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Development of Learning Video: Mangroves and Phytoplankton In Batu Ampar, West Kalimantan

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Abstract

Background: Mangrove forests experience rapid destruction; nonetheless, Indonesia has the widest mangrove area in the world. Conservation efforts must involve all parties, including education. This research was to develop learning video media about mangroves and phytoplankton. **Methods:** The method used was development research with a 4D model (defined, designed, developed, and disseminated) to develop a video containing the environmental conditions of mangroves and their unique roots in Batu Ampar. The video was evaluated by validators using a questionnaire as a research instrument. The assessment used a Likert scale. The video was also tested limitedly. Data were analyzed to calculate the content validity ratio (CVR) and the percentage category of students as respondents. **Results:** Learning video media about mangroves and phytoplankton in Batu Ampar obtained CVR 1,00 and categorized it as valid and suitable for learning media. Based on the limited test, students showed that both cognitive and affective were very good, but psychomotor was only a good category.

Keywords: Limited Test, Mangrove, Phytoplankton, Validity, Video Development

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Introduction

Mangrove is a type of forest usually located on the coast or river in tropical or subtropical areas. Indonesia, an archipelagic country in the tropics region, has a large mangrove area of 3,364,076 ha (Indonesia Maritime Institute, 2012). However, according to FAO (2005), the area of mangrove forests in Indonesia from 1980 to 2005 decreased by 2.9 million ha. The destruction rate is estimated at 200,000 ha. year^{-1}. Mangrove destruction occurs due to human activities such as making ponds, converting land into fields, and using wooden boards excessively (Cahyo, 2007).

Mangroves are ecosystems between land and sea with ecological, social, and economic functions. The unique root characteristic of mangrove formation is that it grasps the land from erosion due to sea abrasion. The presence of mangroves physically prevents abrasion on the beach and can prevent damage from the tsunami (Setyawan, 2006). Mangroves have unique and complete characteristics of their vegetation. In east Maluku, mangrove vegetation is relatively good, dominated by *Rhizophora apiculate* and *Sonneratia alba* among the 18 species of mangrove that were found (Suyadi et al., 2021). However, partial destruction occurred due to wood logging for fine wood, a small-scale industry for smoked fish that is for trade. Effective management is needed to coordinate among ecology, economy, industry, and housing needs, including education. The root characteristics of mangroves can block the wave, providing a good area for several marine organisms, such as Mollusces and Crustacea dominated by Gastropodas and Brachyura (Karimah, 2017). Mangroves can also be developed for ecotourism.

Awareness improves knowledge of important functions such as carbon storage and oxygen supply for climate balance, which drives the conservation of mangroves (Pradisty et al., 2021). They found 14 true mangroves dominated by *Rhizophora stylosa, Avecennia marina, Bruguira gymorhiza,* and *Sonneratia alba* in Sumberkima village, Bali. In Riau-, the decline of mangroves reached 13.4% between 2000-2019. Declination occurred due to human behavior, with an average decline of 2.495,9 hectares yearly (Oktarini et al., 2022)—over 98% of mangrove changes into other functions. There is an argument to change the attitude toward mangroves. However, the erosion of mangrove forests in Indonesia occurs rapidly (Indonesia Maritime Institute, 2012). Mangrove destruction commonly occurs in many areas. Mangrove forests are lost in Malaysia, Myanmar, Cambodia, Indonesia, and Guatemala (Hamilton & Casey, 2016). The loss of mangroves in Southeast Asia is a big concern and has reached a reduction between 0.16 – 0.37% per year (Hamilton & Casey, 2016).

In West Kalimantan, mangrove forests are shrinking every year. Conservation efforts require the involvement of many parties, including the education field. Limited knowledge of mangrove education becomes an obstacle to mangrove conservation. Dissemination of information that is short, interesting, and provides basic knowledge is needed for the general public as well as student learning in educational institutions. Kubu Raya Regency has the widest area of around 129,604,125 ha of the total area of mangroves in West Kalimantan (Renstra BPSPL Pontianak 2020-2024). The condition of mangroves in West Kalimantan is dominated by Avicennia sp. and Rhizophora sp. Baginda & Hidayat (2021) developed a video about the flora and fauna of mangrove forests, but this video was still limited in its use. Several videos available on YouTube show different segments about mangrove forests. Therefore, this research aims to develop video media that is informative, concise, clear, and interesting.

