



## Development of Environmental Pollution Handling Flipbook Based on Surabaya Local Wisdom to Train Students' Ethno-conservation

Dwi Wahyu Agustina<sup>1\*</sup>, Fida Rachmadiarti<sup>2</sup>, Sunu Kuntjoro<sup>3</sup>

<sup>1,2,3</sup> State University of Surabaya, Surabaya, Indonesia



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### ABSTRACT

One of the efforts to deal with environmental pollution by exploring natural potentials and traditions in the local community is ethno-conservation education. This study aims to develop a flipbook of environmental pollution handling based on Surabaya's local wisdom to train students in Ethno-conservation. The type of research is Research and Development with the ADDIE model of Branch theory. Theoretical feasibility is reviewed from the results of expert validation, while empirical feasibility is examined from the readability test. The data obtained were analyzed by descriptive qualitative. The results obtained are a validation score of 3.88, a percentage of 97% and the category is excellent, and the legibility test is at level 10. Hence, the Flipbook has the potential to be used in learning the handling of environmental pollution based on Surabaya local wisdom to train students in ethno-conservation.

## INTRODUCTION

One of the problems we face today is the declining quality of the environment. The fulfillment process to offset the increasing human growth, directly and indirectly, impacts environmental pollution problems. Human attitudes and behavior that are not anticipated with an environmental preventive approach will further exacerbate the ecological situation. Environmental pollution mainly comes from human activities due to attitudes and behavior toward nature (Erhabor & Don, 2016). It is often increasing in big cities. Surabaya City is the capital of East Java Province. The city of Surabaya is known as the second largest metropolitan city in Indonesia after Jakarta, with a rapid rate of population growth and development with a population of 2,971,300 people and an area of 328.8 km<sup>2</sup> (BPS, 2020). The strategic position of the city of Surabaya as the center of community economic activity in East Java and its surroundings has resulted in many large companies in the services, industry, and trade sectors being based in the city of Surabaya. This high productivity cannot be separated from environmental problems. Apart from increasing problem-solving skills, the introduction of nature Ethno-conservation needs to be instilled in students as the nation's next generation to minimize the impact of natural damage.

Ethno-conservation is a way for local people to take advantage of the biodiversity of flora and fauna and to preserve nature around their homes wisely, which has been passed down from generation to generation so that it becomes a tradition of the local community. The role of environmental education not only leads to the habituation of conservation actions and behaviors but also prioritizes the idea of real environmental improvements (Hamid, 2021). According to Arrosid et al. (2019), the 2013 curriculum has been developed in the revised 2017 curriculum. There have been several improvements,

including integrating and strengthening character education. Character formation involves three elements: understanding, mindset, and action. Preliminary research shows that 71.4% of teachers think that students do not have an understanding of ethno-conservation even though ethno-conservation character development has an essential role in forming individuals who have high awareness, sensitivity, and understanding of the environment so that they can implement it in everyday life as a form of effort maintenance of the environment and preventing damage to nature (Sumarmi, 2021).

Based on the results of Tivani's research (2016) state that the character of students caring for the environment is directly proportional to the intensity of students facing the context of environmental problems presented in learning resources. In this case, students can internalize values through a changing mindset in responding to environmental damage. Ardoin's research (2020) shows various ways to implement environmental education to deal with environmental and conservation issues. To achieve maximum results, it is necessary to collaborate so that conservation can achieve concrete and measurable results (Knight et al., 2019). Environment-based education aims to increase awareness and sensitivity to protecting the environment (Rusdiyanto, 2015). Biology subjects can be one of the accommodations for achieving conservation education.

Along with technological developments, various innovations continue to occur in the world of education. The results of preliminary research on high school biology teacher respondents in Surabaya show that media use in the learning process currently dominates. As much as 57.1% of teachers personally develop media to facilitate transferring knowledge to students. Media that is often developed is digital media in the form of PowerPoint or e-books. Utilization of digital media can significantly increase students' memory and comprehension levels in understanding various concepts in science (Oronce & Manalo, 2021). In this context, it is wise to look at the integration of digital media and mobile devices, enabling students to manage instructional content, set personal goals, and exchange ideas with others in an appropriate manner (Figueiredo et al., 2016). Integrating various techniques in implementing the material makes the teaching-learning process innovative and engaging (Espinosa, 2018). Flipbook, as a digital book innovation, can be a support for interactively visualizing the context of the material. Flipbook can give the impression of being flipped through a book. Flipbooks have several advantages, including loading files in the form of images, sounds, videos, and animations (Wicaksono & Kuswanti, 2020).

