



Redefining *Katol*: A Synthesis of Culture, Economy, and Education Toward a Sustainable Culture-based Teaching Model

^aEron Anthony Guarde, ^bCristian John Urtola, and ^{b*}Reynaldo Inocian

^a College of Teacher Education, Cebu Normal University, Cebu City, Philippines

^b Professor VI, Social Sciences Department, College of Arts and Sciences, Cebu Normal University, Cebu City, Philippines

*Corresponding author: inocianr@cnu.edu.ph

Article citation details: Guarde, E.A., Urtola, C.J., & Inocian, R. (2022). Redefining *Katol*: A Synthesis of Culture, Economy, and Education Toward a Sustainable Culture-based Teaching Model. *Magister – Journal of Educational Research*, 1(1), 51-67.

Abstract

The Philippines is a high-risk zone for dengue cases in Asia. Responding to this context is the use of mosquito repellents produced by insecticide industries. Coiled mosquito repellent called *katol* has become one of the remedies among Filipinos that has been part of their way of life as a people. An existing gap was found in the cultural aspect of *katol*. Redefining *katol* relative to its connection in academia requires analysis of its economic and cultural relevance, identifying usage issues, and designing a culture-based teaching model based on its manufacturing procedures. A grounded theory and Heideggerian interpretive phenomenology designs were employed in the study. Factory visits, observations of the factory demonstration, and interviews with the research participants were conducted. The economic significance of *katol* in the informal sector is seen among the resilient workers who worked in the factory to earn a living and convenient stores that sold the coiled *katol* to middle-income Filipinos who wanted to protect their children from mosquito bites because of its affordable price. The use of *katol* is culturally significant. The belief that *Katol* provides health protection for the family, the number of years of utilization of this repellent, and its practice of ignition, i.e., safe from fire accidents, prove the cultural significance of *katol*. These economic and cultural findings in the study of *katol* outweigh the dispute that it is unsafe for the health conditions of individuals if endemic botanical compounds and solutions are used. With the cultural orientation in the manufacturing process as a reference, a *katol* culture-based teaching model is designed to remind the next generation of learners regarding its sociocultural orientation.

Keywords: *katol*, home insecticide, qualitative, cultural bridge, culture-based teaching model

1. Introduction

The outbreak of dengue is a global concern. The occurrence of the wet seasons in the Philippines that covers at least five to six months has been a potential breeding ground for mosquito infestation. For many years, the many cases of dengue have been challenging for the government to mitigate. The Philippine health department reported 56,000 dengue cases in the first quarter of 2019 (News Desk, 2019). Greif et al. (2017) rejoined in this report that the Philippines is a "high-risk" zone of dengue incidence in Asia. There have been a lot of means introduced by home insecticide industries to avoid mosquito-borne diseases. Still, the most traditional, popular, and affordable among them is the *katol* or mosquito coil. Using *katol* is more prevalent among families with low socio-economic status (van Eijk et al., 2016). *Katol* is an insect-repelling incense that is in spiral-shaped coils. It is inexpensive and easy to use. One coil usually lasts about eight hours for someone to have a sound sleep in the evening. It is available in green coils that produce a generally unpleasant smell when lighted. But technology has given rise to brands offering different colors and pleasant scents. In the past, much research has focused on the health impact of mosquito coils, which is the most significant among its users (Liu et al., 2003).

After studying four common mosquito coil brands from Malaysia and two from China, the paper revealed alarming health risks gained from its emission rates of PM2.5, particulate-phase polycyclic aromatic hydrocarbons (PAHs), and carbonyls (aldehydes and ketones). The study reported that burning one mosquito coil releases identical fine particles as burning 75–135 cigarettes. This study has encouraged the public to be cautious in choosing a mosquito coil brand as its emission rate of pollutants highly depends on the base materials used to create a smoldering effect. Naz et al. (2018) concluded that the deleterious effects of mosquito repellents to health-related issues and cause pathological effects on the body's organs, even if this technology prevents mosquito bites (Sibanda et al., 2018). Because of this, some mosquito coil manufacturers started to seek new base materials to reduce pollutant emissions (Zhang et al., 2010). With that, the local manufacturer of *katol* in the Philippines has ensured they are not far from progress. It is important to note that many non-smoking mosquito killers have been introduced in the industry, but none seem to outweigh the market performance of *katol*. This paper unveiled significant factors other than economic that would explain why the mosquito coil remained resilient in the home insecticide market. The obvious answer to this is its culture of how it is produced in manufacturing companies and patronized by Filipino households.

If looking closer into the problem, there is a massive crack in the research gap about mosquito *katol*. The gap is investigated in an experiment, evaluating the safety and health-related issues in using it. With this, redefining the image of *katol* culture, economy, and education becomes inevitable. Many people are confused about why there is a need to see it from a different lens, especially its sociocultural lens. *Katol* is something only a few people would be interested in knowing about its multibillion-dollar investment in repellent industries and the havoc mosquitos bring to people's health conditions. Most people do not even know what it is made of, and it does not seem like people have cared for it. But that is not the case; this paper asserts that there is more to *katol* than being a mosquito killer or a subject of non-ending scientific experiments. Many alternatives have been introduced to avoid dengue or malaria, but why did *katol*, despite modernization

and rapid urbanization, still stand smoking in the homes of a typical Filipino family? The obvious answer to this is the beliefs and practices people attach to its utilization in preventing dengue, which has remained cultural for decades in the country's mosquito-repellent industries. This study aims to develop an augmented perceptual picture of *katol*. So it includes its manufacturing process and economic and cultural relevance to the communities' end users.

