Journal of Urban Mathematics Education
December 2023, Vol. 16, No. 2, pp. 68–89

Integration of Ethnomathematics in Teaching Geometry: A Systematic Review and Bibliometric Report

Patrick Kyeremeh
St. Joseph's College of Education, Bechem - Ghana

Francis Kwadwo Awuah
Kwame Nkrumah University of Science & Technology, Kumasi-Ghana

Esenam Dorwu
Kwame Nkrumah University of Science & Technology, Kumasi-Ghana

Due to the growing interest in the integration of ethnomathematics in mathematics education, we undertook a systematic literature review and bibliometric analysis of research on the incorporation of ethnomathematics in geometry teaching from 2011 to 2021. The search for 37 relevant research articles was done on Google Scholar, Scopus, and by hand search of some key journals. Data retrieved were analyzed descriptively by using Excel and NVivo. The findings showed that literature on ethnomathematics in teaching geometry is mainly produced and consumed in Indonesia, Zimbabwe, Nigeria, and Israel. Also, the findings revealed that the research topics/themes addressed by literature on ethnomathematics integration in teaching geometry can be grouped into five themes: views, practices, effects, challenges, and development of competence. Most of the studies conducted in this area employed ethnography. From the present study, it was observed that the number of research article publications relevant to the present study has increased exponentially, especially from 2018 to 2021. Therefore, it is our belief that this review will aid in the creation of systematic review procedures and reviews that are specifically concerned with the incorporation of ethnomathematics into geometry instruction.

KEYWORDS: integration of ethnomathematics, geometry teaching, systematic review, bibliometric analysis

---

PATRICK KYEREMEH is a Ph.D candidate in Mathematics Education at Kwame Nkrumah University of Science & Technology, Kumasi-Ghana. He is also a lecturer in the Department of Mathematics & I.C.T at St. Joseph's College of Education; Post Office Box 15, Bechem – Ghana, Digital Address: B3-0021-5204; email: pkyeremeh@joscobechem.edu.gh. His research focuses on ethnomathematics, values and valuing in mathematics education, teacher education, curriculum and instruction.

FRANCIS KWADWO AWUAH, Ph.D is a lecturer in Mathematics Education in the Department of Teacher Education at Kwame Nkrumah University of Science & Technology, Kumasi-Ghana; Private Mail Bag KNUST Post Office Kumasi; email: awuahfrancis67@gmail.com. His research focuses on STEM education, ethnomathematics, and problem-solving.

ESENAM DORWU is a MPhil. candidate in Mathematics Education at Kwame Nkrumah University of Science & Technology, Kumasi-Ghana; Private Mail Bag KNUST Post Office Kumasi; email: esenamdorwu99@gmail.com. Her research centers on values and valuing in mathematics education, problem-solving, and mathematical thinking.

Recognizing the part mathematics plays in societal stratification and addressing systemic injustices that marginalized people have been ongoing challenges in mathematics education (and education in general) (Bullock & Larnell, 2015). These challenges could be attributed to Martin and Larnell's (2013) assertion that, the presence of urban mathematics education enterprise and its theoretical and empirical soundness are typically taken for granted by scholars due to different viewpoints and orientations. Milner (2012) explained that researchers, theoreticians, and practitioners do not all agree on what constitutes urban education. To reach a compromise, Milner advised these academics to conceptualize urban education "consistent with the population and social contexts studied" (Milner, 2012, p. 560). Milner argued that "urban education typically has some connections to the people who live and attend school in the social context, the characteristics of those people, as well as surrounding community realities where the school is situated" (p. 558).

Urban mathematics education has experienced several historical turning points over the past 60 years, including the emergence of social and sociopolitical movements that sought to challenge the long history of values, ideologies, and critical omissions that have characterized mainstream mathematics education (Martin & Larnell, 2013; Parks & Schmeichel, 2012). Through theoretically and empirically sound research, urban mathematics education focuses on issues of equity, power, race, class, and identity while also addressing geospatial concerns locally and globally (Martin & Larnell, 2013). This research informs teaching, learning, and policy in urban mathematics classrooms.

The historical moment of the social turn, as described by Stinson and Bullock (2012), acknowledged the significance of social variables, equity, discourse, and relationships. It is believed that learning and teaching mathematics are sociocultural phenomena that are best understood in their respective social and cultural contexts. The social-turn moment, a pivotal time in the development of urban mathematics education, was distinguished by the inclusion of socio-cultural and situative viewpoints as well as a focus on issues of equality and discourse acknowledgment of access to school mathematics. The sociopolitical turn moment on the other hand views identity, power, and knowledge as intertwined and originating from (and produced inside) social discourses (Gutiérrez, 2013). It focuses on themes relating to identity, power, and the social context of mathematics education.

These historical conceptions of mathematics education in urban settings can change the conversation about and enhance the experiences and results of children who have traditionally been underrepresented in mathematics education. The inclusion of social and political elements as crucial in understanding how these influence teaching and learning outcomes is made possible by these historical moments. Among the phrases frequently used in discussions of mathematics education are

equity and social justice. Although equity and social justice are receiving more recognition and focus in mathematics education scholarship and practice (Larnell et al., 2016), many of the concepts and viewpoints have been incorporated into the mainstream discourse with little generatively critical evaluation. This urges the development of innovative teaching strategies that promote social justice and equity in urban schools. In response to this appeal, Rubel (2017) suggested culturally relevant pedagogy and teaching mathematics for social justice as equity-directed instructional strategies for the context of urban schools.

The educational activities designed in accordance with culturally relevant pedagogy principles concentrate on the function of mathematics in a sociocultural framework that uses the theories and notions connected to an ethnomathematical perspective to address issues (Rosa & Orey, 2020). According to Rosa (2010), teaching mathematics for social justice and employing culturally relevant pedagogies in teaching mathematics are both examples of ethnomathematics. Given that mathematics was developed by humans and that its mathematization is a sociocultural phenomenon, ethnomathematics opens up to the social-turn. It was stated by Brandt and Chernoff (2014) that "by bringing ethnomathematics into the classroom, educators are empowering those whose voices and ideas have traditionally been marginalized" (p. 33).

Ethnomathematics uses the etymology of three Greek roots, *ethno*, *mathema*, and *tics* (Rosa & Orey, 2016). From the etymological point of view, Rosa and Orey (2011) defined ethnomathematics in the following:

> "*ethno* refers to members of a group within a cultural environment identified by their cultural traditions, codes, symbols, myths, and specific ways used to reason and to infer. *Mathema* means to explain and understand the world in order to transcend, manage and cope with reality so that the members of cultural groups can survive and thrive, and *tics* refer to techniques such as counting, ordering, sorting, measuring, weighing, ciphering, classifying, inferring, and modeling" (p. 35).

