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Utilization of AI-Based Visual Media on Artocarpus camansi Plants as a Science Learning Resource

Wahyuni Arafani[1]*, Hadyatul Muizzatissalmi[1], Kadek Sukma Darma Putra[1], Aliefman Hakim[1]

[1]Master of Science Education, Postgraduate, University of Mataram, Indonesia.

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Corresponding Author:
Wahyuni Arafani
wahyuniarafani919@gmail.com

Abstract: This research focuses on the use of the Artocarpus camansi plant, also known as "Kluwih," in science learning based on visual media and Artificial Intelligence (AI) technology. This study aims to describe the plant organs (morphology) of the Artocarpus camansi plant (leaves, flowers, fruits, seeds, and trees) and examine the potential use of AI technology in visualizing the characteristics of this plant as a learning resource. This research is included in qualitative descriptive research in the form of a review article. The instruments in this study used observation, interviews, and documentation. Data analysis involved three stages: data reduction, data display (data presentation), and drawing conclusions. The results of the study indicate that Artocarpus camansi has various important components such as stems, leaves, flowers, seeds, and fruits, each of which plays a role in the growth and reproduction processes. The use of AI-based visual media can improve students' understanding of the learning material, facilitate a more interactive teaching and learning process, and enable a more in-depth explanation of the biological aspects of the Artocarpus camansi plant.

Keywords: AI; Assemblr; Artocarpus camansi; Science Learning Resources.

Introduction

Currently, the use of technology is experiencing increasingly rapid development. This is evident in the ease of obtaining and conveying information through various media, facilitating communication between people, including in the field of education (Nurussofiah et al., 2022). Education is the most important factor in life, unlocking one's potential through the knowledge and insight gained. Education can improve the quality of human resources, thus impacting national progress (Habe & Ahiruddin, 2017).

In the digital era, teachers face various challenges that impact their roles and responsibilities (Kamila et al., 2022). Furthermore, each student has different needs and learning styles. Teachers must be able to address these challenges by providing learning tailored to their individual needs (Sari, 2021). One area supporting technological development in the digital era in industry, healthcare, agriculture, business, and education is the implementation of Artificial Intelligence (AI) (Aurelia and Prasetya, 2023).

In learning, the application of Artificial Intelligence technology is introduced to a problem to create a solution. The purpose of utilizing AI is to assist in visualizing forms of teaching materials, learning media, and others, thereby generating new innovations that are useful in assisting the learning process in the field of education in particular (Aurelia and Prasetya, 2023). The chosen strategy must also be a major concern for teachers to implement in the classroom to facilitate a good learning and teaching process (Fauziningrum et al., 2023). In facing these challenges, Artificial Intelligence (AI) technology offers exciting potential (Rusmiyanto et al., 2023).

By leveraging AI technology, teachers can better address the challenges emerging in the digital age. The use of AI helps improve efficiency, personalize learning, provide effective feedback, and enhance teaching effectiveness, while also preparing students for an increasingly technology-driven world. Therefore, the use of AI technology in teaching is crucial for improving the quality of education and student learning outcomes (Mambu et al., 2023).

According to Hamalik (1994) in Padang (2022), the use of learning media in the teaching and learning process can awaken ideals, new interests, motivation, and even have a psychological impact on students

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(Padang et al., 2022). Learning media developed with technology can improve students' science learning outcomes in terms of cognitive, affective, and psychomotor aspects (Fakhrudin, 2019).

Natural Science (IPA) learning has an important role in developing students' scientific knowledge, skills, and attitudes.Students are generally familiar with science material because it directly applies to everyday life. However, students often struggle to grasp scientific concepts because there's so much to learn (Candra et al., 2023). Furthermore, some material is abstract, making it somewhat difficult for students to grasp.

One effective approach to science learning is to utilize contextual and relevant teaching materials to the students' environment. One such teaching material with significant potential but still underutilized is the kluwih (Artocarpus camansi). The kluwih plant is a vegetable with a resinous fruit that thrives in tropical climates like Indonesia (Sunarjono, 2006).Furthermore, the use of kluwih can be combined with visual media. The use of virtual technology helps students understand better because it can present abstract concepts (Nurasia et al., 2021).

Kluwih, also known as kuluh, has several advantages that make it suitable as a teaching material. The anatomical, morphological, and physiological structures of the kluwih plant can be used to explain basic science concepts such as tissue structure, organs, organ systems, and chemical structure. Using kluwih as a teaching material can also increase student engagement, as students can directly observe and study real objects around them.

