Development of Digital Books Based on the RANDAI Learning Model Integrated with West Sumatra Local Wisdom on Environmental Change Material

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Abstract: Environmental damage can occur due to a person's lack of understanding about the environment, so the role of local wisdom needs to be revived to increase understanding regarding the environment. In understanding Environmental Change material, students need problem solving abilities. This problem-solving ability can be supported through problem-based learning models such as the RANDAI (Reciting, Analyzing, Narrating, Doing, Assesing & Implementing) learning model which is realized in the form of digital books. This type of research is development research using the Plomp model with preliminary research stages, prototyping phase, and assessment phase which are limited to practicality testing. The research subjects were three biology lecturers at Padang State University, two biology teachers and 26 students in class XI MIPA 3 at SMA Negeri 5 Pariaman. The instruments used were initial investigation questionnaires, self-evaluation questionnaires, expert review questionnaires, one to one evaluation questionnaires, small group evaluation questionnaires, field test questionnaires, and practicality questionnaires. Based on research conducted, the average validity value is 90.23% in the very valid category. The average practicality test by teachers and students is 88.21% in the practical category, so it can be concluded that the Digital Book Based on the Integrated RANDAI Learning Model of West Sumatra Local Wisdom on Environmental Change Material developed is very valid and practical.

Keywords: Digital Books; Environment; Local Wisdom

Introduction

Indonesia is one of the countries with great natural wealth in the world (Lestari et al., 2021). The existence of diverse natural resources needs to be managed well so that harmony between humans and nature is maintained so as to create a good living environment. According to (Imanika & Rohman, 2022), the characteristics of a good living environment can be seen from the smooth circulation of clean air, the presence of clean water sources, waste management, and the presence of large numbers of shady trees. The reality on the ground is just the opposite, environmental pollution is increasing day by day increasingly widespread, this pollution occurs in various sectors, both on land, at sea and in the air.

Environmental pollution also occurs in several areas of West Sumatra. According to data from the Central Statistics Agency (BPS) of West Sumatra Province (Sumbar) 2018, there were 319 water pollution, 50 land pollution and 160 air pollution that occurred in a number of West Sumatra villages/sub-districts in 2018 (BPS, 2018). One type of pollution that is widespread today is water pollution. Water pollution in several sub-districts of Padang City is classified as high to very high (Ningsih et al., 2022). The percentage of water pollution in West Padang District is 39.48% and South Padang 51.03%.

This can be caused by a loss of concern for environmental protection. One indication that causes this loss of concern is a lack of understanding and the fading of local wisdom values (Niman, 2019). Local wisdom values need to be understood and preserved so that they will be known by future generations. The Minangkabau are the majority tribe of West Sumatra whose lives depend heavily on nature. This is stated in the Minangkabau philosophy which reads "Alam Takambang becomes a teacher", meaning that nature develops into a teacher, where apart from being a source of livelihood, nature is also a source of knowledge for society (Nengsi & Eliza, 2019).

One form of local wisdom of the Minangkabau people regarding forest management is Rimbo Larangan. Rimbo Prohibition is a customary rule that functions to protect the jungle/forest. Several things are regulated in Rimbo Prohibition, including that forest product collection can only be done for the needs of the community, not individuals. Apart from that, there is a prohibition on hunting protected animals and poisoning fish in the forest area which is prohibited (Afrianti, 2020).

Lubuk Ban is a form of local wisdom in protecting water resources in West Sumatra (Ilhami et al., 2018). The fish harvesting process is only carried out within a predetermined time period and without the use of dangerous chemicals. This is done to maintain existing biota and not pollute water conditions. The ban hole also functions to restore environmental damage to the river and preserve local fish. The prohibited fish area in Dharmasraya Regency is called Lubuk Larangan Ngalau Agung and is located along 1 km of the Batang Pangian River. Lubuk Ban has a local fish species, namely Belido (Chitala, sp.) which is a protected fish species (Matondang, 2021).

