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Kasedesede as a Culturally Responsive Medium for Mathematics Learning: Students' Perceptions and Numeracy Outcomes

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ABSTRACT: This study aimed to analyze students' perceptions of the Kasedesede traditional game as a medium for mathematics learning and to examine its relationship with numeracy performance. A quantitative descriptive design was employed with a saturated sample of 39 fifth-grade students in Baubau City, Southeast Sulawesi. Data were collected through a Likert-scale questionnaire consisting of six dimensions: engagement, enjoyment, mathematical understanding, literacy-numeracy, attitudes toward mathematics, and socio-educational benefits, together with a contextual numeracy test. Descriptive statistics, regression analysis, and Support Vector Machine with heatmap visualization were used for analysis. The results indicated that students expressed highly positive perceptions of Kasedesede-based lessons, with enjoyment and engagement emerging as the most influential dimensions. Regression results showed that perceptions significantly predicted numeracy outcomes, accounting for 26.2% of the variance. Further analysis confirmed that enjoyment, literacy-numeracy, and socio-educational benefits played a dominant role in shaping performance. These findings suggest that integrating traditional games into mathematics lessons not only supports conceptual understanding but also fosters motivation, positive attitudes, and collaborative learning. The study contributes to the body of knowledge on ethnomathematics and culturally responsive pedagogy, highlighting the potential of traditional games as innovative and humanistic strategies for improving literacy and numeracy in primary education.

Keywords: ethnomathematics, numeracy, student perceptions, traditional games

ABSTRAK: Penelitian ini bertujuan untuk menganalisis persepsi siswa terhadap permainan tradisional Kasedesede sebagai media pembelajaran matematika serta mengkaji hubungannya dengan kemampuan numerasi. Penelitian ini menggunakan desain deskriptif kuantitatif dengan sampel jenuh sebanyak 39 siswa kelas V di Kota Baubau, Sulawesi Tenggara. Data dikumpulkan melalui kuesioner skala Likert yang terdiri atas enam dimensi, yaitu keterlibatan, kesenangan, pemahaman matematika, literasi–numerasi, sikap terhadap matematika, dan manfaat sosio-edukatif, serta dilengkapi dengan tes numerasi kontekstual. Analisis data dilakukan menggunakan statistik deskriptif, analisis regresi, dan Support Vector Machine dengan visualisasi heatmap. Hasil penelitian menunjukkan bahwa siswa memiliki persepsi yang sangat positif terhadap pembelajaran berbasis permainan Kasedesede, dengan dimensi kesenangan dan keterlibatan sebagai faktor yang paling berpengaruh. Hasil regresi menunjukkan bahwa persepsi siswa berpengaruh signifikan terhadap kemampuan numerasi dengan kontribusi sebesar 26,2% terhadap varians. Analisis lanjutan menegaskan bahwa kesenangan, literasi–numerasi, dan manfaat sosio-edukatif berperan dominan dalam membentuk capaian numerasi siswa. Temuan ini

menunjukkan bahwa integrasi permainan tradisional dalam pembelajaran matematika tidak hanya mendukung pemahaman konseptual, tetapi juga menumbuhkan motivasi, sikap positif, dan pembelajaran kolaboratif. Penelitian ini berkontribusi pada pengembangan kajian etnomatematika dan pedagogi responsif budaya dengan menegaskan potensi permainan tradisional sebagai strategi inovatif dan humanistik untuk meningkatkan literasi dan numerasi di pendidikan dasar.

Kata kunci: etnomatematika, numerasi, persepsi siswa, permainan tradisional.

INTRODUCTION

Education in the twenty-first century is increasingly shaped by the rapid transformations brought about by the Fourth Industrial Revolution and Society 5.0, which emphasize not only technological advancement but also human-centered learning and social relevance. Primary education, as the foundation of lifelong learning, plays a pivotal role in nurturing students' literacy and numeracy skills, which are recognized as essential competencies for success in both academic and social domains (Fousiya & Saleem, 2024). Global assessments highlight the urgency of strengthening these competencies. For instance, the Programme for International Student Assessment (PISA) 2023 reported that more than 60% of Indonesian students scored below the minimum proficiency level in mathematics and reading literacy, placing Indonesia significantly behind the Organisation for Economic Co-operation and Development (OECD) average (Nandang Mustafa, 2023). This persistent underperformance underscores the pressing need to rethink pedagogical strategies that can address the gap between curriculum objectives, instructional practices, and students' learning needs.

The challenges are particularly evident in mathematics education, where conventional teaching methods remain dominant. Teacher-centered instruction often emphasizes abstract problem-solving and rote memorization, which leaves many students disengaged and struggling to internalize fundamental concepts. This disconnection has been widely noted in both Indonesian and international contexts, with students perceiving mathematics as an abstract, difficult, and irrelevant subject (Amelia & Harahap, 2021; Djannah et al., 2024). Such perceptions directly contribute to a decline in students' motivation and confidence, leading to limited opportunities to develop logical reasoning, problem-solving skills, and the numeracy required for everyday life. Consequently, there is an urgent demand for innovative teaching approaches that bridge abstract mathematical concepts with students' concrete, lived experiences.

Addressing this challenge, scholars have increasingly emphasized the integration of playful, engaging, and context-based learning methods. One promising approach is the use of educational games to create meaningful learning experiences. Games provide a dynamic learning environment that encourages active participation, creativity, and critical thinking, while simultaneously reducing anxiety associated with traditional mathematics instruction. Numerous studies have demonstrated that game-based learning enhances students' motivation and conceptual understanding in mathematics by creating an enjoyable and participatory atmosphere (Muspita & Ningsih, 2024; Wahyuni & Witanto, 2025; Zi-Xuan Ding, 2023). By embedding mathematics within game mechanics, students

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are not only motivated to learn but also able to make meaningful connections between abstract concepts and everyday applications. However, much of the current practice still relies on modern digital or classroom-based games that often lack relevance to students' cultural and social contexts. In this regard, traditional games emerge as an alternative pedagogical resource that is culturally rooted, affordable, and inherently familiar to students.

Traditional games, as part of local cultural heritage, carry embedded mathematical and social values that can enrich mathematics education naturally. For example, ethnomathematical studies have shown that traditional games such as *engklek* and *congklak* help children develop an understanding of number systems, counting strategies, and geometric concepts (Sahara & Fitriani, 2022; Tusolihah et al., 2022; Yunita, 2018).

Among the many traditional games found across Indonesia, *Kasedesede* a hopping game originating from Southeast Sulawesi, particularly in Baubau City stands out for its distinct educational potential. This game combines physical activities, such as jumping across numbered squares, with cognitive processes of counting, estimating, and strategizing moves. Such activities naturally train students in numeracy, pattern recognition, and basic arithmetic operations (Karina et al., 2021; Lynch et al., 2015). In addition to cognitive benefits, *Kasedesede* fosters collaboration, communication, and decision-making skills, thereby promoting social interaction and empathy among students. By situating mathematics within this cultural practice, students are more likely to perceive learning as enjoyable, relevant, and meaningful.