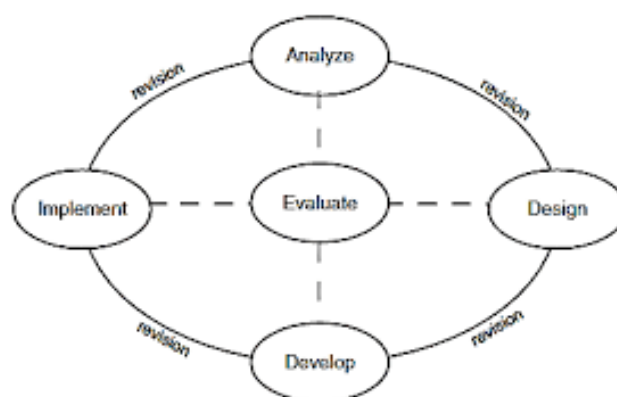
This study aims to develop a flipbook of environmental pollution handling based on Surabaya local wisdom to train students' Ethno-conservation. Based on the researchers discovered above, motivated researchers to conduct development research, namely developing a flipbook of Environmental Pollution Handling based on Surabaya local wisdom to train students' ethno-conservation, which is theoretically and empirically feasible to be used as alternative teaching material in training ethno-conservation of students on Environmental Pollution material for class 10<sup>th</sup> high school.

## RESEARCH METHOD

### General Background

This research is development research using the ADDIE (Analyze, Design, Development, Implementation, Evaluation) instructional model of Branch theory. The purpose of this research is to produce a flipbook for handling environmental pollution based on Surabaya local wisdom to train student's ethno-conservation students in 10<sup>th</sup> class 10<sup>th</sup> SHS that are theoretically and empirically feasible. This Flipbook can later be used to

supplement learning the chapter Environmental Change, Biology subject for class 10<sup>th</sup> SHS. Flipbook development will be carried out in June 2022 in the Postgraduate Program at the State University of Surabaya. Figure 1 is the flowchart of the research procedure.



**Figure 1.** Research procedure.

### Instruments and Procedures

The theoretical feasibility data collection technique uses the method of review and validation. Validation is carried out using the instrument validation sheet that has been reviewed. Validation was carried out by 3 (three) validators: media expert lecturers, subject matter expert lecturers, and biology teachers. The formulation of questions on the validation sheet was adapted based on the National Education Unit Agency (NEUA) with adjustments according to the needs of researchers. The questions consist of 5 (five) aspects, namely: (1) presentation feasibility components, (2) content feasibility components, (3) linguistic feasibility components, (4) suitability of local wisdom approaches, and (5) ethno-conservation habituation. The assessment uses the criteria "Yes" and "No" with a score of 1-4 based on a Likert scale with representations of (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree (Riduwan, 2013). Empirical feasibility data collection techniques use readability tests. The legibility method was carried out by selecting the initial, middle, and final readings on a 100-word flipbook. Then count the number of sentences and syllables. The number of syllables obtained is then multiplied by 0.6. The number of sentences and syllables obtained is then converted into a Fry chart. The readability test was repeated three times.

### Data Analysis

The theoretical feasibility data analysis technique is carried out in a quantitative descriptive manner with the formula:

$$\text{Validity Score (\%)} = \frac{\sum \text{Score earned}}{\sum \text{Maximum score}} \times 100\%$$

The percentage of validation results obtained is then interpreted in Table 1.