Integrating local wisdom in learning can be done through teaching materials, especially in Environmental Change material for class X SMA. However, based on preliminary research questionnaire analysis conducted at SMAN 5 Pariaman, of the 44 students in class. The presence of local wisdom in learning also supports students' problem solving skills. Environmental problems are closely related to everyday life, so students are required to be able to think critically in solving problems that occur in their environment (Surayanah, 2020). However, based on preliminary research questionnaire analysis, it was found that the tendency for students to learn based on problem solving was relatively low, namely only 15.60% of the total 44 students in class XI MIPA at SMA Negeri 5 Pariaman for the 2021/2022 academic year. For this reason, it is necessary to apply a learning model based on problem solving. One of them is by implementing the RANDAI learning model.

The RANDAI learning model itself is a learning model developed from the Problem Based Learning (PBL) learning model. The distinctive characteristics of the PBL model according to Meilasari & Yelianti (2020) can be seen from problem solving activities in students' real lives. The difference between the RANDAI learning model and PBL lies in the first syntax of the RANDAI learning model, namely reciting the problem (problem orientation) which is presented in the form of a kaba (story with elements of Minangkabau culture), whereas in the PBL learning model there are no special provisions for the problems presented. Then in the final RANDAI syntax there is Implementing the solution, namely taking lessons from the problems discussed previously. This last stage is also not found in the PBL learning model.

The word RANDAI itself is an abbreviation of the syntax of the RANDAI learning model which consists of six stages. The first stage is Reciting the problem or orienting the problem through kaba (story). The second stage is Analyzing the problem. The third stage is Narrating the solution. The fourth stage is Doing the solution or carrying out investigations/experiments on the problem. The fifth stage is Assessing the solution or presenting the results of investigations/experiments and facilitating other groups to provide assessments. The sixth stage is implementing the solution or implementing the solution and taking lessons from the problems that have been resolved (Arsih et al., 2021).

This RANDAI learning model can be published in digital book form. The presence of multimedia elements (images, sound and video) in digital books will increase students' interest in learning. This is supported by preliminary research questionnaire analysis data that as many as 84.09% of students at XI MIPA at SMAN 5 Pariaman stated that the most popular learning media were digital books which contained multimedia (pictures, sound and video).

Not only does it attract students' interest, the use of digital books also has several advantages compared to textbooks, including: (1) has a more attractive appearance, (2) is practical to use, (3) does not require expensive costs, (4) has facilities for text searches that can make it easier for readers, (5) can be accessed easily, (6) the copying process is faster (between laptops/smartphones), and (7) can be used on laptops/smartphones (Pradani & Aziza, 2019). Digital books are also environmentally friendly because they do not use paper (paperless) (Mahendri et al., 2023).

Nurulaini et al. (2022), have developed an online module with local wisdom in Sukabumi in Environmental Change material, however a digital book containing specifically West Sumatra local wisdom with the RANDAI learning model has not yet been found. Based on this background, the researchers concluded that the development of digital books based on the

RANDAI learning model integrated with West Sumatra local wisdom in Environmental Change material needs to be carried out.