Moreover, there have been so many mosquito coil players in the market over the last seven decades. Still, the one that pioneered local production is Greencoil Industries, the manufacturer of Lion-Tiger Katol. Today, it is already the most prominent local manufacturer of mosquito coil in the Philippines and the most significant competitor of SC Johnson and Son's Baygon, an Indonesian-based company. Euromonitor International (2018) reported strong growth in the home insecticide industry due to the increasing cases of mosquito-borne diseases, rising incomes, and education campaigns that support its sales. It added that insecticide coils are far more prevalent in rural areas and low-income communities due to their affordability and value. *Katol* is needed in a tropical place like the Philippines because of its humidity and torrential rains during monsoon seasons, which drive Filipinos to use this product. The presence of a local manufacturer makes *katol* more meaningful to the country as it is not just about being tied geographically but also giving more economic significance to its usage.

The researchers believed that a more authentic look into the process of making *katol* could be achieved by getting the participation of Greencoil Industries. Aside from the fact that it is the largest manufacturer of mosquito coil in the country, this study also wanted to state that it is always better and more helpful to patronize locally made products. The 'Lion-Tiger Katol' has been part of Filipino homes since the company introduced its insecticide coils. Significantly, this paper draws its content from the pioneer itself. This paper never intends to promote Greencoil Industries and its products. It is a mere concurrence that the company suited the paper's requirements to fulfill its objectives in designing a teaching model, i.e., culture oriented – based on the culture of *katol* production. This teaching model opens a new paradigm – a more expansive vista for Filipino teachers and educators worldwide to establish a difference in teaching using the Katol Culture-based Teaching Model or the KCTM. This KCTM effectively instills the learners' consciousness and national identity when effectively used in the instructional process. Once another research tests its efficacy, its methods will be comparable with the production of *katol* repellent. Currently, the company is open to several studies to make the production of *katol*, i.e., safe for the users' health conditions, comparable, and with the KCTM efficacy.

Generally, this study is highly significant for *katol* users, Filipino culture, and teachers. There are scientific facts that most *katol* users have yet to seem to understand, but it affected their ways of using the product. Enlightening them of this information might reduce exposure to health risks and inappropriate usage. It is worth remembering that culture is also an essential aspect of one's ethnic identity. Many products like *chicharron*, *rosquillos* (Cosido et al., 2015), and *puso* (Cabasag et al., 2021) paved the way for the rise of the meaningful cultural identity of Cebuanos. They represented people's history, local economy, and heritage. As for *katol*, it might not be an original product of any place in the Philippines, but its presence and origin may put light on

some parts of the Filipinos' missing sociocultural identity. This paper considers the cultural perspective as a meaningful way to redefine *katol*. Also, there has been much artistic research that led to the creation of pedagogical designs of teaching based on previous literature (Cabasag et al., 2021; Inocian & Luzano, 2022; Cuyno et al., 2019; Inocian et al., 2019; Balaza et al., 2021; Saguin et al., 2020; Inocian et al., 2020; Pacaña et al., 2019; Inocian et al., 2020; Tejada et al. 2018; & Inocian et al., 2019). The literature, as mentioned above, documented some Cebuano cultures that innovated culture-based teaching models. Based on its findings, culturally oriented teaching models are crafted as a product of innovation. Hence, redefining *katol* and its process could lead this paper to meaningful signification in a contextualized teaching model.

Review of Related Literature

It is said that culture trumps everything (Grodnitsky, 2017). The economic and cultural significations of *katol* trump the basic fabric of Filipino identity in protecting life from the havoc of a mosquito-killer disease – dengue. With this cultural fabric, economic and cultural attributes are vital in academia. Its processes in producing *katol* serve as the basis for designing culture-based oriented teaching. The lack of literature and studies about mosquito coil inspired this paper to initiate a meaningful approach in redefining the subject that would put on a new perspective for the academe in making *katol*-related studies.

Economic Signification of Mosquito repellents

Vector-borne diseases impose severe risks to public health and negatively impact countries' economic development (Mavundza et al., 2013). Insect repellents are available at an affordable economic price (Das et al., 2016). Much cheaper than this available in the market is *mosbar* or repellent soap (Yap, 1986 in Rowland et al. 2004). The use of essential oil (EO) repellent is found economical, safe, and less toxic compared to the use of synthetic elements (Hazarika et al., 2022; Zhang et al., 2022). As deemed in the literature mentioned above, the economic significations of the use of mosquito repellents depend on their low toxicity, i.e., affordability of one's budget and the latest innovations using natural elements rather than synthetic materials.

Perceived Risks of Katol

While producing mosquito repellents is an antidote to mosquito bites to prevent dengue, malaria, and other related diseases, these repellents negatively affect the body. Liu et al. (2003) unveiled the alarming health implications of the emission rates of pollutants from burning a mosquito coil. This is supported by Hazarika et al. (2022) that synthetic repellents are harmful and toxic to the body. It was suggested that some brands pose a higher risk of air pollutants, which vary due to the different content of organic fillers or biomass used for smoldering (Liu et al., 2003). Botanical compounds are one of its solutions, even if it is highly volatile (Lv et al., 2022). It asserted that people should know how to choose cleaner brands of mosquito coils to reduce exposure to the risk of respiratory illness. Zhang et al. (2010) supported the findings of Liu that the emission rates of toxic compounds depend on the types of base materials used in making *katol*. He evaluated a new type of mosquito coil made from charcoal powder and compared its emission rates with many current-market brands. Findings showed that the charcoal-

based coil has lower emission rates than conventional brands. While it is clear that many manufacturers have or have not followed developments like this, what matters most is that companies have learned to adapt to the call to have healthier products. This paper adds significance to this development. The series of ongoing laboratory experiments to ensure safety in people's health conditions manifests the connection between culture and science.

The connection of katol in Philippine culture

The nexus of the arts and sciences can never be underestimated. Scientists are accessing knowledge of the natural plants and oils which ethnic communities use to investigate the bioassay of some native species of plants potential for essential oils in the production of mosquito repellents. Basra and Singh (2022) found that residents have average knowledge, attitudes, and practices regarding the spread of dengue fever. Regarding disseminating dengue fever, media communication is used, like television, radio, and newspaper (Basra & Singh, 2022). This access to use knowledge in the investigation process and its dissemination is one aspect of culture.

