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Ethnobiological Study of *Kawung* Motif to Promote Knowledge of *Batik* Through Educational Video Production

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Abstract

There has been a decline in the knowledge of batik among younger generations, including its meaning and underlying philosophy. Knowledge of batik may be cultivated by creating educational videos incorporating ethnobiological studies. No studies have been conducted on kawung batik in educational video production. This research aims to examine batik kawung from an ethnobiological perspective and create an educational video to facilitate Knowledge of batik instruction. The research method is exploratory and qualitative. The research methodology employed various techniques, including interviews, document analysis, and a review of relevant literature. The findings indicated that the kawung batik motif was derived from the geometrical arrangement of kolang-kaling. This batik will reflect the meanings of purity, perfection, and completeness. The tools and materials utilized remain traditional, with a 12-step manufacturing process. Five species are associated with the production of kawung batik, which are classified into eudicots and monocots. The study's findings on kawung batik have been transformed into an educational video to impart Knowledge of batik. Knowledge of batik has the potential to facilitate the simultaneous teaching of local wisdom, indigenous knowledge, and biodiversity.

Keywords

kawung, biodiversity, knowledge of batik, educational video, ethnobiology

Introduction

Batik represents one of Indonesia's most significant cultural heritages. *Batik* was designated as Indonesia's intangible cultural heritage by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) on October 2, 2009 (Aprianti *et al.*, 2022). This recognition is commemorated as National *Batik* Day, which President Susilo Bambang Yudhoyono established. The global recognition of *batik* as a cultural heritage not only strengthens the identity of the Indonesian nation in the eyes of the world but also provides important support for the preservation and development of *batik* art in the country. Therefore, the community must demonstrate a commitment to Knowledge of *batik*, which will facilitate the advancement of this cultural heritage.

Knowledge of *batik* can be defined as the comprehension of the knowledge and awareness of the attitudes associated with *batik*. The word "*batik*" has its etymological roots in the

Javanese language, specifically in the word "*ambhatik*." The word *batik* is composed of two significant terms: *amba*, which signifies "wide" or "broad," and *titik* or *matik*, which denotes the act of forming a dot (Suryaningsum *et al.*, 2019). *Batik* can be classified as an art form akin to painting and writing (Agustin, 2014). Regrettably, not all individuals, particularly the younger generation, possess adequate Knowledge of *batik*, which encompasses an understanding and awareness of *batik*.

The limited comprehension and awareness of *batik* is a recurring theme in numerous studies. The research conducted by Putri and Awrus (2022) indicates a lack of comprehension among students enrolled in *batik* courses at SMK. The *batik* works produced by these students are of suboptimal quality. Furthermore, the limited awareness of *batik* is evident in research examining interest in its use. As evidenced by Aruman and Suyani's (2011) research, students' interest in wearing *batik* has noticed a notable shift. Similarly, a lack of Knowledge of *batik* is observed among Generation Z, who are expected to become the nation's future leaders.

A body of research substantiates the paucity of knowledge of *batik* among Generation Z. As stated by Atika *et al.* (2020), Generation Z has a paucity of understanding regarding the philosophy behind *batik* motifs. They perceive *batik* as a form of art that should be preserved as part of Indonesia's cultural heritage. This finding is consistent with the findings of Luwistiana and Septianingsih (2019), which indicate that the younger generation cannot distinguish between traditional *batik* and modern motifs, including *batik* motifs. As posited by Darmansa *et al.* (2019), members of Generation Z tend to prioritize the pragmatic aspects of *batik*, including its applications in fashion design, handicrafts, and visual communication design technology. They exhibit less interest in the philosophical connotations associated with *batik* motifs.

The lack of proficiency in *batik* is the result of a multitude of contributing factors. One of the primary factors contributing to the limited comprehension of *batik* is the lack of interest among students in the subject matter, including a lack of familiarity with the historical development and intricacies of the art form (Putri & Awrus, 2022). The younger generation must be made aware of the history of *batik*, including its motifs and philosophies, to ensure this art form's preservation. One of the most renowned *batik* motifs is the *kawung* motif. The Indonesian art history book identifies the *Kawung batik* motif as belonging to the geometric decorative group, which includes ancient motifs (ceplukan, keplok) and *Batik Keraton* motifs (prohibition motifs) (Muliani, 2018). The origin of the *kawung* motif is thought to be the kolang-kaling fruit, which is believed to represent perfect self-control and serves as a reminder of humanity's origins (Satriawan, 2019).

