RESEARCH ARTICLE

An ESD-oriented e-book based on siwalan of Tuban to enhance creative thinking skills

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Abstract: The 21st-century skills require education in Indonesia to train 4C skills (Communication, Collaboration, Critical thinking, and Creative thinking), which are fundamental parts of students facing the era of society 5.0, one of which is creative thinking skills. Teaching materials to support these skills still need to be improved. This research aims to produce e-book based on the local wisdom of Siwalan (*Borassus flabellifer* L.) from Tuban oriented to Education for Sustainable Development (ESD) to train students in grade X creative thinking skills on valid and practical biodiversity material. The validity of e-book was determined by three experts, namely two expert lecturers and one biology teacher. Readability test results measured the practicality of e-book. The results of the validity test obtained a score of 3.88, which is a very valid category, while the practicality test based on the fry graph was categorized as practical at level 10, suitable for the reading of grade X students. The results showed that the e-book based on Siwalan local wisdom is valid and practical for learning. Integrating contextual learning materials based on local wisdom can train 21st-century skills that foster students' concern for sustainable development.

Keywords: creative thinking; e-book validity; ESD; local wisdom; siwalan

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Article history:
Received: 26 August 2024
Revised: 6 November 2024
Accepted: 11 November 2024
Published: 19 November 2024

10.22219/jpbi.v10i3.35992

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p-ISSN: 2442-3750
e-ISSN: 2537-6204

How to cite:
Sonia, S., Yuliani, Y., & Isnawati, I. (2024). An ESD-oriented e-book based on siwalan of Tuban to enhance creative thinking skills. *JPBI (Jurnal Pendidikan Biologi Indonesia), 10*(3), 968-978. https://doi.org/10.22219/jpbi.v10i3.35992

Introduction

21st-century education aims to develop and improve high-order thinking skills that include cognitive abilities, one of which is creative thinking as the development of new solutions to meet 21st-century needs (González-Pérez & Ramírez-Montoya, 2022). The role of education is very influential in shaping and directing students to have these competencies in facing the realities of the 21st century (González-Salamanca et al., 2020). Creative thinking skills are needed to find new innovations in life to create new ideas or combine ideas based on existing knowledge to be used in solutions to problems from different perspectives (Thornhill-Miller et al., 2023; Zakiah et al., 2020).

Creative thinking is the ability to synthesize ideas, generate new ideas, determine the effectiveness of existing ideas, and produce solutions to problems (Sumarni & Kadarwati, 2020). Creative thinking skills are the highest level or stage in the thinking process and are included in reasoning, which is characterized by the ability to solve problems in unique and different ways (Mursid et al., 2022; Rahayuningsih et al., 2023; Tok et al., 2022). Indicators of creative thinking according to (Torrance, 1972) are fluency (thinking fluently), flexibility (flexible thinking), originality (original thinking), and elaboration (detailed thinking).

The students' creative thinking ability in Indonesia still needs to improve, as evidenced by the results of TIMSS and PISA, which use contextual questions that demand reasoning and creativity. TIMSS results in 2019 showed Indonesia ranked 70 out of 78 countries, while in PISA in 2022, it got an average score of 366. Students' thinking is still unsystematic, and they find various obstacles in solving problems and compiling problem-solving steps (Puspitasari et al., 2018). Research by Zubaidah et al. (2017) stated that the average value of students' creative thinking skills was only 23.44 out of a score of 100. Another study showed that the score of students' creative thinking skills in learning was only 34 out of 100 (Nuswowati & Taufiq, 2015). In line with Hakim et al. (2017) students' scores on creative thinking indicators were 34.22 (fluency), 40.96 (flexibility), 34.33 (elaboration), and 35.45 (originality).

Entering the industrial revolution 4.0, all activities are carried out by utilizing science and technology in

21st-century education, which encourages educators to be technologically literate so that they can make maximum use of technology in the learning process (Liesa-Orús et al., 2020). Implementation of technological adaptation in education, for example, by using digital-based learning tools (Nasution et al., 2023).

One of the contents of the Law of the Republic of Indonesia Number 32 of 2009 concerning Environmental Protection and Management Article 1 paragraph 30 states that local wisdom is a noble value in the order of community life to protect and manage environmental sustainability and organisms in the environment as an effort to maintain ecosystem balance. The independent curriculum is one of the government's efforts to support concrete actions to preserve the local wisdom of each region in Indonesia through education (Agus et al., 2021; Holilah et al., 2024).