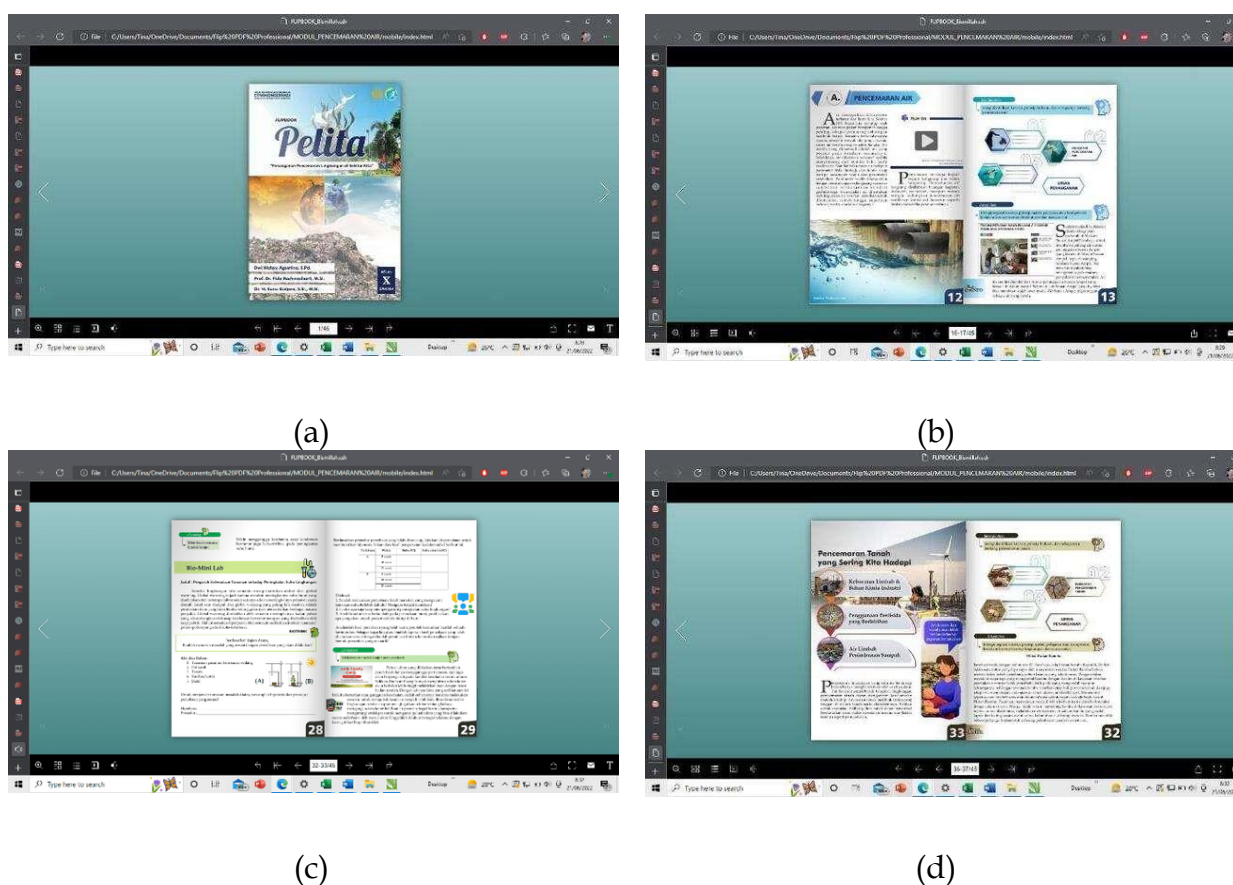
**Table 1.** Interpretation criteria score validity.

Scales	Validation Level
85.01% - 100%	Very valid
70.01% - 85%	Quite Valid
50.01% - 70%	Less Valid
1%-50%	Invalid

The practical feasibility data analysis technique was carried out using a Fry graph. Flipbook legibility is declared appropriate if the meeting point of the vertical line indicating the number of sentences per 100 words and the horizontal line indicating the number of syllables per 100 words lies at levels 9-11 (Muwaffaqoh et al., 2021). The readability rating of the discourse should be increased by one level and reduced by one level.

## RESULTS AND DISCUSSION

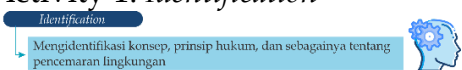

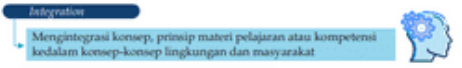

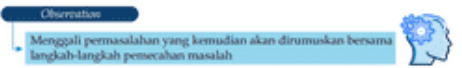








The research has developed Flipbook for handling environmental pollution based on Surabaya local wisdom to train students' Ethno-conservation. The environmental pollution material in this Flipbook is divided into 3 (topics): water pollution, air pollution, and soil pollution. Figure 2 is the result of theoretical feasibility and empirical feasibility. Here are views of the Flipbook.



**Figure 2.** (a) Initial View of Flipbook, (b) Water Pollution Sub-Material, (c) Air Pollution Sub-Material, (d) Soil Pollution Sub-Material.

To facilitate students to explore local wisdom and train student's ethno-conservation, Flipbook is equipped with features that support student activities. The description of the features in the Flipbook is in **Table 2**.

**Table 2.** Description of the features in Flipbook.

Growth Activity Ethno-conservation Habituation	Feature	Information
<b>Activity 1. Identification</b> 		This can facilitate students identify the initial concept of pollution
<b>Activity 2. Integration</b> 		This can facilitate students to integrate material concepts into environmental and community concepts.
<b>Activity 3. Observation</b> 	 	This can facilitate students to explore environmental pollution problems and the potential of existing local wisdom.
<b>Activity 4. Planning</b> 	 	This can facilitate students in planning follow-up on a laboratory scale
<b>Activity 5. Evaluate</b> 	 	This can facilitate students to follow up and/or evaluate pollution handling based on ethno-conservation

### Theoretical Feasibility

Theoretical feasibility is the feasibility obtained based on the results of expert validation, namely material expert lecturers, media expert lecturers, and biology teachers (Falah et al., 2021). The components of the validation assessment are in the form of presentation, content, language, approaches to local wisdom, and ethno-conservation habituation listed in the validity instrument.