Prior research on the *Kawung batik* motif has already been conducted. The research on the *Kawung batik* motif has been conducted in several different areas, including the design and utilization of the motif, such as its use as an interior aesthetic element in hotels (Muliani, 2018), an exploration of *Kawung* motifs in craft art installations (Satriawan, 2019), the use of modular interlock in textile products (Direja & Rais, 2013), and the design development of *Kawung* motifs (Direja & Rais, 2013). Regrettably, studies on *batik* motifs are seldom conducted and do not address the domain of education, such as Biology. It has been proposed that the study of *batik* should be incorporated into the educational curriculum (Iskandar & Kustiyah, 2017).

One strategy for addressing this challenge is to create an educational video about the *kawung batik* motif. Educational videos are visual or audio-visual materials that provide explanations of a given subject matter, utilizing both sound and text. They are designed to facilitate comprehension among students (Makalalag *et al.*, 2021). The educational video on the *kawung* motif contains content that elucidates the *kawung* motif from an ethnobiological perspective. Ethnobiological research is concerned with elucidating the interconnections between humans and their environment across historical and geographical boundaries. Ethnobiological research encompasses a range of disciplines, including botany, zoology, anthropology, ecology, and history (Medeiros, 2014). Ethnobiology is a field of study that draws upon the natural sciences, social sciences, and humanities (Ambrosio, 2014). Consequently, the video was examined from three distinct perspectives: ecological, botanical, and historical.

Creating an educational video about the *kawung batik* technique is of significant importance. The educational video can address the deficiency in Knowledge of *batik*, encompassing both comprehension and awareness of the subject matter. Therefore, this research aims to examine the *kawung batik* motif using an ethnobiological approach and describe the educational video that has been made. Educational videos offer numerous advantages for conveying information to students. Educational videos have been demonstrated to enhance student learning outcomes (Makalalag *et al.*, 2021; Turyati *et al.*, 2019). Video can be use in the first step to introduce species diversity (Adinugraha *et al.*, 2024). Furthermore, educational videos can be utilized as promotional media (Winelis & Sodik, 2016). Videos about the *kawung batik* motif are disseminated on social media platforms, including YouTube. The role of social media in promoting *batik* is paramount (Sriganda *et al.*, 2021).

Methods

This research employs an exploratory approach, integrating ethnobiological studies and qualitative descriptive methods. Ethnobiological studies were conducted to develop learning content, while descriptive qualitative research was employed to elucidate the content of educational videos. The research was conducted at the Jakarta Textile Museum, located at Kota Bambu Selatan, Palmerah, West Jakarta, DKI Jakarta, Indonesia, 11420. The data collected encompasses the history and methodology of the *kawung batik* technique, an examination of the species utilized in its production, and a detailed account of the educational videos.

Information regarding the history and methodology of the *kawung batik* technique was obtained through interviews. An interview is defined as a meeting between two or more individuals with the objective of acquiring information through a process of questioning and answering (Arismunandar, 2013). The interview technique was conducted with key informants using a semi-structured approach. The key informant was the *batik* instructor at the Jakarta Textile Museum. This data was processed using descriptive qualitative data and related to the literature of journal articles with keywords "*kawung batik*," "*batik*," "*kawung batik* motif," and "*kawung batik* philosophy."

The data utilized in the study of the species in the production of *kawung batik* were obtained by applying interview techniques and examining the literature study. A literature study is an activity undertaken to search for and collate existing written works authored by other scholars (Hadna *et al.*, 2016). The objective of the literature study was to examine the Western scientific or biological aspects of the species utilized in the production of *kawung motif batik*. The data were analyzed using descriptive and qualitative methods. The data for the educational video description were collected through qualitative observation and documentation, which were then used to create the educational video content. The data were analyzed using qualitative descriptive methods. These descriptive analyses included examining the video production process, the video's narrative flow, and the video's explanatory content. Additionally, the images displayed in the educational video were also analyzed.

