



Javanese Ethnomathematics in a Book Of Centini

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Abstract: *As one of the most important Javanese literary manuscripts, Serat Centini is an invaluable source of knowledge about Javanese culture. This study aims to reveal how mathematical elements such as patterns, symmetry, grouping, and classification are reflected in the narrative and descriptions of Serat Centini, and how these concepts contribute to the cultural and social understanding of Javanese society through the perspective of ethnomathematics. The method used is textual and contextual analysis of relevant verses in Pupuh 11-20, focusing on the identification and interpretation of mathematical elements. The results show that Serat Centini consistently employs mathematical concepts in its narrative structure, such as symmetrical arrangements in ritual descriptions, the use of numerical patterns in grouping, and the classification of cultural elements, which reflect the deep understanding of mathematics in Javanese culture.*

Keywords: *Serat Centini; Ethnomathematics*

1. Introduction

Javanese culture is one of Indonesia's rich and diverse cultural heritages, encompassing various aspects of life from art and literature to religious traditions. As part of Indonesia's cultural heritage, Javanese literature can be said to be like a complex and interesting showcase of Javanese culture (Widiyarti, 2013). Wisdom Local as a cultural product that is born out of the need for values, morals and rules become a model for carrying out an action (Utami, 2017). Loss of local wisdom it could be said to be a cultural collapse, a collapse of civilization (Aryanto, 2023). One of the significant Javanese literary legacies that holds great value in understanding local culture and wisdom is the "Serat." Serat refers to collections of ancient manuscripts containing stories, teachings, and important cultural values within a society (Agusta, 2022). In Javanese literary tradition, "Serat" often refers to prose or poetry works that encompass various aspects of life, such as morality, religion, history, and local wisdom. Serat is usually written in classical Javanese and serves as a primary source for understanding the life and culture of Javanese society in the past. Serat not only serves as a repository for the knowledge and wisdom of ancestors but also as a medium to pass on traditions and teach values to future generations (Minardi, 2021).

One of the most well-known Serat to this day is the "Serat Centini." As one of the most important Javanese literary manuscripts, Serat Centini is an invaluable source of knowledge about Javanese culture. This work was written in the early 19th century by several poets under the command of Prince Adipati Anom Amangkurat III from the Surakarta Palace (Kristianto, 2021). Serat Centini consists of dozens of volumes and contains thousands of verses that cover various aspects of daily life, spirituality, customs, education, and even scientific knowledge. Serat Centini contains various sciences includes philosophers, Sufism, primbon, mystics, history, religion, predictions, symbols, customs, good, bad days and so on (Chodjim, 2019). This manuscript not only documents stories and moral teachings but also provides detailed descriptions of cultural practices, food recipes, traditional medicine concoctions, as well as the Javanese belief system and cosmology.

The monumental literary work from the Javanese tradition, often considered an encyclopedia of 19th-century Javanese life, was written under the command of Prince Adipati Anom Amangkurat III from the Surakarta Palace. Specifically, in Volume 2 of Serat Centini, stanzas 11–20 provide a profound depiction of Javanese society's life in the past (Musrichah, 2021). Through these stanzas, we can explore various aspects of the social, cultural, and spiritual life of the Javanese people of that era. However, to understand the values inherent in that culture, a broader and deeper approach is necessary. Some studies also adopt interdisciplinary approaches such as merging literary, historical and anthropological studies to provide a more complete picture about the context and significance of Serat Centini (Setiawan, 2019).

One intriguing approach to understanding literary works like Serat Centini is through the lens of ethnomathematics. Ethnomathematics is the study of how traditional societies comprehend, use, and develop mathematical concepts within their cultural context (Turmuzi, 2022). Ethnomathematics emerged as a new concept that was influential reciprocity between mathematics, education, culture, and politics. Ethnomathematics stated

as a study of mathematical ideas in primitive society (Irawan, 2022). Just as mathematics employs literary metaphors, literature is also abundant with ideas that can be detected and explored by a mathematically perceptive eye (Hart, 2023). Mathematics is knowledge obtained by reasoning that uses definitional terms carefully, clearly and accurately. Mathematics too serves to solve various kinds of problems in life, one of which is by using reasoning (Dwiyati, 2023). In Serat Centini, ethnomathematics can help us understand the messages embedded within the manuscript, both from aspects of patterns, symbols, and word repetitions. This not only reveals the philosophical and moral values contained within but also the mathematical knowledge system that might be embedded in the practical daily descriptions. Serat Centini contain various information related to arithmetic, including the pronunciation of numbers, the application of numbers in the form of numerology and pentungan, the use of cycles to express the year, mathematical calendars, and so on. The following are arithmetic-related themes contained in Serat Centini (Prabowo, 2021). Mathematics often believes in the presence of infinity (infinite), literature also often plays this. Of course, mathematics like anything remains other in the world, can be talked about and included in literature as content, such as topics in novels, dramas, poetry, or philosophical treatises (Rotman, 2011).

