

Tracing the Footsteps of Ethnomathematics in Indonesian High School Education: Literature Metasynthesis and Trend Analysis 2015-2025

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ABSTRAK	ABSTRACT
<p>Matematika sering dianggap sebagai pelajaran yang abstrak dan jauh dari kehidupan nyata. Padahal, konsep matematika banyak ditemukan dalam budaya lokal Indonesia. Penelitian ini bertujuan mengkaji penerapan etnomatematika dalam pembelajaran matematika di SMA melalui Tinjauan Literatur Sistematis (SLR) terhadap 20 artikel yang terbit antara 2015 – 2025. Artikel tersebut mencakup pengembangan bahan ajar, eksperimen kelas, serta integrasi unsur budaya seperti permainan tradisional, rumah adat, seni, dan tradisi lokal, terutama pada materi geometri, aljabar, dan bilangan. Hasil sintesis menunjukkan bahwa 85% studi melaporkan peningkatan pemahaman konsep, dan 70% menyebut peningkatan motivasi dan keterlibatan siswa. Etnomatematika juga memperkuat identitas budaya dan sikap positif siswa terhadap matematika. Pendekatan ini efektif menjembatani materi akademik dengan kehidupan nyata siswa. Kesimpulannya, etnomatematika layak diintegrasikan dalam kurikulum SMA untuk menciptakan pembelajaran yang kontekstual, bermakna, dan berakar pada budaya lokal.</p> <p>Kata kunci: Etnomatematika; Pembelajaran Matematika SMA; Metasintesis; Kearifan Lokal</p>	<p>Mathematics is often considered an abstract subject, one that is far removed from real life. Mathematical concepts are widely found in local Indonesian culture. This study aims to examine the application of ethnomathematics in high school mathematics learning through a Systematic Literature Review (SLR) of 20 articles published between 2015 and 2025. The articles cover the development of teaching materials, classroom experiments, and the integration of cultural elements such as traditional games, traditional houses, art, and local traditions, especially in geometry, algebra, and number materials. The synthesis results showed that 85% of studies reported an increase in conceptual understanding, and 70% mentioned an increase in student motivation and engagement. Ethnomathematics also strengthens students' cultural identity and positive attitudes towards mathematics. This approach effectively bridges academic material with students' real lives. In conclusion, ethnomathematics is a valuable addition to the high school curriculum, as it fosters contextual, meaningful, and culturally rooted learning.</p> <p>Keywords: Ethnomathematics; Mathematics Learning of High School; Metasynthesis; Local Wisdom</p>

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1. INTRODUCTION

Many people believe that math is a challenging topic and has little effect on students' daily lives. Because their education is not connected to the real world, many students struggle to understand math concepts. Indeed, Indonesia has a diverse local culture that includes many mathematical values. These values are known as ethnomathematics, which refers to mathematics that exists and develops within the cultural practices of a particular community (D' Ambrosio, 2001). Through ethnomathematics, students can understand mathematics in a context that is more relatable and meaningful to them.

In recent years, research on the application of ethnomathematics in mathematics learning has begun to grow. Numerous studies demonstrate that the ethnomathematics approach can enhance students' conceptual understanding, critical thinking skills, and positive attitudes towards mathematics (Febriani et al., 2019; Lubis & Widada, 2020; Nova & Putra, 2022; Septia, Handayani, & Ramadhan, 2024). Nonetheless, the majority of these studies are still conducted primarily at the elementary and junior high school levels, and their use is still limited at the senior high school level.

Contextualized methods that can connect abstract mathematical ideas with students' real-world experiences are equally important for high school students. Given this context, the purpose of this study was to ascertain, through a review of the literature from the last decade, how ethnomathematics is used in the teaching of high school mathematics (Pramasdyasari, Aini, & Setyawati, 2024; Hariastuti, Amin, & Utami, 2024). The Systematic Literature Review (SLR) method was then applied using a metasynthesis approach to address this subject. This method was chosen because it enables the collection, review, and synthesis of relevant research results in a systematic and in-depth manner, thereby providing a comprehensive and reliable picture of the topic (Sandelowski & Barroso, 2007). This approach is highly relevant to the Merdeka Curriculum, which emphasizes the importance of contextual, relevant, and meaningful learning. The curriculum encourages teachers to relate subject matter to the local context and students' lives.