Method

This type of research is development research using the Plomp development model. The stages of this research are preliminary research, prototyping phase and assessment phase which are limited to practicality testing. This is due to limited time and funds from researchers so they cannot carry out effectiveness tests at the final stage. This research was conducted from March 2022 to February 2023 with research subjects namely three biology lecturers at Padang State University, two biology teachers at SMA Negeri 5 Pariaman, 44 students in class XI MIPA SMA Negeri 5 Pariaman for the 2021/2022 academic year, and 26 Class XI MIPA 3 students at SMA Negeri 5 Pariaman for the 2022/2023 academic year.
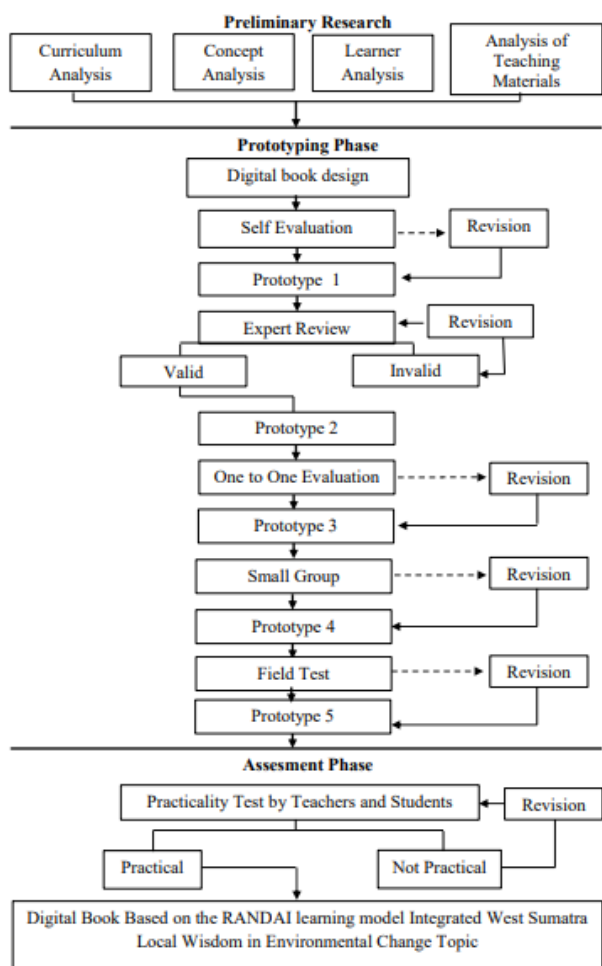

Figure 1. Research Flow According to Plomp Development

The preliminary research stage was carried out by providing an observation questionnaire on the availability and use of biology teaching materials which contained curriculum analysis, concept analysis, student

analysis and teaching material analysis. The questionnaire was given to 44 students in class XI MIPA SMA Negeri 5 Pariaman for the 2021/2022 academic year and a biology teacher at SMA Negeri 5 Pariaman.

The prototyping phase begins with creating a digital book design. Next, a self-evaluation is carried out which produces prototype 1. The results of the self-evaluation will go to the expert review stage by three biology lecturers at Padang State University to produce prototype 2. The digital book is then observed and assessed by three students through a one to one evaluation questionnaire to produce a prototype. 3. Next, the digital book was observed and assessed by six students through a small group evaluation questionnaire and prototype 4 was produced. The prototyping phase ended with a field test carried out by 26 students and prototype 5 was produced.

The assessment phase is the final stage, namely in the form of a practicality test which aims to determine the practicality of the digital book that has been developed. The practicality test was carried out by giving practicality questionnaires to students and teachers at SMA Negeri 5 Pariaman.

Result and Discussion

Based on the Plomp development model, this research consists of three stages, namely preliminary research, prototyping phase and assessment phase.

Preliminary research

The preliminary research stage was carried out by giving questionnaires to 44 students in class use of biology teaching materials. Through this questionnaire, an analysis of the curriculum, concepts, students and teaching materials is carried out. Based on the results of the preliminary research questionnaire by teachers in the curriculum analysis section, it is known that the teaching materials used in the Environmental Change material have not been optimal using the Problem Based Learning (PBL) model which is prioritized in the Independent Curriculum.

The problem-based learning model is suitable for use in environmental change material because students will be asked to actively think critically in solving environmental problems around them. This is in accordance with the opinion of Novelita (2022) who said that the PBL model can train students to think critically because learning begins with presenting problems that are appropriate to the lesson material. Problem-based learning is also in line with the objectives of the Independent Curriculum which prioritizes student involvement in the learning process, so that students can gain direct learning experience (Marta et al., 2020).

The book developed in this research uses the RANDAI learning model which is a development of the

PBL model. The application of the RANDAI learning model creates a fun learning environment through kaba (stories) as an innovative approach to problem solving (Arsih et al., 2021). The word RANDAI is an abbreviation of the syntax of the RANDAI learning model which consists of six stages. The first stage is Reciting the problem or orienting the problem through kaba (story). The second stage is Analyzing the problem. The third stage is Narrating the solution. The fourth stage is Doing the solution or carrying out investigations/experiments. The fifth stage is Assessing the solution or presenting the results of investigations/experiments and facilitating other groups to provide assessments. The sixth stage is implementing the solution or implementing the solution and taking lessons from the problems that have been resolved (Arsih et al., 2021).