Results and Discussion

The history and process of making the *Kawung batik motif*

Batik is a cloth whose decorations are created using liquid wax *malam* (Aprianingrum & Nufus, 2021). In the 20th century, numerous *batik*-related activities emerged (Afreliyanti, 2014). The informant also noted that six distinct *batik* techniques have been utilized since ancient times, including written *batik*, stamped *batik*, dyed *batik*, combined *batik*, painted *batik*, and *batik* printing. The *Kawung batik motif* is a *batik motif* that takes the form of circles. These circles are arranged in a neat, geometric pattern reminiscent of the *Kawung fruit* (a type of coconut, sometimes also considered a palm or kolang-kaling) (Christanti *et al.*, 2020). As stated by the informant, the arrangement of four *Kawung* circles and a single circle in the centre constitutes the *Kawung batik* pattern, which is believed to symbolize *pasaran* days in the Javanese calendar. There are five types of *pasaran*: *Legi*, *Pahing*, *Pon*, *Wage*, and *Kliwon*. This design symbolizes the close and cooperative relationship between neighbours, which allows village communities to coexist peacefully and harmoniously.

The informant indicated that the royal family was the sole group permitted to wear the *Kawung batik motif* then. The general populace does not wear the *batik*, as it has a specific meaning associated with the Javanese royal family and nobility. The motifs of *Parang*, *Semen*, *Udan Liris*, *Sawat*, *Alas-alasan*, *Cemungkiran*, and *Kawung* are among those prohibited in *batik* design. Following the division of territory by the Mataram Kingdom, the Yogyakarta and Surakarta regions were established. Subsequently, *batik* relics of the Mataram Kingdom were adopted by many individuals, leading to its recognition as a prominent cultural heritage in Indonesia—the utilization of specific tools and materials outlined in **Table 1** and **Figure 1**.

Table 1. Tools and Materials in the *Kawung Batik* Making Process

Name of Tools and Materials	Explanation
<i>Kain mori</i> (<i>Mori cloth</i>)	<i>Mori cloth</i> is the optimal material for producing <i>batik</i> because it exhibits the ideal grammage, neither excessively thick nor thin (Yunus, 2022). The thread density is precisely calibrated, and the material boasts high absorbency, rendering it particularly well-suited for <i>batik</i> techniques that necessitate multiple

	stages before completion.
<i>Canting</i>	<i>Canting</i> is a tool that applies liquid <i>malam</i> (wax) to create motif patterns in written <i>batik</i> . According to Hariyanto (2014), <i>canting</i> comprises three primary components: the <i>nyamplung</i> , the <i>cucuk</i> , and the <i>gagang</i> . The <i>nyamplung</i> is the <i>malam</i> (wax) receptacle crafted from copper. The <i>cucuk</i> is the conduit through which the <i>malam</i> is dispensed, while the <i>gagang</i> is the <i>canting</i> stalk, typically constructed from bamboo or wood.
<i>Anglo</i> (Brazier)	<i>Anglo</i> is used to heat liquid <i>malam</i> (wax) to a desired temperature. It is typically constructed from terracotta, a clay-based material. Unlike other heating devices, a brazier lacks a closed heating chamber, allowing the open burner fire to draw directly on the fuel.
<i>Wajan</i> (Wok)	<i>Wajan</i> is a tool utilized to apply liquid <i>malam</i> (wax) and its subsequent melting.
<i>Malam</i> (wax)	<i>Malam</i> is a specific wax material utilized in the <i>batik</i> technique. <i>Malam</i> , the Indonesian word for wax, functions as a colour barrier for the fabric, enabling the patterns created to be discernible. <i>Malam</i> exhibits a brown hue, encompassing both light and dark shades. <i>Malam</i> combines paraffin, pine resin (<i>gondorukem</i>), and animal fat.
<i>Gawangan</i> (Wooden frame)	<i>Gawangan</i> is used to spread the cloth that will later be <i>batiked</i> . This tool is usually used to make <i>batik</i> paintings or by beginners who use <i>canting</i> or brushes.
<i>Dhingklik</i> (Wooden chairs)	<i>Dhingklik</i> is a seat used when making <i>batik</i> . <i>Dhingklik</i> is made of wood with three to four supports and is usually for one person only.
<i>Celemek</i> (Apron)	<i>Celemek</i> is a cloth used after clothing to protect the front of the body.