The culture of each region influences local wisdom. One of the local wisdom that exists in East Java and is still firmly held in the siwalan plant by the Tuban community. People of Tuban utilize every part of the organs of the siwalan plant, ranging from roots, stems, leaves, and flowers to fruit, based on experiences gained by ancestors passed down from generation to generation (Aksa & Hasibuan, 2023). Ethnobotanical research on siwalan is essential to explore the local wisdom of the Tuban community towards this million-benefit tree so that it can become documented and published scientific information. Thus, the local wisdom of the Tuban community related to siwalan can be passed on to the next generation so that it does not experience a decline in quality or even extinction.

Local wisdom can be socialized to students through integration into the learning process. Local wisdom in Indonesia, along with educational values and science concepts, especially biology, can be used as a learning resource. Local wisdom can be implemented through a contextual approach relevant to the student's learning environment, such as culture, social environment, and daily habits. Incorporating local wisdom in contextual materials can make learning more relevant and meaningful. Besides that, it can also foster the spirit of environmental conservation through sustainable development. Aristyasari et al. (2023) have developed an e-book based on local wisdom of medicinal plants in Bromo Tengger Semeru National Park with creative thinking skills presenting plants as herbal medicine with the results of the e-book as a reference for teachers to develop learning media by the context of local wisdom. Another research by Sary et al. (2023) developed learning modules including contextualized books and LKPD integrated with local wisdom of mushrooms in Raden Soerjo Mojokerto Forest Park. Other local wisdom that has been integrated into learning is the local wisdom of the Sasak tribe in formal science learning (Mashami et al., 2023).

The United Nations (UN) officially endorsed the 2030 agenda with 17 Sustainable Development Goals (SDGs) or "Global Goals for Sustainable Development", one of which is contributing to the field of education (Elmassri et al., 2023). Education is a tool to achieve sustainable development goals, especially creative thinking in modern sustainable education. Education for Sustainable Development (ESD) is a dynamic learning concept in which students acquire new knowledge, think in new ways, and produce new knowledge (Thamrin, 2020).

The integrated e-book of local wisdom of siwalan Tuban oriented to ESD facilitates contextual learning to train creative thinking skills. Local wisdom is integrated into biodiversity material according to the independent curriculum. Siwalan as a form of local wisdom based on the apperception and appreciation of the Tuban community is interesting to study further because only a little research has been done, especially in education (Maulidiyawati et al., 2019; Puspitasari & Ni'mah, 2024; Sa'diyah et al., 2024). ESD fosters students' conservation spirit towards local wisdom by involving activities that train creative thinking skills by implementing relevant solutions to contextual problems. Of the various existing studies, research that develops e-books based on local wisdom and is also based on ESD is still rarely found.Therefore, this research aims to develop digital learning tools based on local wisdom siwalan (*Borassus flabellifer* L.) Tuban Oriented Education for Sustainable Development (ESD) to Train Creative Thinking Skills of High School Students.

Method

This type of research uses the research and development method (Research and Development). This research design applies the 4D model, which consists of five steps, namely: (1) Define, (2) Design, (3) Develop, and (4) Disseminate developed (Thiagarajan et al., 1974). The use of the 4D model is because it is clear and straightforward when developing teaching materials and is consistent in each stage. This research was conducted at the Biology Education Postgraduate Study Program at Universitas Negeri Surabaya. This research was limited to the product's development process, validity, and practicality. The steps of the research method are interpreted in Figure 1.

The stages of this research refer to the 4D research model. The first stage of defining is divided into several stages. The define stage consists of several stages: curriculum analysis, student analysis, task analysis, material analysis, and formulation of learning objectives. Furthermore, the design stage includes instrument selection, e-book attachment selection, format selection, and initial design. The development stage contains expert validation from two expert lecturers and one biology teacher. The

implementation stage includes an assessment of the practicality of the e-book attachment through a readability test. The sample of this study was 50 students of grade X MA Salafiyah Kerek Tuban.
The data comes from the instruments developed, namely non-test instruments such as validation and practicality sheets. The data collection method used the e-book device validation method and calculated the readability level of the textbook. The validation sheet uses a Likert scale to assess four aspects: (1) presentation feasibility, (2) content suitability, (3) language suitability, (4) suitability of ESD content with local wisdom, and (5) achievement of creative thinking skill. Suggestions and input from validators will be followed up to improve the development of e-book based on Siwalan local wisdom. The readability of the textbook was used to calculate the practicality of the e-book, which was then entered into the Fry Chart.