To further enrich students' learning experiences, integrating artificial intelligence (AI) technology into science lessons can be an innovative solution. One effective use of AI is the development of interactive 3D media that visualizes the organs of the kluwih plant: the stem, leaves, flowers, fruit, and seeds. This 3D media allows students to explore the plant's morphological structure in detail and dynamically, thus better understanding the function and role of each part.

The use of AI technology in science learning not only aids understanding but also supports the development of technological skills relevant to current developments. Therefore, integrating AI into science learning using teaching materials like keluwih not only improves the quality of learning but also prepares students to face the challenges of an increasingly digital future.

Furthermore, the use of kluwih in science lessons can support holistic and integrative learning. Kluwih can be an effective tool for teaching science concepts comprehensively and contextually. The use of kluwih also aligns with efforts to increase environmental awareness and sustainability. Through schools, which are the formal educational pathway, awareness of the importance of the environment can be instilled in children from an early age.

Environmental awareness is crucial for school-age children to develop a sense of environmental stewardship from an early age. Therefore, environmental stewardship needs to be taught in schools, one of which is through science learning (Santika et al., 2018). By studying local plants such as kluwih, students are encouraged to learn more about and appreciate the biodiversity around them, as well as to understand the importance of environmental conservation. Therefore, integrating kluwih as a teaching material in science learning not only provides educational benefits but also contributes to the development of environmentally conscious students' character.

This article further discusses various ways to utilize kluwih and AI technology as teaching materials in science learning, as well as the potential benefits of this approach. It is hoped that this will inspire educators to leverage local potential and modern technology in the learning process and improve the quality of science education in schools.

Method

This article is compiled based on a literature review method of articles that examine qualitative descriptive research. Qualitative descriptive research (QD) focuses on answering research questions related to the who, what, where, and how of an event or experience, which are then studied in depth to find emerging patterns in the event (Kim, H., Sefcik, JS, & Bradway, C., 2016).

This research was conducted at the location of the growing point of the Artocarpus camansi (kluwih) plant located on Jln. Gajah Mada 19, Leneng, Praya District, Central Lombok Regency, West Nusa Tenggara, with coordinates: -8.6977397, 116.2559117. The object of research in this study is the Artocarpus camansi (kluwih) plant. In this study, the data collection techniques used were observation, interviews and documentation.

Data analysis was conducted using a qualitative descriptive approach, involving three stages: data reduction, data display, and conclusion drawing. Data reduction emphasizes focusing on the data to be collected by the researcher. This process continues from the initial formulation of the research question until the data is collected. After data reduction, the next step is to display the data to facilitate understanding of what occurred and plan further work based on that understanding. The third step in qualitative descriptive

data analysis is drawing conclusions and verifying them.

Based on the third step in the data analysis above, it can be concluded that conclusions in qualitative descriptive research may or may not answer the initial problem formulation. The expected conclusions in qualitative research are new findings that have never existed before (Wiwin Yuliani, 2018).

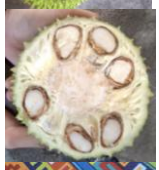
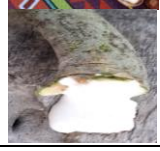
Results and Discussion

*Artocarpus camansi*in Indonesian it is called "Kluwih". On the island of Lombok itself this plant is known as "Kulur" or "Kuluh". Artocarpus camansi, known as kluwih, is a fruit tree originating from the Southwest Pacific region (Asia, Eastern Australia and Western America). Artocarpus camansi is a large tree that can grow up to 15 meters tall or more with broad leaves, thorny fruit, seeds, sap & taproot. Artocarpus camansi (Kluwih) can grow in gardens as well as in places that have a lot of water flow/channels, such as rivers, and grows near ditches. The taxonomic order of Artocarpus camansi is:

Regnum : *Plantae*
Subkingdom : Tracheobionta
Superdivision : Spermatophyta
Division : *Magnoliophyta*
Class : *Magnoliopsida*
Subclass : Hamamelididae
Order : *Urticals*
Family : *Moraceae*
Genus : *Artocarpus*
Species : *Artocarpus camansi*