This demonstrates how individuals of particular cultures have historically acquired skills that enable them to simulate social environment and situations in order to explain and comprehend these phenomena. D'Ambrosio (2001) considers ethnomathematics as the combination of cultural anthropology and mathematics. Ethnomathematics studies the relationship between mathematics and the whole cultural and social life (D'Ambrosio, 2016). Ethnomathematics offers the opportunity to link school mathematics to students' meaningful cultural referents and lived experiences. This has resulted in the growing interest in integrating ethnomathematics in mathematics education to improve learners' academic achievement (Mosimege,

2012; Rosa & Orey, 2020), partly due to the opportunities that ethnomathematics offers for students to learn mathematics in a more meaningful and engaging way by connecting academic mathematics to their experiences, culture, and environment. To meet the constant and ongoing shift in the demographics of students in mathematics classrooms around the world (Rosa & Orey, 2020), a significant adjustment in mathematical instruction is required. It is therefore important for teachers to incorporate ethnomathematics into geometry teaching (Rosa & Orey, 2020).

Geometry, a branch of mathematics that deals with shapes and spaces and their properties has been considered a key aspect of academic mathematics (National Council of Teachers of Mathematics [NCTM], 2000). Its study helps people to depict the world in a systematic way. However, Geometry is perceived as one of the most complicated aspects of mathematics to learn and teach (Fouze & Amit, 2021). Some researchers (e.g., Gerdes, 2014; Rosa & Orey, 2020) attribute this challenge with the learning of geometry to the disconnections between the students' real-life experiences and the learning process in the classroom. Integrating ethnomathematics in the teaching of geometry could have significant effect on students' learning success in geometry and mathematics in general (Umar et al., 2019). This explains why there is a drastic shift of focus in the field of ethnomathematics on integration of ethnomathematics in the teaching of geometry (Lidinillah et al., 2022). The aim of our study is to establish the global research patterns for the past 10 years in studies that integrate ethnomathematics and geometry through systematic review and bibliometrics analysis.

Due to the recent large growth in the quantity of academic publications, researchers have found it difficult to stay current with research trends and update their expertise regarding the integration of ethnomathematics in teaching geometry (Briner & Denyer, 2012). In this review, we will provide an overview of recent re-search in the integration of ethnomathematics in geometry. We also aim to contribute to the development of systematic review methodologies, particularly the ap-proaches required for conducting reviews in the field of ethnomathematics, as well as reviews that have a specific focus on the integration of ethnomathematics in teaching geometry.

In our review, only one related systematic review (Lidinillah et al., 2022) was identified on the integration of ethnomathematics in mathematics curriculum and teaching. This study was delimited to Sundanese ethnomathematics and its integration into the mathematics curriculum. It appears that none of the previous studies or re-views have provided a comprehensive, systematic review, and bibliometric report on the integration of ethnomathematics in teaching geometry. Several indices, in-cluding the distribution of publications over the previous ten years, journals, coun-tries, and the primary topics garnering the most attention and their shifts in foci over time, were descriptively evaluated to map the patterns on the current subject.

For this study, we undertook a systematic literature review of ethnomathematics integration focusing on empirical research on the integration of ethnomathematics in geometry. In our quest to determine the patterns of research on this topic and potential research goals, the study sought to answer the following research ques-tions: (1) What are the trends of topics or themes?; (2) Which research designs or approaches are mostly employed?; (3) What are the most researched countries?; and (4) What are the leading journals?

Methods

Inclusion Criterion

We only included research articles that focused on the integration of ethnomathematics in geometry that were written in English and published in peer reviewed journals from 2011 to 2021. We excluded conference proceedings, theses, reports, bibliog-raphies, and other types of "grey literature", because they are typically regarded as being of lower quality, and less reliable (Hartling et al., 2017; Mahood et al., 2013; Nivens & Otten, 2017).

Literature Search and Evaluation

Our searches for relevant research articles were done on Google Scholar and Scopus databases in February 2022. There exists empirical evidence suggesting that Google Scholar is a highly effective tool for locating specific scholarly literature, and continues to be a widely utilized resource among researchers (De Winter et al., 2014; Gehanno et al., 2013). Similarly, Scopus is considered the most extensive database for peer-reviewed literature (Niven & Otten, 2017). We therefore deem Google Scholar and Scopus as important database for our primary source of data. A hand search of the issues published in the key academic journals in the field of ethnomathematics, such as *Journal of Mathematics and Culture; Revista Eletrônica de Educação Matemática – REVEMAT;* and *Revista Latinoamericana de Etnomatemática*, was also done. This was done in an effort to draw publications that were not already in the aforementioned electronic databases. To locate all pertinent research publications, a backward and forward search was done in Google Scholar and Scopus.

We started the literature search by using the keywords “integration of ethnomathematics in teaching geometry”, “integration of ethnomathematics”, “use of ethnomathematics”, “geometry teaching”, and “ethnomathematics.” The words “geometry,” “plane,” and “solid shapes” were combined with the words above as search keywords because of our focus strictly on geometry. In our pursuit to ascertain the preliminary relevance of the research articles, we engaged in the practice of briefly skimming the entire documents. During this procedure, we examined the titles and abstracts in relation to the study's objectives and criteria. These were done to find

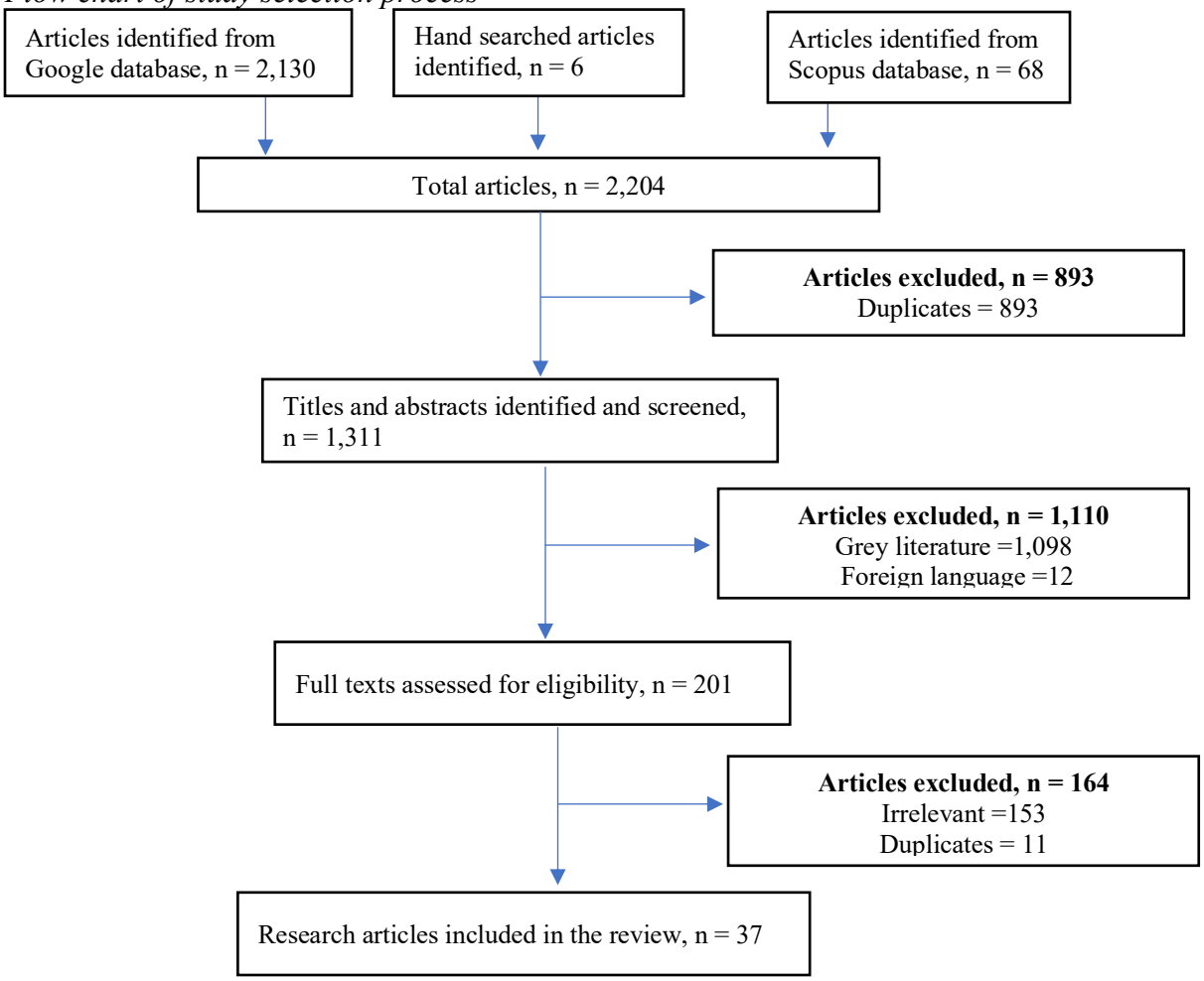
out whether the articles met the set criteria. In order for a research article to be deemed eligible, it must satisfy the following conditions: (1) it must have undergone publication in peer-reviewed scholarly journals; (2) it must have been published within the timeframe of the past decade (2011 – 2021); (3) it must center its focus on the integration of ethnomathematics in the teaching of geometry; and (4) it must have been based on empirical research methodology. A total of 37 relevant research articles were found to meet the study criteria.

