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Influence of the Use of Culturally Themed Educational Games on Pupils' Acquisition of Basic Arithmetic Skills in Lower Grades of Public Primary Schools in Malindi Sub-County, Kilifi County

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Abstract

The purpose of the study was to examine influence of the use of culturally themed educational games on learners' acquisition of basic arithmetic skills in lower grades of public primary schools in Malindi Sub-County, Kilifi County. The study was guided by the following research question: How does the use of culturally themed educational games influence the acquisition of arithmetic skills among lower grade learners in public primary schools? The study was informed by Ethno-mathematics Theory. The study adopted a mixed methods approach, employing a convergent design. A cross-sectional and phenomenology designs were employed to collect quantitative and qualitative data respectively. The target population included 82 public primary schools, 82 head teachers, 415 lower grade teachers, 2,880 lower grade pupils, and one Sub-County Director of Education (SCDE) from Malindi sub-county. Stratified sampling was used to select 10 public primary schools, systematic sampling to select 288 lower grade pupils, simple random sampling to select 81 lower grade teachers, purposive sampling to select 10 head teachers, and one SCDE. Data collection instruments included questionnaires for teachers, interview guides for head teachers and SCDE, and focus groups discussion guide for learners. Reliability was confirmed using Cronbach's Alpha coefficient of 0.8. Validity of qualitative instruments was ensured through expert review, pilot testing, triangulation, and member checking to enhance trustworthiness and credibility. Quantitative data was analyzed using descriptive and inferential statistics while qualitative data was subjected to thematic content analysis. The study observed ethics. The study revealed that culturally themed educational games enhanced pupils' engagement, participation and acquisition of basic arithmetic skills among lower grade pupils in public primary schools. The findings showed that culturally relevant games had the potential to promote meaningful and effective numeracy learning. The study recommends teachers to integrate culturally themed educational games in mathematics instruction as well as education stakeholders to provide resources and training to facilitate implementation.

Key Words: Culturally themed educational games, Use of educational games, Game-based learning, Culture-based learning, Acquisition, Basic arithmetic skills, Numeracy skills, and Lower grade learners

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Background to the Study

Educational games with cultural themes are pedagogical activities that incorporate learners' cultural experiences, indigenous knowledge, traditions, local resources and community practices to support classroom instruction. Game-based learning is the purposeful use of games as educational tools to facilitate engagement, motivation, problem-solving and learning . The basic arithmetic skills are the fundamental mathematical skills, which include number recognition, counting, addition, subtraction, multiplication, division and basic problem solving. D'Ambrosio (1985) notes that the development of mathematics happens through human cultural interactions and social practices. Mathematics learning can be more meaningful when it is related to the lived experiences of learners. Using culturally relevant games in lower primary education, pupils can relate abstract mathematical ideas to known activities, which improves conceptual understanding and numeracy development (Nurhanan & Santoso, 2025; Permata et al., 2021).

Education stakeholders have highlighted the importance of instructional approaches that facilitate meaningful and context-based learning particularly in foundational mathematics. UNESCO (2021) reports that many pupils globally finish early grades without achieving expected numeracy competencies despite improved access to education. Similarly, the World Bank (2022) identifies learning poverty as a major problem, with pupils unable to perform basic arithmetic operations and mathematical reasoning. UNICEF (2022) suggests that traditional methods that depend on memorisation and abstract procedures might hinder pupils' understanding in the absence of connections between mathematical ideas and their social environments. Therefore, organisations such as UNESCO (2023), Education International (2021), and the Global Partnership for Education (2023) promote the use of learner-centred approaches that incorporate local experiences and culturally relevant resources to enhance foundational learning outcomes.

The acquisition of basic arithmetic skills by lower primary pupils is a major educational concern worldwide especially when mathematics is taught using abstract methods that have little connection with the pupils' daily experiences. An alternative strategy has been proposed, consisting of culturally themed educational games that combine play, cultural familiarity and mathematical practice. Number sense, computational skills and problem-solving skills can be developed by the pupils using traditional games, local materials and community-based activities (Zainovi et al., 2024; Jacob & Dike, 2025). D'Ambrosio (1985) in the ethnomathematics theory, says that mathematics is culturally situated and comes from human activities. Rosa and Orey (2021) also state that the infusion of cultural practices such as counting, measuring, designing, and explaining in mathematics instruction improves pupils' understanding and application of mathematical concepts.