**Table 3.** Recapitulation of the feasibility of presentation components.

Assessment Aspects	Average score	Percentage	Interpretation
Display Quality	4	100%	Very Valid
Quality of Use	4	100%	Very Valid
Layout Quality	4	100%	Very Valid
Image Quality	3.67	92%	Very Valid
Video Quality	4	100%	Very Valid
Average	3.93	98%	Very Valid

Based on **Table 3.** the average presentation feasibility percentage obtained is 98% and is categorized as very valid. This is because the Flipbook has a colorful display quality accompanied by pictures and videos supporting good resolution material. The preparation of each content in the Flipbook is arranged in a neat layout composition,

image, and video content according to the context of the material, clearly visible, and can be *pop-up* to make the Flipbook attractive. Good presentation quality will help students better understand the material being discussed. Features of Flipbook, which can be flipped back and forth, provide an experience similar to opening a conventional printed book but with a different feel because there are animation, video, and sound effects (Hamid, 2021).

**Table 4.** Content feasibility component summary.

Assessment Aspects	Average score	Percentage	Interpretation
Curriculum suitability	3.67	92%	Very Valid
Content Quality	4	100%	Very Valid
Contextual Concept	4	100%	Very Valid
Process Skills	4	100%	Very Valid
Systematics	3.89	97%	Very Valid
Average	3.91	98%	Very Valid

Based on **Table 4**, the average percentage of content feasibility obtained is 98% and is categorized as very valid. This is because the preparation of each sub-material in the Flipbook is based on material analysis that adjusts essential competencies, referring to Permendikbud No. 37 of 2018 with CC 3.11. Analyzing data on environmental change, its causes, and impacts on life, and CC 4.11 Formulating ideas for solving problems of environmental changes that occur in the surrounding environment so that the components in the learning aspects meet standardization. This can cause the developed Flipbook to play an optimal role in presenting learning material that accommodates understanding of students' concepts, skills, and attitudes (Perdana et al., 2021).

**Table 5.** Recapitulation of language feasibility components.

Assessment Aspects	Average score	Percentage	Interpretation
Language Use	3.67	92%	Very Valid
Language Structure	3.33	83%	Quite Valid
Use of Terms	4	100%	Very Valid
Resources	3.67	92%	Very Valid
Average	3.67	92%	Very Valid

Based on **Table 5**, the average percentage of language feasibility obtained is 92% and is categorized as very valid. The use of language in Flipbook uses simple and easy sentences for students to understand. The use of language in media or teaching materials should be guided by the NEUA, namely having an educational category aligned with students' cognitive level and following and using the correct terms (Welter et al., 2022).

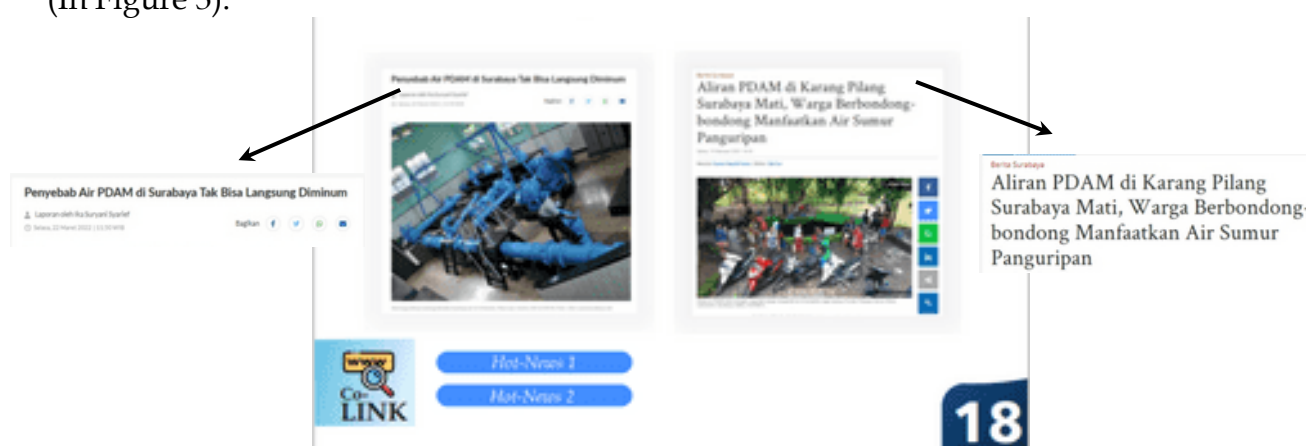
**Table 6.** Recapitulation of local wisdom approach and ethno-conservation habituation.