A growing body of literature has supported the effectiveness of integrating traditional games into mathematics classrooms. Brandão et al (2023) found that traditional games can effectively address the challenges faced by students in mathematics, especially in basic operations, thereby improving the overall teaching-learning process in elementary school environments. Based on the literature, a research review by Russo et al (2024) highlighted that non-digital games have a positive impact on mathematics learning outcomes in elementary classrooms. Analyzing 34 manuscripts from 2003 to 2022, they found that these games effectively develop mathematical skills and improve students' dispositions toward mathematics. Thus, integrating traditional games into mathematics classes is supported by evidence of their effectiveness in enhancing the learning experience. Studies have found that games like *engklek* not only improve students' mathematical understanding but also strengthen their confidence and willingness to engage with mathematical tasks (Dinda Kusuma Wardani et al., 2024; Fatonah & Naemah, 2022). Moreover, (Fitriana & Ridlwan, 2021)argue that transformative learning approaches that incorporate local cultural practices enhance students' literacy and numeracy while simultaneously fostering social cohesion and shared values. Despite these promising findings, research focusing specifically on students' perceptions of *Kasedesede* as a medium for numeracy development remains scarce. Furthermore, previous studies have predominantly employed qualitative or small-scale experimental designs, with limited use of quantitative

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approaches that systematically link students' perceptions to measurable learning outcomes.

The research gap lies in the limited empirical studies that comprehensively examine primary school students' perceptions of using the Kasedesede traditional game in mathematics learning and its relationship with numeracy achievement, particularly through the application of advanced analytical approaches such as machine learning to identify the most dominant perception dimensions influencing learning outcomes.

Theoretically, this study is grounded in two complementary frameworks Ethnomathematics and Realistic Mathematics Education (RME). According to D'Ambrosio (2001), ethnomathematics refers to the study of how cultural groups understand, express, and apply mathematical ideas in their daily lives. It situates mathematics as an integral part of culture not merely a set of abstract formulas, but a living, contextual system of knowledge. In educational settings, ethnomathematics helps students realize that mathematics is not detached from their social reality but embedded in cultural activities such as traditional games, weaving patterns, architectural designs, and local trade practices (Rosa & Shirley, 2016). By integrating traditional games like *Kasedesede*, students learn not only numerical and geometric concepts but also cultural values such as cooperation, precision, and social responsibility. Meanwhile, Realistic Mathematics Education (RME), developed by Freudenthal (1991), views mathematics as a human activity that must start from realistic contexts meaningful to students (Prahmana et al., 2020). RME emphasizes that learning should begin with real-life situations and gradually move toward abstract formalization through *guided reinvention*, *didactical phenomenology*, and *self-developed models*. In this framework, *Kasedesede* functions as a didactical phenomenon that allows students to rediscover mathematical meanings through concrete, enjoyable, and reflective experiences.

The integration of ethnomathematics and RME provides a robust pedagogical foundation for this study. Ethnomathematics offers authentic cultural and social contexts, while RME provides methodological guidance for transforming these contexts into meaningful learning experiences. Thus, incorporating the *Kasedesede* traditional game into mathematics learning not only enhances conceptual understanding and numeracy skills but also nurtures students' character, cultural identity, and reflective thinking as humanistic learners of mathematics.

This study seeks to bridge the gap between cultural practices and mathematics learning by examining how the integration of the *Kasedede* traditional game influences students' perceptions and numeracy achievement. Specifically, it aims to analyze primary school students' perceptions of *Kasedesede*-based mathematics learning (across six key dimensions engagement, enjoyment, mathematical understanding, literacy-numeracy, attitudes toward mathematics, and socio-educational benefits) and determine how these perceptions relate to students' numeracy outcomes. By combining descriptive and regression analyses with machine learning techniques such as Support Vector

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Machine, the study intends to identify the most dominant dimensions contributing to numeracy performance.

This research contributes to the advancement of ethnomathematics and culturally responsive pedagogy by offering empirical and methodological insights into how traditional games can serve as innovative, meaningful, and human-centered strategies for improving mathematics education in primary schools.

RESEARCH METHOD

This study employed a quantitative descriptive research design aimed at examining primary school students' perceptions of the integration of the traditional *Kasedesede* game into mathematics learning and investigating how these perceptions relate to students' numeracy performance. Quantitative research is particularly suitable for systematically explaining the relationships among variables by transforming perceptions and learning outcomes into measurable indicators expressed through numerical data (Clarke & Collier, 2015). The descriptive approach allows researchers to capture the characteristics of students' perceptions across multiple dimensions and to identify the extent to which these dimensions contribute to numeracy outcomes. Such an approach has been widely used in educational research to map students' attitudes, engagement, and achievements in ways that provide both generalizable patterns and meaningful pedagogical insights (Ruz et al., 2020).

The study was conducted at SD Negeri 2 Nganganaumala, located in Baubau City, Southeast Sulawesi Province, during February and March 2024. This site was purposively chosen because of its strong cultural ties to traditional practices and its proactive integration of local cultural elements into school activities. The contextual grounding of research in culturally rich environments is essential for evaluating the role of ethnomathematics in shaping mathematics learning (Hayati et al., 2024). The socio-cultural environment of the students, who remain actively engaged with local games in their daily lives, provided a unique opportunity to observe the pedagogical potential of *Kasedesede*.

The participants in this study were all 39 students enrolled in grade V at the school. The use of saturated sampling ensured that the entire population was included, given its relatively small size. This strategy, often referred to as census sampling, allows for the comprehensive analysis of all members of a defined group without excluding variability (Hossan et al., 2023; Omair, 2014). Grade V was deliberately selected because students at this level are developmentally positioned to begin abstract reasoning and possess sufficient reading skills to independently complete questionnaires and tests. These characteristics make them ideal subjects for a study exploring both perceptions and numeracy outcomes (Fatihatul Jannah et al., 2024; Siskawati et al., 2022).

The *Kasedesede* game was integrated into mathematics learning during two meetings, where students were encouraged to actively participate in game-based tasks related to counting, sequencing, and arithmetic problem-solving. Following these activities, students completed perception questionnaires and contextual numeracy tests. Two types of data were collected: students' perceptions and

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numeracy achievement. Student perceptions were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), where higher scores indicate more positive perceptions toward mathematics learning through the *Kasedede* traditional game, distributed across six dimensions: engagement, enjoyment, mathematical understanding, literacy-numeracy, attitudes toward mathematics, and socio-educational benefits (Hartwig & Rohrer, 2025; Maamin et al., 2021; Siller & Ahmad, 2024; Weinhandl et al., 2024). These dimensions were derived from theoretical and empirical frameworks that highlight the multifaceted nature of students' experiences in mathematics learning. Table 1 provides an overview of these dimensions and their operational definitions, which guided the design of questionnaire items.

Table 1. Description of Students' Perception Dimensions in the Kasedesede Game-Based Mathematics Learning

Dimension	Description
Engagement	Measures the extent to which students are actively and enthusiastically involved in the learning process during the game.
Enjoyment	Captures whether students feel happy, comfortable, and less bored while participating in game-based learning.
Mathematical Understanding	Assesses the effectiveness of the game in helping students grasp mathematical concepts in a contextual way.
Literacy and Numeracy	Focuses on students' ability to follow instructions, apply logic, and perform arithmetic during gameplay.
Attitudes toward Mathematics	Evaluates the influence of game-based learning on students' general perspectives toward mathematics.
Socio-Educational Benefits	Examines how the game supports cooperation, communication, discipline, and peer interaction.