The searches identified 2,204 articles. Google and Scopus databases provided 2,198 articles (see Figure 1), and handsearching from some key peer-reviewed journals in the field of ethnomathematics yielded 6 more articles. We screened the abstracts of the 1,311 studies to further decide their relevance to the research topic for data extraction and analysis. The data extraction was independently performed by two review authors. Any discrepancies were documented and settled through arbitration by the other review author or by consensus. We developed data extraction forms with the review purpose in mind in capturing information needed for descriptive analysis.

Following the exclusion of 1,110 articles, a comprehensive corpus of 201 studies was obtained for the purpose of assessing their quality. We included 37 relevant research articles (see Figure 1). Two author reviewers read the fulltexts of 37 relevant research articles to carefully assess each study in light of the stand-ards for quality. This was also done in a parallel and independent manner, and differences between the results were discussed and settled. Based on the criteria used for inclusion/exclusion, a checklist was employed in the evaluation of the relevant research articles. To ensure quality assessment of reviews, scholars recommend the use of checklists in evaluating research studies (Templier & Paré, 2015). These texts were classified according to the kind of research questions addressed, meth-odology used and country researched. Figure 1 provides an overview of the study's selection process.

Figure 1

Flow chart of study selection process

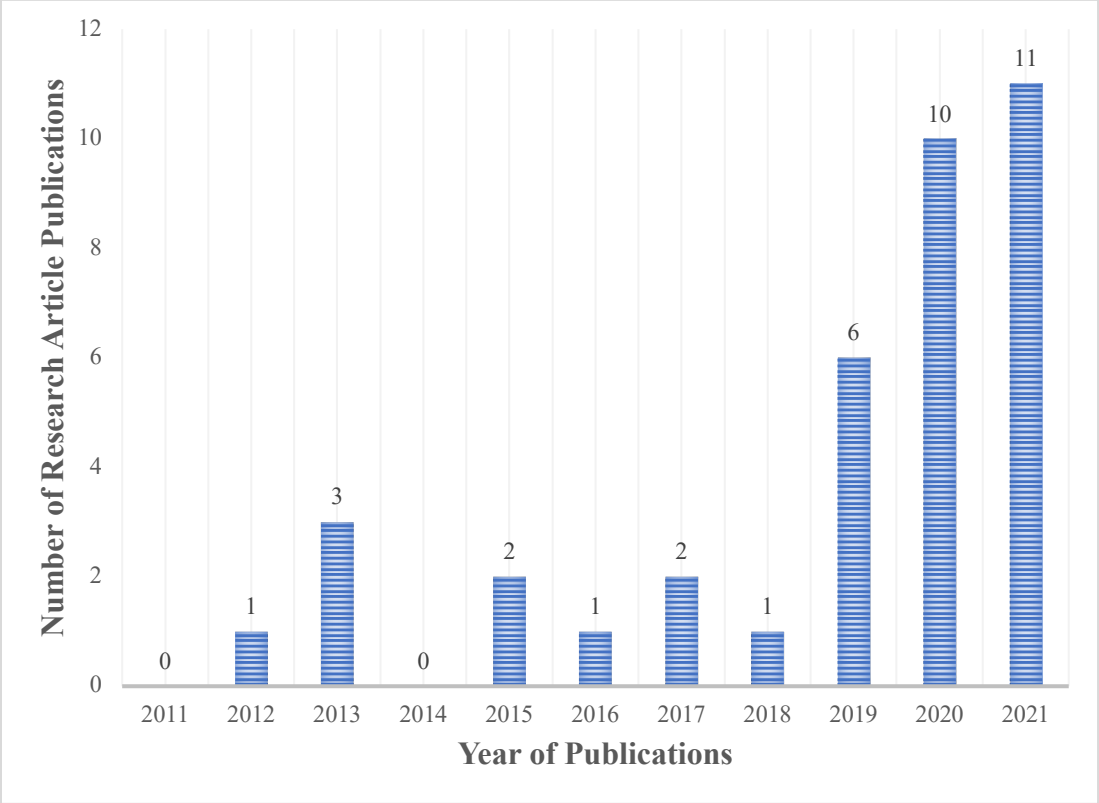


Note. A chart showing article selection processes

Findings

Figure 2

Number of Publications from 2011 to 2021



Note. Research publications from 2011 to 2021

From Figure 2, a total of 37 relevant research articles were published from 2011 to 2021. Among these articles, 27 were published within the period of 3 years from 2019 to 2021 (e.g., Age & Akaazua, 2021; Maryati & Prahmana, 2019; Pathuddin et al., 2021; Prahmana & D'Ambrosio, 2020; Shahbari & Daher, 2020; Sunzuma & Maharaj, 2021; Umar et al., 2019). By 2018, only 10 relevant articles had been published (e.g., Abdullah, 2017; Abiam et al., 2015; Haryanto et al., 2016; Maryati & Prahmana, 2018; Massarwe et al., 2012; Ogunkunle, & Nchelem, 2015; Unodiaku, 2013; Verner et al., 2013). From Figure 2, it could be observed that, the number of research article publications relevant to the study has increased exponentially.