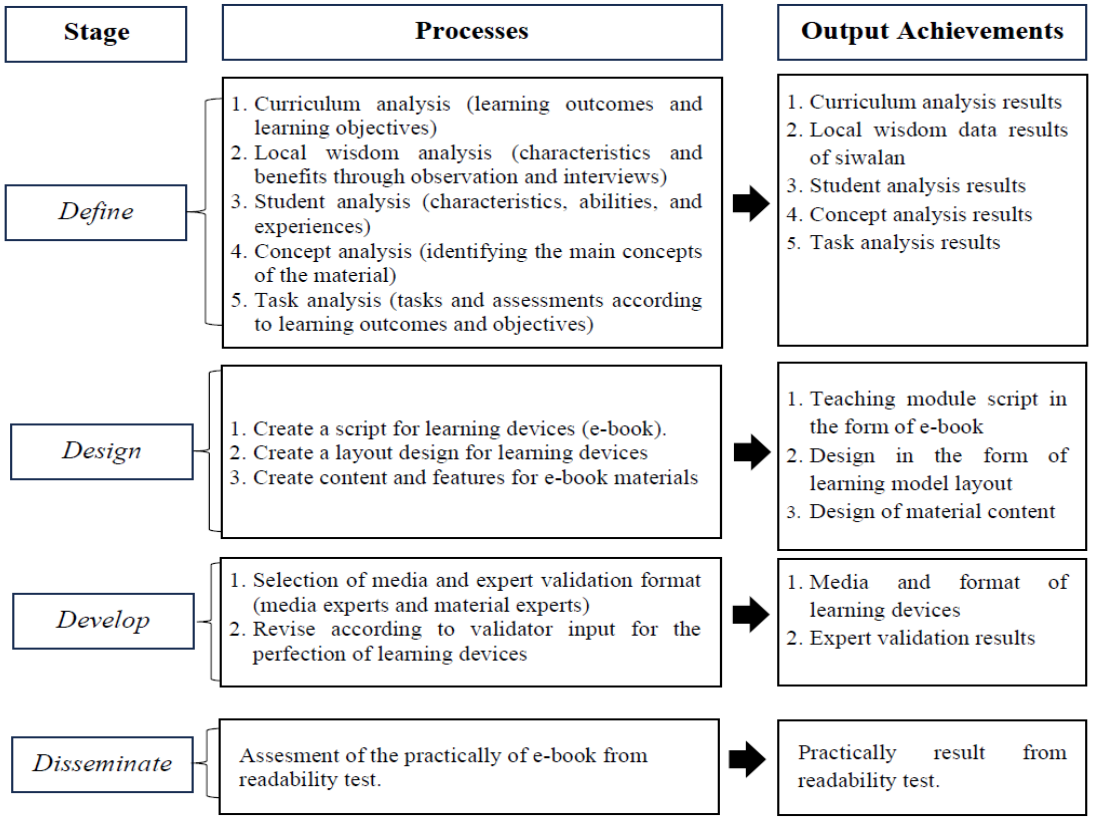

Figure 1. Research methods

The validation results were analyzed descriptively and quantitatively. The validity of the device is analyzed after obtaining scores from validators and finding the average score of each aspect. The data of e-book validation results will be determined using a Likert scale (Table 1).

Table 1. Likert score criteria

Score	Category
4	Very Good
3	Good
2	Quite Good
1	Not Good

Next, the average value of the validation value of all aspects is determined. The value obtained from the validator. The average result can be calculated according to the formula 1 (Agustina et al., 2021).

$$\text{Average score} = \frac{\text{The sum of the scores for each criterion of all validators}}{\text{number of of validators}} \quad (1)$$

The average value of the total validation of all aspects is used to determine the level of validity of the e-book. The values obtained are interpreted based on the interpretation of validity as in Table 2 (Ratumanan & Laurens, 2011).

