A Systematic Literature Review on the Effect of Traditional Games in Mathematics Teaching and Learning (Scopus Database)

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Abstract
Much research has shown the positive effect of traditional games on supporting students in learning mathematics. This systematic literature review (SLR) aims to explore research findings on implementing traditional games in mathematics teaching and learning. Through a tight screening process using PRISMA 2020 Framework, we identified 16 articles from the Scopus Database that align with the purpose of this SLR. The result of this SLR showed that research about the implementation of traditional games in mathematics classrooms had been primarily conducted in Asia regions, especially Indonesia; primary school students are frequently the subject of research; geometry is the most frequent mathematics topic taught using traditional games; cognitive ability is more frequent as a research focus, in term of effect of the implementation of traditional games; qualitative approach mostly applied for the study; and start from 2018 the research about the implementation of traditional game in mathematics instruction is still being carried out.

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Abstrak
Banyak penelitian telah menunjukkan efek positif dari permainan tradisional dalam mendukung siswa belajar matematika. Tinjauan literatur sistematis (SLR) ini bertujuan untuk mengeksplorasi temuan penelitian tentang penerapan permainan tradisional dalam pembelajaran matematika. Melalui proses penyaringan yang ketat dengan menggunakan PRISMA 2020 Framework, kami mengidentifikasi 16 artikel dari Database Scopus yang sesuai dengan tujuan SLR ini. Hasil dari SLR ini menunjukkan bahwa penelitian tentang implementasi permainan tradisional dalam pembelajaran matematika lebih banyak dilakukan di wilayah Asia, khususnya Indonesia; siswa sekolah dasar paling sering menjadi subjek dalam penelitian tersebut; geometri merupakan topik matematika yang paling sering diajarkan menggunakan permainan tradisional; kemampuan kognitif lebih banyak menjadi fokus penelitian, dalam hal pengaruh implementasi permainan tradisional; pendekatan kualitatif lebih banyak digunakan sebagai pendekatan penelitian; dan mulai dari tahun 2018, penelitian tentang implementasi permainan tradisional dalam pembelajaran matematika masih terus dilakukan.

I. INTRODUCTION

What is the first thing that comes to mind when discussing the traditional game? Most of us may say it is fun, bringing happiness, enjoyment, engagement, and culture. However, more than that, the traditional game provides many lessons for its players, starting from character building (Marlina, 2017; Masyhuri & Suherman, 2020; Shinta et al., 2019), social skills (Melianasari & Suparno, 2018; Suhaebah, 2019; Widiana et al., 2018), motoric (Kamid et al., 2021; Supriadi et al., 2019), and even cognitive ability (Aini et al., 2022; Nur'aeni, Muharram, et al., 2019). Therefore, no wonder traditional games can be integrated into teaching and learning practice to support a specific learning objective; it is included in developing students' mathematical understanding (Risdiyanti et al., 2019; Yumiati et al., 2023).

The game's characteristics that can bring enjoyment (Aarseth, 2014) can solve the problem of student's lack of achievement in mathematics by developing students' motivation to learn mathematics. Research has shown the impact of traditional games on enhancing students' interest in mathematics (Aras & Zahrawati, 2021) to promote their motivation in learning (Aguilar, 2021; Harackiewicz et al., 2016). In addition, applying traditional games as the context for teaching mathematics is also a part of the effort to build students' positive perception of mathematics since many students seem to see mathematics only as part of the formula and abstract things, such as numbers (Safari, 2021),

even though in reality mathematics is around them.

Implementing traditional games in mathematics teaching and learning can be a form of implementing a realistic mathematics education approach since the traditional game is a thing that students can imagine and find in their daily activities. It is, along with what realistic means, real situations or situations that students can imagine (Van den Heuvel-Panhuizen & Drijvers, 2020). Besides the use of Realistic Mathematics Education can support the development of students' mathematical abilities (Juandi et al., 2022; Tamur et al., 2020), such as reasoning (Ariati & Juandi, 2022). It also creates a meaningful learning experience for students by connecting what they already know with what they should learn (Gunstone, 2015).

