Literature Review: Ethnomathematics of the Angkola Batak Tribe in Mathematics Learning

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ABSTRACT

Objective: This research is to find out whether ethnomathematics in the Angkola Batak culture can be used in mathematics learning, and it seeks to know which cultural artifact or philosophy of ethnomathematics is more widely used in learning. Method: This research is a literature review by collecting metadata through the PRISMA model. Articles from Google Scholar from 2018 to 2023 were collected with the help of Publish and Perish. This methodology consists of well-defined review stages, eligibility criteria developed and explained from information sources, a literature search strategy, a literature selection process, and data synthesis based on the literature. Results: Of the 14 articles used as research samples, there were four articles each for elementary school (ES) and junior high school (JHS), meaning ethnomathematics is more suitable for use at elementary and middle school levels. Using cultural artifacts as a learning medium is more common than using philosophy from that culture. Novelty: This research produces information that learning using ethnomathematics is more suitable for children with a semi-concrete learning level.

INTRODUCTION

Education and culture are two elements that cannot be separated in everyday life because culture is a complete and comprehensive unity that occurs in a society. Education is a basic need for every individual in society. One thing taught in education is mathematics. Mathematics influences human character, such as religion, social life, language, economics, and so on (Hibatillah, 2020; Intania & Sutama, 2020; Ismail et al., 2022; Isro’iyah & Herminingsih, 2023; Jaelani et al., 2020). Humans try to develop this process using mathematics to fulfill basic life needs such as measuring, understanding modeling, and solving everyday problems (Juhaevah, 2022). Each place has different processes and characteristics according to the social culture of each region. Many scientists say that mathematics is integrated with culture.

Mathematics and culture are an interrelated unity. It is necessary to note the historical forms of mathematical ideas that occurred in various places in cultural contexts before traditions originating from past cultures were lost. D’Ambrosio (1985) said that mathematics practiced among cultural groups, such as ethnic groups that inhabit certain areas, labor groups, children of specific age groups, and professional classes, is called Ethnomathematics (Mania & Alam, 2021). Ethnomathematics is a science that is used to understand how mathematics is adapted from culture and functions to express the relationship between culture and mathematics (Hartati, 2022; Mania & Alam, 2021; Munthahana et al., 2023; Putra & Mahmudah, 2021; Sari et al., 2023). It can also be described as an art or technique developed by various people to explain, understand, and overcome problems in their environment. Ethnomathematics is a program that seeks to study how students understand, articulate, process, and ultimately use mathematical
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ideas, concepts, procedures, and practices and can solve problems related to daily activities (Ervi & Ambrita, 2022). Ethnomathematics is not new but has existed since the introduction of mathematics. Through ethnomathematics, mathematical concepts can be studied in cultural practices (Moriolkosu et al., 2020; Nurjanah et al., 2021; Prahmana & D’Ambrosio, 2020; Sari et al., 2022; Umbara et al., 2021).

Ethnomathematics aligns with constructivism theory, which helps students improve their understanding and knowledge of mathematics by connecting school subjects with their previous experiences and knowledge. Students at school come from different cultural backgrounds, and a teacher must respect these differences (Darling-Hammond, 2021; Joram et al., 2020; Karlberg & Bezzina, 2022; Lee et al., 2020; Rowan et al., 2020). When teachers respect differences in ways of learning that are influenced by culture, this will foster self-confidence (Alaei & Ameri, 2021; Cutri et al., 2021; Pishghadam et al., 2023; Suri & Chandra, 2021; Tuhuteru, 2023; Ulfa et al., 2021). Education is a process of transfer of knowledge as an interactive activity in learning which is carried out interactively (Ariani & Tawali, 2021; Rivadeneira & Inga, 2023; Sardi et al., 2022; Uzumcu & Acilmis, 2023; Wahyuuddin et al., 2022). Culture-based learning can be divided into three types: learning about culture, learning with culture, and learning through culture. Four things must be considered in culture-based learning, namely substance and competency in the field of study, meaningfulness, and learning process, assessment of learning outcomes, and the role of culture (Adlis et al., 2022; Bina et al., 2023; Faidah & Maarif, 2022; Fuad et al., 2020; Mustakim & Hasan, 2020). Culture-based learning emphasizes achieving integrated understanding rather than just in-depth understanding.

Indonesia is an archipelagic country; each island has different ethnic groups and cultures. Simple examples on the island of Sumatra consist of Acehnese, Minangkabau, Mandailing, Malay, and other cultures. Mandailing is the name of a tribe and region in the Mandailing Natal district, North Sumatra (Pane et al., 2022). The Mandailing tribe has similarities with other ethnic groups, such as the existence of a clan system and respect for customs. Mandailing culture has customs, heritage, or traditions that must be maintained and preserved by the current generation. Because Mandailing culture has characteristics that differentiate it from other regional cultures, Mandailing culture must be preserved as a national culture. Some of the Mandailing cultures are the Bagas Godang and Sopo Godang traditional houses (Siregar & Malau, 2021), the Gordang Sembilan musical instrument (Grace et al., 2022), the Mandailing script writing system, traditional woven cloth, Ulos/Abit Godang, and Traditional Speech Markobar (Ardian, 2023). The research question in this article is how this culture can be used in learning? Can the Batak Angkola culture be used in the learning model?

