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THE EFFECTIVENESS OF ETHNOMATHEMATICAL APPROACHES ON STUDENTS' MATHEMATICAL CREATIVE THINKING SKILLS IN INDONESIA: A META-ANALYSIS STUDY

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Abstract: This meta-analysis study aimed to investigate the effectiveness of ethnomathematical approaches to students' mathematical creative thinking (MCT) skills in Indonesia. Twenty-two articles in the last decade were synthesised from online databases through a rigorous selection process based on inclusion and exclusion criteria. Data analysis was carried out using a meta-analysis technique of a random effect size model using Cohen's g. This study showed that mathematics learning with an ethnomathematical approach significantly improved students' mathematical creative thinking skills with an effect size of 1.247, which is relatively large. This study does not have publication bias constraints, so the results are scientifically reliable. Therefore, this study suggests that schools in Indonesia integrate an ethnomathematical approach to mathematics learning to support students' MCT skills. Further research is recommended to develop a learning model with an ethnomathematical approach focusing on enhancing students' MCT skills.

Keywords: Meta-analysis, effectiveness, ethnomathematics, mathematical creative thinking

INTRODUCTION

Higher-order thinking (HOT) is a significant aspect of human resource development in the current educational paradigm (Mardhiyana & Sejati, 2016). HOT skills with logical and divergent thinking methods allow individuals to generate original ideas (Maharani, 2020), solve problems innovatively, and adapt to rapid change (Chinedu et al., 2015; Kwangmuang et al., 2021; Nurlaela, 2015). Creative thinking (CT) is one of the fundamental HOT skills for individuals to develop and encounter unpredictable challenges (Dilekçi & Karatay, 2023). CT process requires individuals to analyse existing information, evaluate their ideas, and create new solutions. An elaboration process in CT involves dividing knowledge into essential parts, understanding their meanings, and generating new ideas by combining different elements. This process is crucial for enhancing HOT skills in certain situations. Moreover, thinking creatively is one of the four primary competencies demanded in the recent disruption era. A creative thinker is an individual who can solve

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problems and encounter challenges with a variety of unique approaches, create innovative ideas, connect concepts, and find solutions without being limited by ordinary thought (Meika & Sujana, 2017).

Developing students' CT skills is one of the main goals of mathematics learning (Damayanti, 2018; Ramadhanta et al., 2024). The CT has a significant role in helping students generate ideas for solving mathematical problems (Hadar & Tirosh, 2019). This is because problem-solving involves the process of thinking to produce a concrete solution (Suherman & Vidákovich, 2022a). The CT process trains students' sensitivity in understanding mathematical problems that affect the ability to consider information, formulate ideas, make patterns and relationships with open minds, make decisions, and apply innovative solutions (Azhari & Somakim, 2014; Yayuk & As'ari, 2020). Therefore, teachers as facilitators must strive to stimulate students' MCT skills by involving students in complex mathematical activities (Nurhidayah et al., 2020; Szabo et al., 2020).

One of the approaches to developing students' MCT skills is ethnomathematics (Faiziyah et al., 2020; Heriyanto et al., 2021; Ilma et al., 2024a; Ramadhani et al., 2020a). Previous research utilised ethnomathematics to explore the cultural context in the wetland environment, which was constructed into a mathematical problem to facilitate students' HOTS skills (Fajriah et al., 2021). Ethnomathematics is an approach that involves studying the cultural aspects of mathematics, including how mathematics is practised, used, and understood in a cultural context (Balamurugan, 2015; Machaba & Dhlamini, 2021). Mathematics learning can be studied by integrating mathematical concepts derived from the local community's local wisdom, traditions, and culture (Choeriyah et al., 2021). Implementing culture-based mathematics learning can increase students' interest in mathematics because they understand that mathematics is relevant to problems in daily life (Brown et al., 2019). Ethnomathematics is considered academic mathematics with a focus on knowledge of social, historical, political, and economic aspects or other aspects (Pais, 2011), so ethnomathematics is not only limited to the mathematical understanding of a particular society (Suherman & Vidákovich, 2022c). The ethnomathematics approach to students' CT is an imperative discussion in mathematics education. Still, empirical research that specifically tests the effectiveness of ethnomathematics approaches to student CT has not been widely studied. Earlier research tends to be concerned with other aspects, such as conceptual understanding or problem-solving skills, without exploring how ethnomathematics can directly enhance students' CT (Gunay & Takunyaci 2023; Nur et al. 2020; Nursyahidah, Saputro, & Rubowo 2018). Furthermore, the previous study results show variations in effectiveness based on educational level, geographic region, and differences in the learning instruction applied. Therefore, this research combines the results of different studies and provides a more comprehensive conclusion regarding how an ethnomathematics approach can advance the CT skills of students in Indonesia.

Previous research has shown that ethnomathematics can develop students' CT abilities by examining math learning from different perspectives, using various problem-solving strategies, and connecting math to students' daily experiences (Faiziyah et al., 2020; Machaba & Dhlamini, 2021; Ramadhanta et al., 2024; Suherman & Vidákovich, 2022c). Previous research has limited understanding of the effectiveness of ethnomathematics in developing students'

overall CT abilities. By combining data from multiple studies, meta-analysis offers a systematic way to combine these scattered findings, evaluates effects more comprehensively, and identifies patterns not detected in individual studies. It also shows statistical power and provides more generalizable conclusions. Thus, this meta-analysis offers a greater comprehension of the extent to which ethnomathematics is effective in enhancing CT in Indonesian students. Therefore, this meta-analysis study aims to investigate the effectiveness of ethnomathematical approaches to developing students' MCT skills in Indonesia. The articles synthesised in this study are articles published in the database in the last decade.

METHOD

Research Design and Procedure

This study conducted a meta-analysis to analyse the effectiveness of the ethnomathematical approach on students' MCT skills in Indonesia. Meta-analysis is a quantitative research design that aims to systematically study and synthesise the results of quantitative estimates from several previous relevant studies (Borenstein et al., 2009). The meta-analysis includes establishing research relevance criteria, data collection, screening, data extraction, and statistical analysis. The meta-analysis procedure was visualised in Figure 1.