Research in developed countries has shown that culturally relevant learning activities can improve early mathematics competencies. In Finland, Hemmi and Ryve (2021) researched lower primary pupils' culturally relevant mathematics pedagogy by contextualising mathematics instruction with everyday tasks, including shopping, cooking, and measurement tasks. The study found that pupils who were taught using contextualised activities were better at accurate counting, estimation and problem solving than pupils taught using abstract methods. The researchers did find, however, that successful implementation depended on the teachers' ability to connect the

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cultural activities with formal mathematical concepts. In Japan, however, similar findings have been reported by Shimizu (2022) who found that linking familiar experiences to mathematics instruction improved pupils' understanding of the arithmetic operations by helping them connect mathematical concepts to practical situations. But to achieve sustainable results, it was important to be in line with the curriculum's expectations.

Additional evidence from developed contexts suggests that culture-based educational activities can improve pupils' engagement and conceptual understanding, but also expose challenges in their implementation. Nicol et al. (2020) investigated the use of cultural games, storytelling, community activities and familiar materials in diverse classrooms in Canada. The findings revealed that culturally connected activities improved pupils' confidence, engagement and understanding of mathematical ideas. But the study also found challenges around teacher readiness, instruction time and curriculum requirements. The findings indicate that cultural-themed educational games require deliberate planning and teacher competence to produce meaningful results. While positive experiences with culturally responsive mathematics instruction have been reported in developed countries, there remains a need to investigate how such approaches function in contexts where resources and teacher preparation may differ significantly.

There is also evidence to suggest that culturally based mathematics approaches have the potential to improve pupils' arithmetic learning in African countries. In Nigeria, the TurcoMat Study (2024) investigated the use of indigenous problem-solving situations and locally available materials in the teaching of mathematics. The study found that students involved in culturally grounded activities did better in arithmetic accuracy and spatial reasoning than students who received traditional instruction. However, the study found barriers to implementation, including teacher readiness and lack of instructional resources. In South Africa, Prediger and Zindel (2022) explored indigenous game-based methods that used traditional games such as Morabaraba, Diketo, and Tsheretshere. These culturally familiar games were found to support pupils' number sense, spatial reasoning and problem-solving abilities, although effective outcomes depended on teachers' understanding of how to link games with mathematical concepts.

Other African countries have experienced similar benefits when they have used culturally contextualised approaches to learning mathematics. Waiswa et al. (2024) investigated culturally contextualised mathematics instruction with indigenous problem-solving strategies and community-based activities in Uganda. The study revealed that pupils who took part in culturally responsive mathematical activities had better numeracy skills than those that were taught through conventional methods. These results show the significance of using familiar experiences such as trading, sharing and household activities to facilitate arithmetic learning. However, issues regarding the availability of resources and the capacity of teachers continue to be major concerns. Evidence shows that educational games with a cultural theme can reinforce basic learning of mathematics in the African context, but the success of these games requires their proper integration into classroom teaching and sufficient teacher support.

Concerns on pupils' foundational mathematics achievement in Kenya have led researchers to explore alternative instructional approaches. Despite educational reforms, the Usawa Agenda (2023) and Uwezo (2021) have consistently reported the weak ability of pupils to perform basic

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mathematical tasks. The Competency-Based Curriculum (CBC) emphasises learner-centred approaches, practical application of knowledge and contextualised learning (Kenya Institute of Curriculum Development (KICD, 2023). The use of culturally relevant materials has been shown to have potential in teaching mathematics in Kenya. For example, a study carried out by Begi (2024) found that learners in Nairobi County who were exposed to familiar examples and local learning resources demonstrated better engagement and understanding of mathematical concepts. Similarly, Manoo et al. (2024) found that teachers in Kathonzweni Sub-County, Machakos County, used indigenous problem-solving strategies and local artefacts to enable learners to relate mathematics to their daily experiences.