There have been many products like *chicharron*, *rosquillos*, and *puso*, which paved the way for the rise of the meaningful cultural identity of Cebuano. Regarding *katol*, the study is culturally significant because this has been part of the way of life of Filipinos. There are scientific facts that most *katol* users have not seemed to understand; yet, it affected their way of life. Having a sound sleep at night protected by *katol* is a cultural practice that every Filipino buyer never forgets to purchase in the market. The *katol* represents people's local economy and culture. Though *katol* is not an original product in any place in the Philippines; but, its creation may lighten some parts of the Filipinos' missing identity. Hence, this paper considers the cultural perspective as a meaningful way to redefine *katol*, not as a repellent but as a culture-based teaching model.

Culture-based education and teaching

The use of mosquito repellents was influenced by the level of education and socio-economic status in India (van Eijk et al., 2016). In education, Kishore et al. (2003) studied the impact of health education intervention on knowledge and community action for malaria control in Delhi. They collected post-intervention data to assess and analyze the management control of malaria in the slum areas of Delhi. The study found that the knowledge of community members about the causes, seasons, and breeding places of mosquitoes causing malaria and the attitude and behavior of their health workers significantly improved statistically after the intervention (Abaya, 1994; Greif, 2020a; Greif, 2020b). In the Philippines, the government delivered several information drives and action training to fight dengue or malaria infestation, most of which were relatively successful. However, this education also involves using preventive materials like home insecticides. While many types of research have outlined the safety of using *katol*, this paper also highlighted the ways of making *katol* that can be replicated in the teaching process. The findings of this study would explain that education about home insecticide also matters as no one should avoid dreaded diseases by forming another. Hence, promoting this information drives education stakeholders' KCTM utilization and patronization. Also, there has been a lot of cultural research that led to the creation of pedagogical designs of teaching like the Ugmad Teaching Model of Inocian et al.

(2017) on the traditional farming practices of upland areas in Cebu, Philippines; the PUSO Teaching Model of Cabasag et al. (2021) in giving recognition of puso weaving industry in Cebu; the Gitara Teaching Model of Inocian and Luzano (2022) in recognizing the culture and economic significations of guitar making industry of Lapu-Lapu City; the Labada Teaching Model of Cuyno et al. (2029) in recognition of the laundry cultural practices of women in the rural areas; and the COVID-19 Teaching model of Saguin et al. (2019) that responded on the current realities of COVID and other contemporary issues in society. Similarly, making *katol* could lead this paper to meaningful associations in the sociocultural and scaffolding theories of education, thus creating a significant teaching model.

Objectives of the Study

This study developed an augmented perceptual picture of *katol* or mosquito coil in the Philippines by (1) analyzing its economic and cultural significance, (2) identifying its usage issues, and (3) designing a culture-based teaching model based on its manufacturing procedures.

2. Research Methodology

2.1. Research design

The study utilized a grounded theory design. As an interpretive approach to research, grounded theory is anchored on a sufficient amount of data by searching for patterns systematically and by extrapolating concepts from data (Walsh & Rowe, 2022). The processes in the actual production of *katol* repellent, as verbal data, patterns were determined based on the signifiers of *katol* to create the semiotic significations of the KCTM. This KCTM was exemplified and elaborated in the instructional process using the Heideggerian Interpretive Phenomenology. A Heideggerian Interpretive Phenomenology is a design that deals with the 'pathways' in the research process where nothing is viewed as constant; everything is changing and continuously evolving (Conroy, 2003). In Heidegger's clearing-in-the-woods metaphor, none in research are paved in concrete; it has to create a new pattern of understanding (Conroy, 2003) or a new paradigm. Hence, the KCTM as an innovative teaching model is a philosophy drawn from its existing *katol* production processes – as a unique pattern of understanding on how culture-based lessons are conducted in the classroom as found in Table 1 and its Interpretive Philosophical Stance in Figure 1.

2.2. Research Tool

Direct observations in regular visits, unstructured interviews, and data mining of secondary sources were used as primary tools and techniques to gather data. The interview guide was checked and validated by three social science experts, which were used during the interview of the research participants. During the direct naturalistic observations in the manufacturing site, the processes in the production of *katol* and the interview of the research participants were documented through a video camera. The documentation served as a basis during the actual transcription of verbal data.

2.3. Research Environment

Greencoil Industries is the research environment of the study. It is located in Mandaue City, Cebu, where factory visits, demonstrations, and in-depth interviews with the owner and factory manager were conducted. To triangulate verbatim accounts, ten user families of *katol* in Cebu City and Surigao del Sur, Philippines, were asked questions to provide vital information and meaning to confer the data given by the *katol* stakeholders. Greencoil Industries is the largest local manufacturer of *katol* in the country.

2.4. Inclusion and Exclusion Criteria

In the selection of the factory stakeholders, an enumeration sampling was used. At the same time, convenience sampling was used in selecting other research participants, like the *katol* users, after a letter of permission was secured. The criteria for choosing the primary informants are as follows: owner or employees of the *katol* factory who worked for at least five years in the company, engaged in the actual and daily process of *katol* production, and become familiar with the nitty-gritty in the production process. While the *katol* users in Cebu and Surigao were selected in a convenience sampling using these criteria: they come from a typical poor and middle-income family, have been a user of *katol* for at least five years, and are accessible to researchers' location and safety.

2.5. Data Gathering Procedure

After the letters of permission and intent were sent to the *katol* stakeholders and users, an initial meeting was held to agree on the official time and place for the scheduled visit, demonstration, and interview. When everything was set, the interview guide, video camera, notepad, pens, letter of informed consent, tokens, and other provisions were prepared. Before intrusion into the factory, the researchers restated the primary purpose of the conduct of the study, the anonymity of their whereabouts was kept confidential. Questions in the interview guide were asked in either English or the vernacular versions for the non-English speakers. Responses of the research participants were recorded in both audio and print. The print recordings are indicated in the researchers' field notes that also reflected notes generated during the actual naturalistic observation of the site and demonstration made by the *katol* production workers. After the engagements with the research participants, words of gratitude were expressed.