Table 1
Number of Publications per Journal and Journals' Impact Factor

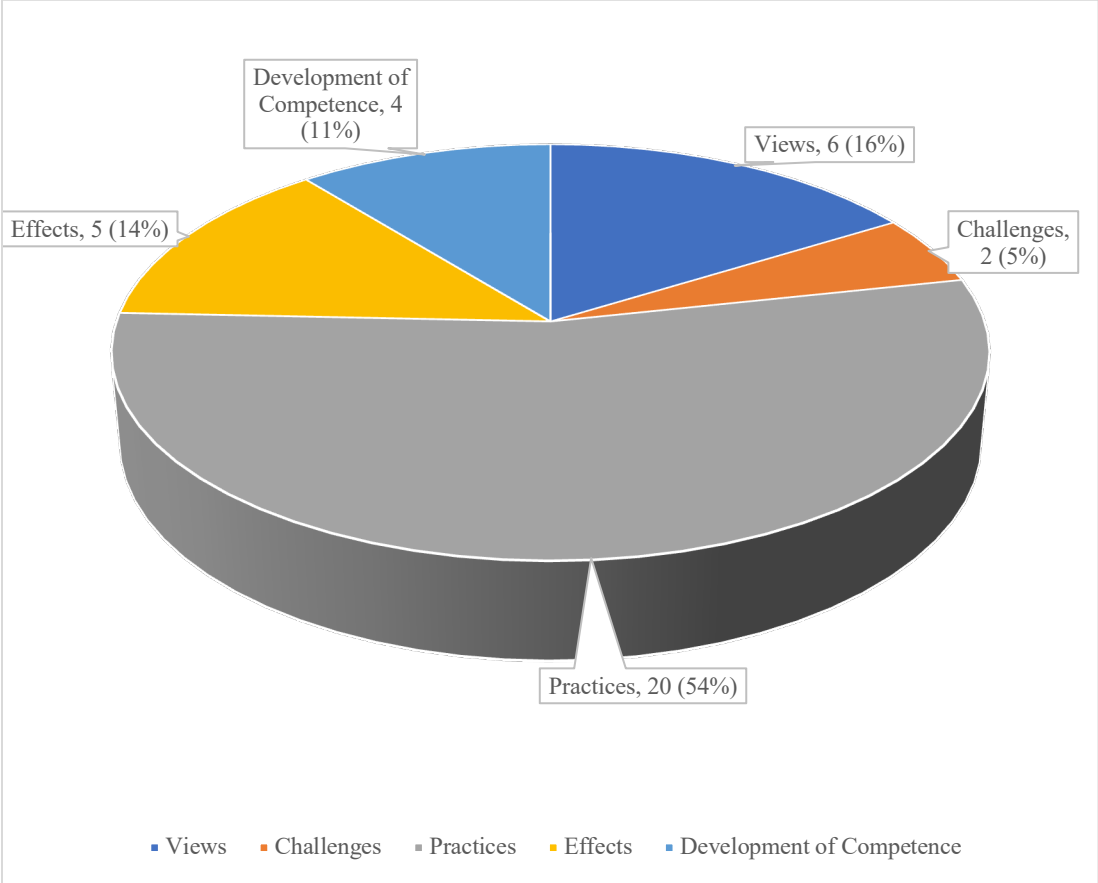
Name of the Journal	PUB	IF	Name of the Journal	PUB	IF
Journal on Mathematics Education	5	4.3	European Scientific Journal	1	0.7
Journal of Mathematical Behaviour	2	2.6	MaPan: Jurnal Matematika dan Pembelajaran	1	0
Journal of Mathematics & Culture	2	0.9	Applied Sciences	1	2.7
Jurnal Iqra': Kajian Ilmu Pendidikan	2	8.1	International Journal of Inclusive Education	1	3.1
Creative Education	2	1.0	EURASIA Journal of Mathematics, Science and Technology Education	1	2.5
International Journal of Mathematical Education in Science and Technology	2	1.0	Indomath: Indonesia Mathematics Education	1	1.4
Bolema, Rio Claro (SP)	1	0.4	Acta Didactica Napocensia	1	6.2
Ethnomathematics Journal	1	0	IJAEDU- International E-Journal of Advances in Education	1	1.0
Abacus (Mathematics Education Series)	1	2.3	Indonesian Journal of Science and Mathematics Education	1	0
Australian Journal of Teacher Education	1	1.5	Journal of Teaching and Learning in Elementary Education	1	0
Journal of Scientific Research & Reports	1	4.0	International Journal of Research and Innovation in Applied Science	1	0
International Journal of Education in Mathematics, Science, and Technology	1	1.5	Educational Research Reviews	1	7.8
Turkish Journal of Computer and Mathematics Education	1	0.2	IOSR Journal of Research & Method in Education (IOSR-JRME)	1	3.2
International Journal of Scientific & Technology Research	1	0.3	Journal of Education and Practice	1	7.2
Journal of Curriculum Studies	1	2.1			

Note. Authors' computations based on Google Scholar and Scopus *PUB* – Publications, *IF* – Impact Factor

As depicted in Table 1, 37 relevant research articles were published by a total of 29 peer-reviewed journals. Six of the peer-reviewed journals have more than 1 relevant article publication. From Table 1, the *Journal on Mathematics Educa-tion* was found to be the leading journal in number of research article publications with 5 publications, followed by the *Journal of Mathematical Behaviour; Journal of Mathematics & Culture*; *Jurnal Iqra': Kajian Ilmu Pendidikan; Creative Edu-cation*; and *International Journal of Mathematical Education in Science and Tech-nology* with 2 research articles each.

The remaining peer-reviewed journals namely *Bolema, Rio Claro (SP); Ethnomathematics Journal; Abacus (Mathematics Education Series) ; Australian Journal of Teacher Education; Journal of Scientific Research & Reports; International Journal of Education in Mathematics, Science, and Technology; Turkish Journal of Computer and Mathematics Education; International Journal of Scientific & Technology Research; European Scientific Journal; MaPan: Jurnal Matematika dan Pembelajaran; Applied Sciences; International Journal of Inclusive Education; EURASIA Journal of Mathematics, Science and Technology Education; Indomath: Indonesia Mathematics Education; Acta Didactica Napocensia; IJAEDU- International E-Journal of Advances in Education; Indonesian Journal of Science and Mathematics Education; Journal of Teaching and Learning in Elementary Education; International Journal of Research and Innovation in Applied Science; Educational Research Reviews; IOSR Journal of Research & Method in Education (IOSR-JRME)* ; *Journal of Education and Practice;* and *Journal of Curriculum Studies* have 1 relevant research article each. Again, Table 1 shows that 24 of the 29 peer-reviewed journals have an impact factor.

