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A Meta-Analysis On The Effect Of Ethnomathematics To Students' Ability In Geometry

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Abstract. Geometry skills are fundamental in studying mathematics in three dimensions. In schools, it is expected to make schemes of methods and solutions so that students in junior high school can more easily understand geometry lessons by providing tangible examples in students' environments. One of the solution keys to mathematics lessons, especially in geometry, is to combine it with ethnomathematics.

In this study, a meta-analysis is reviewed to present an empirical synthesis of studies designed to deliver a systematic design of ethnomathematics related to the meta-analysis's geometric learning education submission, empirical studies are used on the analysis of journal articles from 2015-2021.

This research is focused on empirical studies using mixs-methods this meta-analysis conduct to gain knowledge of ethnomathematics on the general effect of students' geometric skills. This method aims to examine and combine all pertinent studies, both published and unpublished, so that a weighted mean effect size would be derived. This meta-analysis aims to review the quantitative results of empirical studies of the effect of ethnomathematics in conveying students' geometric abilities

The results of this study are statistically significant with small mean scores on effect sizes and heterogeneity test results between studies. Linear models are used to describe the independent variables that affect all effect sizes. The meta-analysis results were obtained. The effect of ethnomathematics has a positive impact on learning geometry in secondary schools. Ethnomathematics can be used as a solution to learning geometry to improve students' geometry skills.

Key words: ethnomathematics; geometry ability; junior high school; meta-analysis.

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INTRODUCTION

Learning mathematics combined with ethnomathematics is a way to make mathematics related to students' cultural environment. Furthermore, mathematics learning, especially culture-based geometry, will be contextually meaningful learning based on students' experiences as members of a cultural society. Various kinds of local wisdom can be developed in education based on local wisdom (Ulfah & Purwanti, 2020). Ethnomathematics is the key to finding relationships in mathematics when cultural groups integrate with the field of mathematics (Balamurugan, 2015). According to (Richardo, 2016), ethnomathematics has an essential role in learning: facilitates students to construct mathematical concepts, ethnomathematics provides a learning environment that creates good motivation and fun.

Geometry plays a critical role in mathematics with theoretical and practical characteristics (Choi & Park, 2013). Besides, geometry is also a fundamental skill that must master in mathematics (Abdullah & Zakaria, 2012). In the level of Junior High Schools, geometry materials include the correlation between lines, angles, triangles and squares and use them in problem-solving (Syarifudin et al., 2019). Many students still have difficulty learning geometry from the importance of studying geometry (Chiphambo & Feza, 2020).

The geometry ability has a characteristic in students exploring spatial shapes dimensions compared to other branches of mathematics (Ramlan, 2016). Geometric learning and student practice apply to traditional mathematics knowledge in the school curriculum. Learning geometry in junior high school indicates that students have thought geometry informal deduction abilities (Hardianti et al., 2017).

The domain of geometry is direct learning to integrate ethnomathematical practices in the school curriculum (Verner et al., 2019). Learning geometry and geometric objects is a model in the student environment as objects (Maričić & Stamatović, 2018). The cultural involvement can be seen in a geometric design in cultural artifacts and broadens students questions about geometric properties and cultural values (Verner et al., 2013). Geometry is a part of mathematics that

deals with shapes and lines (Chiphambo & Feza, 2020).

The meta-analysis results from the synthesis of parameter estimate to determine various studies' effects (Price et al., 2019). This method aims to examine and combine all pertinent studies, both published and unpublished, so that a weighted mean effect size would be derived (Sugano & Mamolo, 2021). Many researchers acknowledge that the meta-analysis method's evidence has the advantage of generalizing based on the multiple types of evidence selected (Kneale et al., 2019). Specific statistical technique methods use meta-analysis to combine similar studies provided evidence of several phenomena with the same results (Van aert et al., 2019). They can compare with several studies that have been grouped (Langan et al., 2019). Meta-analysis is a combined method of all studies to determine the effect using the synthesis of all selected studies (Papadimitropoulou et al., 2019). Based on the meta-analysis's purpose to determine ethnomathematics' effect on students' geometric abilities. Quantitative methods to explore the influence between ethnomathematics and geometry skills in junior high school education.

