



Evaluating Ethnomathematics-Based RME for Students' Mathematical Conceptual Understanding and Mathematical Literacy Using the CIPP Model

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Abstract

Contextual and meaningful mathematics learning is essential for supporting students' conceptual understanding and mathematical literacy. However, a comprehensive evaluation of the implementation of ethnomathematics-based Realistic Mathematics Education (RME) is still needed to examine the alignment between instructional planning, classroom implementation, and learning outcomes. This study evaluates the implementation of the ethnomathematics-based Realistic Mathematics Education (RME) approach using the CIPP evaluation model, which encompasses context, input, process, and product. This study employs an evaluative approach, with data drawn from documentation, observations, and interviews conducted in two eighth-grade classes at a public junior high school in Yogyakarta. The data were analysed descriptively according to the alignment of each evaluation component. The results showed that the context evaluation achieved a 100% alignment rate, input 90%, process 94.12%, and product 100%, all falling into the "very good" category. The evaluation results also showed an increase in students' conceptual understanding and mathematical literacy from the pretest to the posttest, as well as average learning outcomes in line with the KKTP. Thus, the implementation of ethnomathematics-based RME can be deemed very effective in supporting active, contextual, and meaningful mathematics learning.

Keywords: CIPP evaluation; Conceptual understanding; Ethnomathematics; Mathematical literacy; Realistic Mathematics Education

1. INTRODUCTION

Mathematics is a fundamental discipline that plays a crucial role in developing the logical, critical, and systematic thinking skills required to address the challenges of the twenty-first century. This is consistent with the framework developed by the Organisation for Economic Co-operation and Development (OECD), which emphasises the importance of the processes of formulating, employing, and interpreting and evaluating in mathematical literacy. These competencies enable students to use mathematics meaningfully in a variety of everyday contexts (Burkhardt et al., 2024). Furthermore, mathematical literacy contributes to the development of twenty-first-century skills, including critical thinking,

creativity, inquiry skills, independence, initiative, perseverance, the effective use of information, systems thinking, communication, and reflection (OECD, 2023).

Mathematical literacy cannot be separated from conceptual understanding in mathematics, as solving problems such as those assessed by PISA requires students to possess a strong understanding of fundamental mathematical concepts (OECD, 2023, p.20). According to Findell et al. (2001), understanding mathematical concepts enables students to connect various ideas coherently, recognise the applicability of concepts across different contexts, and learn new ideas more easily. Furthermore, Van de Walle et al. (2006) argue that a strong understanding of mathematical concepts enables students to establish more connections, thereby facilitating the integration of new ideas with previously acquired knowledge.

In addition to the importance of mathematical literacy and conceptual understanding, the results of the Programme for International Student Assessment (PISA), administered by the Organisation for Economic Co-operation and Development (OECD), indicate that Indonesian students' mathematics performance in 2022 ranked 69th among 81 participating countries, with an average score of 366, compared with the international average of 472 (OECD, 2023). Given the relationship between mathematical literacy and conceptual understanding, students need a strong foundation in mathematical concepts to solve mathematical problems such as those assessed in PISA. Therefore, the PISA results suggest that Indonesian students' mathematical conceptual understanding remains relatively limited.

To address this issue, meaningful and contextualised learning is needed to enhance students' mathematical literacy and conceptual understanding, as it enables them to connect new knowledge with their existing experiences (Ausubel, 2010). Relating mathematics to real-world contexts also helps students understand the functions and applications of mathematical concepts more effectively (OECD, 2023).

The Realistic Mathematics Education (RME) approach offers a potential solution by positioning realistic problems as the starting point for mathematics learning (Freudenthal, 2002). The selected realities should be familiar and relevant to students (Freudenthal, 2002). According to Sunzuma et al. (2021), real-life situations should be connected to students' cultural backgrounds. Artefacts, art, and traditional practices can serve as forms of cultural integration for exploring mathematical concepts (Gerdes, 1999). Mathematics education that is adapted to specific cultural contexts is referred to as ethnomathematics (Marsigit, 2016). Integrating RME with ethnomathematics strengthens the contextual dimension of learning by utilizing local culture as a learning resource (d'Ambrosio, 1985).

