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An Analysis of Students' Mathematical Connections from an Ethnomathematical Perspective

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ABSTRACT

Purpose of the study: This study aimed to analyze students' mathematical connection ability from an ethnomathematical perspective. The study focused on identifying students' ability to connect mathematical concepts with daily life and cultural contexts embedded in Sundanese culture.

Methodology: This study employed a survey research design. Data were collected using an ethnomathematics-based mathematical connection test and teacher interviews. Cluster random sampling was used to select 120 eighth-grade students from three junior high schools in Cibeunying Kidul, Bandung, Indonesia. Descriptive statistical analysis was applied to analyze the collected data.

Main Findings: Findings revealed that students' mathematical connection ability from an ethnomathematical perspective was generally categorized as low. Connections with daily life achieved a higher percentage than connections among mathematical topics, although both indicators remained low. Ethnomathematical contexts derived from Sundanese culture provided meaningful situations for identifying students' mathematical connections.

Novelty/Originality of this study: Novelty of this study lies in examining students' mathematical connection ability from an ethnomathematical perspective rather than merely implementing ethnomathematics in learning. Cultural elements were used as analytical perspectives to reveal mathematical connections, contributing to the development of culturally responsive mathematics education and extending existing knowledge regarding mathematical connections.

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1. INTRODUCTION

The ability to establish mathematical connections is considered one of the fundamental competencies that students need to develop in mathematics learning [1], [2]. This ability enables students to relate mathematical ideas, connect mathematics with other disciplines, and apply concepts to various real-life situations. Mathematical concepts are interconnected rather than separated into independent topics [3]. Through mathematical connections, students can develop a deeper and more meaningful understanding of mathematics. Therefore, fostering students' mathematical connection ability has become an important objective in mathematics education.

Despite its importance, students' mathematical connection ability remains relatively low. Many students experience difficulties in linking concepts between mathematical topics and applying mathematical ideas to everyday problems [4], [5]. Learning activities are often carried out in a formal and procedural manner, causing mathematics to be perceived as abstract and disconnected from students' experiences. Such conditions reduce students' interest and motivation in learning mathematics [6]. Consequently, mathematics learning becomes less meaningful and does not optimally support the development of mathematical connections.

Previous studies have shown that students' mathematical connection ability is still categorized as low. Several researchers reported that students encounter difficulties in connecting mathematical concepts with daily life and other fields of knowledge [7], [8]. In addition, previous studies have emphasized the importance of contextual learning to facilitate students' understanding of mathematics [9]. Ethnomathematics has also been recognized as an approach that integrates cultural elements into mathematics learning. However, most existing studies have focused on the exploration of cultural objects or the implementation of ethnomathematics in learning activities.

Although previous studies have provided valuable findings, research specifically examining students' mathematical connection ability from an ethnomathematical perspective remains limited [10]. Existing studies tend to focus on improving learning outcomes, mathematical communication, or problem-solving skills rather than exploring mathematical connections [11], [12]. Furthermore, studies investigating how cultural contexts contribute to the formation of mathematical connections are still scarce. This indicates that there is a need for further investigation regarding the relationship between mathematical connections and ethnomathematics. Therefore, this issue presents an important area for further research.

Investigating students' mathematical connection ability from an ethnomathematical perspective is important because mathematics and culture are inseparable components of human activities [13], [14]. Integrating cultural contexts into mathematics allows students to understand concepts through experiences that are familiar to them. Such learning experiences can make mathematics more meaningful and relevant to students' daily lives [15], [16]. In addition, the integration of culture in mathematics learning can foster students' appreciation of local wisdom and cultural heritage. Hence, understanding students' mathematical connections within cultural contexts is essential for supporting meaningful mathematics learning.

The novelty of this study lies in its focus on analyzing students' mathematical connection ability through an ethnomathematical perspective [17], [18]. Unlike previous studies that primarily examined ethnomathematics as a learning approach, this study emphasizes the role of cultural contexts in revealing students' mathematical connections [19]. The study explores how students relate mathematical ideas to local cultural practices and everyday experiences [20], [21]. Through this perspective, the research provides a more comprehensive understanding of students' mathematical connections. Therefore, the findings are expected to contribute to the development of culturally responsive mathematics education.