Assessment Aspects	Average score	Percentage	Interpretation
Approach Suitability Surabaya Local Wisdom	4	100%	Very Valid
Ethno-conservation Habituation Suitability	4	100%	Very Valid
Average	4	100%	Very Valid

Based on **Table 6**, the average percentage of the feasibility of the local wisdom approach and ethno-conservation habituation obtained is 100% and is categorized as very valid. Local wisdom-based learning can positively influence learning outcomes due to its

benefits in improving students' scientific literacy (Ramdiah et al., 2020). The local wisdom approach in developing this Flipbook includes local knowledge, skills, and resources in the Surabaya area for handling environmental pollution. Local wisdom as a component of the learning material will also assist in accomplishing learning objectives that develop theoretical knowledge, skills, and attitudes (Jumriani et al., 2021). With the application of learning media that internalizes the values of local wisdom in learning, it is hoped that it will be able to train students' Ethno-conservation habituation. This can be realized by displaying local wisdom approaches to support the growth of ethno-conservation students in handling environmental pollution. Ethno-conservation habituation can be carried out with student activities: (1) cultivating skills in identifying concepts, legal principles, and so on regarding environmental pollution, (2) integrating material concepts and principles of environmental pollution into environmental and socialization concepts, (3) observing a problem environment which then formulated steps to solve the problem in the discussion, (4) made a follow-up plan on environmental pollution problems by internalizing local wisdom values, (5) carried out follow-up or evaluation. By recognizing these phenomena and values, it is hoped that students will know how rich the surrounding natural values are and the values inherited from our ancestors so that later, students will be aware of their sensitivity to the surrounding environment (Sharif, 2018).

In the water pollution sub-material, the first activity is observation. Students identify initial concepts or information needed to formulate efforts to deal with water pollution based on ethno-conservation including factors, indicators, and the impact of water pollution. Furthermore, in the integration activity, the discourse "The Tradition of Pilgrims Bringing Home the Water of the Sunan Ampel Well" in the BIOINFO feature, students integrate the previously identified concepts into the concept of environment and society. Then in the observation activity, the students explored the problem of water pollution through the study of articles/news, namely "The Causes of PDAM Water in Surabaya Cannot Be Drink Immediately" and its relation to "PDAM Flow in Karang Pilang Surabaya Dead, Residents Flock to Take Advantage of Panguripan Well Water" (In Figure 3).

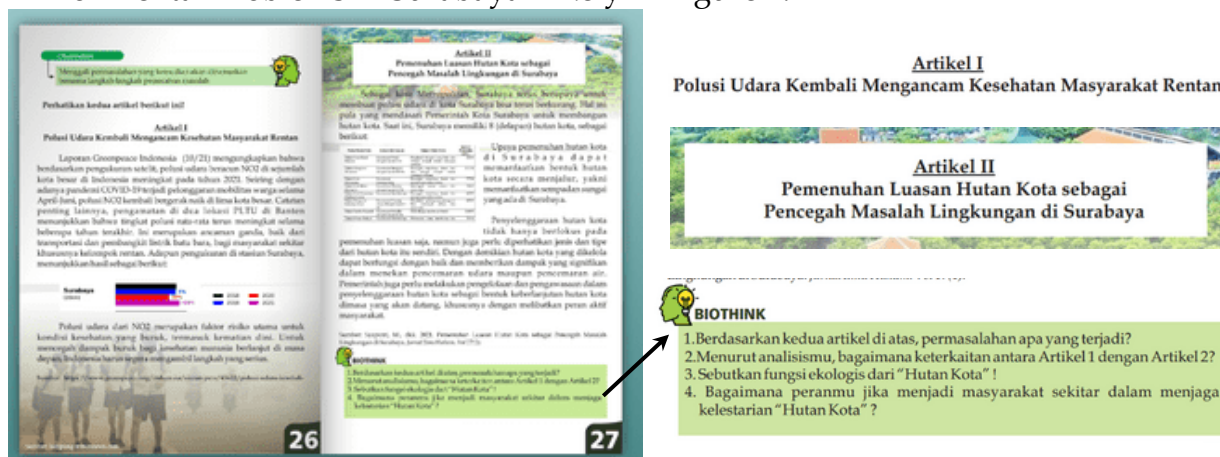


**Figure 3.** Study of articles/news on the sub-material of water pollution linked to local wisdom of Surabaya.

Through the analysis of the two articles, students understand the relationship between water pollution problems and alternatives that the community can address water pollution in the environment by utilizing local potential, namely water resources from

the Panguripan Well, so that awareness and concern for protecting environmental resources grow. The growth of students' awareness and concern for the environment can be identified through the emergence of ideas to create a more efficient and effective conservation area management system so that the wider community can benefit directly or indirectly. In the end, it is hoped that the community's ecological awareness can be increased (Tivani, 2016). After that, students carry out planning activities, namely making follow-up plans. Students test water samples through a virtual lab. In the virtual lab presented, students test water samples contaminated with *Escherichia coli* bacteria. Then through the BIOTHINK feature, students analyze treatments that can be carried out on water contaminated with *Escherichia coli* bacteria and ways that people can do as an alternative to getting water clean from a well or river. An engaging story can stimulate the imagination, help develop students' intelligence and clear emotions and help them adjust to anxiety when figuring it out (Hendratno et al., 2022). In Evaluation activities, students carry out follow-up and/or evaluation. The follow-up carried out by students on the sub-material of water pollution is the manufacture of simple water filtration that utilizes materials around them. Students can access the video tutorial provided in the BIOTIC feature first and then make a poster related to a simple water filtration design that utilizes materials around them. At the end of the lesson, students answered the questions in the reflection feature to overview the growth of students' ethno-conservation after carrying out the provided activity stages.