Methods

The research method was Development Research (DR) by implementing the results of the mangrove inventory in Batu Ampar with the 4D Model (Define, Design, Develop, and Disseminate). The 4D model from Thiagarajan et al. (1974) produced learning products (Arywiantari et al., 2015). In this study, the process only reached the development stage until limited testing.

Table 1. Work Steps in the Stages of Video Development on Mangrove and Phytoplankton in Batu Ampar.

No	Stage	Step
1.	Define	• RPS analysis • Video analysis • Material restriction
2.	Design	• Material selection • Media format • Initial plan ➢ Synopsis ➢ Storyboard ➢ Scenario ➢ Script
3.	Develop	• The making of media • Validation • Limited test

Define Stage

A semester learning plan analysis of several mangrove-related courses was carried out as a reference in implementing the use of video. The material developed consisted of general mangroves and their functions, describing their importance in life. Conservation efforts are carried out by providing a center for mangrove activities. The mangrove plants

identified at the location illustrate several types of mangrove plants. The video material is enriched by sampling phytoplankton to indicate the water quality around the mangrove forest.

The selected media involved technology with audio-visual results that can be accessed offline and online. The media developed is audio-visual media, namely video. The duration of the video is short but contains illustrations of mangroves in general, their role in the environment and society, and the process of sampling and observing phytoplankton, which are invisible to the naked eye.

Design Stage

The design stage aims to design learning media according to the analysis results that have been determined. The media format and product-making process are the main basis for this stage. Selection of Video Content: The media selection was done to identify what was needed with the characteristics of the material and the student's needs. The media selected based on the initial analysis of the materials needed were pictures of the mangrove environment, mangrove utilization, and examples of phytoplankton sampling and measuring water quality around the mangrove forest in Batu Ampar, West Kalimantan. Back sound and narration are prepared for synchronization with video images showing the unique forms of mangrove plant roots to be included to become a basic understanding of students about the root system. Video Format: The video format was done to adjust the content of learning media to the mangrove ecosystem in Batu Ampar, West Kalimantan. Initial Design: The initial design was a video design for students by writing a synopsis, storyboards, scripts, and scenarios.

Development Stage

This development stage produced video media products that were evaluated and tested on students. This stage was divided into video making, validation, and limited testing. In making the video, when the production started, it was about mangrove forests in general and specifically in the mangrove-protected forest in Batu Ampar, environmental conditions, and water quality measurements around the mangroves. The material related to the course on mangroves was formulated based on the semester learning plan. Material enrichment was carried out if the criteria regarding mangroves in the semester learning plan were relatively few or none.

After editing, we continue editing the frame, sound, and narration. At this stage, video editing used the Filmora application. Video made were then evaluated using an instrument in the form of a questionnaire with 11 aspects and 18 assessment indicators. These aspects were format, content, language, simplicity, synchronization, emphasis, balance, audio, image, durability, and effectiveness. Assessment based on the Likert scale with the choices strongly disagree (1), disagree (2), agree (3), and strongly agree (4). The validators were biology lecturers from FKIP (2 people), the Faculty of Mathematics and Natural Sciences (1 person), the Faculty of Agriculture (1 person), and the Faculty of Forestry (1 person). The selection of lecturers from various faculties aims to obtain an assessment of knowledge about mangroves.

The next step was to test the video on ten students who had passed plant taxonomy, ecology, anatomy, and physiology courses. Media effectiveness was observed based on cognitive, affective, and psychomotor testing. The response questionnaire contained 14 statements with five negative statements. The assessment used a Likert scale.