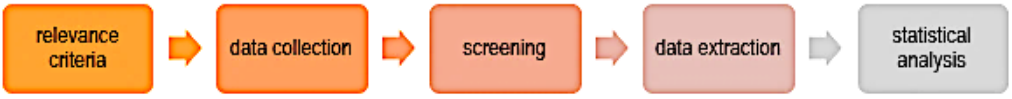

Figure 1 Meta-Analysis Procedure

Research Relevance Criteria

Determining research relevance criteria aims to assess the literature of research results by the criteria used in a systematic review using meta-analysis. The criteria for the relevance of the research used in this study are 1) The literature of research results published in the last decade, namely 2014-2024; 2) The research uses experimental or quasi-experimental research methods; 3) The study applied an ethnomathematical approach to at least one experimental class with a comparison of conventional learning as a control class; 4) The literature of research results must contain the sample size, mean value, and standard deviation of each research class; or sample size and t-value; or sample size and p-value; or sample size based on F-value.

Data Collection

The relevant literature collection stages are carried out through online databases such as Publish or Perish, Springer Publishing, Elsevier, Directory of Open Access (DOAJ), Education Resource Information Center (ERIC), IOP Sciences, AIP Proceedings, and Google Scholar. Furthermore, searching for relevant literature on online databases using the keywords "ethnomathematics" and "creative thinking skills".

Screening of Relevant Literature

Literature screening is conducted to assess the suitability of literature obtained from the literature collection process as analysis material in the research. It is carried out according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines, with four stages: identification, screening, eligibility, and

inclusion. The PRISMA protocol can be seen in Figure 2.

The results of the identification stage in the online database obtained 3630 articles that matched the keywords "ethnomathematics" and "creative thinking skills". Then, the screening stage was reviewed on the article's suitability with the research relevance criteria, where 3471 articles have inappropriate publication years, and 117 articles have inappropriate research designs. At the eligibility stage, the full-text articles were reviewed. The eligibility review results contain twenty-two articles containing the necessary statistical data for a meta-analysis.

Data Extraction

The data extraction stage identifies quantitative data in the research literature in the meta-analysis database. The quantitative data contained in this study is data on the number of samples (N), average score of students' creativity in mathematics learning ($\bar{x}$) and the standard deviation (SD) from each control and experiment class. Meanwhile, the results of the interpretation of the effect size values obtained referring to Cohen's guidelines ($g \geq 1.3$, substantial effects; $1.30 < g \leq 0.80$, large effects; $0.80 < g \leq 0.50$, moderate effects; $0.50 \leq g < 0.00$, small effects) Hedges's g was used (Cohen et al., 2017).

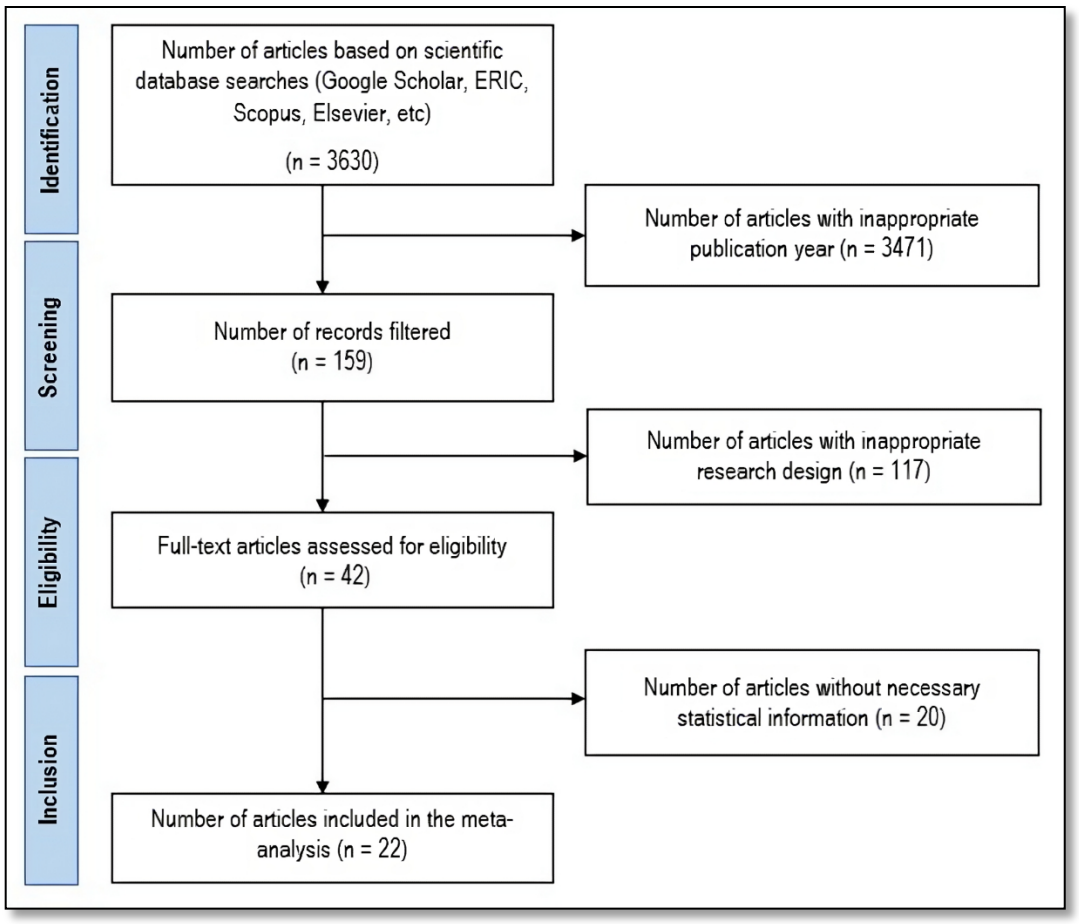

Figure 2 Flow Chart the Implementation of PRISMA

Statistical Analysis

The stages of statistical analysis in meta-analysis research include calculating Hedges's g of each study, conducting a heterogeneity test, calculating the combined effect sizes, and analysing and evaluating the research bias. The statistical analysis used in this study was carried out using the OpenMEE application. The app has features to conduct complete meta-analysis research. In addition, the OpenMEE software can also efficiently analyse subgroups (variable moderators).