The next analysis is concept analysis which aims to identify, detail and systematically organize the main concepts studied (Yolanda & Wahyuni, 2020). From this analysis, it is known that 59.09% of students answered that the teaching materials used did not optimally contain contextual examples and local wisdom in supporting the concept of Environmental Change material, so the digital book that was developed included contextual examples and local wisdom of West Sumatra in the Environmental Change material. According to 50% of students, the explanation of the concepts/material presented was not yet detailed, so the book that was developed contained more detailed concepts. The following are details of the concept of Environmental Change material developed in the digital book. Environmental balance and change; Types of environmental pollution and the impacts they cause; Types of waste (organic, inorganic and hazardous and toxic materials); Waste recycling process; and Efforts to save the environment.

Student analysis is carried out to see trends in students' learning methods. How students learn about environmental change material can be seen in Figure 2.
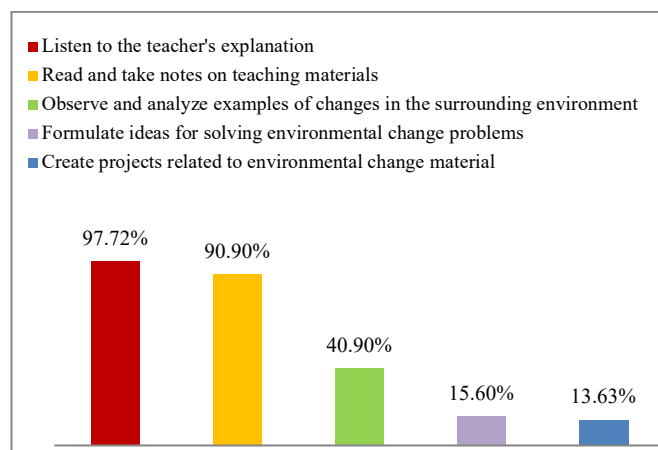

Figure 2. Diagram of how students learn about environmental change.

The low level of problem solving and project creation activities on Environmental Change material can be seen through the questionnaire with a percentage of 15.60% and 13.63%, so the digital book being developed needs to contain problem solving and project creation activities. Environmental changes are events that can be observed in everyday life (Juriah & Zulfiani, 2019). Thus, a learning model is needed that encourages students to find problems, understand problems, solve problems and build their own concepts.

Apart from that, it refers to the learning criteria that students like, namely learning with multimedia teaching materials. However, the teaching materials that were most widely available and used by students at that time were textbooks (97.72%) and it was stated by 68.18% of students that these teaching materials had not been optimally packaged to attract students' interest in learning. Most of the teaching materials used in schools are limited to printed teaching materials. Even though other forms of teaching materials such as multimedia teaching materials are more effective and interesting in learning (Kresnadi & Pranata, 2020). So it can be concluded that at this preliminary research stage, 100% of students in class.

Prototyping phase

At this stage a digital book was developed based on the RANDAI learning model integrated with West Sumatra local wisdom. The material content design and digital book design were created using Microsoft Word 2010 software and design applications via Canva. Creating digital book applications using Flip PDF Professional software and Website 2 APK Builder Pro. The colors in the digital books being developed are dominated by green, orange and blue. The type of writing used is Cambria font. The choice of color and type of letter is based on a preliminary research questionnaire so that it is in accordance with the wishes of students.

The parts of the digital book in the initial design consisted of cover, foreword, table of contents, list of images, instructions for using the book, competency review and material consisting of RANDAI learning content, concept deepening, information literacy, let's solve problems rubric, project assignments and self reflection. At the end is the bibliography and author biodata.