Although Kenya has made efforts to promote contextualised learning, evidence of systematic use of culturally themed educational games remains limited. The CBC encourages the use of local resources, practical experiences and learner-centred strategies by teachers, but culturally themed games are not formally identified as a specific instructional approach in mathematics teaching (KICD, 2023). Earlier work has shown how cultural resources can be used to support mathematics learning, but their use is hampered by such factors as teacher preparedness, inconsistent implementation, and a lack of instructional materials. Begi (2024) and Manoo et al. (2024) argue that culturally relevant approaches need institutional support and teacher competence to transform cultural experiences into effective mathematical learning activities. Therefore, there is need for further research to determine the effect of culturally themed educational games on pupils' acquisition of basic arithmetic skills.

Kilifi County offers a significant context within which to study culturally themed educational games as children's daily lives are intertwined with cultural and economic activities that involve mathematical ideas. Farming, fishing, trading, construction, and indigenous crafts include counting, measurement, estimation, patterns and spatial reasoning that can be transformed into meaningful mathematics learning experiences. However, in some schools, mathematics teaching may still rely heavily on textbook and abstract approaches that restrict opportunities for pupils to connect classroom mathematics with their cultural environments. UNICEF (2022) and the World Bank (2022) note that teaching approaches that reflect the experiences of students improve learning. Hence, exploring culturally themed educational games in Kilifi County could offer insights into how culturally responsive approaches contribute to foundational arithmetic development.

Continued concerns on mathematics learning outcomes and instructional relevance inform the need to explore culturally themed educational games in Malindi Sub-County. Mweri et al. (2025) showed that the use of culturally contextualised classroom activities in Malindi increased pupils' engagement and their capacity to make sense of mathematical concepts. But the study also found limitations in terms of teacher professional development, resources and consistency in implementation. Cultural relevance may increase participation, but it is unknown whether educational games with a cultural theme relate to the acquisition of basic arithmetic skills of lower grade pupils. Considering the significance of early numeracy development, Malindi Sub-County provides a suitable environment to examine whether the use of culturally familiar games in mathematics teaching improves pupils' basic arithmetic skills.

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The current research intends to address the knowledge gaps that exist by examining the impact of culturally themed educational games on the acquisition of basic arithmetic skills of lower grade pupils in public primary schools in Malindi Sub-County, Kilifi County. Earlier studies have demonstrated the potential of culturally responsive mathematics approaches in improving engagement and conceptual understanding (Prediger & Zindel, 2022; Waiswa et al., 2024). However, there is a lack of empirical evidence on the unique role of culturally themed educational games in early arithmetic achievement in the Kenyan coastal context. Thus, the study addresses this gap by providing evidence on the effect of culturally grounded games on the development of foundational numeracy skills among pupils, and insights for teachers, curriculum developers and education stakeholders on effective mathematics instructional strategies.

Statement of the Problem

Learner-centered and culturally sensitive methods improve learners' engagement and acquisition of numeracy in a variety of educational settings. Globally, Rosa and Orey (2021) and D'Ambrosio (2020) stress that including ethno-mathematics into teaching improves conceptual understanding. Similar increases in learner engagement and performance have been documented regionally in Africa by Mwakapenda (2022) and Mosimege (2023), supporting the applicability of culturally grounded pedagogies.

According to the Kenya National Examinations Council (2024), less than 45% of learners achieve the requisite numeracy competences despite Kenya's rich indigenous knowledge systems. Teachers and parents alike have noted that this disparity is primarily caused by a continued emphasis on examination-oriented instruction and a lack of contextualization of mathematics curriculum. If this pattern continues, many learners run the risk of finishing primary school without a solid foundation in numeracy, which would hinder their ability to advance academically and solve real-world challenges. While local evidence by Nurhanan (2023) and Mweri at el. (2025) shows continued underutilization of ethnomathematical approaches, teacher unpreparedness, and neglected learner factors like socioeconomic status and language background. Thus, the purpose of this study was to investigate influence of ethno-mathematics-based instruction on acquisition of arithmetic skills among lower grade learners in public primary schools in Malindi sub-county, Kilifi County, Kenya.

Research Question

How does the use of culturally themed educational games influence the acquisition of basic arithmetic skills among lower grade learners in public primary schools in Malindi sub-county, Kilifi County?