Data Analysis

Media Validity Test

The validation results from the validator were analyzed using Content Validity Ratio (CVR) analysis according to Lawshe (1975), explaining that CVR is a content validity approach to determine the suitability of items with dominance as measured based on the

CVR formula. The formula cuts between disagree and agree evaluation from the validator. Disagree evaluation from validators gives a negative score, and agree, oppositely, gives a positive score.

$$CVR = \frac{Ne - \frac{N}{2}}{\frac{N}{2}}$$

Ne: Number of validators agreeing on the validity of the media (considered agreeing if the value of each aspect with an average range of 3.0–4.00; if < 3.00, then it is considered not agreeing with the media validity).
N: Total number of validators

Content Validity Ratio (CVR) is a method for measuring agreement among raters about the importance of an item. Provisions regarding the CVR index, according to Lawshe (1975), are as follows:

1) When the number of respondents who agreed or strongly agreed was less than ½ of the total respondents (5), then the CVR value = -
2) When the number of respondents who agreed or strongly agreed was ½ of the total respondents (5), then the CVR value = 0
3) When all respondents choose (5) agree or strongly agree, the CVR value = 1 (this is set to 0.99 according to the number of respondents). Because the number of respondents used in this study was five, the critical value of CVR = 0.99.
4) When the number of respondents who agreed or strongly agreed was more than ½ of the total respondents, the CVR value = 0 - 0.99.

Table 2. Minimum CVI Value

Total Validators	Minimum Value
5	0,99
6	0,99
7	0,99
8	0,75
9	0,78
10	0,62
11	0,59
12	0,56
13	0,54
14	0,51
15	0,49
20	0,42

After calculating the CVR value for each criterion, calculate the CVI (Content Validity Index) value or the overall average CVR value to illustrate the instrument items. The CVI formula is as follows:

$$CVI = \frac{\sum CVR}{\sum n}$$

Explanation:
$\sum CVR$: total CVR value
Σn: number of items in all aspects

The criteria used in CVI are:
1) If the CVI value is 0 to 1, then the learning media can be said to be valid.

2) If half the number of validators say it is valid, then the learning media is said to be valid.

However, if less than half of the validators say it is invalid, then the learning media is said to be invalid. Lawshe (1975) developed minimum score criteria based on the number of validators (Table 2).

Limited Response Test

Student response questionnaires towards mangrove and phytoplankton videos were analyzed by categorizing each aspect by counting:

1) Total score per statement item with the following formula:

$$\%\ \text{of student response} = \frac{\text{number of student answers per item}}{\text{maximum total score}} x\ 100\%$$

2) I was interpreting the results of the percentage calculation of student response phases for each indicator. The interpretation used was written in Table 3 (Riduwan, 2011).

Table 3. Category of Student Response Assessment Results Interval

Interval Range	Categories
0% - 20%	Very less
21% - 40%	Less
41% - 60%	Enough
61% - 80%	Good
80% - 100%	Very Good

Result

The learning video about mangroves and phytoplankton in Batu Ampar, West Kalimantan, was 16 minutes and 58 seconds long. The video briefly described mangroves with an introduction in the form of mangrove forests in Batu Ampar and the purpose of studying learning media (Figure 1). The frame continued to various types of roots in mangrove forests (Figure 2) and biota that live in mangrove forests and mangrove forest ecosystems. Conservation efforts were carried out in Batu Ampar, and the role and utilization of mangroves were explained by field guides (Figure 3). The learning video also contained methods for sampling and parameter measurement of water quality related to the diversity of phytoplankton (Figure 4).