The search of the literature to obtain studies that include meta-analysis to present geometry capabilities. Meanwhile, the researcher determined the literature's period meta-analysis by having recent studies in the search. The word ethnomathematics was searched through the indexing website, so many research articles will find. This meta-analysis used the articles identified in two stages: a search from a reputable international Journal Information Center, Scimago Journal & Country Rank. We used article searches from 2015 to 2021. The following search for text articles: mathematics, ethnomathematics, geometric skills, pretest-posttest, junior high school, and culture. Second, the literature search was not carried out on the dissertation index, thesis, and master international conference program's journal results.

This meta-analysis aims to review the quantitative results of empirical studies of the effect of ethnomathematics in conveying students' geometric abilities. The research to determine : How the effect of ethnomathematics students' geometric skills according to van Hiele's theory? , Whether there is a significant difference in effect between studies? , Is their heterogeneity in effect size?.

METHODS

This research is focused on empirical studies using mixs-methods this meta-analysis conduct to gain knowledge of ethnomathematics on the general effect of students' geometric skills. Quantitative analysis used in this article aims to determine the relationship between variables by detailing the problem to determine the impact on the study. Quantitative methods are essential to provide an overview of all the events in this section (Becker, 1996). The quantitative research results generalize from the sample to the population (Newman & Ridenour, 1998), answering research questions in seeing the effect of ethnomathematics on geometric ability. In qualitative research, several people's interactions, events, behaviours, and opinions about the views and attitudes (Patton, 1990). Qualitative research provides benefits in understanding geometrical abilities related to ethnomathematics. In this article, qualitative research use to obtain information that answers questions related to formulating research problems.

The study's quantification as an effect estimate is crucial to conclude the meta-analysis process (Veroniki et al., 2019). We review chronologically each meta-analysis published from 2015 until the appropriate data are obtained for re-analysis. The meta-analysis approach provides an estimate of the combined effect of the research that has been carried out (Van Aert & Jackson, 2019). Thus meta-analysis is a vital tool for obtaining study evidence (Shih & Tu, 2019). A meta-analysis study requires excellent accuracy because it considers the chronological year for each published study (Mathur & Weele, 2020). It is beneficial to estimate the effect and consistency of evidence (heterogeneity test) (Li et al., 2019).

A literature search yielded a total of 15 studies. After conducting a review, it produced 15 pieces of literature for use in meta-analysis. Literature that examines the effects of ethnomathematics or studies aimed at making causal inferences (between pre and post-test) falls into the category of using proportions (Karada, 2015). The study used pre-experimental in-analysis and effect sizes for comparison (Borenstein et al., 1986). This meta-analysis study was small (15) to test all predictors of ethnomathematics that affect learning geometry. The small number of samples also limits the examination of the kind of influence of ethnomathematics on geometry.

Systematic reviews were carried out using a modified procedure adopted from the selected items and conducted a structured study of the meta-analysis statements (PRISMA) (Moher et al., 2009). There are many independent variables selected to assign specific marks for the covariates used in the meta-analysis. This article divides into two categories in the selection procedure: methodological content studies and substantive studies' content. The study content in the form of methodology refers to the research design factors. Two exciting features: (1) type of publication (journal articles/international conferences) and (2) research design.

Table 1. Description of the effect of ethnomathematics on geometric capabilities

Geometry ability	Ethnomathematical influence	Examples of its application
Visualization	Can provide examples of geometric shapes by the cultural building forms around students	Describe geometric shapes by giving examples of actual buildings according to the student's cultural scope
Analysis	Can apply geometric shapes following cultural buildings	Can provide an analysis of the similarity of geometric buildings and cultural buildings
Informal deduction	Combining explanations of identification of geometric shapes and original cultural structures	Can provide individual conclusions from what has been observed
Formal deduction	Making theoretical identification of geometric elements based on natural shapes in the building culturally	Draw theoretic conclusions
Precision	Accuracy in the application of geometric theory and cultural analysis of objects	Can name specific geometrical theories and original shapes that are theoretically appropriate