RME encourages students to reconstruct mathematical concepts through a process of guided reinvention, thereby fostering deeper understanding (Gravemeijer, 1994). An ethnomathematics-based approach further enhances the relevance of mathematics learning by connecting mathematical concepts to students' everyday experiences and cultural contexts, potentially supporting conceptual understanding (Bishop, 1989). Accordingly, the integration of RME and ethnomathematics represents a potential approach to fostering students' mathematical literacy and conceptual understanding through contextual and meaningful learning experiences.

To ensure that the implementation of ethnomathematics-based RME is carried out optimally and produces the greatest possible impact, its effectiveness needs to be evaluated. This evaluation aims to identify the strengths and weaknesses of the instructional implementation, thereby facilitating subsequent improvements and further development (Walsh & Allison, 2024). The evaluation findings provide the information necessary to support better-informed decisions regarding the continuation or modification of the instructional implementation (Pucilowski, 2016; Saewert, 2021; Walsh & Allison, 2024).

The CIPP evaluation model (Context, Input, Process, and Product), developed by Stufflebeam, is an appropriate model for evaluating the implementation of this instructional approach. This model was selected because it provides a comprehensive evaluation, ranging from programme planning to learning outcomes, thereby supporting informed decision-making in programme development (Stufflebeam, 1971). Context evaluation aims to identify the needs, problems, and environmental conditions underlying programme implementation (Stufflebeam & Coryn, 2014). Input evaluation focuses on assessing the strategies, resources, and plans used to achieve programme objectives (Stufflebeam & Coryn, 2014). Process evaluation is conducted to monitor programme implementation and ensure consistency between the planned programme and its implementation in practice (Stufflebeam, 1971). Meanwhile, product evaluation aims to assess the outcomes achieved, both in the short and long term, including the impact on improvements in students' mathematical literacy and conceptual understanding (Stufflebeam & Coryn, 2014).

Several studies have demonstrated the effectiveness of the CIPP evaluation model in comprehensively assessing the implementation of educational programmes. Isnaeni et al. (2024) applied the CIPP model to evaluate a literacy programme at the senior high school level and found that, overall, all four dimensions achieved fairly good results. Similarly, Mulyawan & Rusman (2025) evaluated the implementation of Project-Based Learning in mathematics education using the CIPP model and found that the context, input, process, and product dimensions were all categorised as good, indicating that the instructional programme was implemented effectively. In addition, Qadriah et al. (2022), in their evaluation of mathematics learning in primary schools, demonstrated that the CIPP model was able to provide a comprehensive overview of the implementation of instruction and the achievement of mathematics learning objectives.

Another study by Hevardani (2025) which evaluated GeoGebra-assisted calculus learning using the CIPP model, found that the process and product dimensions achieved high ratings, particularly in terms of improving university students' mathematical conceptual understanding. These findings suggest that the CIPP model can be employed to evaluate mathematics learning, as it enables the systematic assessment of program implementation. However, it remains necessary to examine whether similar findings would emerge when the CIPP model is applied to evaluate the implementation of ethnomathematics-based Realistic Mathematics Education (RME) in relation to students' conceptual understanding and mathematical literacy. Therefore, this study aims to evaluate the implementation of ethnomathematics-based RME and its contribution to students' conceptual understanding and mathematical literacy using the CIPP evaluation model.

2. Methods

2.1 Research Design

This study was conducted to evaluate the effectiveness of implementing an ethnomathematics-based Realistic Mathematics Education (RME) approach in improving students' mathematical conceptual understanding and mathematical literacy. The evaluation employed the CIPP model, which assesses four key dimensions—context, input, process, and product—in the implementation of the ethnomathematics-based RME approach to enhance students' mathematical conceptual understanding and mathematical literacy.

2.2 Research Setting and Participants

This study was conducted at a public junior high school in Yogyakarta, Indonesia, during the first semester of the 2024/2025 academic year. The school had implemented the Merdeka Curriculum, which aligns with the instructional approach used in this study. The research site was selected through random sampling. The participants and data sources included a mathematics teacher who implemented an ethnomathematics-based Realistic Mathematics Education (RME) approach, eighth-grade students, and instructional documents, such as teaching modules, student worksheets, syllabi, and test results.