2.6. Data Analysis

A narrative analysis of the research participants on the identified concepts based on specified codes (Swan & Manning, 1994) was used to analyze the verbatim accounts. Narrative analysis is a method in social research that deals with the research participants' narratives, like their accounts and stories of reality (Earthy & Cronin, 2008). Through a semiotic analysis, the processes of *katol* production were used as a signifier to create the signified KCTM. Semiotic analysis is a systematic analysis of symbols (Swan & Manning, 1994). In the study, the vernacular terms of *andama*, *dugmoka*, *sagola*, *plansadaba*, *bulmaba*, and *dumalaba* in the production of *katol* were analyzed as signifiers or displays of symbols to generate translations and meanings.

2.7. Ethical Considerations

After a letter of informed consent was secured from the Ethics and Review Committee, these were reproduced based on the total number of expected participants. Before the interviews were conducted, the informed consent letter was read to the participants regarding their participation. Those who expressed consent were asked to affix their signature, and those who expressed regret were asked to leave in the designated location so as not to deprive their economic activities. Assurance of anonymity was also given to ensure their confidentiality. After the interview and demonstration were conducted, they gave them a modest token of appreciation and refreshments.

3. Results and Discussion

After a thorough interview and encounter with the people behind the manufacturing of mosquito coil and its users, this study has gathered significant data suited to answer the research objectives. Below is the discussion of the results for each problem:

A. Economic Significance

Katol, as a product, has helped not only Filipino families in the health aspect but also economically. When asked about how mosquito coils have helped them aside from avoiding mosquito-borne diseases, user informants responded:

UI 5: "*Katol is accessible and sellable in sari-sari stores. You can buy one piece if you cannot afford one box. Unlike 'katol,' other mosquito repellents such as lotion and spray can only be bought in bigger stores.*"

UI 9: "*Katol can be used more easily than lotion or spray, and it is more affordable and known to buyers. So I prefer selling 'katol' in my store because it's what the people usually look for.*"

These utterances suggest that *katol* is economically significant to the informal sectors. In economics, the informal sector refers to small-scale enterprises, underground businesses, and other services whose income is not regulated or accounted for by the government. *Sari-sari stores* or convenience stores are the most common form of these businesses. Despite being insignificant to the national income, the informal sector plays a significant role in the economy, especially in a third-world country. This is because they provide an answer to the needs of small consumers. Not all buyers can buy a bulk or a pack of products in supermarkets. Some of them can only buy one sachet of shampoo or just one piece of *katol*. This suggests that the economic significance of *katol* lies not only in its affordability but also in its property of being sellable in the informal sectors, which then helps low-income earners in their day-to-day struggle. Aside from this, user informants also said that:

UI 2: "*Some people use it for packing or sealing products. I also sometimes use it in school projects like making paper designs.*"

UI 6: "*My grandmother used it in sealing a pack of peanuts. She then sells them for five pesos each.*"

UI 4: "*Katol is much less hassle and effective in driving away mosquitoes in an open space, but I think it's more than that. We use katol in selling goods like repacking foods. It's very convenient and helpful.*"

So aside from being sellable in *sari-sari* stores, another significance of *katol* in the informal sector is its utilization for the repacking process. You can see that *katol* is vital for people who earn from small livelihoods and businesses. It is then imperative to conclude that mosquito coils create a significant culture in the informal sector of the Philippine economy.

B. Cultural significance

Most local places in the Philippines are identified by their primary products or delicacies. To name a few, Cebu has *inasal* and *chicharron*, Davao has durian, and Mindanao has *sarimanok*-designed hats and fabric. The mosquito coil has no cultural significance to Filipinos or any Philippine locality. If a place is to claim the mosquito coil, it will be Japan and not the Philippines. The cultural importance of *katol* in the Philippines can be described from a unique perspective. One way to put it is that it creates a possessive version of cultural diffusion and assimilation. Possessive in a way that it enabled Filipinos to own and establish a local term that is not native in origin. At the time, *katol* was originally a brand of mosquito coil in Japan, coming from the Japanese word '*Katori-Senko*,' which means mosquito coil (Gordenker, 2013). It is developed to become the local reference term for mosquito coil in the Philippines (Yu-Jose, 2001). In Cebu, Philippines, *katol* means itchy after being bitten by a mosquito, and to prevent it is to scare the mosquito through a lighted coil called *katol*. So, we can assert that the term *katol* is a cultural bridge between the Philippines and Japan.

Aside from this, *katol* also created a norm for avoiding mosquito-borne diseases among Filipino families. As the patronage of Filipinos to mosquito repellents is supported by geographical explanations, it is significant to note that mosquito coil is still a stand out despite the continuous innovations and other product technologies that could be deemed more effective than *katol*. This product persisted in the market not just because it is more affordable but because, for Filipinos, mosquito repellent already means *katol* and nothing more. This strong association level suggests that *katol* is already a Filipino brand or identity in responding to mosquito-borne diseases. The following utterances from the user informants support this.

UI 7: *We have been used to using 'katol' since the beginning. We are not used to lotion and spray.*

UI 10: *Katol is suitable for Filipinos' taste, pang masa (common).*

UI 2: *We have been used to thinking that dengue is always 'katol', especially in rural areas. Even our family still uses it despite having lotions available.*

UI 4: *People are already used to thinking that 'katol' is cheap but effective in driving away mosquitoes, so they no longer think of something else to use.*

C. Usage Issues

Greencoil Industries has demonstrated how a mosquito coil is manufactured. They also showed the types of base materials used and essential factors in manufacturing to create a safe product. According to the chemist informant from the company, there is no significant harm posed by the insecticide chemicals mixed with the ingredients of *katol*. These active ingredients are toxic to mosquitoes and other insects but not to humans. One proof is that the Food and Drug Administration approves the chemicals used. This draws on one of the major concerns in using *katol*. As FDA classifies

mosquito coils as hazardous substances that need FDA registration, users must be careful when choosing a brand. Recent news showed that some China-made products, such as Baoma and Zenden, are being sold in the market despite being unregistered and approved by FDA. They are found to have cancer-causing compounds due to the wrong type and amount of chemicals used.