2. RESEARCH METHOD

2.1 Research Design

This study employed a survey research design to analyze students' mathematical connections from an ethnomathematical perspective [22]. The survey design was selected because it allows researchers to describe students' mathematical connection abilities based on cultural contexts. The study focused on identifying how students connect mathematical concepts with daily life and cultural practices. Ethnomathematical contexts were incorporated into the test items to reveal students' mathematical connections. Therefore, the research provides a comprehensive description of students' mathematical connection abilities.

2.2 Participants

The participants of this study consisted of 120 eighth-grade students selected through cluster random sampling. The respondents were drawn from three junior high schools located in Cibeunying Kidul, Bandung, Indonesia. These schools represented different learning environments and levels of exposure to ethnomathematics. The selection of participants aimed to obtain diverse information regarding students' mathematical connection abilities. Consequently, the participants provided sufficient data to support the objectives of the study.

2.3 Data Collection

Data were collected using a mathematical connection test and interviews with mathematics teachers. The test items were designed based on ethnomathematical contexts derived from Sundanese culture [23]. The indicators measured in this study included connections among mathematical topics, connections between mathematics and daily life, and connections between mathematics and cultural contexts [24]. In addition, interviews were conducted to obtain supporting information regarding mathematics learning practices in schools. The combination of these instruments enabled the researchers to obtain comprehensive data.

Table 1. Indicators of Mathematical Connections

Indicator	Description
Connections among mathematical topics	Students relate one mathematical concept to another mathematical concept.
Connections with daily life	Students apply mathematical concepts to solve problems encountered in everyday situations.
Connections with cultural contexts	Students relate mathematical concepts to local cultural practices from an ethnomathematical perspective.

2.4 Data Analysis

The collected data were analyzed using descriptive statistical techniques. Students' responses were categorized according to the level of achievement for each indicator of mathematical connections [25]. The analysis focused on identifying students' abilities to establish relationships among mathematical concepts, daily experiences, and cultural practices [26]. Interview data were used to support the interpretation of the quantitative findings. The results were then presented descriptively to provide a clearer understanding of students' mathematical connections from an ethnomathematical perspective.

3. RESULTS AND DISCUSSION

3.1 Overall Students' Mathematical Connections

The findings indicated that students' mathematical connection ability from an ethnomathematical perspective was generally categorized as low. Most students experienced difficulties in relating mathematical concepts and applying them to contextual situations. Although several students demonstrated an adequate understanding of mathematical ideas, many of them encountered obstacles in constructing meaningful connections. These findings suggest that students' mathematical understanding has not yet been fully integrated. Therefore, further efforts are needed to improve students' mathematical connection abilities.

Table 2. Descriptive Statistics of Students' Mathematical Connections

Variable	Mean	Category
Students' Mathematical Connections	20.06	Low

3.2 Students' Mathematical Connections Based on Indicators

The analysis of each indicator showed different levels of achievement among students. Students performed better in connecting mathematics with daily life than in connecting concepts among mathematical topics. However, both indicators were still classified as low. Students frequently encountered difficulties in recalling prerequisite concepts and interpreting contextual problems. Consequently, strengthening mathematical connections across all indicators remains necessary.

Table 3. Students' Mathematical Connections Based on Indicators

Indicator	Mean Score	Percentage	Category
Connections among mathematical topics	10.26	43%	Low
Connections with daily life	9.80	49%	Low

3.3 Students' Mathematical Connections in Ethnomathematical Contexts

The ethnomathematical contexts embedded in the test items enabled students to recognize mathematical ideas in Sundanese culture. Cultural contexts involving traditional games, traditional foods, household utensils, dances, and customary ceremonies provided meaningful situations for students. Nevertheless, students demonstrated varying levels of understanding when solving ethnomathematics-based problems. Several students experienced difficulties in interpreting contextual information and relating it to mathematical concepts. These findings indicate that ethnomathematical contexts have the potential to support the development of mathematical connections, although students' abilities remain limited.