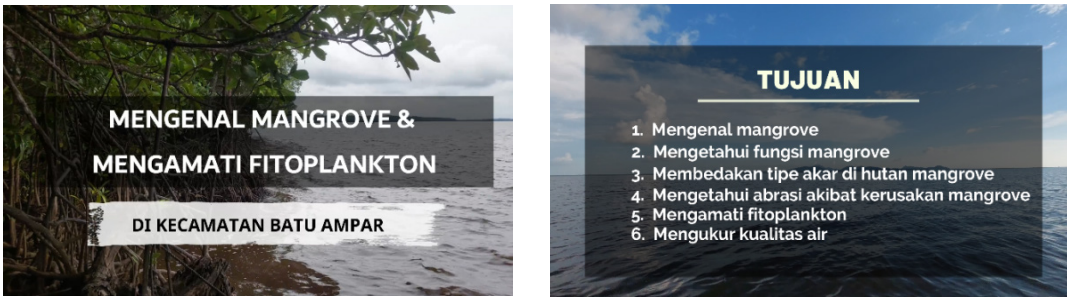
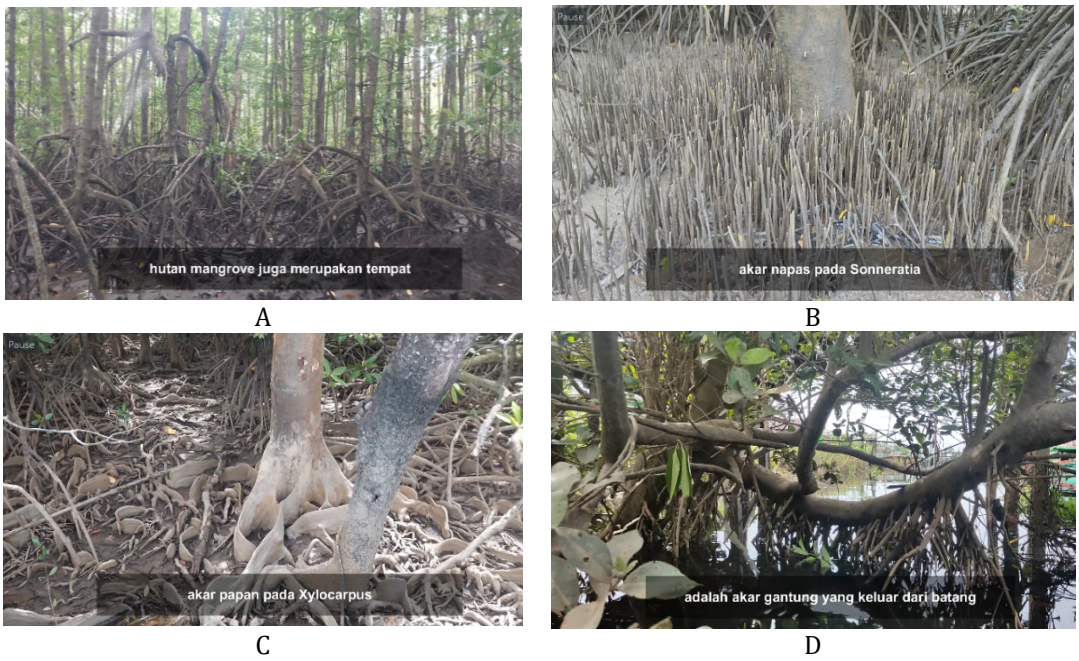