Figure 3. Trends of Topics or Themes



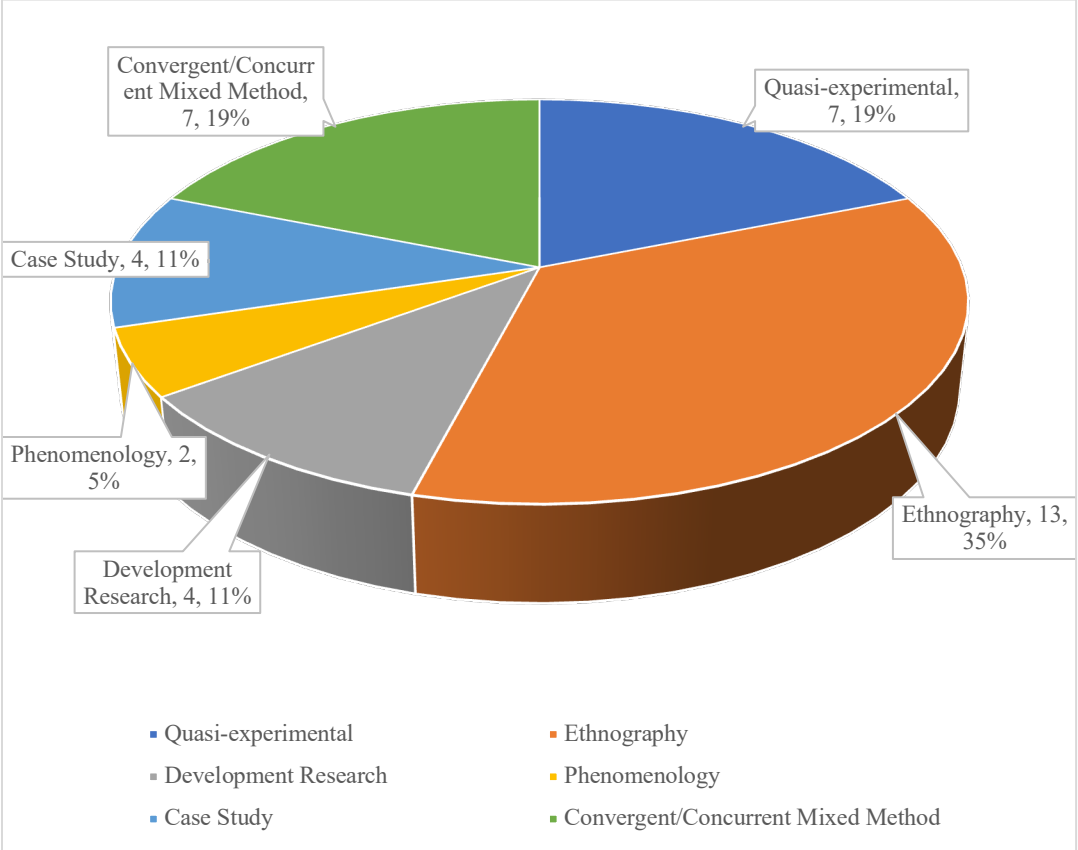
Note. Trends of topics or themes

Figure 3 illustrates the topics/themes addressed by literature on ethnomathematics integration in geometry can be grouped into 5 topics/themes: Views, Practices, Effects, Challenges, and Development of Competence. The figure shows the dominance of the practice of ethnomathematics as a theme with 20 (54%) of the 37 research articles published (e.g., Supiyati et al., 2019; Fouze & Amit, 2019, 2021; Munthahana & Budiarto, 2020; Prahmana & D'Ambrosio, 2020; Huang et al., 2021). These studies explored ethnomathematics in different cultures and how that rich knowledge can be harnessed for the teaching and learning of geometry in schools. There were 6 (16%) relevant article publications (e.g., Mania & Alam, 2021; Sevgi & Erduran, 2020; Sunzuma & Maharaj, 2020a, 2020d, 2021a) that ex-plored the views of teachers regarding the incorporation of ethnomathematics in geometry teaching in schools.

Figure 3 shows that, 5 (14%) of the relevant research article publications (e.g., Age & Akaazua, 2021; Farokhah et al., 2017; Fouze & Amit, 2021; Iluno &

Taylor, 2013) sought to determine the effects of integrating ethnomathematics approaches in geometry classroom. Also, 4 (11%) of the relevant research article publications (e.g., Capua, 2021; Massarwe et al., 2012; Mutagin et al., 2021; Verner et al., 2013) examined the development of competencies through modules for teaching geometry using ethnomathematical approach. From Figure 3, only 2 (5%) rele-vant research publications (Sunzuma & Maharaj, 2019; 2021b) explored teachers' challenges with regards to the incorporation of ethnomathematical approaches into the teaching of geometry.

Figure 4
Research Designs



Note. Research design employed by researchers

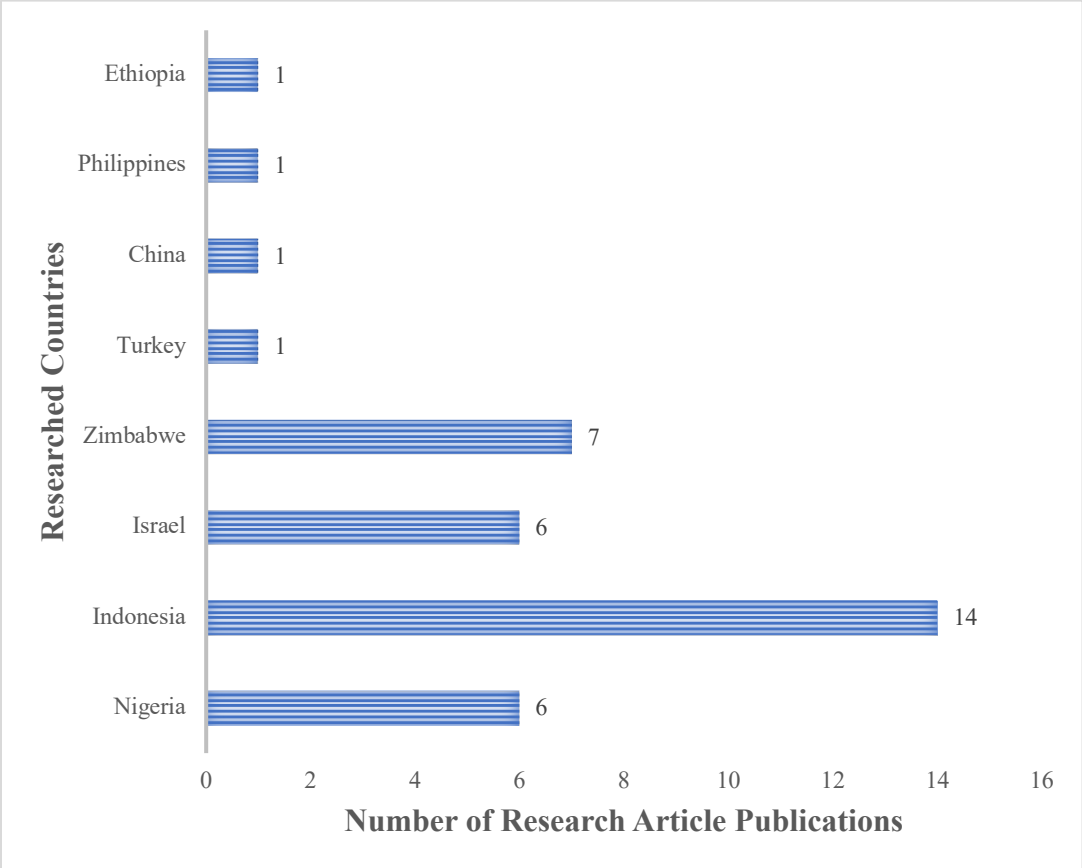
As it is evident in Figure 4, 13 (35%) of the studies employed ethnography whereas 7 (19%) employed quasi-experimental designs. Ethnography was used by studies exploring ethnomathematics in different cultures that can be used in teaching geometry in schools (e.g., Fredy et al., 2020; Maryati & Prahmana, 2018, 2019;

Pathuddin et al., 2021; Prahmana & D'Ambrosio, 2020) while quasi-experimental designs were employed by studies (e.g., Age & Akaazua, 2021; Iluno & Taylor, 2013; Umar et al., 2019) determining the effects of integrating ethnomathematics approaches in geometry classroom.