Table 4. Ethnomathematical Contexts Used in the Study

Indicator	Ethnomathematical Context
Connections among mathematical topics	Traditional dances, household utensils, traditional houses, batik
Connections with daily life	Traditional games, traditional foods, customary ceremonies

Findings of this study revealed that students' mathematical connection ability from an ethnomathematical perspective was generally categorized as low. Most students encountered difficulties in relating mathematical concepts and applying them to contextual situations presented in the test items. These findings indicate that students have not fully developed an integrated understanding of mathematics. Mathematical ideas were often understood separately rather than as interconnected concepts. Consequently, students experienced challenges in constructing meaningful mathematical relationships.

Analysis based on the indicators showed that students performed better in connecting mathematics with daily life than in connecting concepts among mathematical topics. Nevertheless, both indicators were still categorized as low, indicating that students' mathematical connections require further improvement. Ethnomathematical contexts embedded in the problems enabled students to recognize mathematical ideas within cultural practices. However, several students still experienced difficulties in interpreting contextual information and relating it to mathematical concepts. Such findings suggest that contextual experiences alone are insufficient without adequate conceptual understanding.

Results obtained in this study are in line with previous studies reporting that students' mathematical connection ability remains relatively low. Earlier studies also highlighted that students frequently encounter difficulties in linking mathematical concepts and applying them to real-life situations [27]. Moreover, previous research emphasized the importance of contextual learning in facilitating meaningful mathematical understanding. Similar findings support the view that mathematics learning should provide opportunities for students to connect concepts with their experiences. Hence, findings of this study strengthen existing evidence regarding the importance of developing mathematical connections in mathematics education.

Novelty of this study lies in analyzing students' mathematical connection ability from an ethnomathematical perspective. Unlike previous studies that mainly focused on implementing ethnomathematics in learning activities or exploring cultural objects, this study emphasizes how cultural contexts can reveal students' mathematical connections [28]. Findings demonstrate that ethnomathematical contexts provide meaningful situations for identifying students' understanding of mathematical relationships [29]. Furthermore, cultural elements were treated not only as learning resources but also as analytical perspectives for examining mathematical connections. Accordingly, this study contributes to developing culturally responsive mathematics education.

Several implications can be drawn from findings of this study for mathematics learning. Teachers are encouraged to integrate cultural contexts into classroom activities to provide meaningful experiences for students. Utilization of ethnomathematical contexts can help students recognize relevance of mathematics in everyday life and local culture [30], [31]. In addition, integrating culture into mathematics learning may enhance students' appreciation of cultural heritage while simultaneously strengthening conceptual understanding. Therefore, ethnomathematics can serve as an alternative approach to promoting meaningful mathematics learning.

Despite its contributions, several limitations should be acknowledged. Data were collected only from eighth-grade students in junior high schools located in Cibeunying Kidul, Bandung, which may limit generalization of findings. In addition, ethnomathematical contexts employed in this study were restricted to elements of Sundanese culture. Focus of this study was limited to mathematical connection ability and did not examine other mathematical competencies. Future studies involving different cultural settings and broader mathematical abilities are recommended to provide more comprehensive findings.

4. CONCLUSION

This study concludes that students' mathematical connection ability from an ethnomathematical perspective was generally categorized as low, indicating that students still experienced difficulties in relating mathematical concepts to different contexts. Findings revealed that students showed better performance in connecting mathematics with daily life than in establishing connections among mathematical topics, although both indicators remained at a low level. Ethnomathematical contexts derived from Sundanese culture provided meaningful situations for exploring students' mathematical connections and demonstrated the close relationship between mathematics and culture. These results are consistent with the objective of the study, which aimed to analyze students' mathematical connections from an ethnomathematical perspective and provide a deeper understanding of how cultural contexts contribute to mathematical learning. Practical implications of this study suggest that integrating ethnomathematical contexts into mathematics learning can support meaningful learning experiences and promote students' appreciation of local culture. Future studies are recommended to involve

broader cultural settings and investigate other mathematical abilities to provide more comprehensive insights into culturally responsive mathematics education.

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