2.3. Data Collection

Data were collected from various primary and secondary sources. Primary data were gathered through direct observations during the learning process and interviews with the mathematics teacher who implemented the ethnomathematics-based Realistic Mathematics Education (RME) approach. Secondary data were obtained through document analysis of syllabi, teaching modules, test results, and other relevant literature on the research topic.

2.4. Data Analysis

The data were analysed using both qualitative and quantitative descriptive approaches. The analysis involved comparing the data obtained with the ideal standards for each CIPP component proposed by Stufflebeam (2000). The CIPP model comprises four evaluation components, as follows:

a. Context

Context evaluation is conducted to identify and assess the various needs underlying the development or establishment of a programme. In this study, context evaluation data were obtained from a teaching module employing an ethnomathematics-based Realistic Mathematics Education (RME) approach. The teaching module was evaluated in terms of its alignment with real-life contexts and students' lived realities to ensure that it could support the meaningful development of mathematical conceptual understanding and mathematical literacy (Freudenthal, 1973). In addition, the alignment of the teaching module was examined in terms of its relevance to local culture through an ethnomathematical approach, ensuring that the material

presented could connect mathematical concepts with cultural practices in the students' surrounding environment (D'Ambrósio, 2006).

b. Input

Input evaluation focused on assessing the readiness of the resources supporting the implementation of the instructional program. The aspects evaluated included teacher qualifications, such as academic background, the alignment between the teacher's area of expertise and the subject taught, and professional certification. In addition, the evaluation examined the availability of instructional facilities and resources, including internet access, digital and physical mathematics manipulatives, digitally based teaching modules, presentation and collaboration devices, and other classroom support facilities. This evaluation was conducted to ensure that all input components were adequate to support the effective implementation of the instructional program.

c. Process

Process evaluation focused on assessing the implementation of instruction in accordance with the principles of the Realistic Mathematics Education (RME) approach. The aspects evaluated included the teacher's implementation of the core stages of RME, such as presenting contextual problems, facilitating guided understanding, encouraging exploration and discussion, promoting the communication of students' ideas, and guiding students to conclude the learning activities. In addition, the evaluation examined the teacher's role as a facilitator in fostering interactive and meaningful learning, including integrating cultural contexts through an ethnomathematical approach. From the students' perspective, the learning process was evaluated based on their engagement in understanding contextual problems, participating in discussions, constructing mathematical knowledge, communicating their ideas, and drawing conclusions. This evaluation was intended to ensure that the learning process was implemented actively, contextually, and in accordance with the fundamental principles of the RME approach.

d. Product

Product evaluation aimed to assess the extent to which the learning outcomes achieved were consistent with the intended instructional objectives. At this stage, the evaluation focused on students' learning outcomes, specifically their mathematical conceptual understanding and mathematical literacy. The assessment of mathematical conceptual understanding included students' ability to restate mathematical concepts, classify objects according to mathematical concepts, select and apply appropriate procedures, and apply concepts or procedures to solve mathematical problems (Bruner, 1974; National Council of Teachers of Mathematics, 2000; Skemp, 1976). In addition, mathematical literacy was evaluated based on students' abilities to formulate, employ, and interpret and evaluate mathematics when solving mathematical problems, in accordance with the OECD mathematical literacy framework (OECD, 2023).

The evaluation results for each CIPP component were classified according to the percentage of conformity with the evaluation standards proposed by Retnawati (2014). The classification criteria are presented in Table 1.

Table 1. Evaluation Result Categories

Score Range	Criteria
$80 \leq p \leq 100$	Highly Aligned
$60 \leq p \leq 80$	Aligned
$40 \leq p \leq 60$	Moderately Aligned
$p < 40$	Not Aligned

The evaluation findings can be used to develop strategies for improving and refining the ethnomathematics-based Realistic Mathematics Education (RME) approach to enhance students' mathematical conceptual understanding and mathematical literacy.