Figure 1. Opening

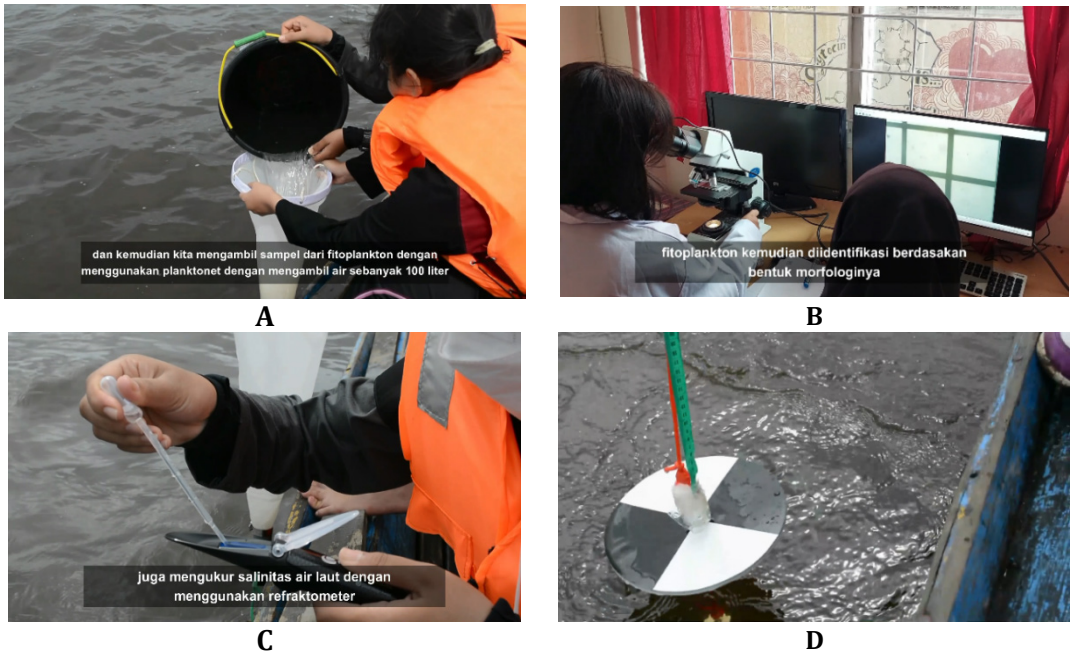


A B C D

Figure 2. Mangrove Root Types in Batu Ampar (A. Stilts-Roots, B. Plank-Roots, C. Breathing-Roots, D. Hanging-Roots)

A B

Figure 3. The Role and Utilization of Mangrove Forests in Batu Ampar (A. Conservation Efforts in Batu Ampar, B. The Role and Utilization of Mangroves)



A **B** **C** **D**

Figure 4. Phytoplankton Sampling and Water Quality Measurement (A. Sample Collection, B. Phytoplankton sample observation, C. Salinity measurement, D. Water brightness measurement)

Table 4. Validation results of learning media about mangroves and phytoplankton in Batu Ampar

Aspect		Assessment Indicators	Validator					Total	CVR	Average of CVR
			1	2	3	4	5			
Format	1	The suitability of image display, writing, and sound in the video with the learning concept	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
	2	The actual image is interesting and easier to understand	4,00	4,00	3,00	4,00	4,00	19,00	1,00	
Content	3	The material in the video is by the learning objectives	4,00	4,00	4,00	3,00	4,00	19,00	1,00	1,00
	4	The information presented in the video is complete and clear	4,00	4,00	4,00	3,00	4,00	19,00	1,00	
Language	5	Use of language that is easy to understand	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
	6	The use of language corresponds to enhanced spelling (EYD)	4,00	4,00	3,00	3,00	4,00	18,00	1,00	
Simplicity	7	The letters used are easy to read	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
	8	The displayed image illustrates environmental conditions	4,00	4,00	3,00	3,00	4,00	18,00	1,00	
	9	The sampling method and water quality measurement provide a clear picture.	4,00	4,00	3,00	4,00	4,00	19,00	1,00	
Cohesiveness	10	Between slide one and the next slide sequentially,	4,00	4,00	3,00	3,00	3,00	17,00	1,00	1,00
Emphasis	11	Information is presented in a clear and interesting way	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
Balance	12	Compatibility of images, text, and audio in each frame	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
Audio	13	The clarity of the voice of the narrator in the video	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
Picture	14	The clarity of the image in the video	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
Durability	15	Video media can be used more than ten times	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
Effectiveness	16	The use of media for individuals, groups, or per class	4,00	4,00	3,00	4,00	4,00	19,00	1,00	1,00
	17	Affordable media prices	3,00	3,00	3,00	4,00	3,00	16,00	1,00	
	18	This learning video can be used in face-to-face or online learning	4,00	4,00	4,00	4,00	4,00	20,00	1,00	

The eleven aspects assessed by five validators achieved an average CVR of 1,00. Each aspect also achieved an average CVR of 1,00. Assessment indicator number 18, namely regarding the effectiveness of media that can be used offline or online, gets the validator's assessment strongly agree (4).