The numeracy outcome was assessed through a contextual mathematics test developed in alignment with the core competencies for grade V. The test items were designed to reflect everyday mathematical challenges embedded within the logic of the *Kasedesede* game. There by ensuring construct validity. Following best practices in educational assessment, both instruments underwent item-total correlation analysis using Pearson's Product Moment and reliability testing through Cronbach's Alpha. Content validity was established through expert judgment involving three validators: two experts in mathematics education and one in educational measurement. The experts evaluated each item based on relevance, clarity, and alignment with the targeted construct using a four-point scale. The average validity coefficient obtained through the Aiken's V formula was 0.86, indicating that the instrument achieved a high level of content validity. Minor linguistic adjustments were made based on expert feedback to improve readability and contextual accuracy. Construct validity was further supported by the results of item-total correlation analysis using Pearson's Product Moment, where all items showed positive

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correlations with the total score (r = 0.339–0.780, $p < 0.05$), confirming that each item contributed meaningfully to the overall construct. The questionnaire achieved a Cronbach's Alpha value of 0.855, indicating high internal consistency and confirming the instrument's reliability (Suryadi et al., 2024). The results of the reliability test using Cronbach's Alpha are presented in Table 2.

Table 2. Reliability Statistics

Cronbach's Alpha	N of Items
.855	25

Data analysis was carried out in three stages. First, descriptive statistics were generated to provide a general overview of students' perceptions and numeracy outcomes. This stage included the calculation of mean scores, standard deviations, and distribution patterns across the six perception dimensions. Descriptive approaches are often crucial in perception studies because they help establish baseline profiles that highlight strengths and weaknesses in students' experiences (Ruz et al., 2020). Second, regression analysis was employed to examine the relationship between students' perceptions and their numeracy achievement. Simple linear regression was selected because of its suitability for testing the predictive power of a single independent variable (students' perceptions) on a dependent variable (numeracy scores)(Li, PhD, 2022; Marill, 2004). The coefficient of determination (R^2) provided evidence of how much variation in numeracy outcomes could be explained by perception scores, complementing similar studies linking attitudes to performance in mathematics

The third stage involved the application of Support Vector Machine (SVM) algorithms as a complementary analytical method to identify the most dominant perception dimensions contributing to numeracy performance. The Support Vector Machine (SVM) analysis was performed using Python's Scikit-learn library with an RBF kernel, C = 1.0, and gamma = 'scale'. Model performance was evaluated using accuracy, precision, recall, and F1-score metrics, supported by heatmap visualization generated with Matplotlib and Seaborn to illustrate inter-dimensional correlations. SVM has been widely acknowledged for its effectiveness in classification tasks where multiple predictors are involved, offering deeper insights into multidimensional educational data (Li et al., 2025). By employing SVM, the study was able to move beyond linear assumptions and explore nonlinear relationships among perception dimensions, thus providing a more nuanced understanding of students' experiences. In addition, the classification results were visualized in the form of a correlation heatmap illustrating the relationships among perception dimensions. This visualization was generated using the *Matplotlib* and *Seaborn* libraries, with color gradients indicating the strength of the relationships darker shades of red represent stronger correlations, whereas blue tones indicate weaker associations.

This triangulated analysis strategy combining descriptive, regression, and machine learning methods strengthened the validity of findings by ensuring that both linear and nonlinear relationships were captured. Such methodological

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pluralism has been advocated in recent educational research as a means to improve the accuracy and interpretability of results (Yuda & Rosmilawati, 2024).

The research also adhered to ethical principles throughout its implementation. Permission was obtained from the school authorities, and the purpose of the study was clearly explained to teachers and students prior to data collection. Participation was voluntary, and students were assured that their responses would remain anonymous and confidential. Data were coded to protect personal identities and stored securely for analysis, in accordance with ethical standards for educational research (Fitriana & Ridlwan, 2021). The emphasis on ethics ensured that the study not only respected the rights of participants but also upheld the integrity of the findings.

This methodology integrated a culturally relevant learning context, robust measurement instruments, and advanced data analysis techniques to explore students' perceptions of traditional game-based learning and its impact on numeracy. By situating the study within a local cultural environment and applying both statistical and machine learning methods, the research responds to the call for innovative approaches that connect abstract mathematical concepts to students' lived experiences. The methodological rigor enhances the reliability of the results while offering a replicable model for future studies in mathematics education that aim to integrate ethnomathematics and emerging analytical technologies.

RESULT AND DISCUSSION

The results of this study are organized into three major sections. First, the descriptive findings concerning students' perceptions of mathematics learning through the traditional *Kasedesede* game are presented. Second, the relationship between these perceptions and students' numeracy performance is examined using regression analysis. Finally, additional insights into the dominant perception dimensions are provided through visualization of inter-dimensional correlations using Support Vector Machine (SVM) and heatmap analysis. Together, these findings provide comprehensive evidence of how traditional games, as culturally rooted pedagogical tools, contribute to mathematics learning outcomes.

Students' Perceptions toward Kasedesede Game-Based Mathematics Learning

The descriptive analysis demonstrated that students held overwhelmingly positive perceptions of the integration of *Kasedesede* into mathematics learning. The summary of the descriptive statistics for both variables is presented in Table 1.

Table 1. Descriptive Statistics

	Mean	Std. Deviation	N
Perception	97.3590	12.40859	39
Numeracy Result	3.7179	.99865	39

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The mean perception score was 97.36 out of a possible 125, with a standard deviation of 12.41, indicating a generally high level of acceptance across the sample of 39 students. These results suggest that students not only welcomed game-based approaches but also felt actively engaged during classroom activities. Such findings echo prior studies that highlight the capacity of traditional games to foster inclusive, enjoyable, and motivating learning environments (Su & Zou, 2024).

Closer examination of the six dimensions of perception reveals differentiated patterns of student experiences. The dimension of engagement showed strong outcomes, with many students expressing enthusiasm for participation during the lessons. Several students reported that they wished to repeat the game outside formal class hours, suggesting that *Kasedesede* transcended the boundaries of school-based activity to become a meaningful part of their daily lives. Engagement in this sense can be understood not merely as task compliance but as an emotional and cognitive investment in the learning process, consistent with the definitions provided by Maamin et al. (2021).

The enjoyment dimension emerged as the highest scoring factor across all dimensions, indicating that the incorporation of the traditional game made learning mathematics fun and less intimidating. Almost all students stated that they felt more enthusiastic about learning mathematics when the lessons were mediated through *Kasedesede*. These findings reinforce the argument of Weinhandl et al (2024), who found that playful, contextualized learning environments significantly reduce mathematics anxiety while building students' confidence. The importance of enjoyment in mathematics learning has long been recognized in the literature as a catalyst for sustained motivation and resilience in problem-solving.

Equally important, the mathematical understanding dimension demonstrated that students perceived the game as an effective medium for conceptual development. Activities such as counting steps, estimating distances, and devising strategies within the rules of *Kasedesede* provided concrete experiences that strengthened their grasp of abstract ideas. This finding supports Maamin et al (2021), who emphasized the role of contextual activities in bridging abstract mathematical concepts with practical experiences. Students reported feeling that operations such as addition, subtraction, and pattern recognition became more tangible through play, aligning with the Realistic Mathematics Education perspective that prioritizes contextual anchoring of concepts.