However, even though much research shows positive findings on implementing traditional games in mathematics teaching and learning (e.g., Atmaja et al., 2021; Fernández-Oliveras et al., 2021; Ibrahim & Ahyan, 2020), but lack of research investigating them in terms of review research, based on Figure 1, the bibliometric search showed that systematic literature review in the traditional game still rarely conducted, mostly technology or digital-based game were reviewed. Even though traditional games have the potential to support students' mathematics performance, it is essential to review research on this topic since it can guide researchers to find gaps and limitations among that research. It will be powerful to encourage other researchers to research the effect of other traditional games that might not be explored yet.

Since much research about the implementation of traditional games were conducted, it can be difficult for a mathematics teacher to identify one-by-one article to get insight and reference on how traditional game can help them improve the mathematics instruction process. Therefore, this research also provides readers, especially mathematics teachers, with broad information about the traditional game that can be used for teaching and learning mathematics. It can be helpful for them to directly identify what type of traditional game they can use based on the learning objectives and students need.

Therefore, based on the purpose of the study, these research questions are proposed:

RQ 1: Where was the research conducted?
RQ 2: Which grade that usually a sample for the research?
RQ 3: What mathematics topics that taught using a specific traditional game?
RQ 4: How does the traditional game affect mathematics teaching and learning?
RQ 5: What is the research approach that is usually used?
RQ 6: How is the growth of the number of the research?

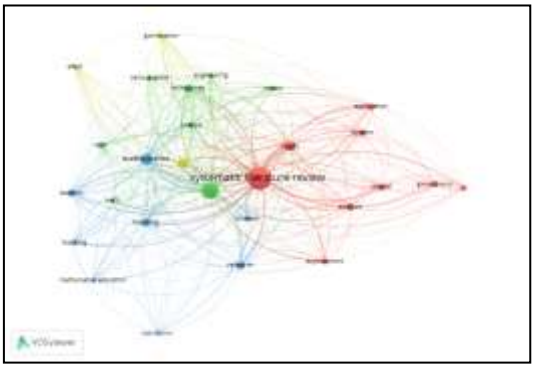

Figure 1. Bibliometric Result

II. METHOD

A. Data Collection

1. Inclusion Criteria

As mentioned before, research on implementing traditional games has been widely conducted. However, this research focuses on broad information about research on the implementation of the traditional game in mathematics teaching and learning process and its effect on students. As a result, Table 1 shows the inclusion criteria for this research. The review must be on published research articles or proceedings; it is excluded review research, thesis or dissertation, or book chapter. The rationale of this decision is to make sure that the article can be accessed by readers easily. The second inclusion is language. The articles must be in English; thus, readers worldwide can understand the research. Since this research focuses on mathematics teaching and learning, the subject taught using the traditional game must be mathematics. The last inclusion is the goal of the research, and this research is limited to the effect of the traditional game on mathematics teaching and learning. Other research goals declined, such as identifying mathematics concepts in traditional games, et cetera.

2. Database and Search Strings

The international and popular database, Scopus, was used to gather the articles for

review. The database was used since it covered many topics and journals. In addition, Scopus provides an advanced feature to facilitate collecting and filtering data. This research used "traditional games" and "mathematics" to search the related articles.

3. Identification

When applying the search strings above, 38 articles are identified. Using automation filtering on the Scopus feature, we limited the study to a conference paper, article (document type), and English (language). This step remains 37 articles to include in the screening step.

4. Screening

This step will filter the article based on the included subject components and research goal. If the article does not focus on implementing traditional games for mathematics subjects and their effect on students, then the articles must be excluded from our consideration. The Screening step consists of three processes. First screening on the title and abstract of the article. Second screening focus on whether the article is open accessed. Meanwhile, the third screening process focuses on whether the articles can answer all proposed research questions. The identification and screening procedure are presented in Figure 2. From 38 articles, only 17 can be passed for further review to answer the research question.