Limited Response Test

Media learning videos about mangroves and phytoplankton were tested in a limited way to 10 students of the Biology Education study program who had passed the courses in plant taxonomy, plant ecology, and plant anatomy and physiology. After observing the video, students filled out a questionnaire for cognitive, affective, and psychomotor assessment (Table 5).

Table 5. Student Responses to Mangrove and Phytoplankton Learning Videos

No	Aspect	Statement	Average (%)	Category
1	Cognitive	1. Learning video media is useful to add to my insight 2. The language used in the learning video media is by the rules of the Indonesian language so that I can easily understand it. 3. After using the learning video media, I had difficulty understanding the material about mangroves. 4. Information regarding the parameter measurement of water quality is clear and easy to understand 5. The images in the learning video media are not to the objectives, so it is difficult for me to understand it. 6. The narrator's voice in the learning videos was unclear and confused me about the explanations.	85,00	Very Good
2	Affective	1. Learning video media motivates me to study ecosystem material 2. Learning videos about mangroves adds curiosity about how mangroves are used for the biotic and abiotic around them. 3. The learning videos bored me while studying the various types of mangrove roots. 4. The learning videos gave me the courage to measure the water quality in the waters. 5. I talk with friends during lessons with video learning media takes place.	81,50	Very Good
3	Psychomotor	1. This learning video made me able to distinguish the types of mangrove roots 2. I can measure water quality from the explanation of this learning video. 3. This learning video makes me actively ask questions about material that I don't understand.	76,70	Good
		Average	82,00	Very Good

Students' cognitive assessment achieved an average score of 85%, with a very good category. The cognitive assessment was designed with three negative statements and three positive statements. Student responses were based on the simplicity of language, display of pictures and accompanying information, the concept of mangroves, and brief observations of phytoplankton. As well as the cognitive assessment, the affective assessment reached an average of 81.5% and was in the very good category. Assessment of student responses based on two negative statements and three positive statements.

The results of student responses to the video regarding psychomotor scores obtained an average of 76.7%, which was in the good category. The assessment was based on three statements related to skills.

Discussion

The mangrove and phytoplankton learning video was 16.58 minutes long. The video shows the mangrove ecosystem and the role and efforts of mangrove conservation in Batu Ampar. The initial analysis results regarding the semester learning plan analysis of plant taxonomy, plant ecology, plant anatomy, and physiology courses in the Biology Education Study Program, FKIP Untan, found that the course has not included mangrove

material in their learning material even though mangroves have an important role in life both ecologically, socially, and economically (Awalah, 2019; Yulianita & Romadhan, 2020).

The importance of mangroves' role can be introduced in learning videos, brief reviews, and interesting information. Putri & Kurniawan (2017) developed educational posters about mangrove forests and concluded that educational posters could be used for mangrove forest tourism in the Indramayu Regency. However, posters will have limitations in use. A video that presents moving images with sound about mangrove explanations will add interest to the study of mangroves (Sadiman, 2014). The opening of the video shows mangroves and the purpose of studying the material in the video (Figure 1). According to Nurzal (2021), an interesting cursory picture will evoke the nature of inquiry to learn more. Various types of mangrove plants are also introduced (Figure 2) to provide an overview of the modification of mangrove roots. Its unique shape is the response of plants to tidal conditions in muddy coastal areas. The learning video also shows conservation efforts and the role and benefits of mangroves (Figure 3).

The mangrove forest area in Kubu Raya district is the widest in West Kalimantan at 129,604.125 Ha (Mongobai, 2022). One of the widest mangrove areas in the Kubu Raya district is the Batu Ampar sub-district. In Batu Ampar, there are mangrove forests that fall into the category of protected forests, production forests, and forests that have been destroyed. However, Batu Ampar, which has the largest mangrove area in Kubu Raya district, is designated as the center of world mangroves (Chandra, 2022) because of the high diversity of mangroves. Of the 40 true mangrove plant species, 33 of them are in Kalimantan, including endemic mangrove species such as *Braguera heinestee* (crocodile eye mangrove), Kandela candle (female Longgadau) (Chandra, 2022). This world mangrove center is expected to become a center for study tours or other activities as a conservation effort Figure (3A). The various roles of mangrove forests are also explained in Figure (3B) of mangroves and their surrounding waters. Several animals, such as crabs (corals) and birds, including eagles, live in this area. Mangrove forests that are maintained can affect the quality of the waters around the mangroves, affecting the water's biodiversity.