In the literacy-numeracy dimension, students demonstrated the ability to process instructions accurately, apply logical reasoning, and carry out computations swiftly during gameplay. The contextual and sequential demands of the game fostered fluency in arithmetic while reinforcing the literacy skills required to comprehend rules and procedures. This outcome is particularly notable because numeracy has been identified as a key indicator in international assessments such as PISA (Nandang Mustafa, 2023). The evidence here suggests that embedding numeracy within culturally relevant activities may contribute to narrowing the gap between Indonesia's performance and international

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benchmarks. The literacy-numeracy aspect is not always explicitly mentioned in all learning, but appears in the context of numeracy skills, understanding instructions, and the use of logic in mathematics, usually as part of the cognitive and understanding dimensions (Maamin et al., 2021). However, studies of engagement and learning strategies contain elements of numeracy and literacy as part of students' cognitive performance.

The attitude toward mathematics dimension also revealed marked improvements. Many students reported greater confidence and reduced fear when confronted with mathematics problems after experiencing *Kasedesede*-based lessons. This shift resonates with the findings of Dinda Kusuma Wardani et al (2024), who reported that traditional games such as *engklek* significantly enhance students' willingness to tackle mathematical challenges. Positive attitudes are crucial as they form the foundation for long-term engagement with the subject (Shone et al., 2024)

Finally, the socio-educational benefits dimension captured the broader influence of the game on collaboration, communication, and interpersonal relationships. Students reflected on experiences of teamwork, helping peers, and sharing strategies during gameplay. These social interactions not only created a supportive learning climate but also contributed to character building, aligning with the transformative learning perspective outlined by(Hasnah et al., 2024). By cultivating empathy, discipline, and cooperation, *Kasedesede* provided a holistic educational experience that extended beyond cognitive learning.

Overall, the descriptive findings underscore that the traditional game fostered multidimensional benefits in mathematics classrooms, encompassing cognitive, affective, and social domains. This evidence reinforces arguments from the ethnomathematics literature that cultural practices can be strategically mobilized to enrich mathematics education (Hidayat, 2023; Varghese & McCusker, 2006).

Relationship between Students' Perceptions and Numeracy Achievement

The second part of the analysis explored the relationship between students' perceptions and their numeracy outcomes using simple linear regression. Results indicated a positive and statistically significant relationship between these variables, with a correlation coefficient (r) of 0.512 and a significance value of p = 0.001. The coefficient of determination (R^2) was 0.262, indicating that students' perceptions explained 26.2% of the variance in numeracy performance. The results of the simple linear regression analysis are summarized in Table 2, which presents the model's statistical parameters, including the correlation coefficient (R), coefficient of determination (R^2), adjusted R^2, and standard error of the estimate.

Table 2. Model Summary of Simple Linear Regression

Model	R	R Square	Adjusted Square	Std. Error of the Estimate
1	.512[a]	.262	.242	10.80421
a. Predictors: (Constant), Numeracy Result				

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b. Dependent Variable: Perception

These findings suggest that while perceptions are not the sole predictor of numeracy outcomes, they represent a substantial explanatory factor. Such results are consistent with earlier research that underscores the influence of affective and attitudinal variables on mathematics achievement (Hendrawan & Marlina, 2022). Positive perceptions are associated with higher levels of motivation, persistence, and willingness to engage in challenging tasks, all of which contribute to improved performance (Amelia & Harahap, 2021).

The regression coefficients further clarified the predictive relationship. For every unit increase in perception scores, numeracy achievement improved significantly, with a regression coefficient (B) of 6.358 (p = 0.001). This result confirms that students' subjective experiences of learning play a measurable role in shaping objective academic outcomes. The detailed coefficients of the regression model are presented in Table 3.

Table 3. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	73.721	6.751		10.921	.000
	Numeracy Result	6.358	1.755		3.623	.001
a. Dependent Variable: Perseption						

These results add to the growing body of evidence that emphasizes the importance of creating positive learning environments to maximize educational outcomes. As highlighted by Muspita and Ningsih (2024), game-based learning provides such an environment by combining cognitive challenges with affective enjoyment. The present study further contributes by quantifying the predictive strength of perceptions, reinforcing the idea that subjective engagement is not merely an ancillary outcome but a determinant of learning success.

Visualization of Inter-Dimensional Correlations

The third stage of analysis employed the Support Vector Machine (SVM) algorithm and heatmap visualization to identify dominant perception dimensions influencing numeracy performance. This advanced approach was adopted to capture both linear and non-linear relationships among variables, thereby offering a more nuanced view of the learning process (Aisyah et al., 2024). To provide a clearer understanding of the relationships identified through the SVM analysis, the correlation patterns among the six perception dimensions were visualized using a heatmap. The visualization highlights the strength and direction of interconnections between dimensions that contribute to students numeracy performance, as presented in Figure 1.

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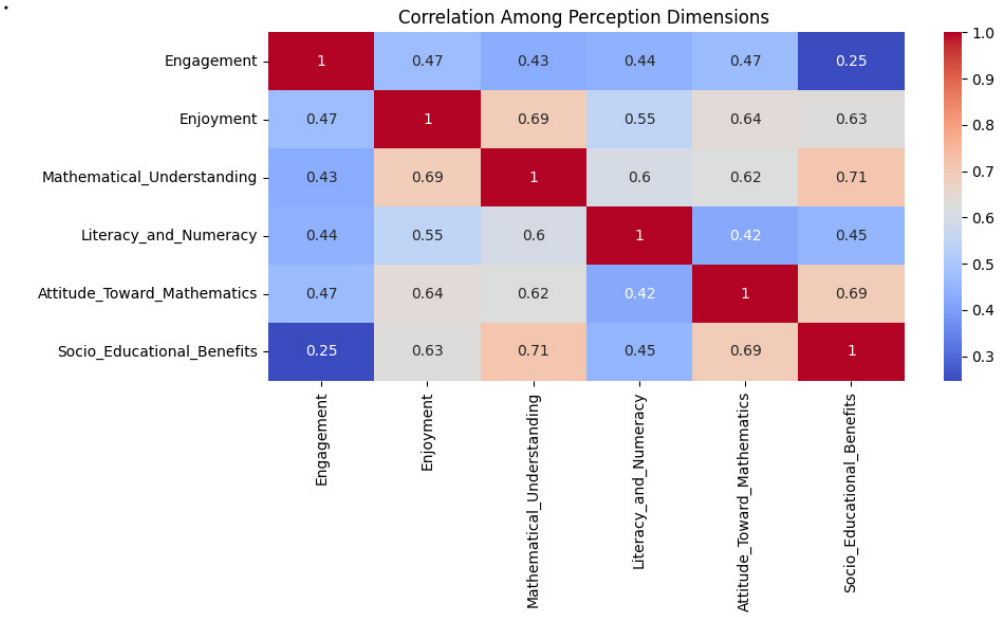

Figure 1. Heatmap of Correlations among Perception Dimensions (*The heatmap illustrates the strength of correlations between perception dimensions)*

The heatmap revealed several noteworthy patterns. The enjoyment dimension exhibited the strongest correlations with mathematical understanding (r = 0.69), attitudes toward mathematics (r = 0.64), and socio-educational benefits (r = 0.63). This suggests that enjoyment served as a central driver of both cognitive and affective gains. When students felt happy and comfortable, they were more likely to grasp abstract concepts, develop positive attitudes, and engage in supportive social interactions. This finding aligns with psychological theories that emphasize the role of positive emotions in enhancing learning capacity (Mahmud & Pratiwi, 2019).