RESULTS AND DISCUSSION

This study selected twenty-two articles published over the past ten years. The included articles were chosen to analyse their effectiveness in using ethnomathematical approaches to students' MCT skills using meta-analysis by reviewing the effect size (Hedges's g). The selected articles consisted of two articles about elementary school students, fifteen about junior high school students, four about senior high school students, and one on an unmentioned subject, displayed in Table 1.

Table 1 Data of Included Research Results

No	Author (year)	Code	Research Subject
1	Aisyah et al. (2024)	APE1	Junior High School
2	Saironi & Sukestiyarno (2022)	APE2	Senior High School
3	Ramadhani et al. (2020b)	APE3	Not Mentioned
4	Nurislamiati & Irfan (2022)	APE4	Senior High School
5	Ilma et al. (2024b)	APE5	Primary school
6	Wawan et al. (2023)	APE6	Senior High School
7	Nugraha et al. (2023)	APE7	Junior High School
8	Ogunkunle et al. (2015a)	APE8	Junior High School
9	Ogunkunle et al. (2015b)	APE9	Junior High School
10	Sari et al. (2022)	APE10	Islamic Junior High School
11	Angreani & Marsigit (2023)	APE11	Junior High School
12	Purnami et al. (2022)	APE12	Junior High School
13	Putri & Azhar (2022)	APE13	Junior High School
14	Kusuma et al. (2019)	APE14	Junior High School
15	Safitriyanti et al. (2023)	APE15	Junior High School
16	Zaenuri et al. (2019)	APE16	Junior High School
17	Yosopranata et al. (2018)	APE17	Junior High School
18	Herianto et al. (2021)	APE18	Islamic Senior High School
19	Cahyono et al. (2023)	APE19	Islamic Junior High School
20	Sipayung et al. (2021)	APE20	Junior High School
21	Asmara et al. (2022)	APE21	Junior High School
22	Permatasari et al. (2020)	APE22	Primary school

Data extraction is essential in meta-analysis, where researchers identify and collect relevant quantitative data from the primary studies included in the analysis. Based on the results of Table 1, data extraction was carried out to collect some samples (N), average score of students' creativity in mathematics learning ($\bar{x}$) and the standard deviation (SD) from each control and experiment class. Furthermore, data transformation is carried out so that the effect size (g) and the variance (Var) are obtained based on each measure of the effect obtained. The extraction results, the size of the impact, and its variability are presented in Table 2.

Table 2 Extracted Data, Effect Size and Variance of Sample

Code	Control Class			Experiment Class			g	Var	Category
	N	$\bar{x}$	SD	N	$\bar{x}$	SD			
APE1	32	48.83	12.74	32	90.04	9.51	3.621	0.165	Very Large
APE2	32	74.2969	7.30898	30	80.4583	7.72286	0.81	0.070	Large
APE3	30	14.02	1.68	30	15.47	1.65	0.86	0.073	Large
APE4	29	79.0079	5.33163	29	97.6742	9.51152	2.388	0.118	Very Large
APE5	24	76.7	8.61	25	86.7	8.34	1.161	0.095	Large
APE6	52	54.5	11.08	54	66.59	10.11	1.133	0.044	Large
APE7	31	75.19	65.895	31	80.35	71.103	0.074	0.065	Small
APE8	39	54.36	10.27	38	84.08	9.65	2.951	0.109	Very Large
APE9	39	54.36	10.27	40	75.75	9.31	2.162	0.08	Very Large
APE10	22	66	13	20	82.34	12.47	1.257	0.114	Large
APE11	31	42.5484	13.19555	31	67.6129	20.93908	1.414	0.081	Very Large
APE12	14	40.07	15.16	16	78.47	13.73	2.592	0.246	Very Large
APE13	40	7.2563	1.79965	40	7.5288	1.34369	0.17	0.05	Small
APE14	32	66.97	6.99	32	76.23	7.66	1.247	0.075	Large
APE15	36	64.3056	10.29235	36	72.5	7.221	0.912	0.061	Large
APE16	30	48.64	14.08	29	55.59	10.92	0.543	0.07	Moderat
APE17	26	66.23	12.78	23	74.47	6.94	0.775	0.088	Moderat
APE18	20	20.05	9.288	21	22.81	10.352	0.275	0.099	Small
APE19	23	61.8	47.659	22	72.294	91.537	0.142	0.089	Small
APE20	32	75.72	6.96	30	84.58	7.43	1.217	0.077	Large
APE21	40	74.75	9.18	40	76.5	9.69	0.184	0.05	Small
APE22	25	68.24	7.568	25	85.72	7.254	2.321	0.134	Very Large

Publication of Bias Test Results

Publication bias is a severe problem in meta-analysis reviews that can make its conclusions inaccurate (Shi & Lin, 2019). Borenstein et al. (2009) suggest a visual inspection method of the plot funnel and a trim-and-fill method to detect and mitigate this risk. Therefore, this study used both methods to measure the effect of publication bias.

Figure 3 presents the funnel plot distribution of the effect size of the 22 studies included in this meta-analysis study. The plot

funnel is symmetrical, with an even distribution of the effect size (Hedges's g) on both sides of the effect size axis. These results show that the probability of publication bias in this study is still relatively low.