Data Analysis Technique

Calculating the effect using descriptive statistics (mean, standard deviation, and correlation). This descriptive statistical measurement uses Hedge's formula to determine the average difference a study using independent groups is as follows (Borenstein et al., 1986): Results on the difference in standard means (δ), this study uses two independent group data as follows;

$$d = \frac{\overline{X_1} - \overline{X_2}}{S_{within}} \quad (1)$$

In the numerator, $\overline{X_1}$ and $\overline{X_2}$ are the samples mean in the two data groups. On value, S_{within} is a standard deviation in the group, aggregated across groups.

$$S_{within} = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}} \quad (2)$$

The values n_1 and n_2 are the samples in the two research groups, and S_1 and S_2 are the value standard deviations in the two study groups. The bias value can be replaced by looking for an unbiased estimate value (Borenstein et al., 1986). To change the bias value, can use a correction factor called J

$$J = 1 - \frac{3}{4df - 1} \quad (3)$$

In the above formula, df is a value degree freedom for know Swithin. The value from two independent group samples is $n_1 + n_2 - 2$. This approach always has an error of less than 0,007 and less than 0.035 if $df \geq 10$.

$$g = J \times d \quad (4)$$

Calculate d and g from the literature using pre-test and post-test values. By calculating the standard average difference (δ) from the study using the sample estimation formula d is

$$d = \frac{\overline{Y_1} - \overline{Y_2}}{S_{within}} \quad (5)$$

Researchers conducted an independent meta-analysis, thus using random-effects analysis to determine the effect value in this study. The random-effects analysis assumed that the effect values differed between the treatment groups and between studies (Karada, 2015). The first step in determining variation is to find the value of Q, which is described by the formula as

$$Q = \Sigma_{i=1}^{k} W_i(Y_i - M)^2 \quad (6)$$

Then, set the Q value assuming that all literature has the same effect size and that all variance is due to sampling errors in the literature. Since Q is the standard value, the value specified relates not to the effect size metric but degrees of freedom (df),

$$df = k - 1 \quad (7)$$

that k is the number of literature.

Determining the homogeneity assumption, the heterogeneity must be statistically significant and proceed by looking for Q value (and df). Heterogeneity helps determine the effect size and the number of estimated "sample sizes" as a determinant of estimator performance (Hong & Reed, 2020).

The alpha value is set at 0.05, with an alpha value more significant than the p-value; the hypothesis is rejected so that the study does not have the same effect size. This test is of significance on both effects and effect estimation accuracy. According to (Grant & Hunter, 2006) proposed using the I^2 statistic to describe this proportion as the signal-to-noise ratio. That is calculated as follows.

$$I^2 = \left(\frac{Q - df}{Q}\right) \times 100\% \quad (8)$$

RESULTS AND DISCUSSION

Analysis of the overall effect value, heterogeneity test are shown in table 2. In the 15 samples combined, the estimated total effect size is 0.155, and the error value is 0.035. It is proven that overall ethnomathematics improve students' geometric skills with an estimated standard deviation of 0.155. Although the size of the effect is small, it is seen the significance value (z-value = 2.641, $p < 0.001$). At the $\alpha = 95\%$ of the estimated mean effect (0.067, 0.215), it is known that 95% of the actual average effect size of ethnomathematics is between 0.067 and 0.215.

The heterogeneity test resulted in a statistical Q of 117.86 compared to the expected value of 14. The null hypothesis test by looking at the statistical results is significant with a p-value less than 0.001. That shows that the variability is substantial by looking at the statistical value on the effect size. The I^2 statistical estimate is 67.571%, meaning that significant differences in effect sizes cause 67.571% of the total observations of variance in the research literature.