The literacy-numeracy dimension also displayed significant correlations with mathematical understanding (r = 0.60) and attitudes toward mathematics (r = 0.42). These associations demonstrate that numeracy skills developed during gameplay are not isolated but intertwined with broader cognitive and affective growth. This echoes the findings of Suryadi et al. (2024), who argued that contextualized numeracy activities strengthen both conceptual comprehension and self-efficacy in mathematics.

Socio-educational benefits showed strong links to both mathematical understanding and attitudes, underscoring the role of collaborative learning in fostering deeper comprehension and more positive dispositions toward the subject. As Fitriana and Ridlwan (2021) contend, group-based activities rooted in cultural practices cultivate not only academic skills but also the social values that underpin sustainable learning communities.

The SVM analysis further confirmed these observations by classifying enjoyment, literacy-numeracy, and socio-educational benefits as the three most dominant dimensions influencing students' numeracy achievement. This

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triangulated evidence underscores that effective mathematics learning requires an interplay of affective enjoyment, cognitive skill-building, and social collaboration.

Taken together, the results indicate that *Kasedesede* is not merely an entertaining activity but a potent pedagogical tool. By embedding mathematical concepts in culturally meaningful play, the game enhanced students' engagement, enjoyment, understanding, and social interaction. These multidimensional benefits translated into measurable improvements in numeracy achievement, with perceptions explaining over a quarter of the variance in outcomes. Moreover, advanced analysis using SVM highlighted the critical role of enjoyment and socio-educational benefits, suggesting that affective and social dimensions are as influential as cognitive ones. The findings substantiate arguments from ethnomathematics that cultural practices provide fertile ground for contextualized learning. They also support the Realistic Mathematics Education approach, which advocates for linking abstract concepts with real-world contexts. By quantifying the predictive relationship between perceptions and outcomes, the study contributes novel evidence to the field of mathematics education, particularly in the underexplored domain of traditional game-based learning.

Students' Perception Dimensions in Kasedede-Based Mathematics Learning

Cognitive Dimension

The findings indicate that *Kasedede* is not merely a recreational activity but also serves as a pedagogical tool that enhances students' cognitive engagement in mathematics learning. By integrating mathematical concepts, such as counting, sequencing, and spatial reasoning into culturally meaningful contexts, students were able to connect concrete experiences with abstract ideas. The simple linear regression analysis revealed a significant relationship between students' perceptions and numeracy achievement, with a coefficient of determination (R^2) of 0.262, meaning that students' perceptions explained 26.2% of the variance in numeracy performance. This finding underscores that cognitive engagement through meaningful play contributes directly to measurable academic improvement. These results align with the Realistic Mathematics Education (RME) approach, which emphasizes linking mathematical concepts to students' real-world experiences to help them "reinvent" mathematical meaning as a human activity (Freudenthal, 1991; Suryadi et al., 2024). In this regard, *Kasedesede* functions as an authentic learning context that bridges formal mathematics with students' lived experiences.

Affective Dimension

Beyond cognitive aspects, the affective dimension demonstrated a strong influence on students' learning success. Analysis using the Support Vector Machine (SVM) algorithm identified enjoyment as one of the most dominant dimensions affecting numeracy achievement. The data showed that students felt more enthusiastic, motivated, and confident when mathematics was taught through the *Kasedesede* game. Enjoyment and curiosity encouraged active

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participation while reducing anxiety commonly associated with conventional mathematics instruction. This finding is consistent with prior studies emphasizing that positive emotions play a crucial role in fostering intrinsic motivation and deeper engagement in mathematics learning (Hendrawan & Marlina, 2022). Thus, the affective dimension, strengthened through culturally grounded contexts, contributes significantly to cultivating positive attitudes toward mathematics and sustaining long-term learning motivation.

Social Dimension

The social dimension of *Kasedesede*-based learning was reflected through students' collaborative, communicative, and empathetic interactions. The SVM analysis revealed that **socio**-educational benefits were among the most significant factors influencing overall student perception. Group activities within the *Kasedesede* game encouraged cooperation, turn-taking, and appreciation of peers' strategies and ideas. These interactions fostered a sense of belonging and increased students' confidence in solving mathematical problems. This finding supports the ethnomathematics perspective, which views local cultural practices as rich and contextual sources of mathematical understanding (Karina et al., 2021; Sahara & Fitriani, 2022). It also aligns with transformative learning theory, which posits that social collaboration not only strengthens cognitive abilities but also nurtures students' character and human values. Thus, integrating traditional games into mathematics learning enhances both intellectual competence and socio-emotional development, while reinforcing students' cultural identity.

Discussion

Students Positive Perceptions and Their Relationship with Numeracy Achievement

The findings of this study revealed overwhelmingly positive perceptions among students toward the integration of the *Kasedesede* traditional game into mathematics learning. The high mean perception score indicates that students experienced mathematics in ways that were more engaging, enjoyable, and socially meaningful. These findings resonate with existing literature demonstrating that culturally relevant games can create inclusive learning spaces that reduce anxiety and build motivation(Shofyana et al., 2024). By embedding mathematical concepts within familiar cultural practices, *Kasedesede* transformed mathematics from an abstract and intimidating subject into an accessible and enjoyable experience. This is particularly significant given longstanding concerns about Indonesian students' underperformance in international assessments such as PISA (Nandang Mustafa, 2023). Conventional teaching methods that rely heavily on teacher-centered instruction and rote memorization have often alienated students from mathematics. By contrast, the findings of the present study suggest that culturally grounded approaches may offer an effective antidote to these issues. When students perceive mathematics learning as relevant to their daily lives, they are more likely to remain engaged and motivated, which aligns with theories of culturally responsive pedagogy and ethnomathematics.

Among the six perception dimensions, enjoyment emerged as the most influential, strongly correlating with mathematical understanding, positive

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attitudes toward mathematics, and socio-educational benefits. This underscores the vital role of affective factors in shaping cognitive outcomes. As the literature on motivation and learning suggests, positive emotions serve as catalysts for deeper engagement and enhanced retention of knowledge. In this context, *Kasedesede* not only provided entertainment but also facilitated conditions under which students were more receptive to abstract concepts.

The findings support Weinhandl et al (2024), who emphasized that enjoyable, game-based environments reduce mathematics anxiety and encourage self-confidence. Moreover, enjoyment fosters resilience in the face of challenging problems, allowing students to persist in mathematical tasks that they might otherwise avoid. The correlation between enjoyment and socio-educational benefits also highlights the relational dimension of learning: students who enjoy learning together are more inclined to cooperate, share strategies, and build supportive classroom communities. The study further showed that literacy-numeracy skills were significantly reinforced through gameplay, with strong correlations observed between literacy-numeracy and both mathematical understanding and attitudes toward mathematics. These results confirm that numeracy is not only a cognitive skill but also a socially embedded practice that can be cultivated through everyday cultural activities. The *Kasedesede* game required students to follow rules, count steps, and apply logical strategies, thereby naturally embedding numeracy tasks within the flow of play. This finding aligns with Suryadi et al (2024) who argued that contextualized numeracy activities enable students to internalize mathematical concepts more effectively than abstract textbook exercises. The present study extends these insights by demonstrating how traditional games can serve as microcosms of numeracy practice, offering repetitive yet varied opportunities for computation and reasoning. Importantly, these outcomes carry broader implications for addressing Indonesia's challenges in numeracy as highlighted by international benchmarks (Nandang Mustafa, 2023). Embedding numeracy into culturally familiar practices could serve as a scalable strategy to bridge the gap between global standards and local realities, particularly in rural or culturally diverse contexts where conventional curricular materials may not fully resonate with students.