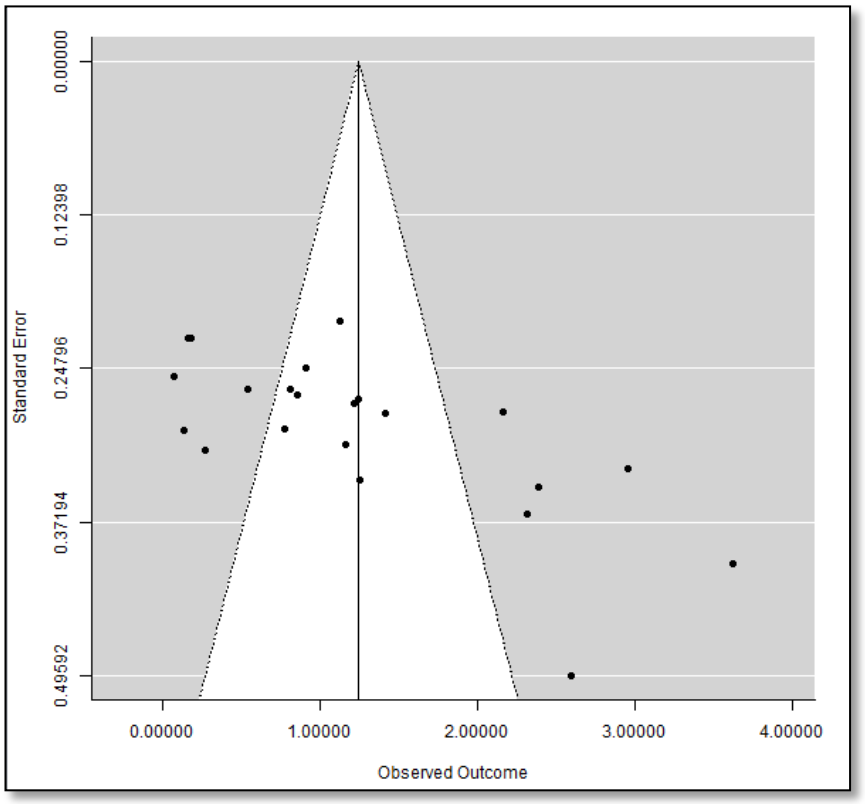

Figure 3 Funnel Plot

Furthermore, a file drawer analysis was conducted using the Rosenthal model to verify this study's absence of publication bias. The results obtained from the analysis obtained a Fail-safe N value of 2885, with the target significance 0.05 dan $p < 0.0001$. The Fail-safe value of N obtained by 2885 far exceeds the threshold of 120 ($120 = 5 \times 22 + 10$; $5k + 10$ (k = number of studies) which indicates a lack of publication bias (Mathur & VanderWeele, 2020). Overall, publication bias was not a significant issue for this study. Thus, there is no substantial evidence of publication bias, so this meta-analysis study is conducted objectively and can be scientifically accounted for.

Heterogeneity Test Results

Twenty-two Hedges' g values were analysed using Fixed Effects and Random Effects models through OpenMEE software. The heterogeneity statistics of values were found to be significant $Q(p < 0.001,\ Q = 195.515$ with $df = 21)$. Furthermore, the percentage I^2 calculated and then obtained a value of 89.259. (Borenstein et al., 2017) stated that $I^2 = 0\%$, This indicates that there is no heterogeneity; when $I^2 < 25\%$, then it is considered to have low heterogeneity; when $25\% \leq I^2 \leq 50\%$, then there is moderate heterogeneity; when $I^2 > 50\%$, hence the high heterogeneity.

Table 3 Heterogeneity Test Result Data

Model	Effect size and 95% confidence interval				Heterogeneity		
	k	g	Lower bound	Upper bound	I^2	Q	p
Fixed	22	1.056	0.938	1.174	89.259	195.515	< 0.001
Random	22	1.247	0.883	1.611			

Note. k = number of Hedges's g.

As shown in Table 3, it was obtained $I^2 = 89.259\ \%$ which means there is high heterogeneity in this study. Thus, these findings provide evidence of heterogeneity. To ensure the validity of this study, Lin and Chu (2018) recommend using a random effect model to get a more accurate estimate of conclusions. In the Random Effects Model, the mean value of g is 1.247, with a confidence interval of 95% of the $0.883 - 1.611$.

Estimation Results of Effect Size Findings

All the articles selected in this study contain a sample of 1353 students from elementary to high school. The sample size ranges from 14 to 54 and has an effect size ranging from 0.883 to 1.611. As the forest plot in Figure 4 shows, one study produced a considerable effect size above 3, likely outliers (Mao et al., 2022).

The results of the forest plot in Figure 3 showed that the combined effect size of the twenty-two studies analysed using the random effect approach was 1.247 ($g = 1.247; p < 0.001$) with positive effects. These results show that the ethnomathematical approach is more effective in achieving students' MCT than conventional learning. Furthermore, this effect size falls under significant effects (Cohen et al., 2017). This shows that ethnomathematical approaches in mathematics learning greatly influence students' CT. Thus, learning with an ethnomathematical approach is highly recommended to be implemented for mathematics teachers in the classroom.

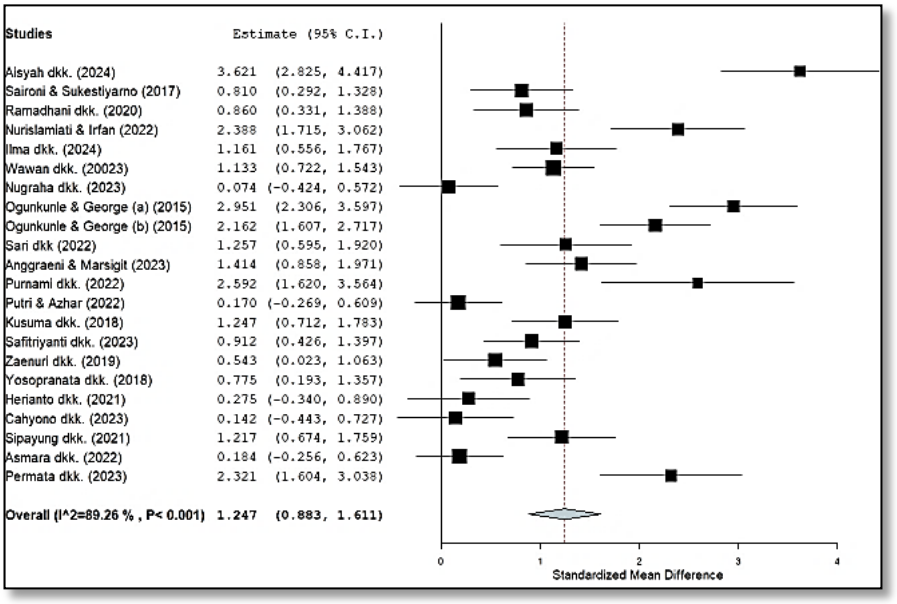

Figure 3 Forest Plot of the Combined Effect Size

Ethnomathematics was introduced by D'Ambrosio (1985) to foster the creation of new mathematical knowledge, aiming to uncover mathematical knowledge from the cultural roots of various communities. This idea has attracted many people to study ethnomathematics through various techniques and data sources. Integrating ethnomathematics in the school curriculum impacts new perspectives on mathematics learning, considering that Indonesian society consists of different ethnic groups and cultures, each with unique characteristics (Suherman & Vidákovich, 2022b).