RESEARCH METHOD

To provide a concrete and comprehensive understanding of how Batak Angkola culture is used in learning and the philosophy of Batak Angkola culture that data is used in learning, researchers conducted library research using the SLR (Systematic Literature Review) method. SLR uses systematic and specific methods to identify, select, and collect all research materials relevant to a particular research question (Prahani et al., 2020; Rizki et al., 2022; Saphira, 2022; Saphira et al., 2023; Suliyanah et al., 2021). SLR is a prevalent review method, so it is widely used in various research fields. The methodology used in this research is the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) model. This methodology consists of well-defined review stages, eligibility
criteria developed and explained from information sources, a literature search strategy, a literature selection process, and data synthesis based on the literature selected.

In searching for related articles, the keywords used for metadata are ethnomathematics OR ethnomathematics) AND (Batak Angkola Culture OR Batak Angkola Culture) AND (Mathematics learning or Mathematics learning). Metadata search using Google Scholar via the Publish or Perish program on November 13, 2023. The search was limited to the last six years, from 2018 to 2023. The Mendeley Reference Manager program assisted in the metadata selection process based on exclusion and inclusion criteria. Figure 1. Shows the flow of the methodology used to select metadata based on predetermined criteria. Figure 1 shows the methodology flow used to select metadata based on predetermined criteria.

Figure 1. Research methodology flow for data selection using the PRISMA model.

Data Extraction and Analysis
Researchers obtained 14 articles from 3524 metadata, as seen in Table 1. Articles were further analyzed to provide data findings regarding the research questions. Initially, a comprehensive review and analysis of the ethnomathematics of the Angkola Batak tribe, level of education, and context in learning mathematics.

RESULTS AND DISCUSSION
Results
Before analyzing the main research objectives, researchers filtered three keywords in the 14 study articles to observe the main themes that will be discussed and analyzed. The three keywords are ethnomathematics, Batak Angkola culture, and mathematics learning. These initial findings indicate that the primary concern of the ethnomathematics of the Angkola Batak culture in mathematics learning is its relationship with aspects of mathematics learning outcomes.

Methodology and Assessment
This section looks at the methodological approaches used in the 14 articles in the systematic review and assessment used to collect the data. Researchers found the development method to be the most dominant method compared to other methods, such as mixed method experiments and descriptive methods. Illustrates data collection techniques in all research from various instruments. The most commonly used instruments are questionnaires, tests and assessments, surveys, and interviews (Some studies use not only one data collection instrument but also mixed instruments or several instruments).

Table 1. Articles that have been selected using the PRISMA model.

<table>
<thead>
<tr>
<th>Years</th>
<th>Level of education</th>
<th>Mathematics Material</th>
<th>Cultural Context</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>Junior high school</td>
<td>Geometry</td>
<td>Gordang Sambilan musical instrument</td>
<td>(Lubis et al., 2018)</td>
</tr>
<tr>
<td>Years</td>
<td>Level of education</td>
<td>Mathematics Material</td>
<td>Cultural Context</td>
<td>References</td>
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<tr>
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</tr>
<tr>
<td>2019</td>
<td>Junior high school</td>
<td>Geometry</td>
<td>Dengklek Game</td>
<td>(Fauzi &amp; Lu’luilmaknun, 2019)</td>
</tr>
<tr>
<td>2019</td>
<td>College</td>
<td>-----</td>
<td>Angkola Batak traditional assembly</td>
<td>(Susilowati &amp; Nasoichah, 2019)</td>
</tr>
<tr>
<td>2020</td>
<td>Elementary school</td>
<td>-----</td>
<td>Batak script</td>
<td>(Lubis et al., 2020)</td>
</tr>
<tr>
<td>2022</td>
<td>General</td>
<td>The concept of number and measurement</td>
<td>The language used by the Angkola Batak</td>
<td>(Rhamayanti et al., 2022)</td>
</tr>
<tr>
<td>2022</td>
<td>College</td>
<td>Development of learning models</td>
<td>Angkola cultural experience in the learning model</td>
<td>(Azizan et al., 2022)</td>
</tr>
<tr>
<td>2022</td>
<td>Junior high school</td>
<td>-----</td>
<td>Makobar Boru</td>
<td>(Putra, 2020)</td>
</tr>
<tr>
<td>2022</td>
<td>Junior high school</td>
<td>Geometry</td>
<td>Ulos woven fabric</td>
<td>(Panjaitan et al., 2022)</td>
</tr>
<tr>
<td>2022</td>
<td>Senior High School</td>
<td>Building Design via Android Number</td>
<td>Encyclopedia of the Batak tribe</td>
<td>(Akhir et al., 2022)</td>
</tr>
<tr>
<td>2022</td>
<td>General</td>
<td>Batak Script</td>
<td></td>
<td>(Ardian, 2023)</td>
</tr>
<tr>
<td>2023</td>
<td>Elementary school</td>
<td>Geometry</td>
<td>Angkola Batak Woven Cloth</td>
<td>(Marta &amp; Tanjung, 2019)</td>
</tr>
<tr>
<td>2023</td>
<td>Senior High School</td>
<td>Number series</td>
<td>Ulos Abit Godang woven cloth</td>
<td>(Salamah, 2023)</td>
</tr>
<tr>
<td>2023</td>
<td>Elementary school</td>
<td>-----</td>
<td>Marsitekka Game</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>Elementary school</td>
<td>Geometry</td>
<td>Tutup Ari</td>
<td>(Harahap et al., 2023)</td>
</tr>
</tbody>
</table>