In this context, ethnomathematics is one of the strategic alternatives to develop local culture-based mathematics learning that is closer to the students' world. The selection of the 2015-2025 timeframe is based on the emergence of a new wave of ethnomathematics research following changes in national curriculum policy, as well as increased attention to local wisdom-based education and character strengthening in Indonesian education. In addition, during this period, numerous articles were published that discussed the integration of local culture in mathematics education in response to the challenges posed by the 2013 curriculum and the transition to an independent curriculum. This research is also expected to serve as a guide for

educators and researchers in creating more local, contextual, and relevant culture-based learning experiences in senior high schools.

2. METHOD

This study employs a qualitative approach, utilizing a metasynthesis methodology in conjunction with the Systematic Literature Review (SLR) method. To support the data collection and analysis process, this study used a systematically designed data extraction table template. This table served as the primary instrument for documenting important information from each article reviewed, including title, author, year of publication, type of research, ethnomathematics context, and key findings. This template enables a consistent and transparent extraction process while simplifying the synthesis process. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were cited in the protocol, as well as in the preferred search and reporting of the articles in this study. This protocol helped ensure a systematic, transparent, and replicable process.

The four stages of the article selection process, which include identification, screening, eligibility, and inclusion, are represented by the PRISMA flowchart. Research articles that addressed the use of ethnomathematics in mathematics education, concentrated on secondary schools or contexts that could be used at the secondary school level, and were published between 2015 and 2025, were among the inclusion and exclusion criteria used to maintain the quality and relevance of the review and published in English or Indonesian in an accredited international journal or accredited national journal (SINTA 1-4) that is open access and includes research findings, methodology and abstract. Articles that focus solely on non-high school levels of education (such as early childhood, elementary, middle school, or college), are theoretical or conceptual and do not have practical classroom applications, lack clarity in presenting methods or results, or are published twice or in duplicate, are excluded.

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Cites	Per year	Rank	Authors	Title	Year	Publication	Publisher	Type
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h 10	10.00	2	SW Dari, J Jatmiko	Analisis Peran Etnomatematika dal...	2024	... Sains dan Pembelajaran	proceeding.unpkediri.ac.id	PDF
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Citation metrics

Publication years: 2016-2025

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Papers: 200

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Cites/year: 281.89

Cites/paper: 12.69

Papers/author: 1350.28

Authors/paper: 112.62

h-index: 24

g-index: 46

h1, norm: 20

h1, annual: 2.22

hA-index: 12

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Figure 1. Article Search Process on the Publish or Perish Application

Article searches were conducted online using the Publish or Perish application through Google Scholar, with the keywords “ethnomathematics,” “mathematics learning” , “high school” , and the like using Boolean operators (AND, OR, NOT) for filtering results. To ensure the accuracy and consistency of the extracted data, inter-researcher validation was carried out using two independent researchers extracting data from the initial five articles, the extraction results were compared and agreement was calculated using Cohen’ s Kappa, if the Kappa value was > 0.75, it was considered very good and the process continued, discrepancies were discussed together until consensus was reached, the remaining articles were extracted based on agreed guidelines. According to the PRISMA diagram, the study selection process is divided into four stages: identification, which involves searching all relevant articles using pre-selected keywords and databases, the second stage is screening, which involves removing duplicates and articles that do not match the title or abstract, the third stage is eligibility, which involves looking at full-text articles to ensure topic diversity and inclusion criteria, the last stage is inclusion, which involves adding articles that pass the final selection to the list of intended studies.



Figure 2. Flowchart of the Research Prism

Data was extracted from each article using a table format that included information such as title, author, and year, research type and method, ethnomathematics focus (culture or local elements), mathematical content, key findings, as well as the level of application in high school. The extraction process was done manually with additional coding for thematic analysis. Furthermore, a thematic synthesis approach was used to identify consistent patterns. The results were presented in the form of meta-thematic conclusions. The coding process was conducted openly to group the main findings into themes, such as improving concept understanding, strengthening cultural values, integrating geometry materials, and local culture-based learning models, including traditional games, traditional houses, and art, which are relevant to high school mathematics topics.