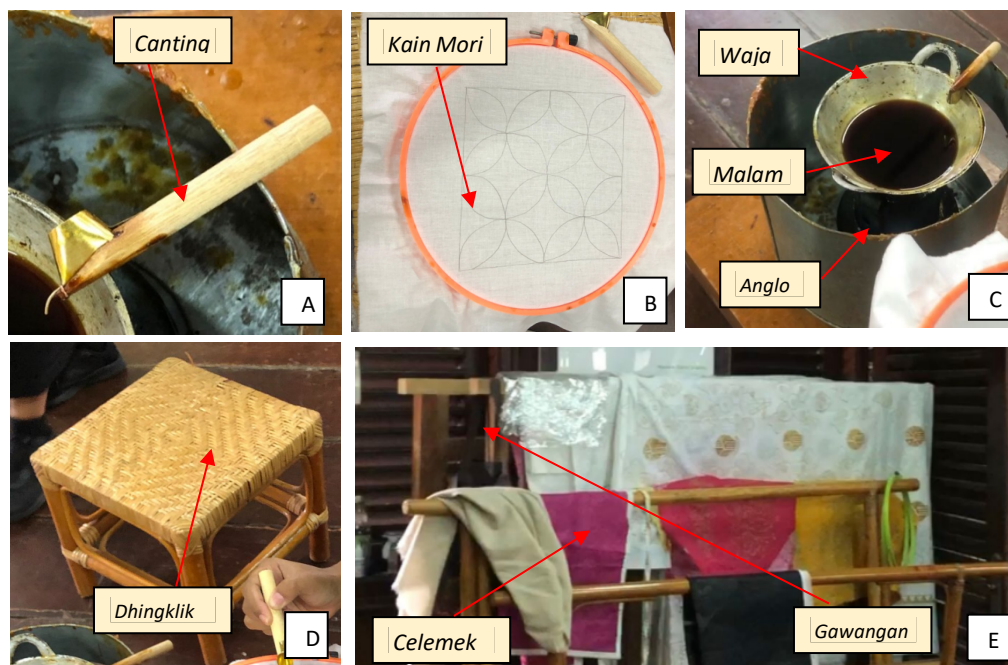


Figure 1. Tools and Materials for Making Kawung Batik. (A) *canting*, (B) *kain mori* (C) *wajan*, *malam*, *anglo*, (D) *dhingklik*, dan (E) *gawangan* and *celemek*

Creating *batik kawung* motifs is lengthy and exacting, necessitating great precision. The initial stage is the *Nyungging* process. The *Nyungging* process represents the initial stage in the creation of written *batik*. This term is employed by those engaged in the practice of

batik to denote the creation of patterns on paper. This process bears a resemblance to the sketching process employed in painting. The *Nyungging* process typically ranges from 15 minutes to an hour, although some instances have been known to require up to a week to achieve the desired pattern. The subsequent process is *Njaplak*, which involves transferring the pattern created on paper to the fabric medium. This process is challenging due to the differences in texture between drawing on paper and fabric. Careful attention is required to achieve precise results. The third process is *Nglowong*, which involves using a *canting* tool. The *canting* is filled with *malam* liquid and used to trace the pattern on the fabric. Incising the *malam* liquid must be done rapidly to prevent hardening.

The subsequent stage is the *Ngiseni* process, which entails the infusion of liquid *malam* into the voids of the extant pattern, thereby enhancing the delineation of the configuration. Subsequently, *Nyolet* is employed, whereby specific areas of the fabric are imbued with colour. This process is undertaken to enhance the outcome's aesthetic appeal. Subsequently, the *Mopok* process is employed, whereby the *batik* is utilized to cover specific portions of the pattern that are not intended to be coloured. In this process, the *batik* no longer requires *canting*; instead, it employs a broader brush, reducing the overall completion time required.

Additionally, the *Nembok* process is nearly identical to *Mopok*, whereby the background of the fabric is coated to prevent exposure to the dye liquid. The subsequent stage is the *Nyelir*, or *Nyelup* process, which involves directly immersing the *batik* cloth into a dye bath. The colours utilized are typically subtle, such as brown, dark green, dark purple, red, and others. After this, the *batik* can dry naturally in the sun until it is fully desiccated.