Another concern in using mosquito coils is the way people utilize the product. Studies mentioned above have made it clear that the harm of using *katol* comes from the smoke instead of the insecticide. This explains why the mosquito coil is designed to be utilized in a well-ventilated area. Due to the smoldering property of mosquito coil, which causes respiratory harm similar to that from a cigarette, it is strongly suggested that users should keep enough distance from the *katol* when using.

D. The KCTM

The manufacturing process of *katol* has provided a cooperative learning model that emphasizes individuality, materials' effectiveness, and constructivism. Before further discussion, be familiarized with the steps in manufacturing mosquito coils:

1. *Preparation of raw materials* (coco shells, coffee pulp, wood powder, onggok powder, and gum resin) - Raw materials are prepared by screening, chopping, then put in the rotary dryer to reduce moisture content.
2. *Pulverizing* – the raw materials are then pulverized until they become a fine powder sized to minus 100 mesh collected by cyclones and filter bags.
3. *Mixing* – all raw material powders will then be poured into a rotary mixing machine to mix it thoroughly.
4. *Kneading* – the mixed powder will be transferred to the kneader, add the actives (insecticides), cassava starch, and coloring matter.
5. *Stamping and drying* – the coils are formed through a stamping machine. One stamp operation produces seven double coils. Wet coils are put on screen rays, then placed in the pushed carts for drying (in the tunnel dryer).
6. *Quality control* – the final suitable coils will now be harvested and undergo a quality assessment before being transferred to a packing machine.

These six processes were analyzed through semiotic analysis and interpretive phenomenology anchored on Lev Vygotsky' Sociocultural theory of learning. Vygotsky describes that the social environment greatly influences learning as a social process (Pathan et al., 2018). In the context of KCTM, the cultural climate of *katol* production, once familiar to the learners, may become a 'treasure trove' for effective learning when contextualized in the learning process.

The KCTM's Interpretive Philosophical Stance

The KCTM is a cyclical model of curricular and instructional innovation. Following the Heideggerian concepts of interpretive phenomenology, the process of *katol* coil production is interpreted in a creative way to tweak the need for a culture-based model of teaching in response to the mandate of Republic Act 10533 on the use of localization and contextualization of instruction in the teaching of basic education in the Philippines. In this innovative model, there are six essential steps in the entire process: *andama* (prepare), *dugmoka* (buzz), *sagola* (assimilate), *plansadaha* (systematize), *bulmaha* (shape), and *dumalaha* (control) with quality.

First, *Andama* necessitates the imperative preparation of the instructional phase, which includes preparing the needed instructional materials and the anticipated learning activities. This also covers the psychological and emotional preparations of teachers and learners in the actual learning engagements. This presupposes the application of the principles of instructional planning in educational leadership. Creatively, this nuances the cultural imperative *andama ang kinanghanganun*, i.e. to prepare what is necessary for the learning process.

Second, *Dugmoka* accepts the nuances of crushing the fossilized knowledge to tickle new and exciting possibilities in learning. This starts from the personal paradigm shift to a more collaborative and engaging argument in forming agreements and disagreements by breaking the walls of the status quo and other forms of ineptness, squalor, intolerance, and apathy. Hence, when this becomes a habit, it will surely make learners live the essence of *dugmoka ang mga gabing buna-buna ug gibati*, i.e., to eliminate fossilized thoughts and hatred for the endorphins to flow and flicker meaningful insights.

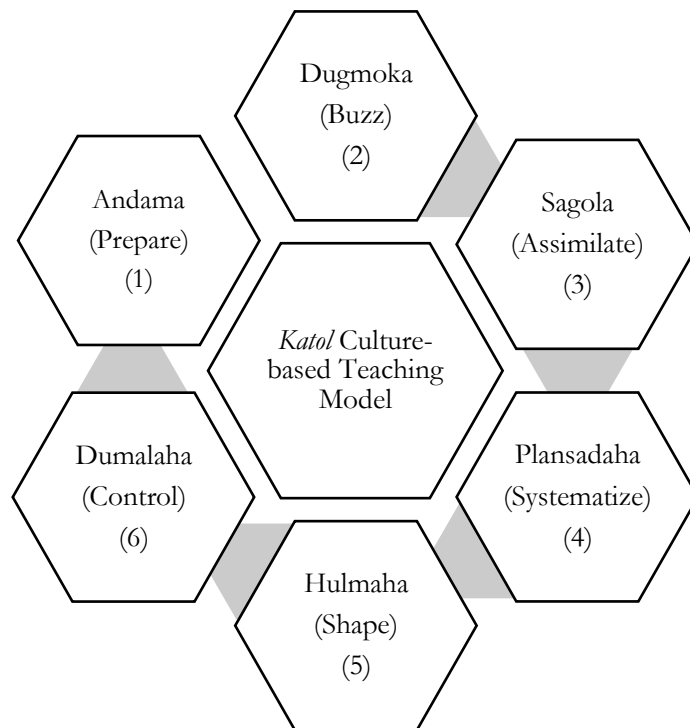


Figure 1. The Cyclical Process of the *Katol* Culture-based Teaching Model or KCTM

Third, *Sagola* welcomes the results of *dugmoka*, when the learners think from multiple perspectives, they can now quickly join the social interaction in Cooperative

Learning groups. They can view a lot of possibilities by listening to other members of the team. They can make suggestions without making sarcasm and other forms of inhibition. Following the tenets of open communication, they are free to express themselves with respect among each other in the team. The teacher facilitates the integration process of learning from different perspectives. In this context, the learners learn to do: *sagola ang mga lain-lain huna-huna ug gibati*, i.e., synthesizing the collective thoughts and feelings of the group.