Also, Figure 4 showed that 7 (19%) of the studies employed convergent/concurrent mixed methods while 4 (11%) employed development. Convergent/concurrent mixed methods were used by studies (Shahbari & Daher, 2020; Sunzuma & Maharaj, 2019, 2020a, 2020b, 2020c, 2021b) to investigate the views, practices and challenges faced by teachers when incorporating ethnomathematics approaches into geometry instruction. On the other hand, development research designs employed by studies (e.g., Capua, 2021; Massarwe et al., 2012; Mutagin et al., 2021) were utilized to create modules aimed at enhancing competencies in teaching geometry through the use of an ethnomathematical approach.

From Figure 4, 4(11%) of the studies employed case study whereas 2 (5%) employed phenomenology. The case study was used by studies (e.g., Mania & Alam, 2021; Sevgi & Erduran, 2020; Sunzuma & Maharaj, 2020d) to explore students' and teachers' views about the integration of ethnomathematics approaches in ge-ometry teaching while phenomenology (Haryanto et al., 2016; Muhammad et al., 2021) was used in studying ethnomathematics in cultural artefacts.

Figure 5
Researched Countries



Note. Countries and their number of research article publications

From Figure 5, it could be observed that Indonesia emerges as the most extensively researched country in this particular field of study with 14 relevant research article publications. These findings could be attributed to the significant efforts made to disseminate state-of-art knowledge in the field of mathematics education, particularly with a focus on ethnomathematics through the establishment of several peer-reviewed international journals such as *Journal on Mathematics Education; Jurnal Iqra': Kajian Ilmu Pendidikan; Indomath: Indonesia Mathematics Education; Indonesian Journal of Science and Mathematics Education; MaPan: Jurnal Matematika dan Pembelajaran* etc. These journals are hosted or affiliated to research institutions and professional bodies such as Universitas Sriwijaya, Indonesian Mathematical Society (IndoMS) etc. Indonesia was followed by Zimbabwe which had 7 relevant research article publications. Then followed by Nigeria and Israel in terms of the number of relevant research article publications. These countries had 6 research article publications each. The remaining countries (Ethiopia, Philippines,

Turkey and China) have been less explored by research focusing on this study. Each of these countries had only 1 relevant research article publication between the period of 2011 to 2021.

Conclusion

Ethnomathematics is a thriving field of study. There is no denying its significance for teaching geometry and mathematics in general. It is remarkably intercultural and cross-disciplinary. It is based on study in a number of areas of mathematics, including anthropology, ethnography, cultural studies, cognitive sciences, history, and social dynamics. We find the beauty, recognition, and analysis of research on the use of ethnomathematics in geometry instruction in the context of academic discourse and analysis to be fascinating. The quality research by Maryati and Prahmana (2018), Massarwe et al. (2012), Prahmana and D'Ambrosio (2020), Sunzuma and Maharaj (2020a, 2021a), and some others are classical references about the research recognition about the integration of ethnomathematics in teaching geometry under different cultures. The increasing interest in the ethnomathematics research results in various research article publications identified by this review study. There are many ongoing studies in this area of ethnomathematics research that are pre-sented at conferences and not get published, that are not even known to most re-searchers. From the study, it could be observed that the number of research article publications relevant to the study has increased exponentially especially from 2018 to 2021. Upon examining the individuals and groups responsible for developing and consuming content relevant to the integration of ethnomathematics into geom-etry teaching, it became evident that Indonesia, Zimbabwe, Nigeria, and Israel emerged as prominent contributors in this field.

In ascertaining the role of ethnomathematics as a key to maximizing the teaching and learning of geometry in Nigeria, Iluno and Taylor (2013) used a quasi-experimental design. The study's results revealed that students who received in-struction through an ethnomathematics approach, which involved leveraging tradi-tional and local shapes to teach conic sections, demonstrated higher levels of aca-demic performance compared to students who were taught using a conventional instructional method. In a comparable setting, Ogunkunle and Nchelem (2015) used a quasi-experimental design to examine the impact of including ethnomathematics in the secondary mathematics curriculum for efficient artisan creative skill devel-opment in Abia State, Nigeria. When taught utilizing an ethnomathematics instruc-tional approach vs. a traditional instructional approach, there was a noticeable dif-ference in the creative talents that students acquired for the development of artisan skills. The effectiveness of a geometry instruction strategy based on ethnomathe-matics was investigated by Abiam et al. (2015) using a quasi-experimental design. The results of the study indicated that using an instructional strategy rooted in

ethnomathematics was more effective in enhancing the geometric competency of Nigerian students compared to the conventional approach.

Fouze and Amit (2021) conducted a study in Israel to examine the incorporation of Bedouin values into geometry teaching. According to the study, students' conception, understanding, success, and motivation to study geometry all improved as a result of employing a n ethnomathematical approach in teaching geometry. Shahbari and Daher (2020) in a similar context looked at the impact of ethnomath-ematics on Israeli middle school pupils' acquisition of triangle congruence through activities based on Islamic geometrical ornamentation. According to the research, students were successful in developing congruence and congruent triangle concep-tions with the use of ethnomathematics.

The findings of these studies affirm Rubel's (2017) assertion that "contextualizing mathematics in students' cultural practices can lend a sense of practical utility to mathematics, often interests students, mediates between students' formal and informal knowledge, and supports mathematics identity development" (p. 73). In light of this, we encourage teachers to always think about the possibility for instructional approach (such as ethnomathematics) that both considers students' soci-ocultural backgrounds and offers a more fulfilling and powerful mathematical learning experience. This calls for teachers to gain knowledge about the de-mographics (culture, environment and experiences) of their students if they are to effectively relate school mathematics to students' realities

Limitations of the Study

The utilization of a review methodology that exclusively incorporates relevant research articles published between 2011 and 2021 may introduce a potential publication bias, as this approach is unlikely to capture studies produced prior to or subsequent to the specified timeframe. Also, limiting searches for relevant research articles to studies that are published in the English language could introduce bias. As this strategy is unlikely to find studies that have not been published in peer-reviewed journals, limiting reviews to research articles published in peer-reviewed journals could subject the review to publication bias.

Suggestions for Future Studies

Future studies can broaden the scope of review of more relevant studies to include grey literature (such as conference proceedings, theses, reports, bibliographies, records of ongoing research etc.), thereby giving a more comprehensive picture of the evidence that is available. Also, future studies can extend databases to other databases that contain collections of non-English language studies in the field of ethnomathematics.

