandung: Alfabeta.

Sani, R. A. (2014). *Pembelajaran Saintifik untuk Implementasi Kurikulum 2013*. Jakarta: Bumi Aksara.

Siagian, R. E. F., Marliani, N., & Lubis, E. M. (2021). Pengaruh Kemandirian Belajar Terhadap Kemampuan Berpikir Kritis pada Siswa Sekolah Menengah Atas. *Jurnal Education*, 7(4), 1798 – 1805.

Sugiyono. (2015). *Metodologi Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung: Alfabeta.

Sugiyono. (2016). *Metodologi Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung: Alfabeta.

Sundayana, R. (2014). *Statistika Penelitian Pendidikan.* Bandung: Alfabeta.

Susilana, R., & Ihsan, H. (2014). Pendekatan Saintifik Dalam Implementasi Kurikulum 2013 Berdasarkan Kajian Teori Psikologi Belajar. *Edutech*, 13(2), 183–195.

Wahyuni, L. & Rahayu, Y. S. (2021). Pengembangan E-Book Berbasis Project Based Learning (PjBL) untuk Melatihkan Kemampuan Berpikir Kreatif pada Materi Pertumbuhan dan Perkembangan Tumbuhan Kelas XII SMA. *BioEdu*, 10(2), 314 - 325.

Windari, G. I., Rahayu, Y. S., & Dewi, S. K. (2022). Pengembangan E-LKPD Materi Pertumbuhan dan Perkembangan Berorientasi Pendekatan Saintifik untuk Melatihkan Keterampilan Proses Sains. *BioEdu,* 11(3), 537 – 548.