Fourth, *Plansadaba* receives the results of the *sagola*. Whatever new learning the learners achieve has to be systematized and repeated thereafter using multiple contexts in worksheets, simulations, gamification, written reports, and publications. This accounts for the learners' response to situated learning in an Open Learning Environment (OLE). This mastery learning task anticipates using the actual transfer of knowledge: *plansadaba ang mga nakat-uman ug nabatyagan*, i.e., using the cognitive and affect lessons learned in real-life situations.

Fifth, *Hulmaha* is the actual crafting or doing of what is planned in the *plansadaba*, where the learners in various teams decide for the common good of the group. They make the other instructional media, props, and other logistics for their chosen academic presentations. They have to craft the needed rubrics for rating their presentations and anticipate the pros and cons of the team presentation. *Hulmaha ang kinabanglanung gamit*, i.e. shaping and anticipating the needed logistics and plan for the team presentation to ensure quality performance.

Sixth, *Dumalaba* culminates the instructional process, where teachers and learners monitor the quality of learning performance through the use of different forms of assessment. *Dekalidad nga pagdumala*, i.e., quality control in assessing and evaluating students' learning. The use of rubrics and checklists necessitates the practical examination of products and tasks of the learners to ensure effective computations of grades and other forms of learning evidence.

The Required Steps of the KCTM as Contextualized in the Teaching of Asian Geography

The *Katol* Culture-based Teaching Model or KCTM reflects the cultural practices of producing Lion Tiger *Katol* as a mosquito coil to prevent mosquito biting in tropical villages of the Philippines. Tweaking the artistic process of the actual production of *katol* to bring this to the instructional landscape in the classroom setting is a challenging response that promotes not only the *katol*-making industry in the Philippines but also the awareness of this culture that will ring a bell of significant attention for a culture-based instructional context.

Step 1: *Andama*. The teacher prepares the use of Flipped Classroom for the learners to access online technology (Dayagbil, Pogoy, Suson, and Derasin, 2018). The learners in Grade VII Social Studies on Asian Civilization access the links provided by the teacher. They study the information found in the accessed links provided on the online political map of Asia and videos to prepare for the *dugmoka*.

Step 2: *Dugmoka*. The use of Problem-based Learning supports the realization of the *dugmoka*, where the learners unfreeze their pre-conceived bias about the digital technology they accessed. With the help of the teacher's guide questions, the cooperative

Table 1. *The Katol Culture-based teaching model*

The <i>Katol</i> Culture-based Teaching Model (KCTM)				
Process of <i>Katol</i> Production	Descriptive Manufacturing Process	Cultural Background	The instructional Contexts	Anchored Learning Theories
1. Andama	<i>Andama</i> is the preparation of raw materials in the production of <i>katol</i> coils.	In <i>Andama</i> , the precision of measurements is determined to produce the desired <i>katol</i> coils.	Preparation of the instructional materials for the actual teaching provides proper motivation to learn.	Flipped classroom requires the maximization of culture-based online technology.
2. Dugmoka	<i>Dugmoka</i> is pulverizing the needed raw materials in preparation for the actual mixing process of <i>katol</i> .	<i>Dugmoka</i> requires proper concentration to produce fine powder in the filter bags.	Engaging Lessons in brainstorming, where learners create webs and other graphic organizers that they find relevant to document their learning process.	Problem-based learning using localized, indigenized, and contextualized culture-based tasks and materials.
3. Sagola	<i>Sagola</i> is the mixing of the material powders in a mixing machine.	<i>Sagola</i> observes the proper utilization of the mixing machine to blend the required material powders.	They are learning the topic as a whole, where the learners successively connect each topic, establishing transition and progression in holistic learning.	Integrative learning in the context of the learners' cultural realities and the nation's realities concerning global issues.
4. Plansadaha	<i>Plansadaha</i> is the process of kneading the essential elements, including the chemicals, the starch, and the coloring materials.	<i>Plansadaha</i> follows repetition in kneading the essential elements to produce the required <i>katol</i> dough.	Learning retention is achieved when mastery of learning is emphasized through repetition.	Mastery Learning is done through daily exercise and worksheets to master the learned skills
5. Hulmaha	<i>Hulmaha</i> is forming, stamping, shaping, and drying the <i>katol</i> coils.	<i>Hulmaha</i> requires detailed molding in shaping the coils in clean trays, carts, and tunnel dryers.	Learning generates meaning based on one's schemata attributed to the association, accommodation, and equilibration.	Cognitive and Constructivist Learning based on the learners' experiences
6. Dumalaha	<i>Dumalaha</i> is the process of quality control in the production of <i>katol</i> coils.	<i>Dumalaha</i> serves as the last process of determining the product quality before packaging and labeling the product.	Assessment and feedback through authentic assessment	Self-Directed learning is apt when the learners are aware of their learning process, which they know how to document.

learning team members engage in brainstorming on the factors of political regionalization of Asian countries according to East, Southeast, South, Southwest, and North-Central Asian regions. The members of the team can speak using their native local language to enhance participation in the team discussion.

Step 3: *Sagola*. Integrative learning is evident in this step when the alphabetized list of Asian countries is provided to the learners. With this list, the class is divided into five teams such that each team takes care of one region. They identify the different countries assigned to them according to the designated Asian region in each of the respective groups. They assimilate the land area, capital cities, climate, and weather conditions, including these countries' socio-economic status, in scaffolding their understanding of political regionalization in Asia.

Step 4: *Plansadaba*. This is the use of Mastery Learning, where the learners take the challenge to observe a system for a more meaningful understanding, i.e., to create ridiculous associations or mnemonics of these countries by region to fix retention in their long-term memory. The ridiculous associations comprise fun and laughter, substantive information, and creativity.