3. RESULTS AND DISCUSSION

3.1 Results

The research data were collected through document analysis, classroom observations, and interviews on the implementation of the ethnomathematics-based Realistic Mathematics Education (RME) approach in two eighth-grade classes at a public junior high school in Yogyakarta, Indonesia. The data were analysed using the CIPP evaluation model, which comprises four dimensions—context, input, process, and product—to provide a comprehensive understanding of the planning, implementation, and outcomes of the instructional approach. The evaluation results for each component are presented in the following sections.

3.1.1 Context Evaluation

Context evaluation was conducted to assess the completeness of the teaching module and the extent to which the instructional design aligned with the characteristics of the ethnomathematics-based Realistic Mathematics Education (RME) approach for the topic of number patterns. This evaluation was conducted following the implementation of the learning process. The evaluation covered the completeness of the teaching module components, the relevance of cultural contexts and contextual problems to students' everyday experiences, the suitability of learning activities for facilitating concept discovery and the development of mathematical literacy, the coherence among mathematical concepts, and the appropriateness of the assessment instruments used. This evaluation aimed to ensure that the instructional design was systematically developed, contextually relevant, and aligned with the intended learning objectives. The results of the context evaluation are presented in Table 2.

Table 2. Context Evaluation Results

Evaluation Component	Evaluation Criteria	Appropriate	Inappropriate
Completeness of the Teaching Module	Teaching module developer identity	✓	
	Students' prior competencies	✓	
	Pancasila Student Profile	✓	
	Instructional facilities and infrastructure	✓	
	Target students	✓	

Design of the Ethnomathematics- Based Realistic Mathematics Education (RME) Approach	Instructional approach employed	✓
	Learning objectives	✓
	Learning assessment	✓
	Meaningful understanding	✓
	Trigger questions	✓
	Learning activities	✓
	Teacher and student reflection	✓
	Student activity sheets	✓
	Teacher and student reading materials	✓
	Glossary	✓
	Cultural contexts aligned with students' environment	✓
	Problem contexts related to students' lives	✓
	Learning activities facilitating students' concept discovery and mathematical literacy development	✓
	Connections among mathematical concepts in learning	✓
	Assessment instruments for mathematical conceptual understanding	✓
	Assessment instruments for mathematical literacy	✓
Total		21 0
Percentage of Conformity		100%
Conformity Level Category		Highly Aligned

According to Table 2, all assessment criteria in the context evaluation achieved 100% alignment and were categorised as highly appropriate. These findings indicate that the teaching module and the ethnomathematics-based RME instructional design met the established criteria and supported the development of students' mathematical conceptual understanding and mathematical literacy.

3.1.2 Input Evaluation

An input evaluation was conducted to assess the readiness of resources supporting the implementation of the ethnomathematics-based Realistic Mathematics Education (RME) approach for teaching number patterns. The evaluation covered teacher qualifications and the availability of instructional facilities and infrastructure. The results of the input evaluation are presented in Table 3.

Table 3. Input Evaluation Results

Evaluation Component	Evaluation Criteria	Appropriate	Inappropriate
Teacher Qualifications	Possessing a minimum academic qualification of a four-year diploma (D-IV) or bachelor's degree (S1)	✓	
	Having an educational background aligned with the subject taught	✓	
	Holding a teaching certificate for the junior high school level		✓
Instructional Facilities and Infrastructure	Availability of internet access supporting digital learning	✓	
	Availability of digital and physical mathematics manipulatives	✓	
	Availability of instructional modules integrated with digital media	✓	
	Availability of projectors for presentation activities	✓	
	Availability of smartphones as supporting learning devices	✓	
	Availability of stationery, whiteboards, markers, erasers, and a comfortable classroom environment	✓	
	Availability of instructional materials supporting learning	✓	
Total		9	1
Percentage of Conformity		90%	
Conformity Level Category		Highly Aligned	

According to Table 3, nine of the ten assessment criteria in the input evaluation were considered aligned, yielding an alignment percentage of 90% and placing the evaluation in the highly appropriate category. These findings indicate that teacher qualifications, along with instructional facilities and infrastructure, generally supported the implementation of the ethnomathematics-based RME approach.