Once the fabric has been allowed to dry, the *Nglorod* process is initiated to dissolve a portion of the *malam* liquid within the fabric. The method entails immersing the cloth in boiling water until the wax is entirely removed, after which the cloth is lifted and allowed to dry. Subsequently, the *Ngretensi* process is employed, whereby the aforementioned method is repeated to embellish the *batik* with dots or lines around the pattern. Subsequently, the *Nyumri* process is employed. In this process, the *batik* maker re-covers several parts of the cloth that do not want to be exposed to colour with *malam*, after which the cloth is dipped back into the dye liquid and dried in the sun until dry. The final stage of the *batik*-making process is *Nglorod*, although this was already completed during the initial step. At this stage, the *batik* maker removes all the *malam* liquid from the cloth. This process is done by soaking the cloth in boiling water and then lifting and drying it in the sun until it is dry. Once all stages have been carried out, the results of the finished *batik* motif can be seen.

The *kawung batik* motif is imbued with profound significance, constantly reminding one of one's cultural heritage and origins. This *batik* reflects the concepts of purity and perfection. The ideology of *Kawung batik* is perceived as holy and sacred, as those who wear it are regarded as exemplifying superior and perfect human qualities. The social situation of Javanese society is represented by four *kawung* arranged in a geometric pattern. The lotus petal design, meanwhile, is a symbol of purity.

Furthermore, the motif of dots extending from the centre of the *kawung* to its four corners symbolizes centralized power (the Sultanate) and justice as the guardian of the

political system. The Sultanate establishes regulations about social relationships (Hartanti & Setiawan, 2019). Using colour transitions between dark and light hues symbolizes the multifaceted nature of human existence. Ultimately, the *kawung batik* motif encapsulates the tenet of ancient Javanese philosophy that urges humans to return to their fundamental essence and never lose sight of their true roots.

Study of Related Species in the Making of *Kawung Batik* Motifs

The term "*Kawung*" is derived from the name of the kolang-kaling fruit, which is native to the aren palm tree. The aren palm (*Arenga pinnata*) is a plant whose numerous parts can be utilized for various household needs and possess economic value (Mulyanie, 2018). *Nira* or sap of palm flower is utilized as the primary raw material for palm sugar, while the fruit is employed as the primary raw material for *kolang-kaling*. The colour of the palm fruit is white, which also contributes to the formation of the *kawung batik* motif. The *kawung* motif is believed to represent concepts of perfection, purity, and innocence. As indicated by informants, the *kawung* pattern is believed to symbolize the emptiness of worldly passions and desires, which is thought to lead to complete self-control. The word "*suwung*" signifies a state of emptiness. This quality engenders a neutral, impartial, and non-intrusive disposition. Instead of imposing oneself, the individual chooses to align with the natural flow of life, allowing surrounding phenomena to function according to their intrinsic nature. The *kawung batik* motif is frequently employed as a representation of sagacious individuals. The species utilized in the production of *kawung batik* are enumerated in **Table 2**.

Table 2. Species Involved in Making *Kawung Motif Batik*

Local name	Species name	Clade	Parts Used	Usability
<i>Aren</i>	<i>Arenga pinnata</i> Merr.	Monocots	Fruit	The primary motif of the <i>kawung batik</i> design is a key element of the style.
<i>Mangga</i>	<i>Mangifera indica</i> L.	Eudicots	Leaf	Natural materials that produce green symbolize growth and fertility.
<i>Tarum</i>	<i>Indigofera tinctoria</i> L.	Eudicots	Leaf	Natural materials that produce blue symbolize a calm, gentle, loyal, and sincere person.
<i>Kelengkeng</i>	<i>Dimocarpus longan</i> Lour.	Eudicots	Leaf	Natural materials that produce yellow symbolize tranquillity, joy, and happiness.
<i>Gambir</i>	<i>Uncaria gambir</i> Roxb.	Eudicots	Leaf	Natural materials that produce black symbolize a person who is whole of authority, brave, strong, confident, full of mystery, and firm in his stance.

The species utilized in creating *kawung batik* are the foundation for *batik* motifs and natural dyes. A total of five species are utilized, which are classified into two main categories: eudicots and monocots. This study identifies four species of the eudicots group and one species of the monocots group. Indeed, studying *batik* can be linked to biology, particularly biodiversity. Through this topic, students can gain insight into the value of biodiversity, including its cultural significance, as exemplified by *batik*. They can also comprehend the classification of organisms, which is a fundamental aspect of biodiversity. The incorporation of ethnobiology in this study demonstrates the potential for integrating

local wisdom or indigenous knowledge, such as that pertaining to *batik*, into the realm of biological learning.