In the air pollution sub-material, the first activity is observation. Students identify initial concepts or information needed to formulate efforts to deal with air pollution based on ethno-conservation, including factors, indicators, and the impact of water pollution. Furthermore, in the integration activity, the discourse "Flower Parade (Surabaya Vaganza)" is presented in the BIOINFO feature. Students integrate the previously identified concepts into the concept of environment and society. Students understand that apart from having aesthetic value, flowering plants also have various ecological functions to help deal with air pollution. For example, the Tabebuia flowering plant (*Tabebuia chrysotricha*) adorns Surabaya as if it were in Japan. Then in the observation activity, students explore the problem of water pollution through a study of articles/news namely "Air Pollution Again Threats the Health of Vulnerable Communities" and its relation to "Fulfillment of Forest Areas Cities as Prevention of Environmental Problems in Surabaya" likely in Figure 4.



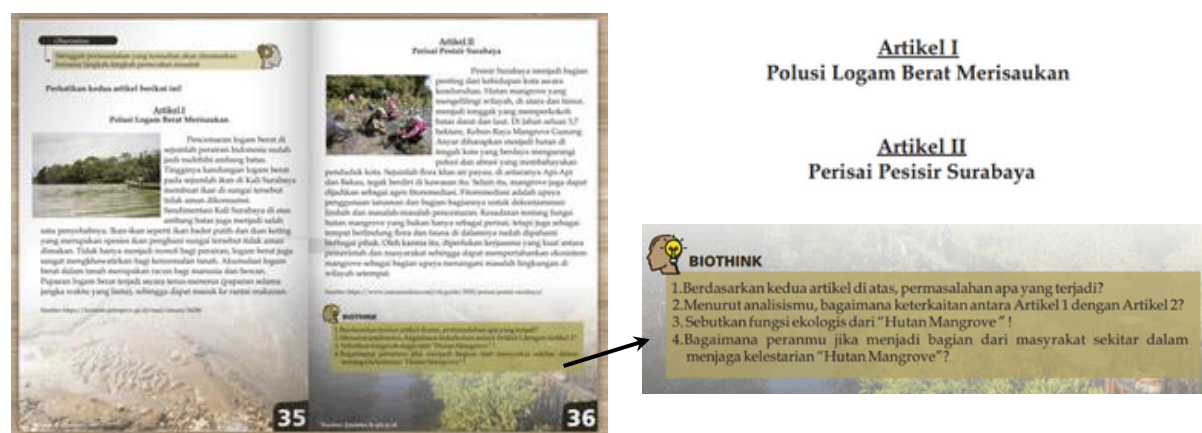
**Figure 4.** Study of articles/news on the sub-material of air pollution linked to local wisdom of Surabaya.

Through the analysis of the two articles, students gain an understanding of the relationship between air pollution problems and alternatives that the community can do to address air pollution in the environment by utilizing local potential, namely the Urban Forest, so that awareness and concern for maintaining the sustainability of the City Forest as an effort to deal with air pollution in Surabaya grow. After that, students carry out planning activities, namely making follow-up plans. In addition to disturbing health, air pollution caused by motor vehicle fumes also increases the earth's temperature. To prove this, students carry out a simple practicum entitled "The Effect of the Existence of Plants on an Increase in Environmental Temperature." In this practicum, students analyze data on temperature changes that occur in the variable presence of plants. Students make predictions about things that might happen to live things on earth if the temperature on the earth's surface continues to increase. In response to this, students analyzed ethno-conservation efforts that could be made to deal with air pollution. Students knowledgeable about feedback value it as an active process, analyze feedback data, make increasingly complex judgments, and act on feedback (Carless, 2022). In Evaluation activities, students carry out follow-up and/or evaluation. Through the BIOTIC feature, the follow-up carried out by students on the air pollution sub-material is making posters as a form of a campaign to reduce gas emissions to overcome air pollution, which the community can do daily. At the end of the lesson, students answered the questions in the reflection feature to overview the growth of students' ethno-conservation after carrying out the provided activity stages.