The variance concerning the mean effect size was 0.054, and the standard deviation value was 0.166 (T statistic). From these findings, it is necessary to test for variability by investigating the role of ethnomathematics and geometric capabilities in terms of effect sizes. The heterogeneity test value is significant (Q-statistic = 117.86, p <.0.1), these results show that there are variables that must investigate to determine other effects. It can also be explained that the effects are significantly different. These assumptions can be caused by factors related to the implementation of the treatment, the number of participants, the type of experiment, and the research design model. For effect on heterogeneity, linear modelling is used. The Comparison Of Effects In A Group

Overall Effect Size

Table 2. Overall Effect Size

Model	Number of literature	Effect size					Two-party test	
Random	15	Estimated value	Error value	Variance	Lower limit	Upper limit	Z-value	p-value
		0.155	0.035	0.002	0.057	0.067	0.215	0.00
	Heterogeneity							
	Q-value	$df(Q)$	Value-p	I-squared	δ-squared	Standard error	Variance	δ

117.86	14	0.000	67.571	0.054	0.022	0.001	0.166

Table 3. Comparison of effects within one group

	Effect size	Hedges'g	Standard error	p-value	Heterogeneity test		
					Q-value	$df(Q)$	p-value
Junior high school							
7th grade	5	0.196	0.039	0.000	0.065	1.00	0.074
8th grades	10	0.103	0.165	0.246			
Types of research							
Pre-experimental	8	0.256	0.095	0.000	2.509	1.00	0.067
Quasi-experimental	7	0.140	0.065	0.109			
Type of treatment							
Treatment with ethnomathematic	9	0.285	0.073	0.006	7.682	1.00	0.017
Curriculum programs	6	0.163	0.079	0.312			

The significance level test results by looking at the differences between subgroups showed that there were differences between the study classes, the value was statistically significant at the level = 0.05 (p-value = 0.074), that these results have a class 7 role in the meta-analysis. Furthermore, in the classification of research types, the results are significant, at the level 0.10 (p-value = 0.067) supports the quasi-experimental study. In the analysis, by looking at the difference in treatment, the results were significant, the value α = 0.10 (p-value = 0.017), these results dominated the treatment with ethnomathematics.

Linear Model

Table 4. Linear Model

	Coefficient	Error	T-ratio	Estimated value df	P-value
Constant effect					
Intercept	0.49	0.18	3.04	10	0.02
7th grades	-0.03	0.18	-0.32	10	0.85
8th grade	0.28	0.17	2.05	10	0.08
Treatment with ethnomathematics	0.31	0.14	-1.5	10	0.06
Curriculum programs	-0,24	0,12	-2,37	10	0,01
	Standart deviasi	Variance	df	Chi-square	p-value
Random effect	0.21	0.06	10	110.77	< 0.001

Table 4 provides the estimated values, the regression coefficient values for the grade level in junior secondary schools are 0.03, and the p-value is 0.85. This value means that the statistical average is not significantly different when paying attention to the ethnomathematicsd factors in the 8th-grade students' learning. The regression coefficient for grade 8 secondary school was 0.28 with a p-value of 0.08. These descriptions show that controlling for the effect factor of ethnomathematical treatment on learning for students is from an average of 0.28 standard deviation lower than for grade 7 students.

The coefficient for ethnomathematics effect is 0.31, p-value = 0.06. That shows that the average for controlling ethnomathematics factors in learning is 0.31. These results indicate that ethnomathematics on learning geometry results in learning that increases achievement by seeing the coefficient value is greater than the standard deviation. In the treatment program according to the curriculum, the coefficient is 0.24, p-value = 0.01. That shows that treatment by the curriculum has not resulted in less optimal learning.

DISCUSSION

Meta-analysis has advantages over other literature review models such as narrative reviews (Borenstein et al., 1986). Meta-analyzes have criteria in the literature analysis that provide the means to regularly examine the effects of these treatments under different circumstances and investigate possible causes of treatment effects

(Zwahlen et al., 2008). The meta-analysis's review and application use a more detailed analysis than any other review method (Borenstein et al., 1986). In this study, the conditions are so strict that the limits refer to the small sample size.