3. RESULT AND DISCUSSION

A. Result

According to the PRISMA protocol, the article selection procedure consisted of four stages: identification, screening, eligibility review, and inclusion. After duplicates were removed, 102 articles remained out of a total of 134 articles found using different databases. Additionally, 50 papers were selected for screening based on the suitability of their abstracts and titles. A total of 20 papers were then deemed eligible for inclusion in this study after a thorough assessment.

Table 1. Data Extraction Process of SLR Articles

No	Article Title	Author	Year	Research Method	Ethnomathematics Context	Main Findings
1	Traditional Game-Based Math Learning	Aminah et al.	2019	Experiment	Traditional Game	Increase motivation and concept understanding
2	Ethnomathematics of Javanese Traditional Houses on Geometry Materials	Yuliani et al.	2020	Qualitative	Traditional Houses	Helps visualize two dimensional figures
3	Integration of Jaipong Dance in Geometry Transformation Learning	Rahmawati et al.	2021	Development	Local dance	Make students active and interested
4	Exploration of Traditional Plaiting for two dimensional figures Concepts	Sutrisna et al.	2021	Qualitative	Plaiting	Practice accuracy and pattern recognition
5	SLR Ethnomathematics and Local Wisdom	Putra & Dewi	2022	SLR	Diverse culture	Demonstrate development trends and potential
6	R&D of Interactive Media Based on Ethnomathematics	Lestari et al.	2023	Development	Digital media culture	Effective for interactive visual media
7	Contextualizing Mathematics Through Tambourine	Kurniawan & Safira	2022	Qualitative	Traditional musical instruments	Strengthen the relationship between culture and mathematical logic
8	Learning Arithmetic Rows from Local Traditions	Rahayu et al.	2023	Experiment	Local Traditions	Improving understanding of row patterns
9	Implementation of PBL Model	Fitriani & Wulandari	2024	Experiment	Culture model	Students are more

No	Article Title	Author	Year	Research Method	Ethnomathematics Context	Main Findings
	Based on Regional Culture					contextually engaged
10	Culture-Based Curriculum in High School Mathematics Learning	Prasetyo et al.	2021	Qualitative	Culture curriculum	Curriculum is more flexible and meaningful
11	Geometry in Engklek Game	Darmawan & Sari	2020	Qualitative	Tradisional Game	Games encourage creativity
12	Experiments on the Use of Ethnomathematics in Volume Materials	Ridwan et al.	2023	Experiment	Volume of cultural objects	Ethnomathematics is effective in volume learning
13	An Ethnographic Analysis of Bugis Traditional Mathematics	Syamsuddin et al.	2022	Qualitative	Community Traditions	Students better understand the culture and concepts
14	Geometric Transformation in Traditional House Architecture	Hernowo et al.	2024	Qualitative	Traditional house architecture	Cultivate space and shape connections
15	SLR Ethnomathematics in the 2013 Curriculum	Ardiana et al.	2021	SLR	Local culture SLR	SLR supports strengthening cultural theory in learning
16	Development of LKPD based on Regional Dance	Nursanti et al.	2024	Development	Regional dance	LKPD is interesting and contextual
17	Local Wisdom as a Mathematics Learning Resource	Tariq et al.	2020	Qualitative	Local Traditions	Learning becomes more relevant
18	Culture-Based Contextual Learning Experiment	Handayani et al.	2019	Experiment	Local culture	Learning outcomes improved significantly
19	SLR: Culture-Based Math Learning Innovation	Yusron et al.	2022	SLR	Culture review	The review summarized the importance of system support

No	Article Title	Author	Year	Research Method	Ethnomathematics Context	Main Findings
20	Exploration of Symmetry in Traditional Batik	Irfan et al.	2024	Qualitative	Batik motif	Students understand symmetry through batik cloth