The results of the initial digital book design then enter the self-evaluation stage. At the self-evaluation stage, several improvements were made, including changing the appearance of the cover to better reflect the topic of environmental change. Change the book usage guide to a digital book usage guide. Added a book profile containing the characteristics of digital books and an explanation of the RANDAI learning stages. Increased the text size from the previous 12 to 14 for easy

reading in digital form. Added concept maps, summaries and pop-up messages. Snapshots of improvements to the self-evaluation can be seen in Figure 3 and Figure 4.
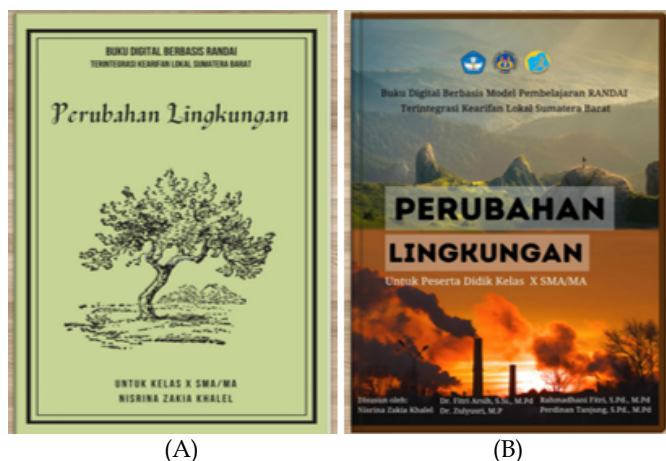

(A) (B)

Figure 3. Cover changes. (A) Cover on original design (B) Cover on prototype 1

Forms of local wisdom from West Sumatra contained in this book include local wisdom in preserving and utilizing forest resources such as Rimbo Larangan Paru in Sijunjung Regency. West Sumatra's local wisdom in preserving and utilizing water resources with the existence of Lubuk Larangan Ngalau Agung. West Sumatra's local wisdom in conserving and utilizing land resources is like the Minangkabau adage "nan slopes are planted with tabu" which means that the slopes are planted with sugar cane because sugar cane functions to bind and strengthen the soil to reduce the occurrence of landslides.

Figure 4. Book Profile on Self Evaluation

The next stage is an expert review by four validators consisting of three biology lecturers at Padang State University and a biology teacher at SMA Negeri 5

Pariaman. The results of the expert review can be seen in Table 1.

Table 1. Validity Test Results

Aspect	Validity Value (%)	Criteria
Content Eligibility	93.22	Very valid
Language	87.50	Valid
Presentation	92.70	Very valid
Graphics	87.50	valid
Average	90.23	Very valid

The validity test in terms of the content feasibility aspect is categorized as very valid with a value of 93.22%. This indicates that the content and material in the digital book being developed is in accordance with the 2013 Curriculum that was being used at that time. Apart from that, the material, data, case examples, images, illustrations and videos presented in digital books are stated to be in accordance with reality and efficient in increasing students' understanding. The development of the content in this digital book begins with curriculum analysis as a basis, so that the material content of the teaching materials developed is also in accordance with the needs of students (Munawwarah et al., 2022).

In the linguistic aspect, digital books are declared valid with a validity value of 87.5%. This shows that digital books have met valid criteria in terms of language so they are easy to understand. In accordance with the opinion of Kosasih (2021) that teaching materials in good language must be easy to understand, marked with effective sentences, avoid double meanings and be simple. Suggestions and improvements made to language are adding meaning to Indonesian from the use of local languages.

The presentation aspect of digital books is considered very valid with a percentage of 92.70%. This very valid criterion shows that the digital book presentation technique is very good, in the sense that it has systematic presentation consistency, concept continuity, and has a clear book identity and instructions. This is in accordance with the opinion of Wachdah, R.L., (2020) that good presentation is seen in terms of systematicity, sequence, consistency and balance between chapters.