References

Abdullah, A. S. (2017). Ethnomathematics in perspective of Sundanese culture. *Journal of Mathematics Education, 8*(1), 1-16.

Abiam, P. O., Abonyi, O. S., Ugama, J. O., & Okafor, G. (2015). Effects of ethno mathematics-based instructional approach on primary school pupils' achievement in geometry. *Journal of Scientific Research & Reports, 9*(2), Article JSRR.19079

Age, T. J., & Akaazua, J. T. (2021). The effect of ethno-mathematics on junior secondary school students' achievement and retention in geometry in Benue State, Nigeria: A corona virus pandemic case study. *International Journal of Research and Innovation in Applied Science (IJRIAS), 6*(4), 95-100.

Brandt, A., & Chernoff, E. J. (2014). The importance of ethnomathematics in the math class. *Ohio Journal of School Mathematics*, *71*, 31-36.

Briner, R. B., & Denyer, D. (2012). Systematic review and evidence synthesis as a practice and scholarship tool. In D. M. Rousseau (Ed.), *Handbook of Evi dence-Based Management: Companies, Classrooms and Research* (pp. 112-129). Oxford University Press.

Bullock, E. C., & Larnell, G. V. (2015). Reframing urban mathematics education: the spatial politics of opportunity. In T. G. Bartell, K. N. Bieda, R. T. Put nam, K. Bradfield & H. Dominguez (Eds.), *Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1285-1290). Michigan State University.

Capua, R. D. (2021). Ethnomathematical practices among Ifugao: input to learning package in plane and solid geometry. *Turkish Journal of Computer and Mathematics Education, 12*(3), 4113-4122.

D'Ambrosio, U. (2001). What is ethnomathematics, and how can it help children in schools? *Teaching Children Mathematics, 7*(6), 308-312.

D'Ambrosio, U. (2016). An overview of the history of ethnomathematics. In M. Rosa, U. D'Ambrosio, D. C. Orey, L. Shirley, W. V. Alangui, Palhares, P., & M. E. Gavarrete (Eds.), *Current and Future Perspectives of Ethnomath ematics as a Programme* (pp. 5-10). Springer.

De Winter, J. C., Zadpoor, A. A., & Dodou, D. (2014). The expansion of Google Scholar versus Web of Science: A longitudinal study. *Scientometrics, 98*, 1547–1565.

Farokhah, L., Arisetyawan, A., & Jupri, A. (2017). The effect of ethnomathematics-based SAVI (Somatic, Auditory, Visualization, Intellectually) approach on mathematical communication skill on geometry in elementary school. *IJAEDU- International E-Journal of Advances in Education, 3*(9), 534-543.

Fouze, A. Q., & Amit, M. (2019). Ethnomathematics and geometrical shapes in Bedouin women's traditional dress. *Creative Education, 10,* 1539-1560. https://doi.org/10.4236/ce.2019.107112

Fouze, A. Q., & Amit, M. (2021). Teaching geometry by integrating ethnomathe matics of Bedouin values. *Creative Education,12*, 402-421. https://doi.org/10.4236/ce.2021.122029

Fredy, F., Halimah, L., & Hidayah, Y. (2020). Malind-Papua ethnomathematics: *Kandara* musical instrument as learning media for geometry concepts in elementary school. *Jurnal Iqra': Kajian Ilmu Pendidikan, 5*(1), 43-57. https://doi.org/10.25217/ji.v5i1.872

Gehanno, J. F., Rollin, L., & Darmoni, S. (2013). Is the coverage of Google Scholar enough to be used alone for systematic reviews. *BMC Med Inform Decis Mak,13* (7), Article pmid:23302542

Gerdes, P. (2014). *Ethnomathematics and education in Africa* (2nd edition). Higher Institute for Technology and Management.

Gutierrez, R. (2013). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education, 44*(1), 37-68. https://doi.org/10.5951/jresematheduc.44.1.0037

Hartling, L., Featherstone, R., Nuspl, M., Shave, K., Dryden, D. M., & Vandermeer, B. (2017). Grey literature in systematic reviews: a cross-sectional study of the contribution of non-English reports, unpublished studies and disserta tions to the results of meta-analyses in child-relevant reviews. *BMC Med Res Methodol.,17*, 64.

Haryanto, H., Nusantara, T., Subanji, S., & Abadyo, A. (2016). Ethnomathematics in Arfak (West Papua-Indonesia): Hidden mathematics on knot of Rumah Kaki Seribu. *Educational Research Reviews, 11*(7), 420-425. http://doi.org/10.5897/ERR2015.2620

Huang, Y., Nong, J., & Lai, P. (2021). The ethnomathematics of Chinese Tulou building architecture as geometry teaching material in elementary school. *Journal of Teaching and Learning in Elementary Education (JTLEE), 4*(2), 148-163. http://dx.doi.org/10.33578/jtlee.v4i2.7881

Iluno, C., & Taylor, J. I. (2013). Ethnomathematics: The key to optimizing learning and teaching of mathematics. *IOSR Journal of Research & Method in Edu cation (IOSR-JRME), 3*(1), 53-57.

Larnell, G. V., Bullock, E. C., & Jett, C. C. (2016). Rethinking teaching and learn ing mathematics for social justice from a critical race perspective. *Journal of Education, 196*(1), 19-29. https://doi.org/10.1177/002205741619600104

Lidinillah, D. A. M., Rahman, R., Wahyudin, W., & Aryanto, S. (2022). Integrating Sundanese ethnomathematics into mathematics curriculum and teaching: A systematic review from 2013 to 2020. *Infinity, 11*(1), 33-54.

Mahood, Q., Eerd, D. V., & Irvin, E. (2013). Searching for grey literature for sys tematic reviews: Challenges and benefits. *Research Synthesis Methods, 5*(3), 221-234.

Mania, S., & Alam, S. (2021). Teachers' perception toward the use of ethnomath ematics approach in teaching math. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 9*(2), 282-298. https://doi.org/10.46328/ijemst.1551

Martin, D. B., & Larnell, G. V. (2013). Urban mathematics education. In H. R. Milner & K. Lomotey (Eds.), *Handbook of Urban Education* (pp. 373-393). Routledge.

Massarwe, K., Verner, I., & Bshouty, D. (2012). Ethnomathematics and multi-cul tural education: Construction of geometric ornaments. *Journal of Mathe matics & Culture*, ICEM 4 Focus Issue, 344-360.

Maryati, M., & Prahmana, R.C.I. (2018). Ethnomathematics: Exploring the activi ties of designing *Kebaya Kartini*. *MaPan : Jurnal Matematika dan Pem belajaran, 6*(1), 11-19.

Maryati, M., & Prahmana, R. C. I. (2019). Ethnomathematics: Exploration of the Muntuk Community. *International Journal of Scientific & Technology Re search, 8*(6), 47-49.