3.1.3 Evaluasi *Process*

A process evaluation was conducted to assess the implementation of learning activities using the ethnomathematics-based Realistic Mathematics Education (RME) approach for the topic of number patterns. The evaluation focused on the implementation of the RME stages and the roles of teachers and students throughout the learning process. The results of the process evaluation are presented in Table 4.

Table 4. Process Evaluation Results

Evaluation Component	Evaluation Criteria	Appropriate	Inappropriate
Implementation of the Ethnomathematics-Based RME Approach	Presentation of culturally based contextual problems	✓	
	Understanding contextual problems	✓	
	Exploration and discussion of problem-solving processes	✓	
	Presentation of problem-solving results	✓	
	Drawing conclusions	✓	
Teacher's Role	Presenting contextual problems	✓	
	Explaining unclear problems	✓	
	Guiding problem-solving activities	✓	
	Encouraging active discussions	✓	
	Guiding the formulation of conclusions	✓	
Students' Role	Acting as a facilitator	✓	
	Encouraging the use of various strategies		✓
	Understanding contextual problems	✓	
	Conducting exploration and discussion	✓	
	Constructing conceptual understanding	✓	
	Presenting and responding to discussion results	✓	
	Formulating learning conclusions	✓	
Total		16	1
Percentage of Conformity		94,12%	
Conformity Level Category		Highly Aligned	

Based on Table 4, sixteen of seventeen process evaluation indicators were considered aligned, yielding an alignment percentage of 94.12% and placing the process in the highly appropriate category. These findings indicate that the ethnomathematics-based RME learning process was implemented very well.

3.1.4 Product Evaluation

Product evaluation was conducted to assess the extent to which learning outcomes were achieved following the implementation of the ethnomathematics-based Realistic Mathematics Education (RME) approach. The evaluation focused on students' mathematical conceptual understanding and mathematical literacy by comparing their performance before and after the instructional intervention. Product achievement was examined by assessing improvements in each indicator, changes in pretest and posttest scores, and the alignment of the final average scores with the Learning Objective

Achievement Criteria (Kriteria Ketercapaian Tujuan Pembelajaran/KKTP). A summary of the product evaluation results is presented in Table 5.

Table 5. Product Evaluation Results

Evaluation Component	Evaluation Criteria	Appropriate	Inappropriate
Mathematical Conceptual Understanding	Restating previously learned mathematical concepts	✓	
	Classifying objects based on mathematical concepts	✓	
	Providing examples and non-examples of a mathematical concept	✓	
	Selecting and applying appropriate mathematical procedures	✓	
	Applying mathematical concepts or procedures to solve mathematical problems	✓	
Mathematical Literacy	Representing real-world problems in mathematical form	✓	
	Using mathematical concepts, facts, procedures, and reasoning to solve given problems	✓	
	Interpreting and evaluating solutions within real-world contexts	✓	
Overall Learning Outcomes	Improvement in students' mathematical conceptual understanding scores from pretest to posttest	✓	
	Improvement in students' mathematical literacy scores from pretest to posttest	✓	
	The mean posttest score for mathematical conceptual understanding met or exceeded the Learning Objective Achievement Criteria (KKTP)	✓	
	The mean posttest score for mathematical literacy met or exceeded the Learning Objective Achievement Criteria (KKTP)	✓	
Total		12	
Percentage of Conformity		100%	
Conformity Level Category		Highly Aligned	

According to Table 7, all twelve product evaluation indicators were aligned, yielding a 100% alignment rate and placing the category as highly appropriate. These findings

indicate that students' mathematical conceptual understanding and mathematical literacy improved from the pretest to the posttest. Furthermore, the mean posttest scores for both competencies met the established Learning Objective Achievement Criteria (KKTP).