Theoretical Framework

The study was anchored on the Ethnomathematics Theory of Ubiratan D'Ambrosio (1985). This theory considers mathematics as a cultural and situated knowledge that is created through social interactions, cultural practices, traditions, and everyday problem-solving experiences . As d'Ambrosio (1985) indicates, mathematical ideas are not only learned in formal classroom settings, but also through community activities such as counting, measuring, trading, designing and reasoning. Ethnomathematics, as Rosa and Orey (2021) claim, considers indigenous and local

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knowledge systems as important resources for learning mathematics. This study employed the theory as a framework in examining the effects of culturally themed educational games on the acquisition of basic arithmetic skills by lower grade pupils in public primary schools in Malindi Sub-County, Kilifi County.

The strength of the Ethnomathematics Theory is based on the connection between formal mathematical concepts and the pupils' cultural experiences that make learning more meaningful and relevant. The theory favours learner centred strategies since it considers pupils as active participants who bring valuable knowledge from their communities to the classroom. According to Rosa and Orey (2021), culturally grounded mathematics instruction enhances students' conceptual understanding, engagement, and problem-solving skills as students connect abstract concepts to familiar experiences. The theory also supports inclusive education by validating diverse cultural knowledge systems and encouraging equity in learning mathematics (Rosa et al., 2022). In this study, culturally themed educational games provide opportunities for pupils to develop arithmetic abilities through familiar, interactive and enjoyable learning experiences.

Ethnomathematics Theory has some weaknesses despite its contributions. These weaknesses may affect the application of the theory in formal education settings. One of the biggest limitations is the challenge of integrating culturally based mathematical activities into standard curricula and assessment systems. Culturally relevant approaches may enhance students' understanding, but teachers may find it difficult to link cultural games to specific curriculum goals and expected learning outcomes (Rosa & Orey, 2021). Moreover, teachers require sufficient knowledge of local cultural practices, pedagogical skills, and resources to develop meaningful learning activities for effective implementation (Naidoo & Parker, 2023). Poorly prepared culturally themed games may be used superficially without establishing clear connections to arithmetic concepts. Therefore, teacher capacity and curriculum support are still important for the effective use of the theory.

The Ethnomathematics Theory was relevant to this study as it provided a foundation for comprehending how culturally themed educational games can help in the learning of basic arithmetic skills for lower grade pupils. The theory guided the study to investigate the use of local cultural experiences, traditional games and community practices as meaningful mathematics learning activities. The pupils in Malindi Sub-County are exposed to cultural activities like fishing, trading, farming and indigenous crafts that have mathematical ideas like counting, measurement, patterns and problem solving. The study investigated, through Ethnomathematics Theory, whether the incorporation of culturally responsive games in teaching mathematics enhances students' comprehension and competence in mathematical skills. The theory also corresponds to the principles of competency-based education which highlights the contextualised learning and practical application of knowledge (KICD, 2023).

Review of Related Empirical Literature

Booker and Goldman (2022) investigated the impact of culturally sustaining game-based learning on elementary learners' arithmetic fluency in the United States through a quasi-experimental study. Finding out if adding cultural narratives to arithmetic games increased computational correctness was the goal. A pretest–posttest control group design was used in the

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investigation. Learners in urban schools in Grade 2 made up the target population. Four schools were chosen using stratified random sampling, producing a sample of 168 learners. Cronbach's alpha (α =.86) was used to determine the reliability of arithmetic examinations, and specialists in mathematics education verified their content validity. Results showed that learners exposed to games with cultural themes improved their addition and subtraction fluency in statistically significant ways. Early mathematics courses should incorporate digital and physical games that are culturally meaningful, according to the authors' recommendations.

The study was carried out in an urban area of the United States with a diverse immigrant population and sophisticated digital infrastructure. In Kenya, rural and peri-urban areas like Malindi sub-county have very different socioeconomic circumstances and access to technology. Furthermore, contextual interpretation was limited by the study's exclusively quantitative approach. By using a mixed methods convergent parallel design and qualitative classroom observations and interviews, the current study will close these gaps and take into consideration socioeconomic constraints affecting Malindi's public primary schools, geographical boundaries, and the cultural uniqueness of the Mijikenda community.

Yamamoto and Kato (2021) looked into how early arithmetic acquisition was affected by traditional Japanese play-based number activities for first-graders in Tokyo, Japan. The goal was to determine whether adding counting games with cultural themes improved computation accuracy and speed. A mixed-method sequential explanatory design was used by the researchers. Learners in elementary schools made up the population. Six schools with a total sample size of 142 learners were found using cluster sampling. Factor analysis was used to demonstrate construct validity, and the test-retest reliability of arithmetic instruments was reported at r =.82. Results showed higher learner engagement and better comprehension of fundamental arithmetic procedures. To promote significant numeracy growth, the authors suggested contextualizing classic games in mathematics education.