B. Data Analysis

In order to make a more straightforward review process and find the answer to research questions, this research uses Coding Framework in Table 2. Country Area Dimension refers to the continent where research about implementing traditional games in math education was conducted. Mathematics topics will answer what topic mathematics can be taught using the traditional game. This research focuses on mathematics school topics based on NCTM (2000). Grade of school refers to the which grade of the subject on the study about implementing traditional games in mathematics education. Meanwhile, the effect of the traditional game refers to the impact of the traditional game on students. The last dimension is the research dimension, which refers to the approach applied to the reviewed articles.

Table 1. Eligibility Criteria

Criterion	Inclusion
Document	Published Research Articles or Proceedings
Language	English
Subject	Mathematics
Research Goal	Effect of the Implementation of the Traditional Game on Students

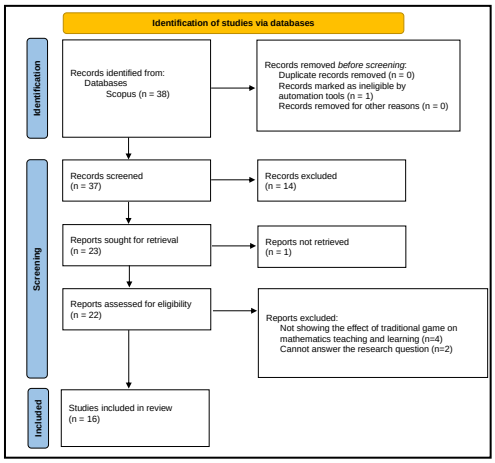

Figure 2. Screening Process Flow

Table 2. Coding Framework

Dimension	Category
Location	Asia Australia America Europe Africa
Mathematics Topic	Algebra Geometry Statistic and Probability Number
Grade of School	Early Childhood Primary School Lower Secondary School Upper Secondary School
Effect of Traditional Game	Cognitive Affective Psychomotor
Research Type	Quantitative Qualitative Mixed-Method Design-Based Research (DBR) Research and Development (R&D)

III. RESULT AND DISCUSSION

A. Result

RQ 1: *Where was the research conducted?*

Figure 3 summarizes where the research about implementing traditional games in

mathematics teaching and learning was conducted. From 16 articles, mainly the study was conducted in Asia (81.25%), then followed by Europe (12.5%) and America (6.25%). We need help finding research about implementing traditional games conducted in Africa or Australia in the Scopus database.

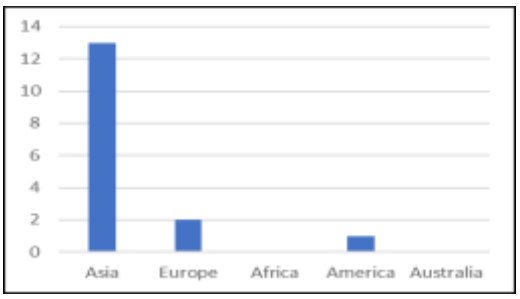

Figure 3. Location Dimension

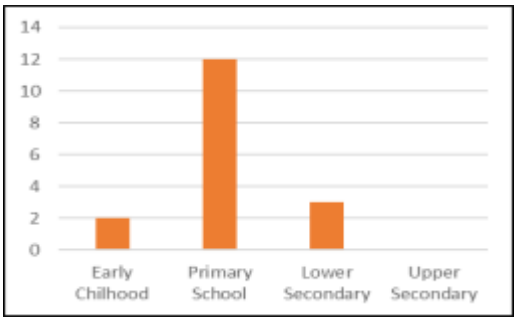

Figure 4. Grade of School Dimension

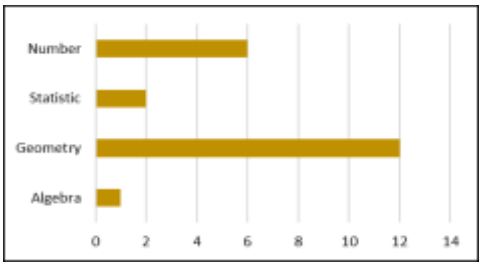

Figure 5. Mathematics Topic Dimension

RQ 2: *Which grade that usually a sample for the research?*

Figure 4 shows the subject's grade on the research about implementing traditional games. Mainly subject of the research focuses on the primary school level (71%), then followed by lower secondary (18%) and early childhood (12%). No articles showed the implementation of traditional games at the upper secondary level. One article showed the impact of using the traditional game for teaching math in early childhood and primary school (Espigares, 2020).