The assessment of the validity of digital books in terms of graphics is categorized as valid with a score of 87.5%. This shows that the design, images, audio and video as well as the operation of digital books are good. Graphic validation is an important aspect because the graphic value shows a picture of how teaching media is designed (Rahmi & Sumarmin, 2021). Suggestions and improvements in terms of graphics include changing the information literacy design to a newspaper-like display and changing the display to digital form in assignment uploads. An attractive design will also increase students' motivation to learn the material. This is in accordance with the characteristics of digital books, including

having an attractive design, being interactive and being able to increase students' learning motivation (Fitria & Lisdiana, 2022). The following is a snapshot of the improvements made at the expert review stage in Figure 4 and Figure 5.
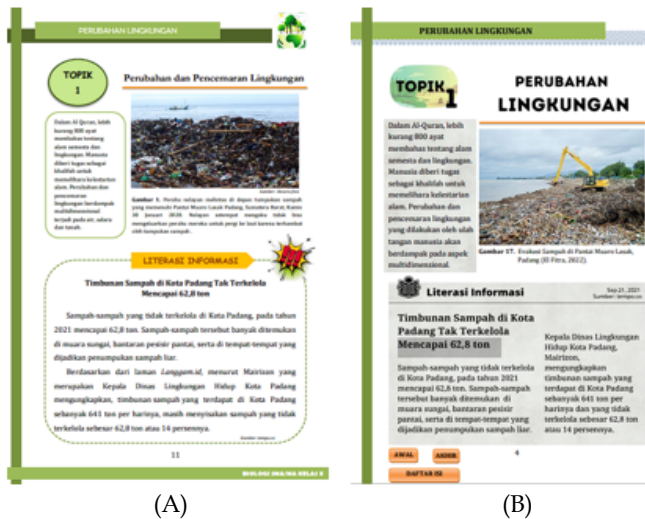

(A)   (B)

Figure 5. Changes to the opening topic (A) Before the expert review (B) After the expert review

The next stage is, one to one evaluation, small group evaluation and field test which is carried out by giving periodic questionnaires to three people, six people and 26 students in class XI MIPA 2 SMA Negeri 5 Pariaman for the 2022/2023 academic year. Aspects of questions at this stage include the appearance of the cover, design and color. Apart from that, the type and size of letters, the language used, the display of images, audio and video in digital books are also used. There were also questions regarding learning based on the RANDAI learning model, presentation of material and integration of local wisdom from West Sumatra as well as the usefulness and ease of use of digital books. Through this questionnaire, it can be seen that students are satisfied with the content and appearance of digital books so that there are no improvements to digital books.
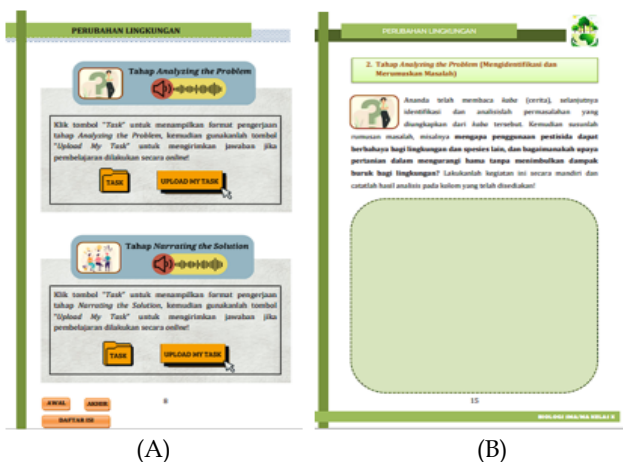

(A)   (B)

Figure 6. Changes in RANDAI learning activities (A) Before expert review (B) After expert review

Table 2. Practicality Test Results by Teachers

Aspect	The Value of Practicality (%)	Criteria
Ease of Use	97.50	Very practical
Learning Time	83.30	Practical
Appearance/Attr activeness	88.80	Practical
Understanding Concepts and Benefits	100	Very Practical
Language	81.20	Practical
Average	90.17	Very Practical

The final stage in this research is the assessment phase. This stage consists of assessing practicality and effectiveness. However, this research focuses on assessing practicality only. The practicality assessment was carried out using a practicality questionnaire on a biology teacher at SMA Negeri 5 Pariaman and 26 students in class XI MIPA 3 at SMA Negeri 5 Pariaman for the 2022/2023 academic year. The results of the practicality assessment can be seen in Table 2 and Table 3.