Regression analysis revealed a significant and positive relationship between students' perceptions and numeracy outcomes, with perceptions explaining 26.2% of the variance in performance. This quantitative evidence reinforces the theoretical claim that perceptions are not peripheral but central determinants of learning outcomes. When students perceive learning environments as supportive, relevant, and enjoyable, they are more likely to engage deeply, which translates into higher academic achievement. While perceptions alone cannot account for all variance in numeracy outcomes, the explanatory power of over one-quarter of the variation is notable. This suggests that educational interventions focusing solely on content delivery without addressing students' affective and perceptual dimensions may be insufficient. Instead, pedagogical innovations should explicitly target the cultivation of positive perceptions, leveraging tools such as culturally grounded games to enhance both engagement and performance. The regression

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coefficients further confirmed that improvements in perception scores corresponded to significant gains in numeracy. This finding is consistent with prior studies demonstrating that positive learning environments not only increase motivation but also sustain long-term academic achievement (Gorai, 2024).

The application of Support Vector Machine (SVM) and heatmap visualization added depth to the analysis by uncovering the dominant dimensions influencing numeracy outcomes. The strong correlations between enjoyment, mathematical understanding, and socio-educational benefits illustrate that effective learning in mathematics is multidimensional, requiring an integration of affective, cognitive, and social elements. This triangulated evidence aligns with Fontana et al (2022), who argued that collaborative and culturally relevant pedagogies enhance both cognitive and social outcomes. The identification of enjoyment and socio-educational benefits as dominant dimensions suggests that emotional and relational aspects of learning may be as crucial as cognitive skills in determining success. These findings are also consistent with the study by Hachem et al (2022), which emphasized that fostering social-emotional skills and creating supportive learning environments are crucial for enhancing students' perceived cognitive competencies and academic performance. Furthermore, the successful application of SVM in this study demonstrates the value of integrating advanced analytical techniques into educational research. While traditional statistical methods capture linear relationships, machine learning algorithms can reveal complex, non-linear interactions that better reflect the realities of learning processes. The use of SVM thus represents a methodological innovation, complementing conventional analysis and offering a more nuanced understanding of the factors driving numeracy outcomes.

The findings contribute to the growing body of literature on ethnomathematics and Realistic Mathematics Education (RME). Ethnomathematics emphasizes the integration of local cultural practices into mathematics instruction to enhance relevance and meaning. Similarly, RME advocates grounding abstract concepts in real-world contexts to promote deeper understanding. The integration of *Kasedesede* reflects both frameworks by situating mathematics within a culturally significant activity that naturally embodies numerical and logical reasoning. These approaches challenge the dominance of universalized curricula that often overlook the cultural specificities of learners. By demonstrating that traditional games can effectively support mathematics learning, this study supports calls for curriculum design that is both globally informed and locally grounded. Such integration not only enhances learning outcomes but also fosters cultural identity and pride among students, aligning with broader educational goals of holistic and humanistic development.

Practical Implications and Limitations

From a practical standpoint, the results suggest that teachers can benefit from incorporating traditional games into classroom practice as a means of contextualizing mathematics. Doing so may help mitigate mathematics anxiety, enhance student motivation, and foster collaborative learning. Teachers should be

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encouraged to explore local cultural resources as pedagogical tools, thereby creating learning environments that are both innovative and culturally resonant. Additionally, the evidence that perceptions strongly predict numeracy outcomes indicates that student feedback should be systematically incorporated into instructional design and evaluation. Schools and policymakers may consider implementing perception-based assessments alongside conventional testing as indicators of instructional effectiveness. This dual approach would ensure that both cognitive outcomes and affective experiences are prioritized in the evaluation of educational success.

While the study offers significant contributions, certain limitations must be acknowledged. The sample was limited to a single school in Baubau City, which may constrain the generalizability of findings. Future research could expand to multiple regions and cultural contexts to explore whether similar outcomes are observed across diverse settings. Additionally, while perceptions explained a substantial proportion of variance in numeracy outcomes, other factors such as teacher effectiveness, home environment, and prior achievement likely play complementary roles. Integrating these variables into future models could provide a more holistic account of learning outcomes. Moreover, while the use of SVM added methodological richness, further application of other machine learning techniques, such as random forests or neural networks, could yield additional insights into complex educational phenomena. Longitudinal studies are also recommended to examine whether the positive effects of traditional game-based learning persist over time and contribute to long-term academic trajectories.

Practical Implications for Teaching and Curriculum Design

The findings of this study hold significant implications for teaching practice and curriculum development in mathematics education. The integration of the *Kasedesede* traditional game demonstrates that culturally grounded learning can transform mathematics from an abstract, teacher-centered subject into an engaging, contextualized experience that resonates with students' everyday lives. For teachers, this highlights the importance of adopting pedagogical strategies that link mathematical concepts to local cultural practices. By incorporating traditional games into instruction, teachers can reduce mathematics anxiety, enhance motivation, and promote active participation and collaboration among students. Moreover, *Kasedesede* exemplifies how mathematics instruction can embody the principles of culturally responsive pedagogy, where learners' cultural identities and experiences serve as resources for meaning-making rather than barriers to understanding.

For curriculum designers, these results underscore the need to embed ethnomathematical contexts into learning materials and lesson structures. Integrating culturally relevant activities, such as traditional games, into the curriculum can help achieve a dual purpose developing numeracy and problem-solving skills while simultaneously nurturing social-emotional competencies and cultural awareness. Curriculum frameworks should therefore encourage teachers to contextualize mathematical content through local practices, ensuring that

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mathematics is taught as a living, human activity rather than a detached set of formulas. Furthermore, assessment models could be expanded to include perception-based and affective indicators alongside traditional cognitive measures. This dual evaluation system would provide a more comprehensive understanding of student learning, accounting for both academic achievement and emotional engagement.

At a broader level, these implications suggest that educational reform efforts in Indonesia and similar multicultural contexts should value local wisdom as a foundation for innovation. Embedding ethnomathematical principles into national curricula can bridge the gap between global educational standards and local realities, ensuring that learning remains relevant, humanistic, and sustainable. In doing so, mathematics education can move beyond rote learning toward fostering critical thinking, cultural appreciation, and lifelong curiosity.

CONCLUSION

In line with the objectives of this study, which were to analyze primary school students' perceptions of the *Kasedesede* traditional game in mathematics learning and to examine its relationship with numeracy achievement, several key findings were identified. First, students expressed highly positive perceptions of *Kasedesede*-based instruction. All six dimensions: engagement, enjoyment, mathematical understanding, literacy-numeracy, attitudes toward mathematics, and socio-educational benefits contributed to students' experiences, with enjoyment and engagement emerging as dominant factors. Second, regression analysis revealed that student perceptions significantly predicted numeracy outcomes, accounting for 26.2% of the variance. Third, further analysis using Support Vector Machine and heatmap visualization highlighted the multidimensional interplay of affective, cognitive, and social aspects in supporting numeracy development.