The video also contained how to measure water quality and related to phytoplankton observations, which were very important as the water's main producers. The higher the water quality, the more diverse the phytoplankton observed using Sadwright Rafter under a microscope and can be linked to Optilab to make it easier to observe phytoplankton. Parameters related to water quality were brightness, salinity and acid levels, amount of dissolved oxygen and carbon dioxide, water flow rate, and wind speed. The development of this video introduces mangroves in general with a unique description of the mangrove root system, inspiring students to preserve mangroves. Of the three-semester learning plan for plant taxonomy, plant ecology, and plant anatomy and physiology courses in the Biology Education Study Program FKIP Tanjungpura University, mangroves have not been included in the material so that mangrove material is needed as material that can open students' insights and efforts to engage in education for mangrove conservation. There is an elective course, namely aquatic ecology. Still, students are not trained in water quality practices or exposed to mangroves, so students' concern for mangroves is low. The learning video about mangroves and phytoplankton lasts 16 minutes and 58 seconds so it can be used in lectures or independent assignments.

Five validators' validation results of the learning video are listed in Table 4. Media validation used a questionnaire containing 11 aspects, namely format, content, language, simplicity, synchronization, emphasis, balance, audio, images, durability, and effectiveness, obtained an average content validity ratio (CVR) of 1,00, which was the minimum CVR value by the validator based on Lawshe method (1975). Achievement of the minimum score determines the eligibility of the media as a learning medium. Widodo (2017) states that language needs to be adjusted to students' language level. Responses of

students with language appropriate to their development will help them understand the material (Syihabudin & Ratnasari, 2020).

The combination of text, images, and the narrator's voice increases students' attention to the material in the video. Sari (2020) stated visible information followed by audio increases material absorption by 30% based on the Dale triangle. According to Sadiman (2014), the media can be selected based on flexibility, practicality, and durability. Learning media about mangroves and phytoplankton can be repeatedly used for independent, group, or even classes. The flexibility of using this media can overcome difficulties if some students are not equipped with gadgets. The flexibility of using video can support offline or online learning and fulfill the use of technology for learning in the 21st century.

After observing the learning video broadcast, students get clear information about the actual conditions in the field and the voice of the narrator who explains each frame. Syihabudin & Ratnasari (2020) say brief information with clear illustrations will be absorbed more quickly. Illustrations of plants and ecosystems can give the impression that the audience is present in the situation of mangroves and observations of phytoplankton. This is by contextual learning. Concrete examples in learning will make it easier for students to remember (Sari, 2020).

Student responses to learning videos also provide a very good category (81.50%) in an affective attitude. The information conveyed clearly can stimulate students to focus on learning and be active in learning. Likewise, students dare to act based on the process pictures in the video. Hadi (2017) explained that a clear process followed by clear pictures and sound will motivate students to do it. This is a novelty of the learning media. The experience they watch in the video brings the students as if going to the mangrove forest. The lectures can stimulate discussion more actively, and the student can be more curious learning mangrove.

Moreover, this video can also educate society so they will be aware of the importance and preservation of mangroves. However, student responses in psychomotor were only in the good category (76.70%). In general, students' responses to water quality measurement with various tools were not as high as those distinguishing the types of roots in the forest. Hesitation to measure without practicing skills shows that a skill does need practice (Banjarnegara, 2022).

Conclusions

Learning videos about mangroves and phytoplankton were valid and feasible (CVR = 1) as learning media to introduce mangroves and how to measure water quality. Students responded very well to learning media for Cognitive (85.0%) and affective (81.5%), which were categorized as very good, while the response to media for psychomotor was only good (76.7%) category.

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Declaration statement

The authors reported no potential conflict of interest.

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