Efforts to develop and integrate mathematical materials that are culturally relevant and that refer to students' own experiences in the mathematics learning curriculum make it possible to apply ethnomathematics (Rosa & Gavarrete, 2017). In the practice of mathematics learning in schools, this approach can be integrated with various learning models, for example, problem-based models (Putri & Azhar, 2022; Zaenuri et al., 2019), project-based model (Nurislamiati & Irfan, 2022), discovery learning model (Aisyah et al., 2024) to technology-based learning models (Fauzi et al., 2021; Richardo et al., 2023). However, implementing ethnomathematics-based learning in the classroom requires more effort from teachers. Teachers should try contextualising the material with everyday situations and local cultural values or practices (D'Ambrósio, 2005; Prahmana et al., 2023). The association of these values with mathematics content in mathematics learning is carried out as closely as possible to students' daily activities so that they perceive mathematics as a meaningful science in their lives. Thus, learning mathematics in the classroom cannot be separated from cultural phenomena in their local environment (D'Ambrosio & D'Ambrosio, 2013; D'Ambrosio & Rosa, 2017; Fairuz et al., 2020; Habibah et al., 2022; Nur et al., 2020; Owens & Muke, 2020).

CT is increasingly becoming a common goal worldwide, and developing better CT skills in students has become an essential trend in the educational revolution (Suherman & Vidákovich, 2024). Implementing the ethnomathematical approaches in mathematics learning positively influences students' MCT ability (Choeriyah et al., 2021b). Through this approach, students are invited to relate mathematical concepts to the local culture they are familiar with to make the learning process more contextual and meaningful (Nur et al., 2020). For example, using patterns and forms from dance movement art in studying geometry can trigger students' CT in understanding the concept of geometric transformation (Habibah et al., 2022). Previous studies show that students who learn through ethnomathematical approaches can better understand mathematical concepts in depth and are more creative in solving mathematical problems because they are used to seeing and solving problems from different perspectives (Owens & Muke, 2020). Essential changes in mathematics teaching need to be made to accommodate the ongoing demographic changes in students in Indonesia (Purnami et al., 2022). The emerging CT process can help students reduce the difficulties they encounter.

This research provided evidence that the difference in effect size between the variables of the ethnomathematical approach and students' MCT in various literature (some fall into the category of minor effects to substantial effects) became more

apparent after the meta-analysis study was conducted, which belongs to the category of significant impacts. Unlike previous studies that primarily focused on problem solving or conceptual understanding (Mao et al., 2022; Nur et al., 2020; Brown et al., 2019) this study fills a gap by specifically targeting creative thinking. The study also ensured objectivity through rigorous publication bias tests, including funnel plot analysis and Rosenthal's file drawer test. In addition, the use of a random effects model accounted for heterogeneity across educational levels and practices, making the findings relevant to diverse contexts. The results of this research are also expected to be the basis for policymaking to optimise the quality of mathematics learning in the classroom. In addition, the results of this research can also be utilised as a reference to compare the integration of ethnomathematics approaches to students' CT in mathematics learning and highlight the importance of applying ethnomathematics-based learning.

CONCLUSIONS

This study found that the ethnomathematical approach was proven to improve the MCT ability of students in Indonesia significantly. This approach contributes to enhancing MCT in society by making mathematics more relevant, contextual and connected to real life and culture. It also bridges gaps in mathematical understanding between different social and cultural groups. This is evidenced by the findings of the meta-analysis study, which shows an effect size of 1.247, which is relatively large. It deduces that the ethnomathematical approach is more effective in achieving students' MCT than conventional learning.

The publication bias test indicates that this meta-analysis research has no publication bias problem, so this research is objective and can be scientifically justified. The results of this research are also expected to be the basis for policymaking so that the quality of mathematics learning in the classroom can be optimised. In addition, the results of this study can also be utilised as a reference to compare the implementation of ethnomathematics approaches to students' MCT in learning mathematics and highlight the importance of the implementation of ethnomathematics-based learning. This study recommends that schools in Indonesia integrate ethnomathematical approaches in mathematics learning because they enrich students' cultural knowledge. Further research is recommended to develop a learning model with an ethnomathematical approach focusing on improving students' CT skills.

REFERENCES

Aisyah, N. A., Abdullah, A. A., Mubarrok, M. N., Adawiya, R., & Dyahsih, A. S. (2024). Penerapan Model Discovery Learning Berbasis Etnomatematika Berbantuan Geogebra terhadap Kemampuan Berpikir Kreatif Matematis. *Mathema Journal, 6*(1), 1-10.

Amalia, N. R., Fajriah, N., & Sari, A. (2019). Pengaruh pendekatan scientific terhadap kemampuan berpikir kreatif siswa smp menggunakan permasalahan open-ended. *EDU-MAT: Jurnal Pendidikan Matematika, 7*(2), 177-186.

Anggraeni, S. S., & Marsigit, M. (2023). Pengaruh Penerapan Metode Saintifik Pada Pembelajaran Geometri Berbasis Etnomatematika Terhadap Kemampuan Berpikir Kreatif Peserta Didik Kelas VIII SMP. *Jurnal Pedagogi Matematika UNY, 9*(2), 157-167. https://doi.org/https://doi.org/10.21831/jpm.v9i2.19638

Asmara, A. S., Fitri, A., Anwar, A. S., & Muhtarulloh, F. (2022). Peningkatan

Kemampuan Berpikir Kreatif dengan Konteks Budaya Lokal Karawang Menggunakan Realistic Mathematics Education Pada Masa Pandemi. *SJME (Supremum Journal of Mathematics Education), 6*(1), 85–92. https://doi.org/10.35706/sjme.v6i1.5761

Azhari, A., & Somakim, S. (2014). Peningkatan kemampuan berpikir kreatif matematik siswa melalui pendekatan konstruktivisme di kelas VII sekolah menengah pertama (SMP) negeri 2 Banyuasin III. *Jurnal Pendidikan Matematika, 8*(1), 1–12.