Table 2. Likert score interpretation criteria

Score	Interpretation Criteria
3.6 ≤ P ≤ 4.0	Very Valid
2.6 ≤ P ≤ 3.5	Valid
1.6 ≤ P ≤ 2.5	Less Valid
1 ≤ P ≤ 1.5	Invalid

Practicality is seen from the results of e-book readability. The readability value is obtained from 100 words in the reading taken from the developed textbook, then the number of sentences and the number of words are calculated. If from the 100 words there are words that do not reach the end of the sentence, then the number of sentences counted is not always intact but there is a remainder, then it is calculated using formula 2.

$$\text{Number of remaining sentences} = \frac{\text{number of words in a sentence that reaches 100 words}}{\text{number of words in the last sentence}} \quad (2)$$

Based on the calculation results, the number of remaining sentences is converted to the vertical axis on the fry graph, while the number of syllables is multiplied by 0.6 and then converted to the horizontal axis on the fry graph (Hidayati et al., 2018).

Results and Discussion

This research uses the 4D model, which produces teaching module products based on the local wisdom of Tuban siwalan (*Borassus flabellifer* L.) oriented to Education for Sustainable Development (ESD) to train creative thinking skills according to the validation results. Teaching modules are learning tools that are systematically and structured to assist learning. The e-book developed by the researcher raises the topic of local wisdom in Tuban Regency. The concept of material in this e-book is biodiversity, which is presented in five subchapters, including levels of biodiversity, biodiversity in Indonesia, benefits of biodiversity, threats to biodiversity, and conservation efforts.

The e-book was developed to help high school students in grade X practice their creative thinking skills during odd semesters. The cover page features a picture of siwalan, a local wisdom plant, with bright color gradations that interpret the material contained, namely biodiversity. The developed e-book has characteristics summarized in Figure 2. Furthermore, the main features of e-book are presented in Figure 3.

Figure 2. Display of the e-book based on local wisdom of siwalan: (a) front cover page, (b) main menu, (c) subchapter cover, (d) instructions for using the e-book, (e) e-book feature mapping, (f) back cover

Figure 3. Main features of the e-book: (a) Bio-Cresiw, (b) Bio-Think, (c) Bio-Caldom, (d) ESD and Bio-Do content

The validation of the e-book was reviewed from three aspects: the feasibility of presentation, content, language, suitability of ESD content with local wisdom, and the achievement of creative thinking skills. Validation was conducted by three expert validators: two expert lecturers and one high school biology teacher. The validation results are presented in Table 3. Overall, the validity score of the e-book developed obtained an average score of 3.8, which is a very valid category, so this teaching module is very feasible to use in learning. The graph of the overall validity results is presented in Figure 4.

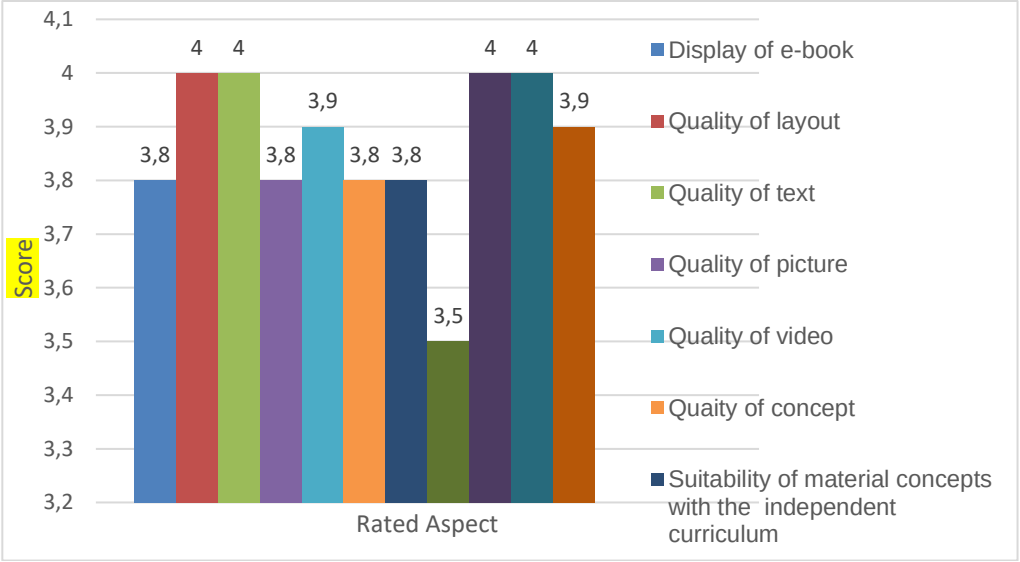

Figure 4. Graph of recapitulation of e-book validation results

The results of the recapitulation of the validity of the e-book show the average score display of e-book 3,8; quality of layout 4; quality of text 4; quality of picture 3.8; quality of video 3.9; quality of concept 3.8; suitability of material concepts with the merdeka curriculum 3.8; e-book systematics 3.5; linguistic appropriateness 4; suitability of ESD content with local wisdom 4; and achievement of creative thinking skills 3.9.