The study included cultural games, but it was carried out in a very homogeneous culture with little socioeconomic inequality and considerable institutional support. In coastal Kenyan towns like Malindi, where language diversity and economic inequality influence schooling, the cultural structures and classroom dynamics are different. Additionally, the study ignored unofficial community-based practices in favor of regulated traditional games. By investigating locally embedded Swahili and Mijikenda games and evaluating their influence across a range of socioeconomic backgrounds using a convergent parallel mixed methods paradigm, the current study will close these gaps.

The usefulness of traditional Ghanaian counting games in raising arithmetic proficiency among lower elementary learners in Accra was investigated by Osei and Antwi (2021). The goal was to determine the connection between numeracy performance and games with cultural themes. They used a design that was quite experimental. Pupils in public schools in Grade 2 were part of the target population. Five schools were chosen using simple random sampling, yielding 154 participants. Curriculum experts confirmed the arithmetic accomplishment test's face validity, and its reliability coefficient was α =.88. The findings showed that when conventional games were used, learners' addition and subtraction skills significantly improved. The study suggested that

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early grade mathematics instruction emphasize ethnomathematical techniques in teacher preparation programs.

The study did not examine rural or marginalized coastal populations because it was primarily focused on metropolitan areas. The coastal region of Kenya and Ghana have different sociocultural environments, especially with relation to community involvement and linguistic integration. Furthermore, the study lacked comprehensive qualitative insights into learner experiences and instead depended exclusively on quantitative indicators. By incorporating qualitative viewpoints from teachers and SCDE, investigating socioeconomic inequalities, and assessing culturally themed games in a rural–coastal Kenyan context using a mixed methods convergent parallel design, the current study in Malindi sub-county will overcome these constraints.

In Kampala, Uganda, Nankya (2023) carried out a study to examine how indigenous play activities can improve lower primary pupils' mathematics abilities. The goal was to find out if adding local counting games enhanced mathematics learning. A pretest–posttest quasi-experimental approach was used in the investigation. Pupils in government schools in Grades 1 and 2 made up the population. Four schools were chosen via purposeful sampling, yielding a sample size of 120 students overall. Split-half reliability (r =.79) was used to assess reliability, and expert review was used to demonstrate content validity. Results indicated that pupils who received indigenous play-based learning performed better in mathematics and were more involved. Institutional support for culturally sensitive instruction in early mathematics was suggested by the study.

The study ignored rural coastal dynamics similar to those in Malindi sub-county in favor of concentrating on an urban Ugandan context. Additionally, it did not examine how socioeconomic barriers influence access to educational resources and lacked qualitative triangulation. Furthermore, it did not evaluate how well mathematics skills were retained over time. By employing a convergent parallel mixed design and combining classroom observations, interviews, and performance data, the current Kenyan study will fill these gaps by capturing regional diversity, and cultural specificity in public primary schools in Malindi sub-county.

In Kilifi County, Kenya, Mwangangi (2023) investigated how culturally appropriate play-based tactics affected lower primary pupils' numeracy abilities. Finding out if including local games enhanced arithmetic acquisition was the goal. Pretest and posttest measurements were used in a quasi-experimental approach. Pupils in public primary schools in Grade 2 made up the population. Using stratified sampling, 136 pupils were included in the sample. Curriculum experts approved the content validity of the arithmetic test, which had a reliability coefficient of α =.84. Findings showed that learners exposed to culturally appropriate games improved their mathematics results statistically significantly. Scaling culturally contextualized techniques throughout coastal counties was suggested by the study.

Despite being carried out in Kilifi County, the study did not use mixed techniques to examine contextual nuances or concentrate only on Malindi sub-county. Additionally, teaching/learning resource differences between the county's rural and urban schools were not examined. By focusing on Malindi's distinct cultural and teaching/learning resource environment

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and using a convergent parallel design to combine quantitative performance data with qualitative classroom experiences and community viewpoints, the current study closed this gap.