Table 3. Practicality Test Results by Students

Aspect	The Value of Practicality (%)	Criteria
Ease of Use	86.90	Practical
Learning Time	86.20	Practical
Appearance/Attractiveness	85.50	Practical
Understanding Concepts and Benefits	85.50	Practical
Language	87.20	Practical
Average	86.26	Practical

Judging from the aspect of ease of use, digital books are considered very practical by teachers with a percentage of 97.50% and practical for students with a percentage of 86.90%. The average aspect of ease of use of digital books is 92.20% in the very practical category. This shows that digital books based on the RANDAI learning model integrated with West Sumatra local wisdom in Environmental Change material have made the learning process easier, easy to use, can be used repeatedly, have economic value and are environmentally friendly. Apart from that, according to Fitrianna et al. (2021) teaching materials that have been declared practical from the aspect of ease are suitable for use and can help students in their learning process.

Based on the learning time aspect of digital books, teachers assess it as practical with a percentage of 83.30% and practical by students with a percentage of 86.20%, so the average for the learning time aspect is 84.75% with practical criteria. This shows that learning time using digital books becomes more flexible and effective because of the ease of access which can be used

anywhere and at any time. Apart from that, digital books can also facilitate students to learn at their own pace. Regarding this, Padwa & Erdi (2021) also argue that teaching materials should be designed so that students can learn them according to their respective speed of understanding.

The appearance and attractiveness aspects of digital books are assessed as practical by teachers with a percentage of 88.80% and practical by students with a percentage of 85.50%, so the average appearance and attractiveness aspect is 87.15% which meets the practical criteria. This shows that digital books are presented using appropriate colors and letters, the cover and overall design are attractive, the display of images, audio and video is attractive and clear, the use of functional buttons is clear and makes students motivated to learn. The digital book has become an interesting teaching material because it can motivate students to learn.

The aspect of understanding concepts and benefits of digital books was assessed as very practical by teachers (100%) and practical by students (85.50%), so that the average aspect of understanding concepts and benefits was 92.75% with very practical criteria. This shows that the material presented in digital books is easy to understand, presented clearly and simply and in accordance with learning objectives. Apart from that, this digital book supports students' problem solving skills through a problem-based learning model, namely the RANDAI learning model. This is in accordance with research by Widyastuti & Airlanda (2021) which states that the problem-based learning model has a positive impact on students' ability to solve problems.

The presence of local wisdom in learning can also support students' problem solving skills. This is because local wisdom is related to environmental problems in everyday life, so that community efforts emerge in dealing with these problems which ultimately creates local wisdom. Through learning local wisdom, students are required to be able to think critically in solving problems (Surayanah, 2020). Not only that, the existence of local wisdom values in teaching materials also becomes a forum for introducing positive values in society to students (Darmayasa et al., 2018). Learning local wisdom is also prioritized in the Merdeka Curriculum because it emphasizes contextual learning and character formation so that learning becomes more useful and meaningful for students (Fitria & Lisdiana, 2022; Siregar et al., 2022; Suantara et al., 2023).

Based on the linguistic aspect, digital books are categorized as practical by teachers with a percentage of 81.20% and practical by students with a percentage of 87.20%, so that the average percentage of linguistic aspects is 84.20% with practical criteria. This shows that digital books have clear sentence structures, according to Indonesian spelling rules, are easy to understand and do not have double interpretations or meanings.

Conclusion

Based on research that has been conducted, digital books based on the RANDAI learning model integrated with West Sumatra local wisdom in Environmental Change material meet the criteria of being very valid and practical, so they can be used in the learning process. The average percentage of validity values is 90.23% with the very valid category and the average percentage of practicality tests by teachers and students is 88.21% with practical criteria.

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Regarding this study, the author declares that there is no conflict of interest.

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