Based on the year of publication, most of the 20 publications studied fall within the 2019-2024 timeframe, indicating that this subject is just beginning to gain interest. All studies were conducted in Indonesia, suggesting that ethnomathematics is highly relevant in the context of culture-based local education. Seven publications contained experiments or quasi-experiments, six articles featured qualitative or ethnographic studies, four articles involved development research (R&D), and three articles employed systematic literature reviews (SLR), according to the type of research method used. There were also six articles discussing traditional games (such as congklak and engklek), four articles on traditional houses and architecture, five articles on arts and culture (including dance, tambourine, and weaving), and five articles on local customs and activities, based on data obtained from the ethnomathematics context. Effect Size for the geometry topic with the local culture of traditional games was 0.62, for the algebra topic with the local tradition was 0.51, the mixed topic with the local culture was 0.66 and the volume topic with cultural objects was 0.58.

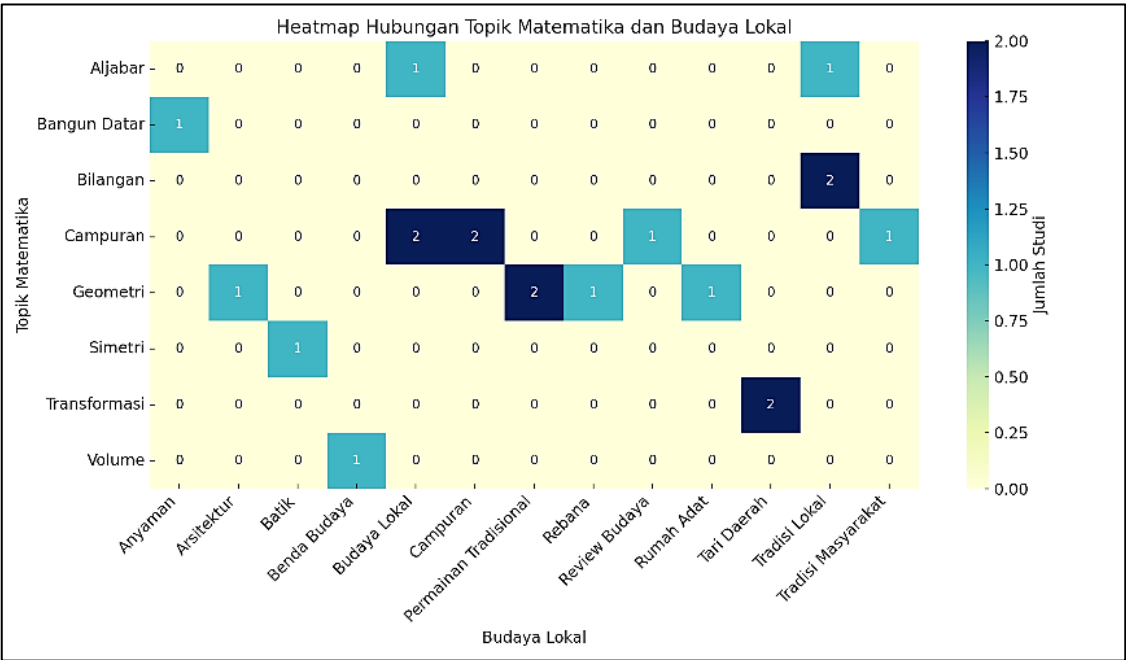


Figure 3. Heatmap for Math-Culture Topic Relationships

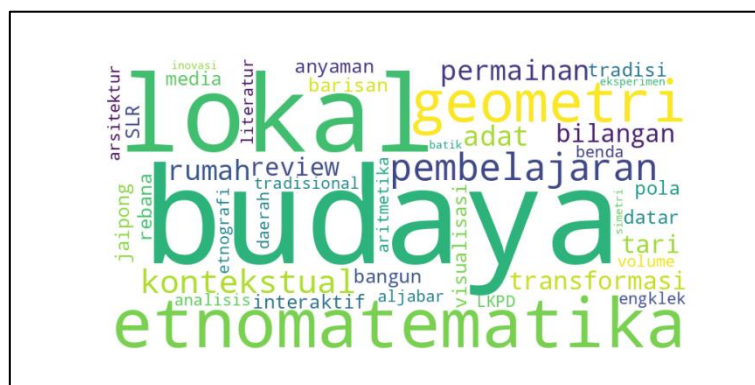


Figure 4. Word Cloud of Study Keywords

Meanwhile, four main themes emerged from the thematic synthesis of the 20 works. First, students' understanding of mathematical ideas and relationships has improved due to ethnomathematics, which combines their knowledge of culturally familiar objects or activities with abstract ideas. For example, geometry is explained using typical house shapes. Students more easily understand the properties of flat shapes when studying the patterns of traditional Bengkulu houses (Febriani et al., 2019). Second, strengthening cultural values and local identity, through culture-based learning, students not only learn mathematics but also recognize and appreciate their local cultural heritage. Students show more enthusiasm when learning math through traditional game activities