Balamurugan. (2015). Ethnomathematics; An Approach for Learning Mathematics from Multicultural Perspectives. International Journal of Modern Research and Reviews. *International Journal of Modern Research and Reviews, 3*(6), 716–720.

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to Meta-Analysis*. In Principles and Practice of Clinical Trials. John Wiley & Sons, Ltd.

Borenstein, M., Higgins, J. P. T., Hedges, L. V., & Rothstein, H. R. (2017). Basics of meta-analysis: I^2 is not an absolute measure of heterogeneity. *Research Synthesis Methods, 8*(1), 5-18. https://doi.org/10.1002/jrsm.1230

Brown, B. A., Boda, P., Lemmi, C., & Monroe, X. (2019). Moving Culturally Relevant Pedagogy From Theory to Practice: Exploring Teachers' Application of Culturally Relevant Education in Science and Mathematics. *Urban Education, 54*(6), 775–803. https://doi.org/10.1177/0042085918794802

Cahyono, B., Rohman, A. A., Setyawati, R. D., & Dzakiyyah, R. 'Ilmi. (2023). Pengembangan Media Pembelajaran E-komik Berbasis Etnomatematik dan Kemampuan Berpikir Kreatif pada Materi Geometri MTs. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 12*(2), 2283-2295. https://doi.org/10.24127/ajpm.v12i2.7398

Chinedu, C. C., Olabiyi, O. S., & Kamin, Y. Bin. (2015). Strategies For Improving Higher Order Thinking Skills in Teaching and Learning of Design and Technology Education. *Journal of Technical Education and Training, 7*(2), 35-43.

Choeriyah, L., Qohar, A., & Subanji, S. (2021a). Student Creative Thinking Analysis in Ethnomathematics Based Inquiry Learning on Transformation Materials. *EDUTEC : Journal of Education And Technology, 4*(4), 585–597. https://doi.org/10.29062/edu.v4i4.218

Choeriyah, L., Qohar, A., & Subanji, S. (2021b). Student Creative Thinking Analysis in Ethnomathematics Based Inquiry Learning on Transformation Materials. *EDUTEC : Journal of Education And Technology, 4*(4), 585-597.https://doi.org/10.29062/edu.v4i4.218

Cohen, L., Manion, L., & Morrison, K. (2017). *Research Methods in Education.* London: Routledge. https://doi.org/10.4324/9781315456539

Damayanti, H. T. (2018). Mathematical Creative Thinking Ability of Junior High School Students in Solving Open-Ended Problem. *Journal of Research and Advances in Mathematics Education, 3*(1), 36–45.

D'Ambrósio, U. (2005). Society, Culture, Mathematics and Its Teaching. *Educação e Pesquisa, 31(1), 99–120. https://doi.org/10.1590/S1517-97022005000100008*

D'Ambrosio, U., & D'Ambrosio, B. S. (2013). The Role of Ethnomathematics in Curricular Leadership in Mathematics Education. *Journal of Mathematics Education at Teachers College*, *4*(1). https://doi.org/10.7916/jmetc.v4i1.767

D'Ambrosio, U., & Rosa, M. (2017). Ethnomathematics and Its Pedagogical Action in Mathematics

Education. https://doi.org/10.1007/978-3-319-59220-6_12

Dilekçi, A., & Karatay, H. (2023). The Effects of the 21st Century Skills Curriculum on The Development of Students' Creative Thinking Skills. *Thinking Skills and Creativity, 47*, 101229.

Fairuz, F. R., Fajriah, N., & Danaryanti, A. (2020). Pengembangan LKPD Materi Pola Bilangan Berbasis Etnomatematika Sasirangan di Kelas VIII Sekolah Menengah Pertama. *EDU-MAT: Jurnal Pendidikan Matematika, 8*(1), 29-38. https://doi.org/10.20527/edumat. v8i1.8343

Faiziyah, N., Sutama, I. S., Wulandari, S., & Yudha, D. A. (2020). Enhancing creativity through ethnomathematics. *Universal Journal of Educational Research, 8*(8), 3704–3710.

Fajriah, N., Suryaningsih, Y., Zainuddin, Z., Masriani, R., & Rahadhian, L. N. R. (2021). Eksplorasi etnomatematika budaya di lingkungan lahan basah sebagai sarana mengembangkan kemampuan berpikir tingkat tinggi peserta didik. *EDU-MAT: Jurnal Pendidikan Matematika, 9*(2), 121–130.

Fauzi, A., Buchori, A., & Wulandari, D. (2021). Pengembangan Media Berbasis Android dengan Fitur Augemented Reality Menggunakan Pendekatan Etnomatematika Materi Bangun Ruang Sisi Datar di SMP. Imajiner: *Jurnal Matematika Dan Pendidikan Matematika, 3*(6), 484-495. https://doi.org/10.26877/imajiner.v3i6.7911

Gunay, K., & Takunyaci, M. (2023). Examining the Effect of Teaching with Ethnomathematics on Students' Problem-Solving Skills on Transformation Geometry. *Journal of Interdisciplinary Education: Theory and Practice, 5*(2), 86–106. https://doi.org/10.47157/jietp.1384160

Habibah, H., Zulkarnain, I., & Budiarti, I. (2022). Eksplorasi Etnomatematika Konsep Geometri Pada Pola Gerak Tari Tradisional Banjar Baksa Kembang. *EDU-MAT: Jurnal Pendidikan Matematika, 10*(2), 266-279. https://doi.org/10.20527/edumat.v10i2.14090

Hadar, L. L., & Tirosh, M. (2019). Creative thinking in mathematics curriculum: An analytic framework. *Thinking Skills and Creativity, 33*, 100585.

Herianto, H., Sumiati, S., & Jusmiana, A. (2021). Pengaruh Pendekatan Etnomatematika Dan Gaya Kognitif Terhadap Kemampuan Berpikir Kreatif Siswa. *Pedagogy: Jurnal Pendidikan Matematika, 6*(2), 1-16. https://doi.org/10.30605/pedagogy.v6i2.1526

Heriyanto, H., Zaenuri, Z., & Walid, W. (2021). Creative Thinking Ability in Habits of Mind-based Ethnomathematics JUCAMA Learning Models. *Journal of Primary Education, 10*(3), 348–358.