Milner, H. R. (2012). But what is urban education. *Urban Education, 47*(3), 556-561. https://doi.org/10.1177/0042085912447516

Mosimege, M. (2012). Methodological challenges in doing ethnomathematical re search. *International Journal of African Renaissance Studies, 7*(2), 59-78. https://doi.org/10.1080/18186874.2013.774698

Muhammad, A. F. N., Marsigit, M., & Soeharto, S. (2021). Learning the concept of two-dimensional figure through Borobudur artifacts for lower graders of elementary school mathematics. *Ethnomathematics Journal, 2*(2), 43-50. https://doi.org/10.21831/ej.v2i2.39885

Munthahana, J., & Budiarto, M. T. (2020). Ethnomathematics exploration in Pan ataran temple and its implementation in learning. *Indonesian Journal of Science and Mathematics Education, 3*(2), 196-209.

Mutagin, A., Syaifuddin, M., & Cholily, Y. M. (2021). Ethnomathematics based geometry module development with a scientific approach to improve stu dents' metacognition ability. *Indomath: Indonesia Mathematics Educa tion, 4*(1), 11-25.

National Council of Teachers of Mathematics (2000). *Principles and standards of school mathematics*. Author.

Nivens, R. A., & Otten, S. (2017). Assessing journal quality in mathematics edu cation. *Journal for Research in Mathematics Education*, *48*(4), 348-368. https://doi.org/10.5951/jresematheduc.48.4.0348

Ogunkunle, R. A., & Nchelem, R. G. (2015). Integrating ethnomathematics into secondary school mathematics curriculum for effective artisan creative skill development. *European Scientific Journal, 11*(3), 1857–7881.

Parks, A. N., & Schmeichel, M. (2012). Obstacles to addressing race and ethnicity in the mathematics education literature. *Journal for Research in Mathemat ics Education, 43*(3), 238-252. https://doi.org/10.5951/jresematheduc.43.3.0238

Pathuddin, H., Kamariah, & Nawawi, M. I. (2021). Buginese ethnomathematics: Barongko cake explorations as mathematics learning resources. *Journal on Mathematics Education, 12*(2), 295-312. http://doi.org/10.22342/jme.12.2.12695.295-312

Prahmana, R.C.I., & D'Ambrosio, U. (2020). Learning geometry and values from patterns: Ethnomathematics on the batik patterns of Yogyakarta, Indone sia. *Journal on Mathematics Education, 11*(3), 439-456. http://doi.org/10.22342/jme.11.3.12949.439-456

Rosa, M. (2010). *A mixed method study to understand the perceptions of high school leaders about English language learners (ELL): The case of mathe matics*. (Unpublished doctorate dissertation). California State University, Sacramento. https://hdl.handle.net/10211.9/1010

Rosa, M. & Orey, D. C. (2011). Ethnomathematics: the cultural aspects of mathe matics. *Revista Latinoamericana de Etnomatemática, 4*(2), 32-54.

Rosa, M., & Orey, D. C. (2016). State of the art in ethnomathematics. In M. Rosa, U. D'Ambrosio, D. C. Orey, L. Shirley, W. V. Alangui, Palhares, P., & M. E. Gavarrete (Eds.), *Current and Future Perspectives of Ethnomathemat ics as a Program* (pp. 11-36). Springer. https://doi.org/10.1007/978-3-319-30120-4_3

Rosa, M., & Orey, D. C. (2020). Principles of culturally relevant education in an ethnomathematical perspective. *Revista de Educação Matemática, 17*. https://doi.org/10.37001/remat25269062v17id306

Rubel, L. H. (2017). Equity-Directed instructional practices: Beyond the dominant perspective. *Journal of Urban Mathematics Education, 10*(2), 66–105.

Sevgi, S., & Erduran, A. (2020). Student approaches resulting from integration of cultural context into transformation geometry. *Acta Didactica Napocensia, 13*(2), 174-185. https://doi.org/10.24193/adn.13.2.12

Shahbari, J. A., & Daher, W. (2020). Learning congruent triangles through ethno-mathematics: The case of students with difficulties in mathematics. *Applied Sciences, 10*, Article 4950. https://doi.org/10.3390/app10144950

Stinson, D. W. & Bullock, E. C. (2012). Critical postmodern theory in mathematics education research: A praxis of uncertainty. *Educational Studies in Mathe matics, 80*(1-2), 41-55. https://doi.org/10.1007/s10649-012-9386-x

Sunzuma, G., & Maharaj, A. (2019). Teacher-related challenges affecting the in tegration of ethnomathematics approaches into the teaching of geometry. *EURASIA Journal of Mathematics, Science and Technology Education, 15*(9), Article em1744. https://doi.org/10.29333/ejmste/108457

Sunzuma, G., & Maharaj, A. (2020a). In-service mathematics teachers' knowledge and awareness of ethnomathematics approaches. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2020.1736351

Sunzuma, G., & Maharaj, A. (2020b). In-service secondary teachers' teaching ap proaches and views towards integrating ethnomathematics approaches into geometry teaching. *Bolema, Rio Claro (SP), 34*(66), 22-39. http://dx.doi.org/10.1590/1980-4415v34n66a02

Sunzuma, G., & Maharaj, A. (2020c). Exploring Zimbabwean mathematics teach ers' integration of ethnomathematics approaches into the teaching and learning of geometry. *Australian Journal of Teacher Education, 45*(7), 77-93. http://dx.doi.org/10.14221/ajte.2020v45n7.5

Sunzuma, G., & Maharaj, A. (2020d). Teachers' views on learner-related variables impeding the integration of ethno-mathematics approaches into the teaching and learning of geometry. *International Journal of Inclusive Education*, https://doi.org/10.1080/13603116.2020.1808717

Sunzuma, G., & Maharaj, A. (2021a). Zimbabwean in-service teachers' views of geometry: An ethnomathematics perspective. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2021.1919770

Sunzuma, G., & Maharaj, A. (2021b). In-service Zimbabwean teachers' obstacles in integrating ethnomathematics approaches into the teaching and learning of geometry. *Journal of Curriculum Studies, 53*(5), 601-620. http://doi.org/10.1080/00220272.2020.1825820

Supiyati, S., Hanum, F., & Jailani, J. (2019). Ethnomathematics in Sasaknese ar chitecture. *Journal on Mathematics Education, 10* (1), 47-58.

Templier, M., & Paré, G. (2015). A framework for guiding and evaluating literature reviews. *Communications of the Association for Information Systems, 37*, Article 6. https://doi.org/10.17705/1CAIS.03706

Umar, I. O. M. S., Tudunkaya, M. S., & Muawiya, H. U. (2019). Effect of ethno mathematics teaching approach on performance and retention in trigonum etry among secondary school students in Zaria local government area Ka duna State, Nigeria. *Abacus (Mathematics Education Series), 44* (1), 104-112.

Unodiaku, S. S. (2013). Effect of ethnomathematics teaching materials on students' achievement in mathematics. *Journal of Education and Practice, 4*(23), 70-77.

Verner, I., Massarwe, K., & Bshouty, D. (2013). Constructs of engagement emerg ing in an ethnomathematically-based teacher education course. *The Journal of Mathematical Behaviour, 32*, 494-507. http://dx.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. *The Journal of Mathematical Behaviour (in press)*. https://doi.org/10.1016/j.jmathb.2019.05.002