3.2 Discussion

The evaluation results indicated that the implementation of the ethnomathematics-based Realistic Mathematics Education (RME) approach for the topic of number patterns achieved a highly Aligned rating across all CIPP components. The context evaluation attained an alignment percentage of 100%, followed by 90% for the input evaluation, 94.12% for the process evaluation, and 100% for the product evaluation. These findings demonstrate strong alignment among the instructional design, the readiness of supporting resources, the quality of instructional implementation, and students' learning outcomes. According to the CIPP evaluation model, the success of an educational programme should not be judged solely by its outcomes but should also be evaluated in terms of the relevance of its context, the adequacy of its inputs, and the quality of its implementation process (Qadriah et al., 2022; Sankaran & Saad, 2022; Stufflebeam & Coryn, 2014; Suryanto et al., 2024; Zhang et al., 2011).

In the context component, all indicators were deemed compliant, with a conformity percentage of 100%. This finding indicates that the teaching module incorporated the necessary components and that the instructional design was aligned with the characteristics of ethnomathematics-based Realistic Mathematics Education (RME). The use of cultural contexts and problems closely related to students' everyday lives provided a meaningful starting point for understanding number patterns. Within RME, contextual problems serve as a means for students to develop mathematical models, strategies, and concepts through a process of guided reinvention. Specifically, contextual problems provide students with an initial point of departure for exploring situations, developing representations or models, and gradually reconstructing mathematical concepts through guided reinvention (Gravemeijer, 1994; Turgut, 2022). Cultural integration reinforces this process by connecting abstract mathematical concepts with cultural contexts and experiences familiar to students, thereby making learning more relevant and meaningful (Nursyahidah et al., 2025; Pratama & Yelken, 2024).

For the input component, the evaluation indicators were generally found to be aligned, resulting in an alignment percentage of 90%. The teacher's academic qualifications and educational background, together with the availability of internet access, projectors, smartphones, mathematics manipulatives, digital teaching modules, and instructional materials, indicate that the instructional resources were generally adequate to support the implementation of the ethnomathematics-based Realistic Mathematics Education (RME) approach. The availability of these resources facilitated the integration of cultural contexts, the exploration of number patterns, and more varied and interactive classroom discussions. However, one indicator was not met, namely the possession of a professional teaching certificate. This finding highlights the need to strengthen teachers' professional development, as academic qualifications, professional competencies, and teaching certification constitute essential components of teacher professionalism, as stipulated in Law No. 14 of 2005 on Teachers and Lecturers and Minister of National Education

Regulation No. 16 of 2007 on Academic Qualification Standards and Teacher Competencies.

For the process component, the evaluation indicators were found to be aligned, resulting in an alignment percentage of 94.12%. The learning process was implemented through the presentation of culturally contextualised problems, problem comprehension, exploration and discussion, presentation of problem-solving results, and the formulation of conclusions. Throughout the instructional process, the teacher presented and clarified contextual problems, facilitated classroom discussions, guided students in solving problems, and assisted them in concluding. Meanwhile, students actively engaged in understanding contextual problems, exploring solution strategies, constructing conceptual understanding, and communicating the results of their discussions. This level of engagement indicates that the instructional process was implemented in accordance with the principles of student-centred learning. The RME approach provides students with opportunities to develop their cognitive abilities through contextual learning activities, collaborative discussions, and the active construction of mathematical knowledge (Fauzan et al., 2024; Johar et al., 2025; Laurens et al., 2017).

Although the process component was classified as Highly Aligned, the indicator related to the use of multiple problem-solving strategies was not fully achieved. This finding suggests that teachers should provide students with greater opportunities to develop, compare, and evaluate different solution strategies. In mathematics education, comparing alternative solution methods enables students to understand the relationships between mathematical concepts and procedures while fostering procedural flexibility in selecting the most appropriate strategy for a given problem. Rittle-Johnson & Star (2009) reported that comparing solution methods promotes the development of conceptual knowledge and procedural flexibility. Furthermore, this process supports the development of students' conceptual knowledge while fostering flexibility in selecting and applying appropriate problem-solving procedures (Ke & Newton, 2024; Mok et al., 2022). Therefore, future instruction should encourage the presentation of multiple solution strategies, facilitate discussions of their similarities and differences, and engage students in evaluating the accuracy and efficiency of each approach.