In the soil pollution sub-material, the first activity is observation. Students identify initial concepts or information needed to formulate efforts to deal with soil pollution based on ethno-conservation, including factors, indicators, and the impact of soil pollution. Furthermore, in the integration activity, the discourse "Myth of the Bamboo Forest" is presented in the BIOINFO feature. Students integrate the previously identified concepts into the concept of environment and society. The bamboo forest in Surabaya is in the Keputih area. Bamboo is often synonymous with magical things, so people believe they cannot cut bamboo indiscriminately. The emergence of this kind of collective trust brings ecological benefits to the Bamboo Forest area. The reason is that people are becoming more careful in interacting with nature there. Residents do not dare to cut bamboo in this conservation area blindly. Instead, they use bamboo that is weathered and dry naturally for their living needs. Bamboo has several conservative functions for soil and water conservation (Mentari et al., 2018). Large-scale bamboo forests, both natural and artificial, can directly impact eco-hydrological processes, such as water purification, groundwater recharge, and moisture retention. Landscapes with bamboo forests absorb and decompose organic waste (Paudyal et al., 2022). Then in the observation activity, students explore the problem of soil pollution through the study of articles/news, namely "Heavy Metal Pollution is worrying" and its relation to "Surabaya Coastal Shield" in Figure 5.

Through the analysis of the two articles, students gain an understanding of the relationship between the problem of heavy metal pollution that causes sedimentation of the Surabaya River and alternatives that the community can do to address water pollution in the environment by utilizing local potential, namely the Gunung Anyar Mangrove Botanical Garden which has the power to reduce pollution and abrasion. Endangering the city's population, there is growing awareness and concern for preserving the Gunung Anyar Mangrove Botanical Garden to deal with soil pollution in Surabaya. Literacy can continuously develop critical and creative thinking. It aims to

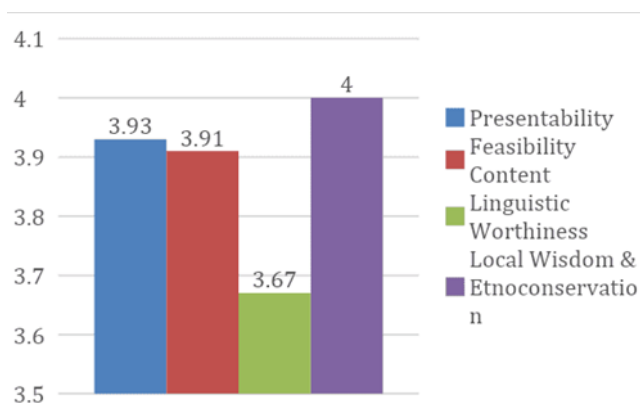
expose students to real-world situations and improve their understanding of the subject matter (Jasrial et al., 2022).



**Figure 5.** Study of articles/news on the sub-material of soil pollution linking Surabaya local wisdom.

After that, students carry out planning activities, namely making follow-up plans. The Wonorejo Coastal Waters are part of the East Coast of Surabaya, which receives the Jagir Wonokromo, Wonorejo, and Gunung Anyar rivers. As with other coastal waters, the Wonorejo Coastal Waters has the potential to accumulate anthropogenic loads brought from its three rivers. This makes the estuary and coastal areas vulnerable to contamination. If mangrove ecosystems are damaged, it will disrupt the impact of the various ecosystem services they provide, most importantly, their role in carbon sequestration (Gouvêa et al., 2022). To prove this, students carried out a simple practicum entitled "Analysis of Wonorejo Mangrove Soil Quality." Soil quality can be measured by observing inherent soil properties (e.g., soil texture) and dynamic soil properties (Recha et al., 2022). In this practicum, students analyze soil quality based on indicators of texture, color, moisture, pH, temperature, and organic content. The factors used in selecting soil quality indicators are adjusted to local conditions, which is one of the necessary steps toward sustainable soil management practices (Prudat et al., 2018).

After knowing the quality of mangrove soil, students analyze the ethno-conservation efforts of Mangrove Forest Areas. In Evaluation activities, students carry out follow-up and/or evaluation. Through the BIOTIC feature, the follow-up carried out by students on the soil pollution sub-material is the creation of Takakura as an organic waste processing method to reduce soil pollution caused by household organic waste. At the end of the lesson, students answered the questions in the reflection feature to overview the growth of students' ethno-conservation after carrying out the provided activity stages. In all aspects, the scoring validity of the developed Flipbook gets an average rating of 3.88 with a percentage of 97%, and the category is very valid, so it is feasible theoretically to be used in learning. In terms of validity, good learning media results in measuring students' abilities in content, presentation, and language are in a suitable category and can be used by making minor revisions (Widiarti et al., 2022). The overall validity assessment graph is presented in Figure 6.



**Figure 6.** Validity score graph.

Flipbook for handling environmental pollution based on local wisdom was developed as learning media for environmental pollution materials for class 10th high school students to train ethnic conservation of students, obtaining good responses from the validator. The following are suggestions and input from the validator.