This meta-analysis included a small sample (15) to test for predictors of overall ethnomathematics affecting geometry learning. This meta-analysis has a relatively small sample, thus limiting the examination of the type of effect of ethnomathematics on geometry. In the selection of meta-analysis literature presented above, in many cases, it is limited to the exploration scale of dispersion size, so the contribution of meta-analysis is to generalize according to its own goals. The general purpose is to determine whether a study is needed to investigate the problem further. This meta-analysis study proves that learning ethnomathematics is necessary for the science of geometry to improve student achievement.

CONCLUSION

This meta-analysis study provides evidence that ethnomathematics on geometry tends to improve geometry skills more effectively than learning. According to the significant results, ethnomathematics learning is better than learning according to the school curriculum. For ethnomathematics learning, it can be used in culture-based education, making learning situations more enjoyable. In other things that must be considered, according to (Rahmawati et al., 2020), during the learning process, teachers must pay attention to differences in cultural backgrounds and students' characteristics to help them construct their knowledge.

This study's findings indicate that the school level affects the students' geometric ability, which combines with ethnomathematics. Grade 8 students show more of their ability in geometry combined with ethnomathematics learning by seeing the results that significantly impact student achievement. Ethnomathematics learning includes more related to student culture, which is specially designed to improve geometric skills. The results of developing learning geometry combined with ethnomathematics by seeing significant results can provide better results in learning.

Further research on integrating ethnomathematics learning in secondary schools can pay more attention to its implementation details. Because teaching and learning activities are closely related to students' local culture, they can also be integrated through teaching methods that are more suitable and effective because the implementation process in the classroom also leads to students' cultural situations. This meta-analysis literature study has not reported a good learning process in the aspects used in learning. More data on potential models of treatment effect measurement will be important in further studies of what may influence treatment effects. Overall, a more detailed meta-analysis is needed to teach ethnomathematics in learning geometry in secondary schools. As discussed earlier, the sample used is small for this meta-analysis's case study, which could be limited in understanding the factors associated with learning geometry combined with ethnomathematics. The meta-analysis results can be carried out in further research to conduct experiments through more detailed teaching methods and report as much detail as possible in the treatment carried out. Then we are required to explore what kind of method is more effective for groups of students in what culture.

Meta-analysis of empirical studies on learning geometry combines ethnomathematics in secondary schools, effectively learning and leading students to geometric skills. It is essential to strive for learning in secondary schools to mix culture with learning geometry. This meta-analysis shows an increase in the geometry analysis skills of junior high school students through grade 8 learning with a combination of ethnomathematics.

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REFERENCES

Abdullah, A. H., & Zakaria, E. (2012). The activities based on van hiele's phase-based learning: Experts' and preservice teachers' views. *Journal of Mathematics and Statistics*, *8*(3), 385–395. https://doi.org/10.3844/jmssp.2012.385.395

Abu, M. S., Ali, M. B., & Hock, T. T. (2012). Assisting Primary School Children to Progress through Their van Hiele's Levels of Geometry Thinking using Google SketchUp. *Procedia - Social and Behavioral Sciences*, *64*, 75–84. https://doi.org/10.1016/j.sbspro.2012.11.010

Balamurugan, M. (2015). Etnomathematics; An Approach For Learning Mathematics From Multikultural Perspective. *International Journal Of Modern Research And Reviews*, *3*(6), 716–720.

Becker, H. S. (1996). The epistemology of qualitative research. In Jessor, R, Colby, A and Shweder, R.A. (eds) Ethnography and Human Development: Context and meaning in social inquiry. *Chicago: University of Chicago Press.*, 53–72.

Borenstein, M., V.Hedges, L., JulianP.T.Higgins, & HannahR.Rothstein. (1986). Introduction to Introduction. In *An Introduction to Information Processing*. https://doi.org/10.1016/b978-0-12-209005-9.50005-9

Chazan, D. (1993). *High School Geometry Students' Justification For Their Views Of Empirical Evidence And Mathematical Proof*. 359–387.