Step 5: *Hulmaba*. Within this step, the learners carefully shape the learning process. This step allows the team members to present their learning outputs as a visible indicator of a successful learning outcome. The ridiculous associations in the mnemonics are matched with corresponding visual scaffolds like maps, photographs, pantomimes, and simulations, highlighting the team members' creativity. They also create the needed rubrics for a rating or modify the existing ones to fit the desired presentation of the learning task.

Step 6: *Dumalaba*. This is the last step of the teaching model, where the team members present their actual presentation on stage. Each of the five team leaders presents a synthesis of the assigned political region in Asia. They have to manage their time, follow the instructions of the team leaders, and rate their team performance based on the agreed rubrics by the team.

4. Conclusion and recommendations

This study concludes a new redefinition of *katol* – a mosquito repellent that does not contribute any harm to human individuals' health conditions; but a symbol that gives birth to a new paradigm in the instructional process that is innovative, culture-based, and reflective. The *katol* is culturally significant as it shares a common ground among Filipinos and presents extraordinary evidence of cultural diffusion and assimilation. This repellent as a symbolic object is also a signifier of the livelihood opportunities in the informal sector of the country's economy. Spiral *katol* also provides a cooperative learning model – a signification of conceptualizing and creating KCTM constructively. The KCTM breaks the fundamental structure of pedagogies that are paved concrete that succumbs teachers to be pure traditionalists. KCTM opens vast opportunities for teachers to be broadminded, reflective, creative, and sensitive to their cultural backgrounds. The study further recommends surveying the efficacy of KCTM as one of the innovative culture-based cooperative learning strategies.

References

- Abaya, E. C. (1994). *Cultural politics of disease control: State-community relations in the struggles against malaria in the Philippines*. Michigan State University.
- Balaza, JM. et al. (2021). Financial literacy integration in the K to 12 social studies curricula in the Philippines: Basis for a Contextualized COVID-19 Teaching Model. *Psychology and Education Journal* 58(3), 802-813.
- Basra, G.K. & Singh, S. (2022). Cross sectional study of dengue fever related knowledge, attitude and practice among different socio-economic groups of population on control of dengue and its vectors in Vijay Nagar area of Ghaziabad (Uttar Pradesh), India. *International Journal of Mosquito Research*, 9(5), 34-39.
- Cabasag, M. A. et al. (2021). The culture and economic attributes of puso street food industry: Basis for a contextualized framework of puso teaching model. *Journal of Research, Policy & Practice of Teachers and Teacher Education*, 11(1), 63-79
- Conroy, S. A. (2003). A pathway for interpretive phenomenology. *International journal of qualitative methods*, 2(3), 36-62.
- Cosido, ICP., et al. (2015, Part I). Carcar chicharon: A potential for tourism impact studies. *Asia Pacific Journal of Multidisciplinary Research*, 3(5), 163-170.
- Cullum-Swan, B. E. T. S., & Manning, P. (1994). Narrative, content, and semiotic analysis. *Handbook of qualitative research*, 463-477. https://www.depts.ttu.edu/education/our-people/Faculty/additional_pages/duemer/epsy_6304_class_materials/Narrative-content-and-semiotic-analysis.pdf
- Cuyno, E. et al. (2019). A complementation of the labada teaching model for a gender sensitized society. *International Journal of Advanced Research (IJAR)*, 7(1), 23-34.
- Das, K., Vasudeva, C. & Dang, R. (2016). Economical novel formulation and evaluation of herbal oils for mosquito and house fly repellent activities. *Annals of Phytomedicine* 5(2), 91-96.
- Dayagbil, F.T., Pogoy, A.M., Suson, E.I.B. & Derasin, C.V. (2018). Flipped classroom in teaching and learning. *CNU Journal of Higher Education*, 12 (0), 30-41. <https://jhe.cnu.edu.ph/index.php/ojs3/article/view/21>
- Earthy S. and Cronin, A. (2008). Narrative Analysis. Chapter in N. Gilbert (ed) *Researching Social Life*, 3rd Edition, Sage.
- Euromonitor International (2018). Home insecticides in Asia Pacific. <https://www.euromonitor.com/home-insecticides-in-asia-pacific/report>
- Gordenker, A. (2013). Mosquito coils. The Japan Times Retrieved on March 10, 2019, from <https://www.japantimes.co.jp/news/2013/07/15/reference/mosquito-coils/#.XRpihegzblU>
- Greif, M. M., Coralles, J., & Letigio, C. J. (2017). Identification of mosquito species in Cebu, Philippines. *IJMR*, 4(3), 113-116.
- Greif, M. M. (2020). The effectiveness of biological mosquito larvicide: bacteria (*Bacillus thuringiensis israelensis*) in liquid formulation. *International Journal of Mosquito Research*, 8(1), 90-94.
- Greif, M. M. (2020). Silica granules to embed *Bacillus thuringiensis israelensis*: biological control of mosquito larvae. *International Journal of Mosquito Research*, 8(1), 58-64.
- Hazarika, H., Krishnatreyya, H., Tyagi, V., Islam, J., Gogoi, N., Goyary, D., ... & Zaman, K. (2022). The fabrication and assessment of mosquito repellent cream for outdoor protection. *Scientific reports*, 12(1), 1-20.