**Discussion**

**Education Level, Cultural Content, and Educational Context**

The 14 research articles that have been collected are divided into four school levels, namely Elementary School (ES), Middle School (JHS), High School (SHS), and General. What general means here is that researchers conduct helpful research for the general public. Ethnomathematics is more widely used in elementary and middle school, likely in Figure 2.

![Figure 2](image_url)

**Figure 2.** Ethnomathematical research on Angola batak culture from 14 articles from 2018 to 2023.
There are four articles each for elementary and middle school levels; this shows that the use of ethnomathematics for learning mathematics can be applied more to concrete development. Piaget stated that knowledge is easily obtained from elaborative exploration, construction, and manipulation activities. Cognitive development has a significant impact on children (Amodia-Bidakowska et al., 2020; Arfé et al., 2020; Cooper & Stewart, 2021; Neece et al., 2020; Vanbecelaere et al., 2020). Elementary school-age children experience concrete operational development; children can think logically but must be assisted with natural objects (Arslanoğlu et al., 2023; Hayun & Hutami, 2024; Permana & Utomo, 2021; Rasmita & Hodijah, 2022; Rohmah et al., 2022). Teachers must be able to guide children in forming particularly relevant concepts. By presenting culture in learning, it creates a concrete learning environment. For example, the Dengklek game can be a medium for children in the elementary school stage to learn geometry. Dengklek has essential geometric elements such as rectangles, squares, and semicircles (Juhaevah, 2022). This media teaches elementary school students the formulas for squares, rectangles, and circles. This can be seen in Figure 3.

![Dengklek game](https://journal.ia-education.com/index.php/ijorer)

**Figure 3.** Dengklek game.

Meanwhile, in terms of cultural content, the first is classified into artifacts, namely cultural objects used, for example, traditional houses, mats, and traditional food. The second is philosophy, namely the meaning of life in that culture (Nur et al., 2020; Sunzuma et al., 2021; Umbara et al., 2021). For example, some meanings can be used in traditional ceremonies as learning. In the 14 articles studied, 64.29% of researchers used artifacts as learning media. Geometry dominates ethnomathematics (Trisnani et al., 2021; Usodo, 2023). The researchers lifted artifacts such as traditional houses, musical instruments, and food to show geometric symbols. The reason is simple: these artifacts are close to the student's environment. However, students still need to understand that these artifacts contain mathematical elements.

For the philosophy of life, only 28.57% is used in learning. This means there still needs to be more meaning to life in mathematics learning. One that uses it is research producing a learning model from the acronym ANGKOLA. The Angkola acronym used is not just an acronym but combines the customs and norms that apply to the Angkola community.
At the tertiary level, the source of learning from the ethnomathematics of the Angkola Batak culture is the philosophy of life in traditional siding activities. Some people must be elders who become policymakers or can be called Dalihan Na Tolu. Many life philosophies can be applied in everyday life in the series of religious activities. However, a few still use it as a learning model. Many studies have proven that using cultural artifacts as learning media can improve learning outcomes and student motivation (Agusdianita & Karjiyati, 2021).

CONCLUSION

Fundamental Finding: This research shows that learning using culture can improve student learning outcomes. Learning that can be used using ethnomathematics is at the elementary school and junior high school levels. By Piaget's theory, at this level, students faced with problems require tools to solve them. The use of philosophy produced from culture still needs to be improved. The ethnomathematics used is still an artifact. Implication: This research aims to determine whether ethnomathematics can be used in learning. From research results by reading journals, ethnomathematics can improve student learning outcomes. The limitation of this article is that it only examines 14 journals, which still needs to be improved to detail whether philosophy can be made a part of learning. The following research examines how the philosophy of the Angkola Batak culture can be raised in learning. Future Research: The following research examines how philosophy in the Angkola Batak culture can be raised in learning.

REFERENCES


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