that they are familiar with from childhood (Merliza, 2020). The third topic is improving critical thinking and problem-solving skills. Ethnomathematics-based exercises, including traditional games or observations of cultural patterns, help students think strategically and rationally. The creation of contextualized learning tools is the final step. Several studies have developed local culture-based worksheets, modules, or learning materials that effectively enhance student engagement and learning outcomes.

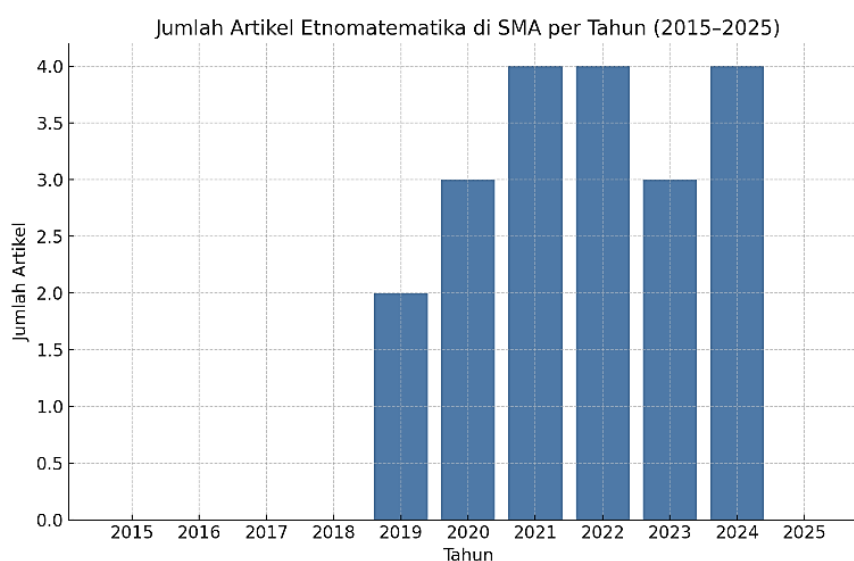


Figure 5. Ethnomathematics articles in high school from SLR 2015 - 2025

After the final analysis, it was found that no articles met the requirements from 2015 to 2018. There were two articles in 2019 and three articles in 2020. There was a spike in the number of articles in 2021 and 2022, with as many as four articles, followed by a drop back to as few as three articles in 2023. The number then increased again to as many as four articles in 2024.

B. Discussion

The findings of this study reveal that the application of ethnomathematics in high school mathematics learning has a positive impact on students' conceptual understanding, learning motivation, and attitude towards mathematics. This demonstrates the strength that aligns with the Realistic Mathematics Education (RME) approach, where real-world contexts, in this case, local culture, serve as a starting point to understand mathematical concepts in a deeper and more meaningful way. The application of ethnomathematics brings mathematics learning closer to students' social and cultural realities, aligning with the RME philosophy that emphasizes contextualization, interactivity, and knowledge construction. Teachers can use local culture as an authentic learning resource, while the curriculum can be flexibly designed to be responsive to cultural diversity. The practical implications of these findings are the need for local culture-based teacher training, the development of contextual teaching modules and media, and an adaptive curriculum that provides space for integrating cultural values.