Table 3. Recapitulation of the validation results

No	Rated Aspect	Average	Category
1	Presentation eligibility		
	a) Display of e-book	3.8	Very Valid
	b) Quality of layout	4	Very Valid
	c) Quality of text	4	Very Valid
	d) Quality of picture	3.8	Very Valid
	e) Quality of video	3.9	Very Valid
2	Content suitability		
	a) Quaity of concept	3.8	Very Valid
	b) Suitability of material concepts with the merdeka curriculum	3.8	Very Valid
	c) Local wisdom of Siwalan Tuban	4	Very Valid
	d) E-book systematics	3.5	Very Valid
3	Linguistic appropriateness		Very Valid
	a) Use of language	4	
	b) Use of terms		
	c) Language structure		
4	Suitability of ESD content with local wisdom	4	Very Valid
	a) Conformity of content in e-book with ESD on biodiversity material		
	b) The problems presented in the e-book with contextual ESD in the scope of biodiversity		
5	Achievement of creative thinking skills		
	a) Fluency indicator is facilitated by the Bio-Think and Bio-Do features	3.9	Very Valid
	b. Flexibility indicator is facilitated by the Bio-Think and Bio-Do features	3.9	Very Valid
	c. Originality indicator is facilitated by the Bio-Cresiw feature	3.9	Very Valid
	d. Elaboration indicator is facilitated by the Bio-Cresiw feature	3.9	Very Valid
	Total average of e-book validity	**3.88**	**Very Valid**

This research produces an ESD-oriented e-book based on the local wisdom of siwalan Tuban that trains the creative thinking skills of grade X high school students on biodiversity material. E-book based on Siwalan's local wisdom are equipped with various features that facilitate students' practice of creative thinking and understanding of the concept of biodiversity material. These features include Bio Cresiw, Bio Think, Bio Watch, Bio Do, Bio Caldom, Bio News, and Bio Question.

Based on the validation results in Table 3 and Figure 4 obtained an average of 3.88, indicating that the e-book based on local wisdom is very valid. The presentation feasibility component obtained a presentation eligibility score of 3.8, display of e-book 4, quality of layout 4, quality of text 4, quality of picture 3.8, and quality of video 3.9, with the overall category being very valid. In the presentation feasibility aspect, the maximum value is in layout quality and text quality with mode 4. The e-book page layout criteria are neatly arranged, with page numbers written using Cambria type in the introduction and numbers in the content and closing sections. Using letters that are easy to read and appropriate makes it easier for students to read books and increases learning motivation (Duke et al., 2021; Wang et al., 2023).

This e-book was developed with files in HTML format that facilitate access through all devices, such as laptops, computers, tabs, and cellphones, without downloading the application. This is by Fitria (2024), which state that the HTML format can be accessed on android, laptops, and computers online and can be opened without Flip PDF Professional software. In addition, switching between pages can also be done quickly accompanied by sound when switching pages so that it can be accessed smoothly and makes it easier to learn the material (Suprapto et al., 2022).

In the aspect of content suitability, the quality of concept 3.8, suitability of material concepts with the independent curriculum 3.8, local wisdom of siwalan Tuban 4, and e-book systematics 3.5. The validation results of local wisdom of siwalan Tuban, which obtained the maximum score, indicate that the e-book has a complete content of local wisdom of siwalan Tuban and supports biodiversity material well. The local wisdom of Tuban siwalan that is contained refers to the values that have developed in the Tuban Regency community with local knowledge that has been passed down from generation to generation, including aspects of culture, cultivation, utilization in the processing of economically valuable products including legen drinks, siwalan ice, jenang, and liquid sugar (juroh). Thus, this e-book can be contextualized teaching material by integrating local wisdom that helps improve the spirit of natural resource conservation (Khalel et al., 2023).