*"There needs to be a review regarding the use of non-standard terms in a flipbook, then to air pollution as an ethnic-conservation habit it is added that the City of Surabaya also has a Car Free Day tradition"* - (Validator 1)

*"A review is needed on some of the wording and language used in the flipbook so that it can provide readers with more knowledge about local wisdom which has the potential to handle environmental pollution properly"*-(Validator 2)

### Empirical Feasibility

Empirical feasibility is feasibility in terms of flipbook legibility. Readability of Flipbook is the level of convenience of students in understanding and being able to read media by using 100 words taken from one page in flipbook reading. The interpretation is carried out using the Fry Graph formulation. Flipbook that facilitates learning for class 10<sup>th</sup> high school students is declared empirically feasible if the readability test results are between levels 9-11 (Agustina & Fitrihidajati, 2020). The results of the readability test are presented in Table 7.

**Table 7.** Recapitulation of readability test results.

Sample Reading	$\Sigma$ Number of Sentences	$\Sigma$ Syllables x 0.6	Levels
Initial Section	6.0	163.4	11
Middle part	5.7	148.8	9
Final Section	7.0	154.6	9
Average	6.2	155.6	10

Based on Table 7, the average reading on Flipbook is at level 10, which can be interpreted according to the level of thinking of 10<sup>th</sup> high school students. The suitability of the level of readability with the level of students' thinking is the central aspect that needs to be considered in compiling a textbook so that students gain a good understanding of the reading (Rahima et al., 2022).

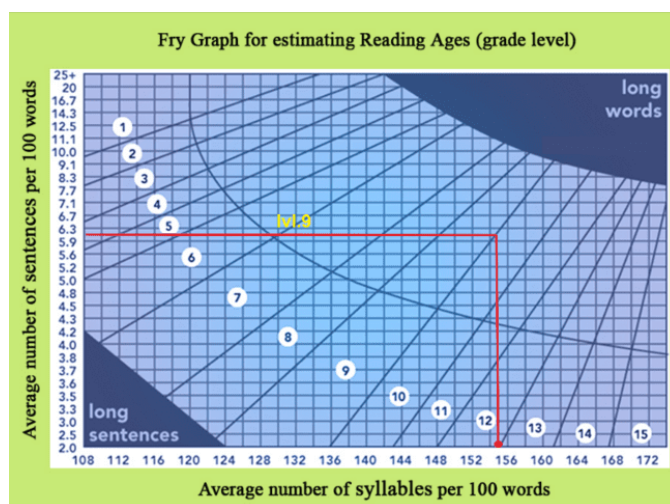


Figure 7. Readability test results.

Figure 7 shows the expected text in every writing is a text that can be read and understood by its readers. The readability of the text provides good results for the reader because, with the readability, the reader can not only read the text but also understand the text (Mursyadah, 2021). The ease of students in using media is one of the values of the practicality of the media. In the learning process, use media that can provide practical learning experiences. In conventional learning, students often need more practical teaching experience to correctly assess their competence (Utina & Baderan, 2019).

## CONCLUSION

Based on the research that has been done, Flipbook for Handling Environmental Pollution based on Surabaya Local Wisdom is developed, which is theoretically and empirically feasible to be used as an alternative teaching material in training ethno-conservation of students on Environmental Pollution material for class 10<sup>th</sup> high school. Theoretical feasibility is a very valid category, while empirical feasibility in terms of readability is in accordance with the level of thinking of class 10<sup>th</sup> high school students. The research was limited to the validity and readability aspects of learning media. However, it can be a reference and alternative for developing learning media with other topics at the same level. Sustainability is needed on a broader scale so that this local wisdom-based Flipbook is proven to be able to train students' ethno-conservation.

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**\*Dwi Wahyu Agustina (Corresponding Author)**

State University of Surabaya,  
Postgraduate Program, Biology Education Study Program,  
Continuing Program Development, Jl. Unesa Lidah Wetan, Surabaya, East Java, 60213, Indonesia  
Email: [dwagustina13@gmail.com](mailto:dwagustina13@gmail.com)

**Prof. Dr. Fida Rachmadiarti, M.Kes.**

State University of Surabaya,  
Postgraduate Program, Biology Education Study Program,  
Continuing Program Development, Jl. Unesa Lidah Wetan, Surabaya, East Java, 60213, Indonesia  
Email: [fidarachmadiarti@unesa.ac.id](mailto:fidarachmadiarti@unesa.ac.id)

**Dr. H. Sunu Kuntjoro, M.Si.**

State University of Surabaya,  
Postgraduate Program, Biology Education Study Program,  
Continuing Program Development, Jl. Unesa Lidah Wetan, Surabaya, East Java, 60213, Indonesia  
Email: [sunukuntjoro@unesa.ac.id](mailto:sunukuntjoro@unesa.ac.id)

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