RQ 3: *What mathematics topics that taught using a specific traditional game?*

From Figure 5, geometry (57%) is the mathematics topic taught using the traditional game. It is followed by Numbers (29%), Statistics (10%), and Algebra (5%). However, some articles show the impact of the traditional game on teaching more than one mathematics topic (e.g., Handayani et al., 2020; Roza Y, 2020).

RQ 4: *How does the traditional game affect mathematics teaching and learning?*

Figure 6 summarizes the effect of the traditional game on students. Cognitive ability (62%) was frequently affected by the implementation of traditional games in the mathematics teaching and learning process, then followed by affective (23%) and psychomotor (15%).

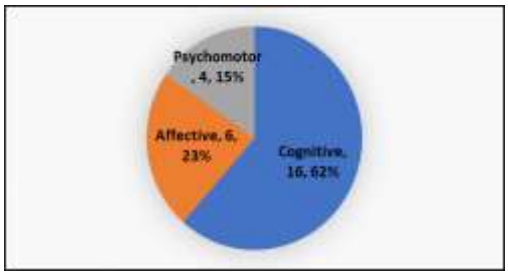

Figure 6. Effect of Traditional Game Dimension

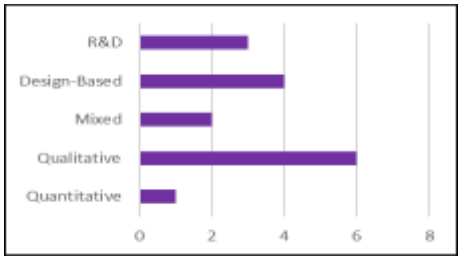

Figure 7. Research Type Dimension

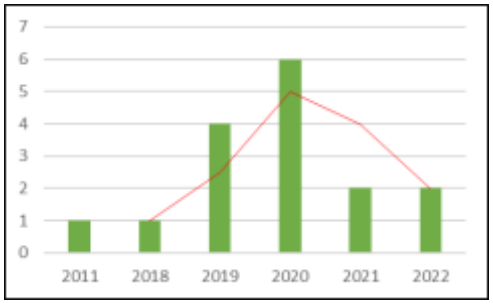

Figure 8. Number of Publication Per Year

RQ 5: *What is the research approach that is usually used?*

Figure 7 shows the research approach usually applied as a method for implementing traditional games in mathematics teaching and learning. From 16 articles, the qualitative approach is frequently used (37.5%). It is followed by design-based research (25%), research and development (R&D) (18.75%), mixed-method (12.5%), and quantitative (6.25%).

RQ 6: *How is the growth of the number of the research?*

Figure 8 shows the number of studies on implementing traditional games in mathematics teaching and learning from 2011-2022. From the Scopus database, research about implementing traditional games in mathematics teaching and learning started recorded in 2011. Nevertheless, there are no articles about it after that year until 2018. Starting 2018 – 2020, the number of research increase significantly. However, it has decreased significantly since 2021.

B. Discussion

This research focuses on the positive effect of implementing traditional games as the catalyst for teaching and learning mathematics. The six research questions were proposed and answered in the Result section to provide better information for researchers or mathematics teachers. Furthermore, the summary of the reviewed articles can be seen in Appendix 1; it is included the authors of the article, the grade of the school, the mathematics topic, and the name of the game.

From 16 articles that were reviewed, the location where the research about implementing traditional games in mathematics teaching and learning is mainly conducted is in Asia; it is precisely in Indonesia (e.g., Kamid et al., 2022; Supriadi, 2022). Based on the Scopus Database, the research development is widespread in Indonesia. Only articles showed Indonesia in the Asia region that conducted the research. Research on implementing the traditional game in the American region was conducted in Canada (Miller & Roehrig, 2018). Furthermore, for the Europe region, only in Spain (Espigares-Gámez et al., 2020; Fernández-Oliveras et al., 2021). However, even though the research about implementing the traditional game was conducted in Spain, the traditional game that the authors use is from Jamaica (Fernández-Oliveras et al., 2021). This finding can be a great example of how culture from another country can be adopted in other countries.