Research on Volume 2 of Serat Centini, particularly on stanzas 11–20, from an ethnomathematical perspective becomes relevant and important. Through this research, we can delve deeper into how the Javanese society of that time viewed the world, organized their knowledge, and related it to practical aspects of daily life, including their understanding of mathematics. Such research will not only aid in appreciating the valuable Javanese cultural heritage but also provide new insights into the relationship between literature, culture, and local mathematical knowledge.

2. Literature Review

2.1 Serat

A "Serat" refers to a type of traditional literary work in Javanese culture, usually in the form of manuscripts or written texts that contain various kinds of content, ranging from fictional stories, moral teachings, and philosophy, to descriptions of customs and traditions (Kristianto, 2021). The word "serat" in Javanese means "writing" or "manuscript," and these works are often written in the form of prose or rhythmic poetry (tembang). Serat not only includes mythological and legendary stories but also serves as a medium for conveying knowledge, including natural sciences, social sciences, and spirituality. These manuscripts were typically composed by court poets or members of the nobility who had access to higher education and writing traditions (Agusta, 2022). Structurally, serat are often written in ancient Javanese or Kawi, using traditional Javanese script. The content of serat is usually very rich and profound, providing insights into the worldview of Javanese society at the time. For instance, a serat could contain guidelines on ethics and morality, military strategies, agricultural systems, ceremonial procedures, and methods for making traditional medicinal concoctions. Additionally, serat often includes deep spiritual teachings, referring to Javanese philosophical concepts such as wisdom, cosmic balance, and the relationship between humans, nature, and ancestors.

2.2 Serat Centini

Serat Centini is a monumental literary work from the Javanese tradition, often considered an encyclopedia of Javanese life in the 19th century. Written under the command of Prince Adipati Anom Amangkurat III from the Surakarta Palace, this manuscript was composed by several court poets in the early 19th century. Serat Centini consists of 12 volumes containing more than 4,000 pages with approximately 722 songs or stanzas, making it one of the longest and most comprehensive Javanese literary works. This manuscript covers various aspects of Javanese society, including religion, philosophy, customs, etiquette, traditional medicine, science, arts, and cuisine (Aini, 2020). Additionally, Serat Centini contains the spiritual journeys and adventures of three main characters: Jayengresmi, Jayengsari, and Rancangapti, who seek the meaning of life and true knowledge. The content of Serat Centini is very rich and detailed, reflecting the local wisdom and knowledge passed down through generations (Minardi, 2021).

In the archipelago's literary treasures, the literary work entitled "Serat Centini" contains a lot of information about the lives of Javanese people, both in terms of aspects sociological, anthropological, psychographic, religious and political (Susili, 2022). Serat Centini is the result of Javanese culture which contains teachings that can provide instructions on how people should live to become good human beings, which morality, and happiness (Wibawa, 2013). This work not only records Javanese cultural practices and customs but also provides a detailed depiction of daily life, including methods of farming, cooking, and preparing traditional medicines. In the spiritual context, Serat Centini combines various belief systems, from Islam and Hinduism to local Javanese beliefs, showcasing the diversity and tolerance in the religious practices of Javanese society.