MorphologyArtocarpus camansi

Table 1. Morphology of the Artocarpus camansi plant

Root (Radix)	Taproot, brown in color.	
Stem (Caulis)	Stems are erect, sympodial branching, sap-like, rough surface, brown in color.	
Leaves (Folium)	The leaves are green, single, alternate, oval in shape, the tip and base of the leaf are tapered, the edges are notched, the veins are pinnate, and the veins on the upper and lower parts of the leaf are hairy.	
Flowers (Flos)	The male flowers of the kluwih/kluwih plant are on average longer and the female flowers are relatively greener in color.	
Fruit (Fructus)	It is oval/oblong in shape, has thorns, the tips of which are brown, starts green and gradually turns yellow as it ripens. The flesh is whitish-yellow.	 
Seeds (Cement)	Kidney-shaped, 3-5 cm long, 12-150 per fruit, brown outer skin and white when cut open.	
Latex	It is milky white in color and not too thick.	

The following is a picture of the location where the Artocarpus camansi plant grows along with documentation of the results of interviews with sources.

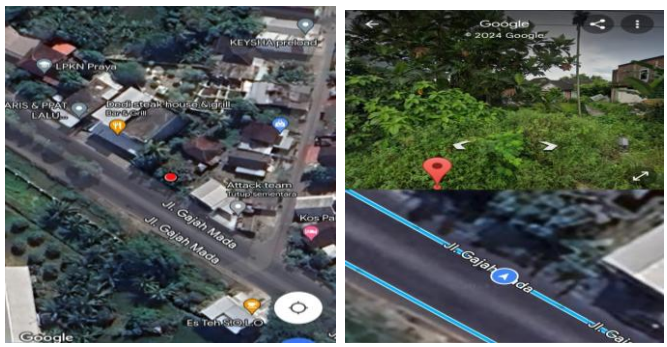


Figure 1. Growing point of Artocarpus camansi

Figure 2. Documentation of interviews with sources

Figure 3. Leaves, fruit and flowers of Artocarpus camansi

Integration of Artocarpus camansi with Science Material in Phase D

Materials that can be related to the Artocarpus camansi plant include the Classification of Living Things, Ecology and Biodiversity, Growth and Development in Plants, Inheritance of Traits, and Biotechnology. The relevance of this material is the Classification or Taxonomic Order of the Artocarpus camansi plant and the interaction between the Artocarpus camansi plant and the environment (biotic and abiotic).

The Learning Outcomes (CP) in this phase are: Students are able to classify living things and objects based on observed characteristics, identify the properties and characteristics of substances, differentiate physical and chemical changes, and separate simple mixtures. Students can describe atoms and compounds as the smallest units of matter and cells as the smallest units of living things.

Integration of Artocarpus camansi with Physics, Biology, and Chemistry Materials

a. Physics

The material that can be related to the Artocarpus camansi plant is the material on Quantities and Units, with the Sub-Chapter on Measurement of Physical Quantities (Mass, Length, and Time). The relevance of this material is measuring tree height, leaf length and width, stem diameter, diameter and radius of kluwih seeds and others. The Learning Outcomes (CP) in this phase are; at the end of phase E, students have the ability to respond to global issues and play an active role in providing problem solving. These abilities include observing, questioning and predicting, planning and conducting research, processing and analyzing data and information, evaluating and reflecting, and communicating in the form of simple projects.

b. Biology

The material that can be related to the Artocarpus camansi plant is the material on the Regulatory Process in Plants, with the Sub-Chapter Tissues, Organs, and Organ Systems. The relevance to this material is the tissues in plants, such as the xylem and phloem transport tissues. Organs in plants include roots, stems, leaves, flowers, fruits, and seeds. Organ systems in plants, for example; the respiratory and reproductive systems in plants. The Learning Outcomes (CP) in this phase are; At the end of phase F, students have the ability to describe the bioprocesses that occur in cells, and analyze the relationship between organ structures in organ systems and their functions as well as abnormalities or disorders that appear in these organ systems.

c. Chemistry

The material that can be related to the Artocarpus camansi plant, namely the material on Functional Groups in Carbon Compounds, with Sub Chapters, including; Organic Compounds Composed of Carbon Chains; Functional Groups as Active Centers in Organic Compounds; Nomenclature of Organic Compounds; Specific Reactions in Functional Groups; Several Important Organic Compounds and Their Benefits. The relevance to this material is the chemical compound content of the Artocarpus camansi (kluwih) plant (in relation to chemical structure). The Learning Outcomes (CP) in this phase are; At the end of phase F, students are able to understand organic chemistry; understand the concept of chemistry in living things.