- Home Insecticides in the Philippines (2019). Euromonitor International. England Retrieved on April 7, 2019, from <https://www.euromonitor.com/home-insecticides-in-the-philippines/report>
- Inocian, R., & Luzano, E. J. (2022). Cultural and economic attributes of guitar-making vis-à-vis the crafting of a contextualized gitara teaching model. *Culture & Psychology*, 1-28. 1354067X221132001.
- Inocian, R. B., Cuestas, N. J. P., Carin, J. K. L., & Canoy, J. D. E. (2019). Unveiling the indigenous art and craft of bakat and its economic significations. *Journal of Cultural Heritage Management and Sustainable Development*, 9(4), 445-467.
- Inocian, R. B., Dapat, L. C., Pacaña, G. B., & Lasala, G. M. (2019). Indigenizing and contextualizing the use of cooperative learning strategies. *Journal of Research, Policy & Practice of Teachers and Teacher Education*, 9(2), 1-18.
- Inocian, R. B. (2020). Exploring a Culturally-Responsive Model and Theory for Sustainable Development in Education Based on Cebuano Context. In *Sustainable Organizations-Models, Applications, and New Perspectives*. IntechOpen. <https://doi.org/10.5772/intechopen.94035>
- Irmano, K. J. V., Sitoy, E. D., Delgado, E. R., Lozano, E. B., & Inocian, R. B. (2020). Cebu's places named after endemic flora: basis for innovative teaching models. *The International Journal of Social Sciences and Humanities Invention*, 7(10), 6241-6255.
- Inocian, R. B., Callangan, A. L. I., Medrano, D. R., & Gualiza, W. G. (2020). Cebuano cultural identities: prospects for a culturally responsive pedagogy. *Journal of Research, Policy & Practice of Teachers and Teacher Education*, 10(1), 45-63.
- Inocian, R. B. (2015). Quadrant modelling in teaching (QMT): Responding to RA 10533 salient provisions. *Asia Pacific Journal of Education, Arts and Sciences*, 2(4), 71-78.
- Kishore, J., Gupta, V. K., Singh, S. V., Garg, S., Kaur, R., & Ingle, G. K. (2008). Impact of health education intervention on knowledge and community action for malaria control in Delhi. *The Journal of Communicable Diseases*, 40(3), 183-192.
- Liu, W., Zhang, J., Hashim, J. H., Jalaludin, J., Hashim, Z., & Goldstein, B. D. (2003). Mosquito coil emissions and health implications. *Environmental health perspectives*, 111(12), 1454-1460.
- Lv, N., Zhao, M., Hao, L., Zhou, X., Chen, H., & Zhou, H. (2022). Eugenol and carboxymethyl cellulose derived nanocoating with insect repellent and long-term antibacterial activity. *Industrial Crops and Products*, 190, 115902.
- Mavundza, E. J., Maharaj, R., Chukwujekwu, J. C., Finnie, J. F., & Van Staden, J. (2013). Larvicidal activity against *Anopheles arabiensis* of 10 South African plants that are traditionally used as mosquito repellents. *South African Journal of Botany*, 88, 86-89.
- Naz, M., Rehman, N., Ansari, M. N., Kamal, M., Ganaie, M. A., Awaad, A. S., & Alqasoumi, S. I. (2019). Comparative study of subchronic toxicities of mosquito repellents (coils, mats and liquids) on vital organs in Swiss albino mice. *Saudi Pharmaceutical Journal*, 27(3), 348-353.
- News Desk (2019). Philippines reports 56K dengue fever cases in Q1 of 2019. Outbreak News Today. Retrieved on April 7, 2019, from <http://outbreaknewstoday.com/philippines-reports-56k-dengue-fever-cases-q1-2019/>
- Pathan, H., Memon, R. A., Memon, S., Khoso, A. R., & Bux, I. (2018). A critical review of Vygotsky's sociocultural theory in second language acquisition. *International Journal of English Linguistics*, 8(4), 232-236.
- Rowland, M., Freeman, T., Downey, G., Hadi, A., & Saeed, M. (2004). DEET mosquito repellent sold through social marketing provides personal protection against malaria in an area of

- all-night mosquito biting and partial coverage of insecticide-treated nets: a case-control study of effectiveness. *Tropical medicine & international health*, 9(3), 343-350.
- Saguin, E. D., Inocian, R. B., & Un, J. L. B. (2020). Contextualized differentiated instruction in contemporary issues vis-à-vis the development of its COVID-19 model. *Journal of Research, Policy & Practice of Teachers and Teacher Education*, 10(2), 18-31.
- Sibanda, M., Focke, W., Braack, L., Leuteritz, A., Brünig, H., Tran, N. H. A., ... & Trümper, W. (2018). Bicomponent fibres for controlled release of volatile mosquito repellents. *Materials Science and Engineering: C*, 91, 754-761.
- TEDx (2017, October 5). *Gustavo Grodnisky: Culture trumps everything*. [video]. YouTube. <https://www.youtube.com/watch?v=KZMLNr3nKTA>.
- Tejada, C. J., Juarez, L. S., Molbog, M. M., & Inocian, R. B. (2018). Upland farming practices basis for a culturally-based ugmad teaching model. *International Journal of Advanced Research*, 6(12), 1066-1074.
- Van Eijk, A. M., Ramanathapuram, L., Sutton, P. L., Peddy, N., Choubey, S., Mohanty, S., ... & Sharma, S. K. (2016). The use of mosquito repellents at three sites in India with declining malaria transmission: surveys in the community and clinic. *Parasites & vectors*, 9(1), 1-13.
- Walsh, I., & Rowe, F. (2022). BIBGT: combining bibliometrics and grounded theory to conduct a literature review. *European Journal of Information Systems*, 1-22. <https://doi.org/10.1080/0960085X.2022.2039563>
- Yu-Jose, L. N. (2001). Building cultural bridges: The Philippines and Japan in the 1930s. *Philippine Studies*, 49(3), 399-416. Ateneo de Manila University
- Zhang, Z., Yang, K., Han, X., Yu, X., & Cheng, Z. (2022). Novel mosquito repellent fiber mat containing nepeta essential oil prepared by coaxial electrospinning. *Polymers for Advanced Technologies*, 33(9), 2943-2951.
- Zhang, L., Jiang, Z., Tong, J., Wang, Z., Han, Z., & Zhang, J. (2010). Using charcoal as base material reduces mosquito coil emissions of toxins. *Indoor air*, 20(2), 176-184.