Students can easily understand the use of sentences in this e-book because it uses everyday language. Even though some foreign terms are not yet known, they are included in the glossary. This makes it easier for students to learn. Research by Ormancı and Çepni (2020) states that using good and correct language makes it easy for students to understand the contents of the studied book. The suitability of ESD content with local wisdom that contains the feasibility of conformity of content in e-book with ESD on biodiversity material and the problems presented in the e-book with contextual ESD in the scope of biodiversity gets a maximum score of 4.

Finally, the achievement of creative thinking skills includes all four creative thinking indicators trained through the feature, with an average score of 3.9. Bio-Think and Bio-Do features facilitate the fluency and flexibility indicators, while the originality and elaboration indicators are encouraged by the Bio-Cresiw feature. Bio-Think feature contains a description of a statement containing questions to facilitate learners to think fluently to come up with ideas (fluency) that vary from different points of view (flexibility) on issues related to the local wisdom of Tuban siwalan. The Bio-Do feature presents questions that facilitate students expressing ideas fluently (fluency) and with varied (flexibility) associated with the sustainable use of natural resources in Indonesia by doing structured assignments. The Bio-Cresiw feature stands for Creative Siwalan, which contains information on the local wisdom of Tuban siwalan in the form of images and narratives that facilitate students to express new ideas (originality) and develop existing alternative ideas (elaboration) towards solving each of the problems presented related to siwalan.

The practicality of e-book can be measured based on the readability of the text. The results of the readability of e-book based on local wisdom of Tuban siwalan are presented in Table 4 and Figure 5. Based on Figure 5, the results of the readability test on the five samples used obtained an average number of sentences of 5.16, the number of syllables of 155.2 so that it can be categorized at level 10 readability.

Table 4. Recapitulation of readability of e-book based on siwalan local wisdom

No	Section	Page	Number of Sentences	Number of Syllables	Level
1	Biodiversity levels	2	5	150	10
2	Biodiversity in Indonesia	20	5.6	160	11
3	Benefits of biodiversity	31	5.2	158	11
4	Biodiversity threats	37	4.8	148	9
5	Biodiversity conservation efforts	43	5.2	160	11
Total Average			**5.16**	**155.2**	**10**

E-book based on local wisdom siwalan have the appropriate number of sentences and syllables per hundred words, namely at readability level 10. The intersection results are added (+1) and subtracted (-1). The readability of the e-book is appropriate for grade 10 if it is at level 9-11. Thus, this e-book is suitable and feasible for 10th grade high school students. E-book are good if the total sentences and syllables in the text are appropriate for the grade level and can be understood by students (Sonia & Yuliani, 2023). E-book with text readings that have a high level of readability are easier to understand. Otherwise, the lower the level of readability of a reading, the more complex the reading, and the more difficult it is to understand. Calculating readability with fry's graph can measure the quality of e-book through the level of books that match students' competence in understanding text readability (Shiyamsyah et al., 2024).