These findings reinforce the frameworks of ethnomathematics and Realistic Mathematics Education by demonstrating that local cultural practices are not only relevant but also effective in fostering mathematical understanding, motivation, and positive attitudes. The main contribution of this research lies in providing quantitative empirical evidence of the link between perceptions and outcomes, as well as methodological innovation through the use of machine learning in primary mathematics education.This study enriches the body of knowledge by positioning traditional games as humanistic and contextually meaningful pedagogical strategies that connect mathematical learning with cultural identity..

Theoretically, the study strengthens the integration of ethnomathematics and RME by showing how culturally grounded contexts like *Kasedede* can serve as realistic learning environments that bridge abstract mathematics and real-life experience. Practically, the findings provide actionable guidance for teachers and curriculum developers to incorporate traditional games into mathematics instruction as culturally responsive tools to enhance engagement, numeracy competence, and motivation in diverse classroom settings.

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REFERENCES

Amelia, D. P., & Harahap, A. (2021). Application of Interactive Multimedia-Based Mathematics Learning Media to Increase Students' Interest in Learning. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, *4*(2), 3153–3161. https://doi.org/10.33258/birci.v4i2.2040

Brandão, L. M. de S., Castro, G. G., Gomes, A. L. M., & Gregorio, E. F. (2023). Uso de Jogos no Ensino da Matemática: Uma Revisão Integrativa. *Cadernos de Educação Tecnologia e Sociedade*, *16*(2), 255–265. https://doi.org/10.14571/brajets.v16.n2.255-265

Clarke, S., & Collier, S. (2015). Research essentials. *Nursing Children and Young People*, *27*(9), 12–12. https://doi.org/10.7748/ncyp.27.9.12.s14

D'Ambrosio, U. (2001). What Is Ethnomathematics, and How Can It Help Children in Schools? In *In Teaching Children Mathematics* (Vol. 7, Issue 6, p. 308). National Council of Teachers of Mathematics. http://math.hawaii.edu/~mchyba/documents/syllabus/Math499/Ethnomath/Ambrosio1.pdf

Dinda Kusuma Wardani, M. Syaffrudin Kuryanto, & Lovika Ardana Riswari. (2024). MINAT BELAJAR MATEMATIKA DALAM PERMAINAN TRADISIONAL ENGKLEK. *Prismatika: Jurnal Pendidikan Dan Riset Matematika*, *6*(2), 422–432. https://doi.org/10.33503/prismatika.v6i2.4052

Djannah, M., Setyaningsih, N., Kholid, M. N., & Reotutar, M. A. C. (2024). Defragmentation of Students' Conceptual Understanding in Solving Non-Routine Mathematics Problems. *Jurnal Didaktik Matematika*, *11*(2), 287–301. https://doi.org/10.24815/jdm.v11i2.38383

Fatihatul Jannah, G., Robicha, N., Khansah Inas Syarifah, & Rasilah, R. (2024). Introduction To Basic Mathematical Concepts Through Learning Media. *Journal of Mathematics Instruction, Social Research and Opinion*, *4*(1), 45–58. https://doi.org/10.58421/misro.v4i1.290

Fatonah, S., & Naemah, Z. (2022). Analisis Pengaruh Games Education (Permainan Angklek) Terhadap Motivasi Belajar Siswa dalam Pembelajaran Matematika Pokok Bahasan Keliling Bangun Datar. *Jurnal Basicedu*, *6*(4), 7209–7219. https://doi.org/10.31004/basicedu.v6i4.3455

Fitriana, E., & Ridlwan, M. K. (2021). PEMBELAJARAN TRANSFORMATIF BERBASIS LITERASI DAN NUMERASI DI SEKOLAH DASAR. *Trihayu: Jurnal Pendidikan Ke-SD-An*, *8*(1), 1284–1291. https://jurnal.ustjogja.ac.id/index.php/trihayu/article/view/11137/4404

Fontana, M., Peverelli, F., & Giacomazzi, M. (2022). Collaboration in East Africa: A

Corresponding author: Rimayasi (rimayasi19@gmail.com)

Contextual Definition. *Education Sciences*, *12*(10), 706. https://doi.org/10.3390/educsci12100706

Fousiya, O. P., & Saleem, T. M. (2024). Education 5.0: Nurturing Essential Life Skills for the Future Generation. *International Journal For Multidisciplinary Research*, *6*(2). https://doi.org/10.36948/ijfmr.2024.v06i02.16511

Gorai, N. (2024). ENHANCING LEARNING AND ENGAGEMENT: THE INTEGRATION OF GAMIFICATION IN ELEMENTARY EDUCATION. In *Futuristic Trends in Social Sciences Volume 3 Book 3* (pp. 79–87). Iterative International Publisher, Selfypage Developers Pvt Ltd. https://doi.org/10.58532/V3BBSO3P2CH1

Hachem, M., Gorgun, G., Chu, M.-W., & Bulut, O. (2022). Social and Emotional Variables as Predictors of Students' Perceived Cognitive Competence and Academic Performance. *Canadian Journal of School Psychology*, *37*(4), 362–384. https://doi.org/10.1177/08295735221118474

Hartwig, M. K., & Rohrer, D. (2025). Students' Perceptions of Effective Math Learning Strategies. *Behavioral Sciences*, *15*(8), 1047. https://doi.org/10.3390/bs15081047

Hasnah, S., Gusnarib, G., & Rahmah, H. (2024). Metode Pembelajaran Bermain: Apakah berpengaruh terhadap perkembangan karakter sosial anak usia dini? *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *8*(6), 2024–2032. https://doi.org/10.31004/obsesi.v8i6.6247

Hayati, R., Syahputra, E., & Surya, E. (2024). SYSTEMATIC LITERATURE REVIEW: CULTURAL INTEGRATION IN LEARNING CONCEPTS WITH AN ETHNOMATHEMATICS APPROACH. *Proceedings of International Conference on Education*, *2*(1), 160–168. https://doi.org/10.32672/pice.v2i1.1333

Hidayat, A. (2023). Teaching mathematics through a cultural lens: Allowing students to resonate the academic content. *Union: Jurnal Ilmiah Pendidikan Matematika*, *11*(3), 376–382. https://doi.org/10.30738/union.v11i3.15840

Hossan, D., Dato' Mansor, Z., & Jaharuddin, N. S. (2023). Research Population and Sampling in Quantitative Study. *International Journal of Business and Technopreneurship (IJBT)*, *13*(3), 209–222. https://doi.org/10.58915/ijbt.v13i3.263

Karina, C. D., U.S, S., & L.A, S. (2021). Eksplorasi Etnomatematika Pada Permainan Tradisional Indonesia Komunitas TGR (Traditional Games Return). *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(2), 1599–1615. https://doi.org/10.31004/cendekia.v5i2.674

Li, PhD, H. (2022). Linear Regression. In *Numerical Methods Using Java* (pp. 915–978). Apress. https://doi.org/10.1007/978-1-4842-6797-4_14