Ole Saitoti (2022) looked into how games with cultural context affected lower primary pupils' acquisition of mathematics skills in Kajiado County, Kenya. The purpose of the study was to ascertain whether incorporating traditional Maasai games improved computing abilities. The study used a quasi-experimental design. Pupils in Grades 1–3 in public primary schools made up the population. Six schools with a sample size of 150 pupils were identified by cluster sampling. The arithmetic assessment's validity was confirmed by expert review and pilot testing, and its reliability was α =.81. Results showed that experimental groups had higher levels of learner engagement and arithmetic mastery. The study suggested incorporating native games into the curriculum to improve students' basic numeracy abilities.

The study was carried out in Kajiado sub-county among pastoralist Maasai people, whose cultural customs differ from those of the Swahili-Mijikenda populations. Generalizability is limited by geographic disparities. Furthermore, there was little investigation of qualitative perspectives on teacher readiness. By using a mixed methods convergent parallel design, the current study filled these gaps by capturing both statistical trends and contextual factors that affect arithmetic learning in Malindi public primary schools, such as language diversity, and coastal cultural identity.

Research Design and Methodology

This study adopted a convergent mixed methods research design to investigate the effect of culturally themed educational games on acquisition of basic arithmetic skills among lower grade pupils in public primary schools in Malindi Sub-County, Kilifi County. The research design provides the overall plan of the study—how the researcher will collect, measure, analyse, and interpret the research data (Creswell, 2023). The convergent design allowed the researcher to collect quantitative and qualitative data at the same time, analyse each strand individually, and combine the findings during interpretation. The quantitative aspect examined the relationship between the use of culturally themed educational games and pupils' arithmetic skills. The qualitative aspect explored the experiences and perceptions of teachers and education stakeholders on the use of culturally relevant games in teaching mathematics. The design enhanced understanding of the phenomenon through the triangulation and complementarity of findings (Jain, 2023).

The study was carried out in Malindi Sub-County, Kilifi County, Kenya, situated along the Indian Ocean coastal region and is part of Malindi Constituency. The sub-county is bordered by Tana River County to the north, Magarini Sub-County to the south, the Indian Ocean to the east and Ganze Sub-County to the west. The area comprises rural and urban public primary schools that vary in educational resources, pupil populations and learning environments. The choice of the region was motivated by the rich cultural practices and economic activities such as fishing, tourism, agriculture and local trade which can offer practical experiences to support culturally themed mathematics instruction. These cultural resources provide an appropriate context for studying the influence of educational games based on familiar experiences on pupils' learning of basic arithmetic skills.

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The target population consisted of 82 public primary schools, 82 head teachers, 2,880 lower grade pupils (Grades 1-3), 415 lower grade teachers and one Sub-County Director of Education (SCDE) from Malindi Sub-County in Kilifi County. Willie (2024) defines target population as the specific group of people or units from which a researcher wants to make conclusions. The sampling method was based on the probability and non-probability approaches to ensure proper representation of the participants. The quantitative component employed stratified, simple random, and systematic sampling techniques to improve representativeness and reduce sampling bias (Creswell & Creswell, 2023). Criterion purposive sampling was used to select the head teachers and the SCDE because of their administrative roles and knowledge of instructional practices. The data were collected through questionnaires, interview guides, focus group discussions, observation guides and document analysis tools. The quantitative data were analysed using descriptive and inferential statistics and the qualitative data were analysed using thematic analysis.

Procedures of validity, reliability and trustworthiness were used on the research instruments to ensure accuracy, consistency and credibility of the findings. Validity is whether instruments correctly measure the constructs they are designed to measure and whether the conclusions that can be drawn from the data are appropriate (Creswell & Creswell, 2023). The researcher validity was obtained by the expert assessment of the relevance, clarity and conformity of the instrument with the objectives of the study. To identify weaknesses and improve the instruments before actual data collection, pilot testing was conducted in public primary schools outside the selected study area. The reliability of the quantitative instruments was evaluated using Cronbach's Alpha, where a coefficient of greater than 0.70 was acceptable (Taber, 2021). Credibility, dependability, confirmability and transferability procedures were used to enhance qualitative trustworthiness. During the research process, the rights of participants were protected, responsible and ethical conduct was maintained, informed consent was obtained, participation was voluntary, confidentiality and anonymity were maintained.