Ilma, I., Riyadi, & Usodo, B. (2024a). Improving Creative Thinking Skills and Learning Motivation Through Ethnomathematics-Based Interactive Multimedia: An Experimental Study in Primary School. *Multidisciplinary Science Journal, 6*(8), 2024141. https://doi.org/10.31893/multiscience.2024141

Ilma, I., Riyadi, & Usodo, B. (2024b). Improving Creative Thinking Skills And Learning Motivation Through Ethnomathematics-Based Interactive Multimedia: An Experimental Study In Primary School. *Multidisciplinary Science Journal, 6*(8), 2024141. https://doi.org/10.31893/multiscience.2024141

Kusuma, D., Kartono, & Zaenuri. (2019). Creative Thinking Ability Based on Students' Metacognition in Creative Problem Solving Learning Model With Recitation and Self-Assessment in

Ethnomatematics. *Unnes Journal of Mathematics Eductaion Research, 8*(1), 25-34.

Kwangmuang, P., Jarutkamolpong, S., Sangboonraung, W., & Daungtod, S. (2021). The development of learning innovation to enhance higher order thinking skills for students in Thailand junior high schools. *Heliyon, 7*(6), e07309. https://doi.org/10.1016/j.heliyon.2021.e07309

Lin, L., & Chu, H. (2018). Quantifying Publication Bias in Meta-Analysis. *Biometrics, 74*(3), 785–794. https://doi.org/10.1111/biom.12817

Machaba, F., & Dhlamini, J. (2021). Ethnomathematics as a Fundamental Teaching Approach (pp. 59–76). https://doi.org/10.1007/978-3-030-82723-6_5

Maharani, N. (2020). The analysis of creative thinking skills of junior high school students in learning natural science on environmental pollution materials with different academic skills. *Journal of Physics: Conference Series*, 1465(1), 12032.

Mao, W., Cui, Y., Chiu, M. M., & Lei, H. (2022). Effects of game-based learning on students' critical thinking: A meta-analysis. *Journal of Educational Computing Research, 59*(8), 1682–1708. https://doi.org/10.1177/0735633121100709 8

Mardhiyana, D., & Sejati, E. O. W. (2016). Mengembangkan kemampuan berpikir kreatif dan rasa ingin tahu melalui model pembelajaran berbasis masalah. *PRISMA, Prosiding Seminar Nasional Matematika*, 672–688.

Mathur, M. B., & VanderWeele, T. J. (2020). Sensitivity Analysis for Publication Bias in Meta-Analyses. *Journal of the Royal Statistical Society Series C: Applied Statistics, 69*(5), 1091–1119. https://doi.org/10.1111/rssc.12440

Meika, I., & Sujana, A. (2017). Kemampuan berpikir kreatif dan pemecahan masalah matematis siswa SMA. *Jurnal Penelitian Dan Pembelajaran Matematika, 10*(2), 8-13.

Nugraha, K. S., Zaenuri, Z., & Suyitno, A. (2023). Kemampuan Berpikir Kreatif pada Model Pembelajaran SAVI Bernuansa Etnomatematika Berdasarkan Gaya Belajar. *JNPM (Jurnal Nasional Pendidikan Matematika), 7*(2), 210-223. https://doi.org/10.33603/jnpm.v7i2.8128

Nur, A. S., Waluya, S. B., Rochmad, R., & Wardono, W. (2020a). Contextual Learning with Ethnomathematics in Enhancing the Problem Solving Based on Thinking Levels. *Journal of Research and Advances in Mathematics Education, 5*(3), 331–344.

Nur, A. S., Waluya, S. B., Rochmad, R., & Wardono, W. (2020b). Contextual learning with Ethnomathematics in Enhancing The Problem Solving Based on Thinking Levels. *JRAMathEdu (Journal of Research and Advances in Mathematics Education), 5*(3), 331-344. https://doi.org/10.23917/jramathedu.v5i3.11679

Nurhidayah, N., Ninawati, M., & Soro, S. (2020). The Influence of Worksheet Implementation Towards Students Mathematics Learning Outcomes. *Indonesian Journal of Elementary Teachers Education, 1*(1), 49-56.

Nurislamiati, & Irfan, M. (2022). Pengaruh Model Pembelajaran Project Based Learning (PjBL) Berbasis Etnomatematika Terhadap Kemampuan Berpikir Kreatif Siswa. *Proximal: Jurnal Penelitian Matematika Dan Pendidikan Matematika, 5*(2), 1–7. https://doi.org/10.30605/proximal.v5i2.1779

Nurlaela, L. (2015). Developing Creative Thinking Skills in Learning at Higher-Educational Institution of Teacher. *3rd UPI International Conference on Technical and Vocational Education and Training,* 114–119.

Nursyahidah, F., Saputro, B. A., & Rubowo, M. R. (2018). Students Problem Solving Ability Based on Realistic Mathematics with Ethnomathematics. *Journal of Research and Advances in Mathematics Education, 3*(1), 13–24.

Ogunkunle, R. A., Harcourt, P., Harcourt, P., George, N. R., & Ed, M. (2015). Integrating Ethnomathematics Into Secondary School Mathematics Curriculum for Effective Artisan Creative Skill Development. *European Scientific Journal, 11*(3), 386-397.

Owens, K., & Muke, C. (2020). Revising The History of Number: How Ethnomathematics Transforms Perspectives on Indigenous Cultures. *Revemop, 2.* https://doi.org/10.33532/revemop.e202007

Permatasari, S. D. A., Budiyono, B., & Pratiwi, H. (2020). Analysis of Mathematical Creativity in The Field of Geometry in Junior High School Students. *Journal of Physics: Conference Series, 1469*(1). https://doi.org/10.1088/1742-6596/1469/1/012157

Prahmana, R. C. I., Arnal-Palacián, M., Risdiyanti, I., & Ramadhani, R. (2023). Trivium Curriculum in Ethno-RME Approach: an Impactful Insight From Ethnomathematics and Realistic Mathematics Education. *Jurnal Elemen*, *9*(1), 298–316. https://doi.org/10.29408/jel.v9i1.7262

Purnami, A. S., Utami, D. R. N., & Kuncoro, K. S. (2022a). Ethnomathematics In the Museum of Sasmitaloka Panglima Besar Jendral Sudirman Yogyakarta In Improving Students ' Creative Thinking Ability. *IndoMath: Indonesia Mathematics Edcuation, 5*(2), 155-164.