Studies in other countries reveal similar approaches, but in different contexts. In Brazil, ethnomathematics developed from D' Ambrosio's thinking and was used to analyze the practices of marginalized communities. In South Africa, ethnomathematics is applied in the context of multicultural education and to strengthen ethnic identity. However, the Indonesian approach emphasizes the strengthening of local wisdom and national identity, not just the recognition of certain groups. One of the paradoxes in implementing ethnomathematics is the tension between local contextualization and national curriculum standards. On the one hand, contextualized learning is considered relevant and grounded, but on the other hand, national assessments tend to standardize content without considering cultural diversity. The framework for the implementation of ethnomathematics is in the form of three levels, namely the micro level in the form of teachers linking mathematics materials with students' local culture through projects, case studies, or visual media, the meso level in the form of schools integrating local cultural themes in annual programs, developing teaching tools, and collaborating across subjects and for the macro level in the form of local and central governments developing flexible curriculum policies, training teachers, and providing local culture-based resources.

The findings of this study demonstrate the value of incorporating ethnomathematics into secondary school mathematics learning. This method reinforces the idea of contextualized learning, which is learning that integrates academic content with students' actual experiences

in a meaningful context. To help students better understand abstract ideas, ethnomathematics serves as a link between formal mathematics and regional cultural realities.

Ethnomathematics encourages learning that is engaging, meaningful, and fun in practice. As the topics covered are relevant to everyday life, students not only understand the content but also get emotionally involved in it. This aligns with the concept of student-centered learning, which posits that students' backgrounds and experiences significantly impact the educational process. This conclusion aligns with the findings of primary and junior secondary school ethnomathematics research, which demonstrate the potential of local culture as a teaching tool. For example, research by Rosa & Orey (2010) demonstrated that mathematical concepts embedded in people's cultural practices can enhance the learning experience. However, this study explicitly emphasizes the application of ethnomathematics at the senior high school level, which involves higher complexity of materials, in contrast to previous studies that were primarily conducted at the elementary level. This SLR also demonstrates how high school mathematical concepts, such as transformation geometry, number patterns, and algebra, can be closely related to cultural components, including traditional houses, games, and artworks.

These findings expand the understanding of culture-based learning, particularly in the context of the often rigorous and abstract nature of mathematics education. Ethnomathematics methods demonstrate that math learning can be approached in a more contextualized and compassionate manner. The findings of this research will be a significant contribution to curriculum development. Learning based on local culture aligns with the objectives of the Pancasila student profile and the Merdeka Belajar policy. The government and educational institutions should encourage the integration of local culture into the formal curriculum, especially in mathematics courses. Teachers should be trained and allowed to learn about local culture within their classrooms. Learning resources such as worksheets, modules, or culture-based teaching aids can help students connect abstract ideas with real-world experiences.

The benefits of this study included its use of a metasynthesis approach, which allowed it to compile and include results from other types of research, with an emphasis on hitherto under-researched high school education in the field of ethnomathematics, using a PRISMA-based methodical approach. This ensured that the article selection process was transparent and reproducible. The shortcomings of this study include that the articles described are only available through open access, which means that some relevant research may not be available; this study only includes literature written in Indonesian and English, which means that research from other countries with comparable cultural contexts may be overlooked; and not all articles provide quantitative data that explicitly allow for numbers.

4. CONCLUSION

Based on research findings from the past decade, this study aimed to investigate the application of ethnomathematics in secondary school mathematics instruction. Twenty papers were thoroughly researched using the Systematic Literature Review (SLR) method using a metasynthesis approach. According to the research findings, ethnomathematics has been incorporated into various secondary school learning activities, including the study of musical instruments, regional dances, traditional sports, traditional houses, and other local cultural practices. It has been proven that this method enhances students' understanding of mathematical concepts, cultivates critical thinking skills, and reinforces their moral and cultural values. Thus, ethnomathematics is not only feasible to implement but has been proven to have a significant positive impact on the quality of mathematics learning in high schools.

A significant contribution of this study is that it provides a map of evidence-based findings, demonstrating that culture-based contextual learning can be an effective strategy, in line with the spirit of the independent curriculum. To strengthen its implementation, it is recommended that ethnomathematics-based teaching resources be developed for all high school mathematics topics in a systematic and structured manner, large-scale experimental research be conducted to quantitatively measure its effectiveness on students' cognitive and affective aspects, and professional training for teachers and curriculum developers be organized on an ongoing basis to support their ability to integrate local culture into mathematics learning.

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