Description of Educational Video about *Kawung Motif Batik*

This educational video aims to disseminate helpful information, particularly to students and Generation Z or the general public who view this educational video, which introduces the *kawung batik* motif and its associated meaning. The production process for educational videos comprises four stages: initial planning, including the plot, time frame, and cast; video shooting; editing; and publication via YouTube social media. The selection of actors for an educational video is also a crucial aspect of the production process. The actor serves as a conduit, conveying information in both verbal and visual forms. Consequently, the individual selected to portray the subject in the educational video must possess the requisite proficiency to convey the material effectively. In the context of the study video on the *Kawung batik* motif, selecting an individual with a profound comprehension of archipelago *batik* would be optimal. Actors must possess a comprehensive understanding of both the historical context and the production process of *Kawung batik*. This ensures that the material can be effectively conveyed to the audience, particularly students, in a clear and engaging manner. Furthermore, actors with a profound understanding of *batik kawung* can motivate the audience to develop a more profound appreciation for and understanding of *batik kawung* as an integral component of the nation's cultural heritage. In other words, selecting the most suitable actors will be a pivotal determinant of the success of this educational video.

The capture of images and video footage of interviews with sources is facilitated by devices compatible with the necessary technology. To ensure the quality of the resulting images and videos is optimal. The shooting took place at the Textile Museum in West Jakarta. Following the capture of images and videos, the subsequent editing process was initiated. This process aimed to enhance the visual appeal of the images, ensuring their suitability for public consumption. The editing process entailed the addition of subtitles to facilitate the comprehension of conversations, the adjustment of audio with images, the provision of explanations for selected images, and the incorporation of background music into the video.

The subsequent phase of the process entails uploading the completed educational video to a social media platform. The selection of YouTube as the platform for uploading this educational video is based on the recognition that YouTube has become the most widely recognized and popular social media platform on an international scale. The majority of people, particularly the younger generation, utilize this application. A broader audience can access and appreciate the videos created by selecting YouTube as the platform. YouTube offers convenient access to anyone with an internet connection. The videos can be viewed at the following link: <https://youtu.be/ZuRopzCJW0c>.

The use of YouTube as a social media platform for disseminating educational videos on *kawung batik* presents a promising avenue for achieving the desired outcomes, namely the propagation of knowledge and the elevation of public consciousness regarding the cultural significance of *kawung batik*. The use of video media in learning offers several advantages. It

can be played on demand or in a calm atmosphere when delivering material. Additionally, it can be used to demonstrate objects that do not require special lighting and can be slowed down or accelerated (Tiwi & Mellisa, 2023). The selection of YouTube as a medium was based on the observation that online videos are a highly preferred leisure activity (Norðdahl *et al.*, 2019). The objective is to create social media content that effectively conveys the significance of *batik* as an intangible cultural heritage while advocating for its preservation (Sriganda *et al.*, 2021). **Figure 2** illustrates the YouTube layer capture image.