Chiphambo, S. M., & Feza, N. N. (2020). Exploring geometry teaching model: Polygon pieces and dictionary tools for the model. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(9). https://doi.org/10.29333/EJMSTE/8358

Choi, K. M., & Park, H. J. (2013). A comparative analysis of geometry education on curriculum standards, textbook structure, and textbook items between the U.S. and Korea. *Eurasia Journal of Mathematics, Science and Technology Education*, *9*(4), 379–391. https://doi.org/10.12973/eurasia.2013.947a

Crowley, M. (1987). The van Hiele model of the development of geometric thought. *Learning and Teaching Geometry, K-12*, 1–16. Retrieved from http://www.csmate.colostate.edu/docs/math/mathactivities/june2007/The van Hiele Model of the Development of Geometric Thought.pdf

Dindyal, J. (2007). The Need for an Inclusive Framework for Students' Thinking in School Geometry. *Montana Council of Teachers of Mathematics*, *4*(11), 1551–3440.

Faiziyah, N., Sutama, Sholihah, I., Wulandari, S., & Yudha, D. A. (2020). Enhancing Creativity through Ethnomathematics. *Universal Journal of Educational Research*, *8*(8), 3704–3710. https://doi.org/10.13189/ujer.2020.080850

Gloriana González, & Herbst, P. G. (2006). Competing Arguments for the Geometry Course: Why Were American High School Students Supposed to Study Geometry in the Twentieth Century? *Imago Mundi*, *71*(1), 11–37. Retrieved from http://www.comap.com/historyjournal/pdf/Vol1No1.pdf%5Cnpapers3://publication/uuid/74AF820C-FC06-4C13-AF40-80415ABCF821

Grant, J., & Hunter, A. (2006). Measuring inconsistency in knowledgebases. *Journal of Intelligent Information Systems*, *27*(2), 159–184. https://doi.org/10.1007/s10844-006-2974-4

Hanid, M. F. A., Mohamad Said, M. N. H., & Yahaya, N. (2020). Learning strategies using augmented reality technology in education: Meta-analysis. *Universal Journal of Educational Research*, *8*(5 A), 51–56. https://doi.org/10.13189/ujer.2020.081908

Hardianti, D., Priatna, N., & Priatna, B. A. (2017). Analysis of Geometric Thinking Students' and Process-Guided Inquiry Learning Model. *Journal of Physics: Conference Series*, *895*(1). https://doi.org/10.1088/1742-6596/895/1/012088

Herbst, P., & Brach, C. (2006). Proving and doing proofs in high school geometry classes: What is it that is going on for students? *Cognition and Instruction*, *24*(1), 73–122. https://doi.org/10.1207/s1532690xci2401_2

Hoffer, A. (1981). "Geometry Is More Than Proof." The Mathematics Teacher. *Http://Www.Jstor.Org/Stable/27962295*, *74*(1), 11–18.

Hong, S., & Reed, W. R. (2020). Using Monte Carlo experiments to select meta-analytic estimators. *Research Synthesis Methods*. https://doi.org/10.1002/jrsm.1467

Karada Ğ, E. (2015). Leadership and organizational outcomes: Meta-analysis of empirical studies. *Leadership and Organizational Outcomes: Meta-Analysis of Empirical Studies*, (June 2017), 1–273. https://doi.org/10.1007/978-3-319-14908-0

Kneale, D., Thomas, J., O'Mara-Eves, A., & Wiggins, R. (2019). How can additional secondary data analysis of observational data enhance the generalisability of meta-analytic evidence for local public health decision making? *Research Synthesis Methods*, *10*(1), 44–56. https://doi.org/10.1002/jrsm.1320

Kobal, D. (2017). *The Power of Geometry in the Concept of Proof*. 735–736. https://doi.org/10.1007/978-3-319-62597-3_129

Kuzniak, A., & Rauscher, J. C. (2011). How do

teachers' approaches to geometric work relate to geometry students' learning difficulties? *Educational Studies in Mathematics*, *77*(1), 129–147. https://doi.org/10.1007/s10649-011-9304-7

Langan, D., Higgins, J. P. T., Jackson, D., Bowden, J., Veroniki, A. A., Kontopantelis, E., … Simmonds, M. (2019). A comparison of heterogeneity variance estimators in simulated random-effects meta-analyses. *Research Synthesis Methods*, *10*(1), 83–98. https://doi.org/10.1002/jrsm.1316