2.3 Ethnomathematics

Ethnomathematics is a perspective for studying literary texts in a transdisciplinary manner. It is an approach that attempts to combine the humanities (literature) with the exact sciences (mathematics) (Endraswara, 2024). According to Richardo (2017) Ethnomathematics is the science used to understand how mathematics works adapted from a culture and serves to reveal the relationships between cultures and mathematics. Ethnomathematics uses broadly related mathematical concepts with various mathematical activities, including counting, counting and measuring activities and so on (Iraratu, 2021). Ethnomathematics is a field of study that examines how various cultural groups understand, develop, and implement mathematical concepts in the context of their daily lives (Muhammad, 2023). The term was originally introduced by Ubiratan D'Ambrosio in the 1970s to describe the relationship between culture and mathematics. Ethnomathematics seeks to recognize and appreciate the unique ways in which various traditional societies use mathematics to solve practical problems, such as in agriculture, architecture, art, commerce, and navigation (Turmuzi, 2022). The ethnomathematical object can be a traditional game, traditional crafts, artifacts and activities (actions) that take the form of culture (Hardianti, 2017). Ethnomathematical elements are cultural elements that contain concepts mathematics, elements of mathematics can be in the form of traditional crafts, games traditional, traditional tools and all activities that take the form of culture (Nova, 2022).

This study involves analyzing mathematical practices that may not be considered formal mathematics in the Western sense but have equivalent concepts and functions. In detail, ethnomathematics examines mathematical elements embedded in cultural artifacts, language, number systems, geometric patterns, and traditional algorithms. Ethnomathematics can also be considered as a program aimed at learning how students understand, articulate, process, and finally use mathematical ideas, concepts, and practices that can solve problems related to their daily activities (Ekowati et al., 2017). For example, ethnomathematics researchers might study how indigenous communities use weaving patterns to teach geometric concepts to younger generations, or how traditional farmers use local number systems to measure and divide harvest yields (Lidinillah et al., 2022).

Endraswara (2024) explains that there are several concepts within literary mathematics, including: literary mathematics, which can actually be traced from the terms mathematics and literature; literary mathematics is often used in learning, such as typography in poetry; literary mathematics is a perspective that needs to be clearly understood, mathematics is not just arithmetic but provides a symbolic world of thought; literary mathematics is a perspective for understanding the phenomenon of literary texts by reading literary texts containing mathematical content.

3. Methods

Researchers use qualitative methods to explore and analyze Volume 2 of Serat Centini, particularly stanzas 11–20, from the perspective of ethnomathematics. Qualitative approaches are chosen because they allow for an understanding of the deep cultural meanings and contexts within the literary text. Data is collected through literature review and then connected with mathematical patterns found within the research object. This study involves a deep textual analysis, including the identification of mathematical patterns and symmetries within its verse structures. The collected data will be analyzed descriptively and interpretatively to uncover how Javanese society in the past understood and applied mathematical principles in their daily lives.

3. Results and Discussion

3.1 Geometry

"In the 'Pocung' manuscript, there are geometric elements found in verses that describe the scenery:"

"kayon gathuk ayom angubêngi gunung | dhuwêt dhuku jirak | jêruk jambu klampok wangi | kêpêl pakèl langsêp pijêtan kokosan".

The phrase "angubêngi gunung" (surrounding the mountain) includes a geometric concept (circle) applied in a geographical context, highlighting the circular patterns that may form around the mountain. Additionally, descriptions of various types of trees growing around the mountain, such as "jêruk jambu klampok wangi" (fragrant klampok guava) and "kêpêl pakèl langsêp pijêtan kokosan" (tall and parallel coconut palms), provide insights into the diversity and spatial distribution of plants. These can be analyzed using concepts of probability distribution in mathematics to understand patterns of distribution and growth tendencies of plants in specific environments more deeply.

Furthermore, descriptions of clothing and jewelry in Tembang Kinanthi exhibit geometric concepts. For example, descriptions of *sinjang* and *ukel* contain geometric elements such as lines, curves, and shapes:

"kang sêmêkan sêkar bênguk | malipis alus waradin | pungkasan tirah sacêngkang | sinalêmpitakên ngarsi | gathukan wironing sinjang | ukêl sèntêg amantêsi ||" (Kinanthi 2)

The descriptions of *sinjang* (belt) and *ukel* (waist ornament) contain geometric elements such as lines, curves, and shapes. Explanations of "sêmêkan" (circle), "sêkar bênguk" (benguk flower shape), and

"sinalêmpitakên" (crossing) demonstrate elements of geometric shapes used to adorn clothing. This reflects the use of geometry in cultural contexts to create beautiful aesthetics and enhance traditional attire.