Li, X., Dong, S., Guo, S., & Zheng, C. (2025). Applying support vector machines to a diagnostic classification model for polytomous attributes in small-sample contexts. *British Journal of Mathematical and Statistical Psychology*, *78*(1), 167–189. https://doi.org/10.1111/bmsp.12359

Lynch, S., Becherer, K., & Taylor, A. (2015). Jump! Jump! *Teaching Children Mathematics*, *22*(1), 56. https://doi.org/10.5951/teacchilmath.22.1.0056

Maamin, M., Maat, S. M., & H. Iksan, Z. (2021). The Influence of Student Engagement on Mathematical Achievement among Secondary School

Corresponding author: Rimayasi (rimayasi19@gmail.com)

Students. *Mathematics*, *10*(1), 41. https://doi.org/10.3390/math10010041

Marill, K. A. (2004). Advanced Statistics: Linear Regression, Part I: Simple Linear Regression. *Academic Emergency Medicine*, *11*(1), 87–93. https://doi.org/10.1197/j.aem.2003.09.005

Muspita, Z., & Ningsih, L. P. (2024). Peningkatan Kemampuan Numerasi Siswa Melalui Pendekatan Kontekstual Berbasis Permainan Edukatif. *ALPATIH Jurnal Inovasi Pengabdian Masyarakat*, *2*(2), 66–78. https://doi.org/10.70115/alpatih.v2i2.201

Nandang Mustafa, A. (2023). REFLECTION ON THE LATEST PISA RESULTS OF INDONESIA. *International Journal of Advanced Research*, *11*(05), 1223–1228. https://doi.org/10.21474/IJAR01/16988

Omair, A. (2014). Sample size estimation and sampling techniques for selecting a representative sample. *Journal of Health Specialties*, *2*(4), 142. https://doi.org/10.4103/1658-600X.142783

Prahmana, R. C. I., Sagita, L., Hidayat, W., & Utami, N. W. (2020). TWO DECADES OF REALISTIC MATHEMATICS EDUCATION RESEARCH IN INDONESIA: A SURVEY. *Infinity Journal*, *9*(2), 223. https://doi.org/10.22460/infinity.v9i2.p223-246

Rosa, M., & Shirley, L. (2016). *In Guise of Conclusion* (pp. 39–40). https://doi.org/10.1007/978-3-319-30120-4_4

Russo, J., Kalogeropoulos, P., Bragg, L. A., & Heyeres, M. (2024). Non-Digital Games That Promote Mathematical Learning in Primary Years Students: A Systematic Review. *Education Sciences*, *14*(2), 200. https://doi.org/10.3390/educsci14020200

Ruz, F., Molina-Portillo, E., & Contreras, J. M. (2020). ACTITUDES HACIA LA ESTADÍSTICA DESCRIPTIVA Y SU ENSEÑANZA EN FUTUROS PROFESORES. *Cadernos de Pesquisa*, *50*(178), 964–980. https://doi.org/10.1590/198053146821

Sahara, N., & Fitriani, F. (2022). The Role of Ethnomathematics Based on Traditional Engklek Games in Improving the Ability to Understand Mathematical Concepts Sipirok Muhammadiyah Elementary School Students. *FINGER : Jurnal Ilmiah Teknologi Pendidikan*, *1*(1), 31–35. https://doi.org/10.58723/finger.v1i1.23

Shofyana, M., Santoso, Y. I., Aditama, M. G., Yulianti, E. H., & Wibisana, M. A. (2024). Bridging Cultures: Integrating Game-based Learning based on Local Wisdom in ELT. *Tell : Teaching of English Language and Literature Journal*, *12*(2). https://doi.org/10.30651/tell.v12i2.23365

Shone, E. T., Weldemeskel, F. M., & Worku, B. N. (2024). The role of students' mathematics perception and self-efficacy toward their mathematics achievement. *Psychology in the Schools*, *61*(1), 103–122. https://doi.org/10.1002/pits.23033

Siller, H.-S., & Ahmad, S. (2024). Analyzing the impact of collaborative learning approach on grade six students' mathematics achievement and attitude towards mathematics. *Eurasia Journal of Mathematics, Science and Technology Education*, *20*(2), em2395.

Corresponding author: Rimayasi (rimayasi19@gmail.com)

https://doi.org/10.29333/ejmste/14153

Siskawati, S., Sary, R. M., & Purnamasari, V. (2022). KESIAPAN SISWA DALAM MENYELESAIKAN SOAL ASESMEN KOMPETENSI MINIMUM (AKM) LITERASI DAN NUMERASI KELAS V SDN PALEBON 1 SEMARANG. *JS (JURNAL SEKOLAH)*, *6*(3), 37. https://doi.org/10.24114/js.v6i3.35323

Su, F., & Zou, D. (2024). A systematic review of game-based assessment in education in the past decade. *Knowledge Management & E-Learning: An International Journal*, *16*(3), 451–476. https://doi.org/10.34105/j.kmel.2024.16.021

Suryadi, A., Kadek Ananda Pratiwi, Putra, I. P. R. A., Yani, K. C., Mirayani, K., & Werang, B. R. (2024). Strategi Efektif dalam Pengembangan Literasi dan Numerasi Siswa SD Kelas V. *PrimEarly : Jurnal Kajian Pendidikan Dasar Dan Anak Usia Dini*, *7*(1), 98–112. https://doi.org/10.37567/primearly.v7i1.2865

Tusolihah, N., Ali Misri, M., & Nursuprianah, I. (2022). Ethnomathematics Eksploration of The Traditional Game of Congklak. *Eduma : Mathematics Education Learning and Teaching*, *11*(2), 203. https://doi.org/10.24235/eduma.v11i2.10300

Varghese, T., & McCusker, D. (2006). On Globalization and Ethnomathematics. *Comparative and International Education*, *35*(1). https://doi.org/10.5206/cie-eci.v35i1.9068

Wahyuni, A. T., & Witanto, Y. (2025). Integrated Volume Card Game Make A Match Learning Model: Improving Motivation of Learning Outcomes of the Concept of Spatial Building. *Journal Evaluation in Education (JEE)*, *6*(1), 166–176. https://doi.org/10.37251/jee.v6i1.1385

Weinhandl, R., Mayerhofer, M., Anđić, B., & Große, C. S. (2024). An Interplay of Enjoyment, Engagement, and Anxieties: The Characteristics of Upper Secondary School Mathematics Students. *Investigations in Mathematics Learning*, *16*(1), 36–51. https://doi.org/10.1080/19477503.2023.2267936

Yunita, D. (2018). *PENGARUH PERMAINAN TRADISIONAL ENGKLENG TERHADAP PEMAHAMAN KONSEP SISWA KELAS III MATA PELAJARAN MATEMATIKA DI SDN BANGSA NEGARA KABUPATEN OKU TIMUR* [UNIVERSITAS ISLAM NEGERI (UIN) RADEN FATAH PALEMBANG]. https://repository.radenfatah.ac.id/11606/1/DEDEK YUNITA %2814270015%29.pdf

Zi-Xuan Ding, T.-S. W. (2023). Using a Level-based RPG Educational Game to Enhance Students' Knowledge of Mathematics. *Tuijin Jishu/Journal of Propulsion Technology*, *44*(4), 6998–7007. https://doi.org/10.52783/tjjpt.v44.i4.2503

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