Li, X., Dusseldorp, E., & Meulman, J. J. (2019). A flexible approach to identify interaction effects between moderators in meta-analysis. *Research Synthesis Methods*, *10*(1), 134–152. https://doi.org/10.1002/jrsm.1334

Maričić, S. M., & Stamatović, J. D. (2018). The effect of preschool mathematics education in development of geometry concepts in children. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(9), 6175–6187. https://doi.org/10.12973/EURASIA.2017.01057A

Mathur, M. B., & VanderWeele, T. J. (2020). Estimating publication bias in meta-analyses of peer-reviewed studies: A meta-meta-analysis across disciplines and journal tiers. *Research Synthesis Methods*. https://doi.org/10.1002/jrsm.1464

Mayberry, J. (2020). The Van Hiele Levels of Geometric Thought in Undergraduate Preservice Teachers. *Journal for Research in Mathematics Education*, *14*(1), 58–69. https://doi.org/10.5951/jresematheduc.14.1.0058

Misnasanti, & Mahmudi, A. (2018). Van Hiele Thinking Level and Geometry Visual Skill towards Field Dependent-Independent Students in Junior High School. *Journal of Physics: Conference Series*, *1097*(1). https://doi.org/10.1088/1742-6596/1097/1/012133

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Grp, P. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement (Reprinted from Annals of Internal Medicine). *Physical Therapy*, *89*(9), 873–880. https://doi.org/10.1371/journal.pmed.1000097

Newman, I., & Ridenour, C. (1998). Qualitative-Quantitative Research Methodology: Exploring the Interactive Continuum Qualitative-Quantitative Research: A False Dichotomy. *Educational Leadership Faculty Publications*, 1–12.

Nichols, J. D. (1996). The effects of cooperative learning on student achievement and motivation in a high school geometry class. *Contemporary Educational Psychology*, *21*(4), 467–476. https://doi.org/10.1006/ceps.1996.0031

Nugraha, Y. S. (2019). Ethnomathematical review of Toraja's typical carving design in geometry transformation learning. *Journal of Physics: Conference Series*, *1280*(4). https://doi.org/10.1088/1742-6596/1280/4/042020

Papadimitropoulou, K., Stijnen, T., Dekkers, O. M., & le Cessie, S. (2019). One-stage random effects meta-analysis using linear mixed models for aggregate continuous outcome data. *Research Synthesis Methods*, *10*(3), 360–375. https://doi.org/10.1002/jrsm.1331

Patton, M. . (1990). Qualitative evaluation and research methods (2nd ed.). Newbury Park, CA: *Research in Nursing & Health*, *14*(1), 73–74.

Polanin, J. R., Pigott, T. D., Espelage, D. L., & Grotpeter, J. K. (2019). Best practice guidelines for abstract screening large-evidence systematic reviews and meta-analyses. *Research Synthesis Methods*, *10*(3), 330–342. https://doi.org/10.1002/jrsm.1354

Price, M. J., Blake, H. A., Kenyon, S., White, I. R., Jackson, D., Kirkham, J. J., … Riley, R. D. (2019). Empirical comparison of univariate and multivariate meta-analyses in Cochrane Pregnancy and Childbirth reviews with multiple binary outcomes. *Research Synthesis Methods*, *10*(3), 440–451. https://doi.org/10.1002/jrsm.1353

Rahmawati, Y., Ridwan, A., Cahyana, U., & Febriana, D. (2020). The integration of culturally responsive transformative teaching to enhance student cultural identity in the chemistry classroom. *Universal Journal of Educational Research*, *8*(2), 468–476. https://doi.org/10.13189/ujer.2020.080218

Ramlan, A. M. (2016). The Effect of Van Hiele Learning Model Toward Geometric Reasoning Ability Based on Self-Efficacy of Senior High School Students. *Journal of Mathematics Education*, *1*(2), 63–72.