Purnami, A. S., Utami, D. R. N., & Kuncoro, K. S. (2022b). Ethnomathematics In the Museum of Sasmitaloka Panglima Besar Jendral Sudirman Yogyakarta In Improving Students ' Creative Thinking Ability. *IndoMath: Indonesia Mathematics Edcuation, 5*(2), 155-164.

Putri, Z. S., & Azhar, E. (2022). Perbandingan Kemampuan Berpikir Kreatif Menggunakan PBL dan Etnomatematika Ditinjau dari KAM. *Union: Jurnal Ilmiah Pendidikan Matematika, 10*(3), 357–370. https://doi.org/10.30738/union.v10i3.13245

Ramadhani, R., Farid, F., Lestari, F., & Machmud, A. (2020a). Improvement of creative thinking ability through problem-based learning with local culture based on students' gender and prior mathematics ability. *Al-Jabar: Jurnal Pendidikan Matematika, 11*(1), 61–72.

Ramadhani, R., Farid, F., Lestari, F., & Machmud, A. (2020b). Improvement of Creative Thinking Ability through Problem-Based Learning with Local Culture Based on Students' Gender and Prior Mathematics Ability. *Al-Jabar: Jurnal Pendidikan Matematika, 11*(1), 61–72. https://doi.org/10.24042/ajpm.v11i1.4961

Ramadhanta, S. A., Simamora, R. E., & Susanti, D. (2024). Enhancing Mathematical Creative Thinking Ability: Experimentation With Realistic Mathematics Education By Embedding Ice Breaking In Junior High School. *EDU-MAT: Jurnal Pendidikan Matematika, 12*(1), 47–66.

Richardo, R., Wijaya, A., Rochmadi, T., Abdullah, A. A., Nurkhamid, Astuti, A. W., & Hidayah, K. N. (2023). Ethnomathematics Augmented Reality: Android-Based Learning Multimedia to Improve Creative Thinking Skills on Geometry. *International Journal of Information and Education Technology, 13*(4), 731-737. https://doi.org/10.18178/ijiet.2023.13.4.1860

Rosa, M., & Gavarrete, M. E. (2017). An Ethnomathematics Overview: An

Introduction. https://doi.org/10.1007/978-3-319-59220-6_1

Safitriyanti, D. E., Sumardi, H., & Haji, S. (2023). Pengaruh model pembelajaran everyday mathematics (em) terhadap kemampuan berfikir kritis dan kreatif siswa smp negeri 01 lebong. *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika, 4*(2), 798–812. https://doi.org/10.46306/lb.v4i2.339

Saironi, M. (2022). Learning With Ethnomathematics Based Open Ended Approach Improves Creative Thinking Ability, Curiosity Character. *Jurnal Sosial Teknologi, 2*(11), 999-1007. https://doi.org/10.59188/jurnalsostech.v2i11.481

Sari, S., Wahyuni, R., & Prihatiningtyas, N. C. (2022). Penerapan model experiential learning berbasis etnomatematika terhadap kemampuan berpikir kreatif matematis siswa. *JUMLAHKU: Jurnal Matematika Ilmiah STKIP Muhammadiyah Kuningan, 8*(2), 47-58. https://doi.org/10.33222/jumlahku.v8i2.2011

Shi, L., & Lin, L. (2019). The trim-and-fill method for publication bias: practical guidelines and recommendations based on a large database of meta-analyses. *Medicine, 98*(23), e15987.

Sipayung, T. N., Imelda, I., Siswono, T. Y. E., & Masriyah, M. (2021). The Differences in Students' Creative Problem-Solving Ability with and without Realistic Methematics Comic Video. *International Journal of Elementary Education, 5*(4), 612-621. https://doi.org/10.23887/ijee.v5i4.41073

Suherman, S., & Vidákovich, T. (2022a). Assessment of mathematical creative thinking: A systematic review. *Thinking Skills and Creativity, 44*, 1–13.

Suherman, S., & Vidákovich, T. (2022b). Assessment of mathematical creative thinking: A systematic review. *Thinking Skills and Creativity, 44*, 101019. https://doi.org/10.1016/j.tsc.2022.101019

Suherman, S., & Vidákovich, T. (2022c). Tapis Patterns in the Context of Ethnomathematics to Assess Students' Creative Thinking in Mathematics: A Rasch Measurement. *Mathematics Teaching Research Journal, 14*(4), 56–79.

Suherman, S., & Vidákovich, T. (2024). Mathematical Creative Thinking-Ethnomathematics based Test: Role of Attitude toward Mathematics, Creative Style, Ethnic Identity, and Parents' Educational Level. *Revista de Educación a Distancia (RED), 24*(77), 1-22. https://doi.org/10.6018/red.581221

Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). Examples of problem-solving strategies in mathematics education supporting the sustainability of 21st-century skills. *Sustainability, 12*(23), 10113.

Wawan, W., Retnawati, H., & Setyaningrum, W. (2023). An Integrative Learning Model to Improve Problem-Solving and Creative Thinking Abilities, Collaboration, and Motivation. *Islamic Guidance and Counseling Journal, 6*(2), 1-21. https://doi.org/10.25217/0020236402400

Yayuk, E., & As' ari, A. R. (2020). Primary School Students' Creative Thinking Skills in Mathematics Problem Solving. *European Journal of Educational Research, 9*(3), 1281–1295.

Yosopranata, D., Zaenuri, Z., & Mashuri, M. (2018). Mathematical Connection Ability on Creative Problem Solving with Ethnomathematics Nuance Learning Model. *Unnes Journal of Mathematics Education, 7*(2),108-113.

Zaenuri, Nastiti, P. A., & Suhito, S. (2019). Mathematical Creative Thinking Ability Based on Students' Characteristics of Thinking Style Through Selective Problem Solving Learning Model with

Ethnomatematics Nuanced. *Unnes Journal of Mathematics Education, 8*(1), 49-57.