In addition, the results of interviews with the community stated that parts of the plant*Artocarpus camansi*(kluwih) can be used, such as:

1. Kluwih tree trunks can be used as firewood and building materials.
2. Kluwih leaves can be used as a diabetes remedy by extracting them into kluwih leaf tea. They can also be used as animal feed.
3. Kluwih fruit flesh can be processed into shredded meat and coconut milk vegetables (lodeh).
4. Kluwih seeds can be consumed by processing them, such as boiling, baking, or roasting them as a snack (Fadzilla, 2018). It's not uncommon for people to let old kluwih seeds go to waste, allowing them to rot and sprout (Adinugraha & Kartikawati, 2012).

Chemical content*Artocarpus camansi*(kluwih):

1. Kulur/kluwih leaves (Artocarpus camansi) contain phytochemical compounds such as alkaloids, tannins, steroids, flavonoids, triterpenoids, glycosides, and anthraquinones (Eryuda & Soleha, 2016; Ayu Ina Solichah, et al., 2021). Kluwih leaves are also known to contain GABA (Gamma Amino Butyric Acid) (Indrowati & Ariyanto, 2012; Ayu Ina Solichah, et al., 2021).
2. Contains flavonoid and phenolic compounds, which are compounds with potential antioxidant properties. Flavonoid and terpenoid compounds. Terpenoid derivative compounds contained in kluwih leaves include friedelinol, squalene, β-

sitosterol, stigmasterol, pitol, lupeol, zonarone, and 9,19-cyclolanos-24-en-3-ol. The stem produces polyprenols and cycloartenol acetate. The bark extracted with n-hexane contains β-amyrin acetate and cycloeugenol.

This article focuses on 3D visualization of the organs of the Artocarpus camansi plant using AI (Artificial Intelligence), specifically the leaves (folium), flowers (flos), fruit (fructus), seeds (semen), and trees. AI is used to prepare images for use in the Assemblr application. Assemblr is an application that allows users to create, share, and explore augmented reality (AR) content (Novianti and Nisa, 2023).

The steps for creating media using Assemblr are as follows:

1. Prepare media in the form of 2D images that will be used in the Assemblr application.

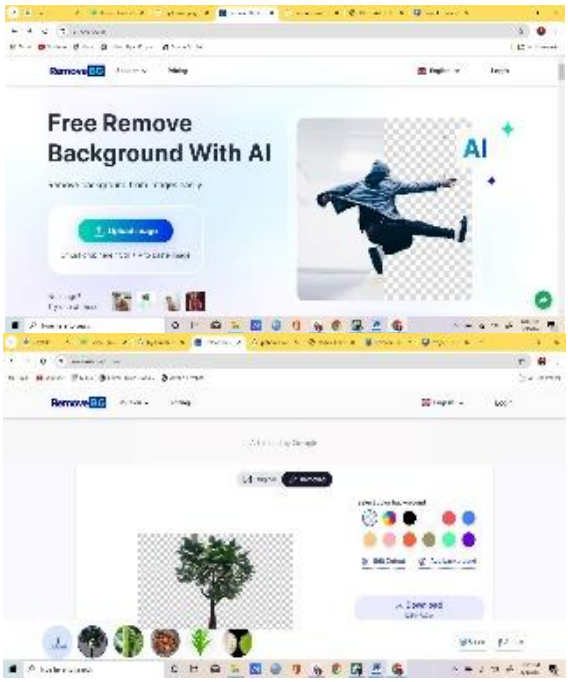


Figure 3. Assemblr application display

2. Open the Assemblr app and register. Then, start creating your media by clicking "Create Your Creation."

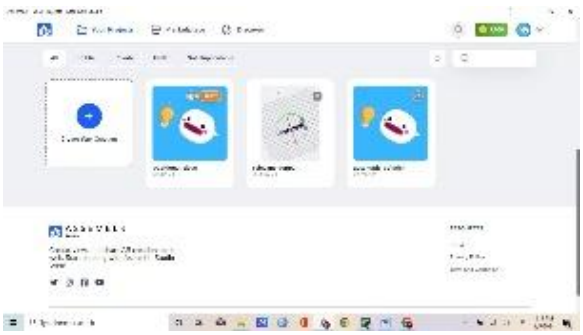


Figure 4. Display of the creation in the assembler application

3. After opening the project page, then insert the image that was previously prepared using Remove BG AI.

Figure 5. Project creation view

4. Apart from images, we can also include text and other information as needed.

Figure 6. Display of the finished media

5. Finally, we can download our work as a link, barcode, or webpage. Scan the barcode below to access a 3D visualization of the plant's organs.