For the product component, all evaluation indicators were found to be aligned, resulting in an alignment percentage of 100% and a Highly Aligned category. These findings were evidenced by improvements in students' mathematical conceptual understanding and mathematical literacy from the pretest to the posttest, with the mean posttest scores for both competencies meeting the established Learning Objective Achievement Criteria (Kriteria Ketercapaian Tujuan Pembelajaran/KKTP). The improvement in mathematical conceptual understanding indicates that students became increasingly capable of restating mathematical concepts, classifying objects, providing examples and non-examples, selecting and applying appropriate procedures, and applying mathematical concepts to solve problems. These findings suggest that the integration of cultural contexts, exploratory learning activities, and classroom discussions enabled students to connect real-world situations with the mathematical concepts of number patterns. These findings support the evidence that RME can enhance students' mathematical cognitive achievement through meaningful and contextual learning experiences (Laurens et al., 2017; Palinussa et al., 2024; Sutarni et al., 2024).

The product evaluation findings are further supported by Fikri et al. (2025), who reported that the implementation of ethnomathematics-based RME assisted by a website had a positive effect on students' mathematical conceptual understanding. Similarly, Utami et al., (2024) demonstrated that RME activities can support students in developing conceptual understanding. These findings are also consistent with the study by Kesuma & Marsigit (2025), which revealed that ethnomathematics-based RME had a positive effect on mathematical literacy. Likewise, Susanta et al. (2023) found that the use of local contexts in mathematical literacy tasks involving number patterns had the potential to enhance students' mathematical literacy activities. In the present study, this improvement was not examined solely as a change in learning outcomes but was also analyzed in relation to the context, input, and process components of instruction. Accordingly, product achievement can be understood as the outcome of relevant instructional design, adequate resource support, and the effective implementation of RME learning stages.

The improvement in mathematical literacy indicates that students became increasingly capable of representing real-world problems in mathematical form, applying mathematical concepts and procedures to solve problems, and interpreting and evaluating solutions within their real-world contexts. These competencies are consistent with the PISA mathematical literacy framework, which encompasses the processes of formulating (formulate), employing (employ), and interpreting and evaluating (interpret and evaluate) mathematics across a variety of real-life contexts (OECD, 2023). The findings of the present study are further supported by the meta-analysis conducted by Pratama dan Yelken (2024), which demonstrated that ethnomathematics-based instruction has a strong positive effect on students' mathematical literacy compared with conventional instructional approaches.

Overall, the CIPP evaluation results demonstrate that the successful implementation of the ethnomathematics-based Realistic Mathematics Education (RME) approach was reflected not only in improved student learning outcomes but also in the alignment of the instructional design, the adequacy of supporting resources, and the quality of the instructional implementation. The integration of cultural contexts brought mathematics closer to students' lived experiences. At the same time, the stages of the RME approach provided opportunities for students to actively explore, discuss, and communicate mathematical ideas. Nevertheless, greater attention should be given to strengthening teacher certification and providing students with more opportunities to employ and compare multiple problem-solving strategies. Furthermore, because this study involved only two eighth-grade classes from a single junior high school, the findings should be regarded as context-specific. Therefore, caution should be exercised when generalising the results to broader educational settings or student populations.

4. CONCLUSION

Based on the results of the CIPP evaluation, the implementation of the ethnomathematics-based Realistic Mathematics Education (RME) approach was classified as Highly Aligned. The context component achieved an alignment percentage of 100%, followed by 90% for the input component, 94.12% for the process component, and 100% for the product component. These findings indicate that the instructional design of the ethnomathematics-based RME approach was well aligned with the instructional objectives, the available resources adequately supported its implementation, the

instructional process was carried out effectively, and students demonstrated improvements in both mathematical conceptual understanding and mathematical literacy from the pretest to the posttest, with the mean posttest scores meeting the established Learning Objective Achievement Criteria (Kriteria Ketercapaian Tujuan Pembelajaran/KKTP). Overall, the findings suggest that the ethnomathematics-based RME approach was Highly Aligned in supporting active, contextual, and meaningful mathematics learning.

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