The primary grade students are frequently subject to or sampled in research about implementing the traditional game. It indicates that almost all traditional games emphasize the development of primary school students. In addition, from a mathematics topic point of view, all mathematics topics, numbers (Nasrullah & Zulkardi, 2011; Risdiyanti et al., 2019), geometry (Fendrik et al., 2020; Supriadi et al., 2019), statistics (Atmaja et al., 2021; Roza et al., 2020), and algebra (Nur'aeni et al., 2020), can be taught using the traditional game. The finding also showed that there still needs to be a paper about integrating traditional games in mathematics education for the upper secondary school level in the Scopus database.

Geometry is a mathematics topic that is frequently taught using the traditional game. It may happen since the traditional game's activities and elements relate to geometry topics. For example, the Pecle traditional game is used for exploring the properties of triangles (Nur'aeni et al., 2020; Nur'aeni, Nur, et al., 2019). *Number* is the second most frequent math topic that uses traditional games as learning media. Along with geometry, many activities and elements of traditional games also relate to numbers. For example, the traditional game Dog and the Goats can support students' counting ability (Fernández-Oliveras et al., 2021). However, mathematics is a fundamental concept taught using traditional games (e.g., Nasrullah & Zulkardi, 2011). We need help finding a paper that discusses how advanced mathematics concepts are taught using the traditional game. This fact refers to the most sample or subject in the research about integrating traditional games in primary school.

When integrating traditional games into mathematics classrooms, the finding shows that cognitive ability is mainly developed using it. Nevertheless, even though traditional game requires the players to do much movement, more articles focus on psychomotor ability is needed—even the effect of integrating traditional games for the affective domain more than psychomotor. In the reviewed articles, cognitive refers to students' understanding, affective refers to students'

attitude, and psychomotor refers to students' motoric activity.

The effect of the traditional game can be shown from many research approaches, namely quantitative, qualitative, R&D, Mixed-Method, and Design-based research. Unfortunately, a lack of research showed empirical evidence of whether the integration of traditional games can positively affect students in the mathematics classroom. It can be seen from only one paper that used quantitative research (Supriadi et al., 2019) and two mixed-method articles for the study (Kamid et al., 2022; Supriadi, 2022).

The growth of study on implementing traditional games in mathematics instruction was primarily conducted in 2020 and started in 2011. Even though no evidence was found in the Scopus database about the same study in 2012-2017, starting from 2018, the same research continued until our last observation, the paper published in 2022. It can indicate that researchers' awareness about the potential of the traditional game for teaching and learning mathematics increased.

IV. CONCLUSION AND SUGGESTION

A. Conclusion

Traditional games are not only inherited from our ancestors. More than that, much research showed how this cultural heritage has the potential to be a catalyst for improving the quality of mathematics teaching and learning. This SLR provides extensive information about implementing traditional games in mathematics instruction, especially for researchers and mathematics teachers. The research on implementing traditional games in mathematics classrooms has been primarily conducted in Asia, especially Indonesia. In research, we must recognize the importance of the subject of research, with specific criteria; most research in the implementation of traditional games in mathematics instruction uses primary school students as the research subject. In addition, geometry is the most frequent mathematics topic taught using traditional games.

Furthermore, this SLR also showed that cognitive ability is more frequent as a research focus regarding the effect of implementing traditional games than psychomotor and affective. From a research method point of view, the qualitative approach was mainly applied to the study. Also, starting from 2018, research about implementing the traditional game in mathematics instruction is still being carried out.

B. SUGGESTION

This research only reviews the implementation of traditional games in mathematics teaching and learning from the Scopus database. Therefore, the result is only applicable to Scopus. It might be given different results if we use additional databases as resources, such as Eric, World of Scientific, Google Scholar, or even specific journals. Further research can explore the same topic from other databases.

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