Moving on to the Gambuh manuscript, this text often involves geometric elements, such as shapes and patterns used to describe clothing or situations. A good example is how santri and Endhang are depicted with symmetric patterns and regular shapes:

"hèh sira bocah catur | mungguh kowe êndi kang pinuju | endhang papat pilihên salah sawiji | santri sakawan umatur | saèstu lakung pakewoh ||" (Gambuh 4)

The depiction of Endhang and santri in symmetric patterns creates a sense of visual harmony and balance. The concept of "endhang papat" (four sides) and "santri sakawan" (many santri) reflects an understanding of geometric patterns and symmetric structures within the Javanese cultural context. This demonstrates that the use of geometry serves not only as a visual representation but also as a means to convey aesthetic values and harmony in daily life.

3.2 Grouping and classification

The concept of grouping and arrangement also appears in the Kinanthi manuscript. For example, four Endhang are arranged in groups with descriptions of similar but different clothing:

"Endhang Aniladi mungguh | jênar lir êmas sinangling | ngrasuk sinjang kêpyur pelag | pinantês satagèn kuning | wungu byur ingkang sumêkan | ukêl canthèl ngrujit ati ||" (Kinanthi 4)

The use of grouping and arrangement concepts in the Kinanthi manuscript is reflected in the description of four Endhang who are arranged systematically and consistently. Each Endhang is described with similar clothing but notable differences (Aini, 2020). This arrangement reflects mathematical concepts of classification and grouping, where similar objects are grouped together. In Javanese culture, such grouping may have deep symbolic or social meanings, reflecting social structure or specific status. Moreover, this systematic arrangement also creates visual harmony in the narrative, enriching the reader's experience and adding depth of meaning to the literary work. Then, Serat Maskumambang demonstrates the use of important mathematical concepts such as grouping and classification, where characters and story elements are categorized based on specific criteria. For example, the following stanza depicts various ritual actions:

"pan pinêlêng dènira amati ragi | cacêgah myang siyam | ngalowong apati gêni | wungu lan kungkum ing toya ||" (Maskumambang 17)

Each action such as controlling anger, fasting, avoiding fire, and bathing in water is grouped together in a stanza that depicts efforts of self-restraint and purification. This grouping not only aids in understanding the narrative structure but also shows the relationship and hierarchy among various story elements. It reflects how mathematical concepts such as grouping and classification are applied in culture and literature, helping readers to understand and organize information more systematically and structuredly.

3.3 Numbers and Patterns

In the Kinanthi song, it uses the concepts of numbers and patterns in its narrative descriptions. For instance, in the description of the four Endhang, the repeated use of the number four indicates a numeric pattern:

"Endhang Brahmani winuwus | babang awak mawèh kingkin | ngrasuk sinjang klungsu rêtna | satagèn cêmêng mathinthing | sêmêkan yuyu sakandhang | ijo ukêl gondhèl pèni ||" (Kinanthi 3)

The use of the number four in describing the four Endhang in the Kinanthi manuscript not only signifies a numerical pattern but also likely holds deep symbolic meaning within the context of Javanese culture. In Javanese culture, the number four often symbolizes harmony, balance, or completeness. In this case, the repetition of the number four may reflect the importance of harmony and orderliness in Javanese social and cultural life (Kristianto, 2021). Additionally, the number four can also refer to structured social divisions, such as the four social classes or the four cardinal directions that influence daily life. Then, in the song Mègatruh, there is a pattern and repetition that reflects an understanding of ethnomathematics, particularly in the laws of marriage and divorce. The song shows a systematic arrangement of the marriage, divorce, and iddah processes. For example, it provides detailed explanations about the sequence and stages of divorce:

"talak siji lan loro ing sajronipun | ngidah wadon garapsari | kalamun ngandhêg puniku | ngidah kuruk salin kamil | dadi sahe yèn wus miyos" (Mègatruh 23).

The Mègatrùh song reflects concepts of ethnomathematics through its systematic arrangement of marriage and divorce laws. The use of patterns and repetitions in describing stages of divorce, such as "talak siji lan loro" (divorce one and two), reflects a structured and consistent framework in the processes of marriage and divorce (Musrichah, 2021). This framework not only serves as legal rules but also creates patterns that are easy to remember and follow, akin to learning mathematical sequences and procedures. The repetition of these rules also illustrates how Javanese society uses patterns and structures in various aspects of their lives, including legal affairs and social regulations, which are integral to Javanese life and culture. Furthermore, Serat Maskumambang exhibits a precise structure and pattern in its narrative, much like many other classical Javanese literary works. Each stanza maintains a uniform and consistent syllable pattern in its line length. For example:

"raras ingkang karasikan tan winarni / wusing sapta dina / Mas Cèbolang angalèntrih / larut bayuning kang āngga ||" (Maskumambang 1)

The Maskumambang manuscript reflects patterns in its narrative, a common characteristic in classical Javanese literature. Each stanza exhibits a consistent and uniform pattern of syllables in its line length, as seen in the example stanza mentioned. This pattern creates a harmonious and symmetrical rhythm in Javanese literary prose, making it easier for readers to absorb and understand the narrative deeply. This structured framework also reflects a profound understanding of aesthetics and beauty in Javanese culture, where symmetry and regularity are considered important in art and literature.

3.4 Symmetry and repetition structure

In the song Pocung, it is presented in the form of Javanese song or poetry (geguritan) which has a very structured format. Each stanza in this song is arranged in structured lines with specific patterns. For example, the first stanza consists of four lines

Mas Cèbolang alon pangandikanipun / Nurwitri Saloka / Kartipala Palakarti / ulun ayun wèruh kang aran Barawa ||

Each stanza follows a pattern of 4 lines with clear pauses at the end of each line. This pattern reflects the concepts of symmetry and regularity, which are important elements in mathematics. A symmetric structure makes it easier for readers to follow the narrative and understand it within a coherent context.

The Serat Kinanthi showcases a rich use of structure and symmetry, which are key elements in ethnomathematics. The stanza structure in this text demonstrates repetitive patterns that reflect an understanding of rhythm and harmony. For instance, each stanza has the same number of lines, and each line maintains a balanced syllable count.

"Endhang Kismani puniku / cêmêng manis amrakati / ngrasuk sinjang tumènggungan / paningsêt satagèn abrit / mingis katon mung sasada / amathinthing matrêm kengis ||" (Kinanthi 1)

Each line consisting of an equal number of syllables demonstrates symmetry and balance, which are important concepts in mathematics. This symmetry can be seen as a form of periodic numerical pattern, where each element within the structure maintains a consistent and orderly relationship with one another (Muhammad, 2023). This indicates that in traditional Javanese literary works like Serat Kinanthi, there is an application of mathematical principles that not only embellish the literary work but also reflect the logical and structured thinking of the society that created it.

Furthermore, Serat Gambuh, like many other Javanese literary works, demonstrates systematic use of structure and symmetry in its narrative. Each stanza consists of a consistent number of lines, and each line contains a similar pattern of syllables. For example:

"sira lan santri catur / amanggona nèng kene sadarum / wusing prèlu sayèktine aku bali / kang liningan matur dhèku / maha wiku lampahnya lon ||" (Gambuh 1)

This pattern reflects a deep understanding of Javanese aesthetics and the influence of mathematics in their literature. Each stanza in Gambuh consists of five lines with a uniform syllable pattern. For example, in the presented stanza, there is a pattern of four syllables in each line, demonstrating clear regularity. The use of this structured format enhances the rhythm and harmony in poetry reading, while also reflecting the important concept

of symmetry in Javanese art. Furthermore, the patterns and symmetry in Gambuh also reflect a profound understanding of Javanese mathematics and philosophy. The consistent number of lines and similar syllable patterns show an awareness of balance and harmony in Javanese literature. Moreover, the use of words and language in these stanzas may also refer to philosophical or spiritual concepts related to numbers and the harmony of the universe.

5. Conclusion

Based on the analysis of Serat Centini volume 2 chapters 11-20 from the perspective of ethnomathematics, it can be concluded that mathematical elements such as patterns, symmetry, grouping, and classification are highly consistent and integrated into its narrative structure. This research reveals how the understanding of mathematics not only becomes part of Javanese literature in general but also reflects a profound mirror of Javanese cultural thought and values. The mathematical structures found in Serat Centini serve not only as aesthetic elements but also as representations of how knowledge is organized and thought about in Javanese culture. More broadly, this study underscores the importance of an ethnomathematical approach in understanding traditional literary works, such as Serat Centini. Applying textual and contextual analysis methods to literary works provides valuable insights into how mathematical concepts are reflected in culture and everyday life. Previous research results also contribute significantly to our understanding of how mathematical concepts have permeated various aspects of Javanese culture and how they are reflected in their literary works.

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