Richardo, R. (2016). Peran Ethnomatematika dalam Penerapan Pembelajaran Matematika. *Almaata.Ac.Id*, *7*(2), 118–125.

Shih, M. C., & Tu, Y. K. (2019). Evaluating network meta-analysis and inconsistency using arm-parameterized model in structural equation modeling. *Research Synthesis Methods*, *10*(2), 240–254. https://doi.org/10.1002/jrsm.1344

Sinclair, N., Bartolini Bussi, M. G., de Villiers, M., Jones, K., Kortenkamp, U., Leung, A., & Owens, K. (2017). *Geometry Education, Including the Use of New Technologies: A Survey of Recent Research*. 277–287. https://doi.org/10.1007/978-3-319-62597-3_18

Škrbec, M., & Čadež, T. H. (2015). Identifying and fostering higher levels of geometric thinking. *Eurasia Journal of Mathematics, Science and Technology Education*, *11*(3), 601–617. https://doi.org/10.12973/eurasia.2015.1339a

Sugano, S. G. C., & Mamolo, L. A. (2021). The effects of teaching methodologies on students' attitude and motivation: A meta-analysis. *International Journal of Instruction*, *14*(3), 827–846. https://doi.org/10.29333/iji.2021.14348a

Syarifudin, Purwanto, Irawan, E. B., Sulandra, I. M., & Fikriyah, U. (2019). Student verbal interaction in geometry problem-solving through cognitive activities. *International Journal of Instruction*, *12*(3), 167–182. https://doi.org/10.29333/iji.2019.12311a

Ulfah, A., & Purwanti, S. (2020). The effectiveness of thematic textbook based on local wisdom on cooperation character of first grade students of primary school. *Universal Journal of Educational Research*, *8*(7), 2996–3001. https://doi.org/10.13189/ujer.2020.080728

van Aert, R. C. M., & Jackson, D. (2019). A new justification of the Hartung-Knapp method for random-effects meta-analysis based on weighted least squares regression. *Research Synthesis Methods*, *10*(4), 515–527. https://doi.org/10.1002/jrsm.1356

van Aert, R. C. M., van Assen, M. A. L. M., & Viechtbauer, W. (2019). Statistical properties of methods based on the Q-statistic for constructing a confidence interval for the between-study variance in meta-analysis. *Research Synthesis Methods*, *10*(2), 225–239. https://doi.org/10.1002/jrsm.1336

Verner, I., Massarwe, K., & Bshouty, D. (2013). Constructs of engagement emerging in an ethnomathematically-based teacher education course. *Journal of Mathematical Behavior*, *32*(3), 494–507. https://doi.org/10.1016/j.jmathb.2013.06.002

Verner, I., Massarwe, K., & Bshouty, D. (2019). Development of competencies for teaching geometry through an ethnomathematical approach. *Journal of Mathematical Behavior*, *56*(May), 100708. https://doi.org/10.1016/j.jmathb.2019.05.002

Veroniki, A. A., Jackson, D., Bender, R., Kuss, O., Langan, D., Higgins, J. P. T., … Salanti, G. (2019). Methods to calculate uncertainty in the estimated overall effect size from a random-effects meta-analysis. *Research Synthesis Methods*, *10*(1), 23–43. https://doi.org/10.1002/jrsm.1319

Weldeana, H. N. (2016). Ethnomathematics in Ethiopia: Futile or Fertile for Mathematics Education? *Momona Ethiopian Journal of Science*, *8*(2), 146. https://doi.org/10.4314/mejs.v8i2.4

Wulan, A. P., Maryaeni, Saryono, D., & Dermawan, T. (2019). "Tundang" folk songs of west kalimantan Indonesia as material of local wisdom based education. *Universal Journal of Educational Research*, *7*(8), 1717–1725. https://doi.org/10.13189/ujer.2019.070810

Zwahlen, M., Renehan, A., & Egger, M. (2008). Meta-analysis in medical research: Potentials and limitations. *Urologic Oncology: Seminars and Original Investigations*, *26*(3), 320–329. https://doi.org/10.1016/j.urolonc.2006.12.001.