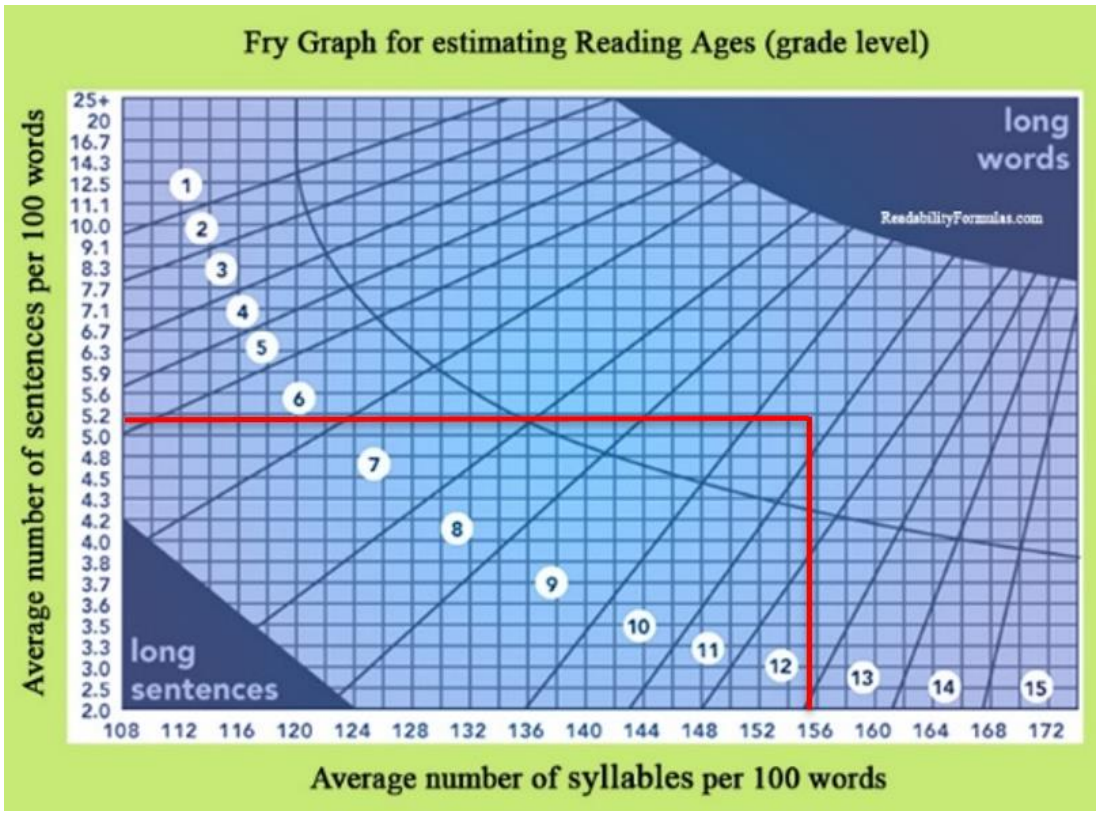

Figure 5. Fry's graph of e-book results

Integrating local wisdom into ESD has the potential to be an important approach in empowering students' creative thinking skills. In line with this study, previous studies have reported that incorporating local wisdom into the education curriculum can improve students' engagement and creativity (Uge et al., 2019). Other publication also reports that integrating local wisdom into learning can encourage students to reflect on values in their daily lives. This condition can improve their critical and creative thinking skills (Jumriani et al., 2021). In line with that, experiential learning that is also integrated with local wisdom can connect students with local cultural heritage and increase the meaningfulness of the learning process (Fathan et al., 2023).

The role of local wisdom in ESD is also increasingly apparent because effective education is education that adapts to the local context. Local wisdom-based learning applies principles that guide students to understand their natural and social environment. This condition can increase the spirit of responsibility and environmentally conscious citizens (Fernando & Yusnan, 2022). This statement is in line with the ESD context where the educational framework must be responsive to local culture while paying attention to global sustainability challenges (Tiwary, 2023).

E-book based on local wisdom of siwalan can be a theoretical solution for new insights into the preparation of digital teaching materials for the independent curriculum, improve the quality of learning and facilitate teachers to train students' creative thinking skills so that they meet the demands of the era of society 5.0. The existence of this e-book can train creative thinking skills based on the results of the implementation of biodiversity material in solution ideas related to the utilization, threats, and preservation of Tuban siwalan local wisdom. The content of biodiversity material is expected to make students analyze problems related to siwalan plants, creatively provide ideas for problem solutions, and implement solutions to publish to the surrounding community to foster the spirit of conservation of natural resources and the environment.

Conclusion

Based on the study results, the ESD-oriented siwalan local wisdom-based e-book to train students' creative thinking skills is valid and practical to implement in learning, supported by validation and readability tests. Based on the validation results, the average score is 3.88, included in the very valid category. The e-book is at a readability level of 10 in accordance with the readability level of grade X high school students. This local wisdom-based e-book product innovation can be teaching material,

especially in the era of Society 5.0, which is by the demands of the 21st century. Based on the study's results, the authors recommend using e-book to train students' creative thinking skill.

Acknowledgment

The author would like to thank Prof. Dr. sc. agr. Yuni Sri Rahayu, M.Si., Dr. Ulfi Faizah, S.Pd., M.Si. and Dr. Novita Kartika Indah, S.Pd., M.Si. as validator lecturers and examiners in e-book development research. Thanks are also addressed to the Ministry of Education, Culture, Research, and Technology of Indonesia for providing the opportunity to research the 2024 Master's Thesis with contract number B/61567/UN38.III.1/LK.04.00/2024.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

S. Sonia: methodology, analysis, original manuscript authoring, reviewing, and editing. **Y. Yuliani:** reviewing and editing. **I. Isnawati:** reviewing and editing

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