Figure 7. Final view for downloading the media results that have been created

Figure 8. Scan barcode to access Assemblr

The following is a summary of the material about plant organs:

1. Leaves (folium)

Leaves are vital plant organs because many metabolic processes, such as photosynthesis, occur there. Photosynthesis produces essential materials for plant survival. Besides their flat, wide blades, leaves also function in respiration and transpiration. The main and additional parts of a leaf include: Leaf Stalk (Petiolus), Leaf Blade (Lamina), Leaf Sheath (Vagina), Stipules, and Tongues (Ligula) (Haryani, 2018).

2. Flowers (flos)

Flowers are genetically controlled modifications of stems and leaves influenced by enzymes and phytohormones. Flower formation is triggered by environmental changes such as temperature, lighting, and water availability. Flowers have the following main parts: (a) Flower petals (calyx); (b) Flower crown (corolla); (c) The male reproductive organ (androecium) is in the form of stamens; (d) The female genitalia (gynoecium) are in the form of a pistil). (Tjitrosoepomo, 2007).

The main function of flowers is to produce fruit. The main function of flowers is to produce fruit (Yudianto, 1992).

3. Fruit (fructus)

A fruit is a flowering plant organ that develops from the ovary and usually protects the seeds. Fruit forms after pollination and fertilization. Fruits are divided into: (a) Pseudofruit (formed from the ovary and other flower parts); (b) True Fruit (formed only from the ovary, without any other significant flower parts).

Then, pseudo fruit is divided into three, namely: (a) Single Pseudo Fruit (formed from one flower with one ovary); (b) Double Pseudo-Fruit (formed from one flower with more than one ovary); (c) Compound fruit (formed from compound flowers, looks like one fruit (examples: jackfruit and keluwih) (Sudjadi, 2007).

4. Seeds (cement)

Seeds in spermatophyte plants are the primary means of reproduction because they contain the embryo of a new plant. Seeds help the plant maintain its species and spread to other places (Rahmat, 2009). The structure of a seed consists of:

a. Seed coat (spermoderm): Derived from the ovule membrane, it consists of two layers in angiosperms. It consists of: an outer layer (testa) and an inner layer (tegmen).
b. Umbilical Cord (funiculus): Connects the seed to the temuni. Once the seeds are ripe, they usually fall off and leave a mark called the seed center.
c. Seed nucleus (nucleus seminis): The inside of the seed, also called the seed contents (Rahmat, 2009).

5. Tree

A tree is a tall plant with a woody trunk and branches that can live for many years. The four main parts of a tree are:

a. Roots: Located in the soil, carrying water and food to the trunk and branches.
b. Trunk: The main part of the tree protected by bark.
c. Branches: Attached to the trunk and growing from the roots to receive sunlight.
d. Leaves: Usually green, use sunlight, water, and food from the roots to help the tree grow and reproduce (Marentek, 2006; Nurfiana and Sulaeman, 2014).

Conclusion

This study concludes that Artocarpus camansi has great potential as a learning resource in science education through the use of AI technology. This plant is not only important biologically, but can also be an effective learning medium with the help of AI-based visualizations. The use of this technology can improve student understanding, make learning more engaging, and facilitate teachers in delivering complex material. Furthermore, a better understanding of plant morphology (plant organs), anatomy, and physiology can be achieved through a more interactive and innovative approach.

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Author Contribution

Conceptualization, Wahyuni Arafani, Hadyatul Muizzatissalmi and Aliefman Hakim; methodology, Wahyuni Arafani; software, Hadyatul Muizzatissalmi; validation, Wahyuni Arafani, Hadyatul Muizzatissalmi, Aliefman Hakim and Kadek Sukma Darma Putra; formal analysis, Wahyuni Arafani; resources, Hadyatul Muizzatissalmi; data curation, Wahyuni Arafani; writing—original draft, Wahyuni Arafani and Hadyatul Muizzatissalmi; writing—review and editing, Wahyuni Arafani, Hadyatul Muizzatissalmi and Aliefman Hakim; visualization, Hadyatul Muizzatissalmi; supervision, Aliefman Hakim; project administration, Kadek Sukma Darma Putra. All authors have read and approved the published version of the manuscript.

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The authors declare no conflict of interest. No funders were involved in the design of the study; in the collection, analysis, or interpretation of the data; in the writing of the manuscript; or in the decision to publish the results.

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