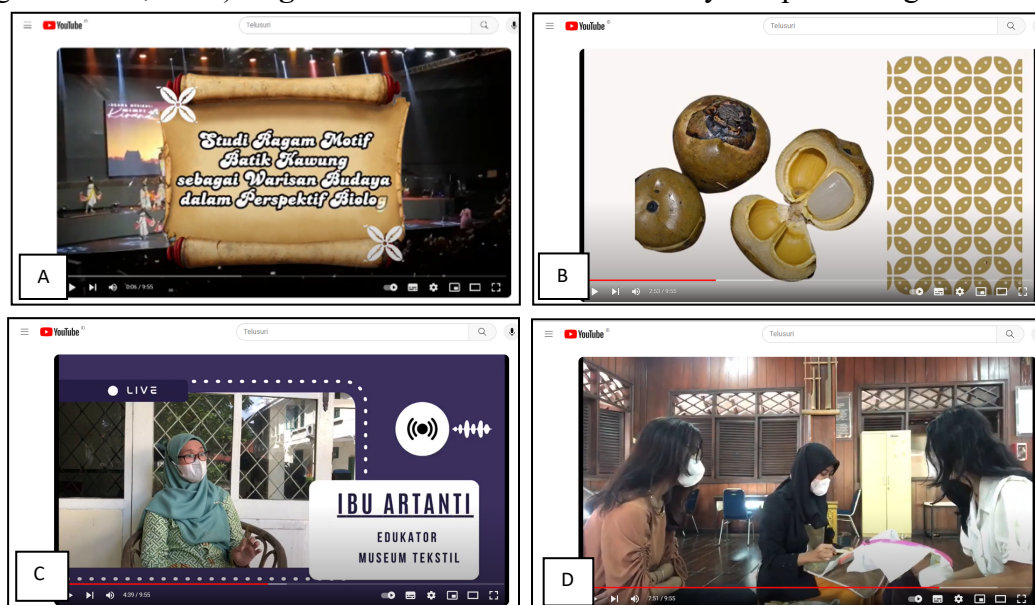


Figure 2. YouTube screenshots of the *Kawung* motif *batik* educational video. (A) Educational Video Title; (B) *Kawung* Motif Explanation; (C) Informant Explanation; and (D) *Kawung* *Batik* Making Process

The educational video content of the *Kawung* motif *batik* through social media is anticipated further to promote Knowledge of *batik* in an unlimited circle. An increased understanding of *batik* can lead to greater public awareness of *batik*. *Batik* is an Indonesian cultural heritage that must be preserved by increasing public awareness of the meaning and philosophy of *batik* so that local wisdom or indigenous knowledge is not lost. If the origin of knowledge can be traced and people are aware of *batik*, it will be more difficult for neighbouring countries to claim *batik* as their own.

A limitation of this study is that educational videos have not been implemented in schools due to time constraints. The dissemination of educational videos is currently confined to the YouTube social media platform. Implementing this educational video in an academic setting will facilitate improvements in the video quality and the ability to assess its efficacy in enhancing Knowledge of *batik*. Comic media can also teach plant knowledge (Napitupulu *et al.*, 2023). An alternative approach to learning local wisdom or indigenous knowledge for students is with a local wisdom and cultural approach. (Adinugraha, 2020, 2022; Adinugraha *et al.*, 2020). Furthermore, it is recommended that additional *batik* motifs be studied through ethnobiological research. Research about motifs is important because various *batik* motifs reflect cultural diversity across diverse regions in Indonesia, characterized by various colours and distinctive designs (Trixie, 2020).

Conclusion

The *kawung batik* motif is derived from the geometrically shaped kolang-kaling sauce arranged neatly and orderly. The *kawung batik* motif is imbued with profound significance, serving as a constant reminder of one's origins for those who wear it. This *batik* reflects the meanings of purity, perfection, and unity. The tools and materials utilized in the creation of *kawung batik* motifs encompass kain *mori* (*mori* cloth), *canting*, *anglo* (brazier), *wajan* (wok), *malam* (liquid wax), *gawangan* (wooden frame), *dhingklik* (wooden chair), and *celemek* (apron). The process comprises 12 steps, including *nyungging*, *njaplak*, *nglowong*, *ngiseni*, *nyolet*, *mopok*, *nembok*, *ngelir* or *nyelup*, *nglorod*, *ngrentesi*, *nyumri*, and *nglorod*. The species utilized in creating *kawung batik* serve as the foundation for *batik* motifs and natural dyes. The five species utilized are classified into two categories: (four) eudicots and (one) monocots. The production of educational videos encompasses four stages: planning, filming, editing, and publication on YouTube.

The teaching of Knowledge of *batik*, with a particular focus on the *kawung* motif, can be integrated with other subjects, such as biology. It is incumbent upon educators to facilitate the integration of biological material, such as palm tree taxonomy, into the learning process. Video-based learning media is also a practical approach to fostering student interest in learning through a combination of audio and visual technology. The utilization of video-based learning media has the potential to facilitate not only the acquisition of knowledge within the classroom setting but also to reach a broader audience on the YouTube platform. This research could contribute to a greater understanding of *batik kawung* from a biological perspective, which could assist in preserving Indonesia's cultural heritage. Therefore, this approach is a comprehensive and innovative step in preserving Indonesian culture and strengthening the connection between cultural and scientific knowledge.

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