Presentation, Interpretation, and Discussion of Findings

Data from lower grade teachers have been collected by the researcher through questionnaires and are presented in this section. This section presents the study findings on the influence of educational games with cultural themes on lower grade pupils' acquisition of mathematics skills in public primary schools in Malindi sub-county. Teachers were asked to agree or disagree (on a 4-point scale) with statements concerning the use of educational games with a cultural theme in mathematics classes. The responses were collected on a five-point Likert scale ranging from 5 (strongly agree) to 4 (agree), 3 (neutral), 2 (disagree) and 1 (strongly disagree). The results are presented in Table 1.

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Table 1
Teachers' Responses on Culturally Themed Games on Arithmetic Skills Acquisition (n=70)

Statement	SA	A	U	D	SD	Mean	SD
I used culturally themed educational games when teaching arithmetic.	13 (18.6%)	30 (42.9%)	9 (12.9%)	10 (14.3%)	8 (11.4%)	3.43	1.31
Culturally themed games increased learners' participation in arithmetic lessons.	14 (20.0%)	29 (41.4%)	10 (14.3%)	9 (12.9%)	8 (11.4%)	3.46	1.31
Learners understood arithmetic concepts better through cultural games.	16 (22.9%)	28 (40.0%)	8 (11.4%)	8 (11.4%)	10 (14.3%)	3.46	1.42
The use of cultural games improved learners' addition skills.	12 (17.1%)	32 (45.7%)	9 (12.9%)	9 (12.9%)	8 (11.4%)	3.44	1.26
Cultural games enhanced learners' subtraction skills.	11 (15.7%)	33 (47.1%)	11 (15.7%)	8 (11.4%)	7 (10.0%)	3.47	1.20
Learners demonstrated improved problem-solving skills after using cultural games.	15 (21.4%)	30 (42.9%)	7 (10.0%)	10 (14.3%)	8 (11.4%)	3.49	1.32
Culturally themed games increased learners' confidence in arithmetic.	14 (20.0%)	27 (38.6%)	11 (15.7%)	9 (12.9%)	9 (12.9%)	3.40	1.37
Learners retained arithmetic concepts longer when taught through games.	16 (22.9%)	28 (40.0%)	10 (14.3%)	7 (10.0%)	9 (12.9%)	3.50	1.36
Cultural games improved learners' speed and accuracy in arithmetic tasks.	11 (15.7%)	26 (37.1%)	12 (17.1%)	14 (20.0%)	7 (10.0%)	3.29	1.29
I observed improved overall arithmetic performance when using cultural games.	13 (18.6%)	29 (41.4%)	8 (11.4%)	10 (14.3%)	9 (12.9%)	3.39	1.35

Source: *Researcher (2026)*

Table 1's findings showed that educational games with cultural themes were frequently utilized to teach mathematics to pupils in lower grades. In particular, 30 (42.9%) of the teachers agreed and 13 (18.6%) strongly agreed that they employed educational games with cultural themes when teaching mathematics, for a total agreement of 43 (61.5%). Nonetheless, 18 (25.7%) teachers had negative opinions, with 9 (12.9%) being unsure, 10 (14.3%) disagreeing, and 8 (11.4%) strongly disagreeing. A moderate to high degree of agreement was indicated by the mean score of 3.43 (SD = 1.31). The Ethno-mathematics Theory (D'Ambrosio, 1985), which contends that mathematics gains greater significance when connected to students' cultural experiences, is supported by these findings. The findings support the results of Booker and Goldman (2022), who found that by relating mathematics education to familiar cultural situations, culturally sustaining games improved learners' arithmetic fluency.

The findings revealed that 14 (20.0%) of the respondents strongly agreed and 29 (41.4%) agreed that culturally themed activities boosted pupils' participation during mathematics courses, yielding 43 (61.4%) positive responses. On the other hand, 17 (24.3%) had opposing opinions, with 10 (14.3%) being unsure, 9 (12.9%) disagreeing, and 8 (11.4%) strongly disagreeing. The statement's mean score was 3.46 (SD = 1.31), suggesting that most respondents that cultural games encouraged active learning. These findings are consistent with Vygotsky's Social Constructivism Theory, which highlights that social interaction and teamwork are key components of successful learning. Games with cultural themes give students the chance to interact, discuss, and work

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together to solve mathematical issues. Yamamoto and Kato (2021) observed similar results, showing that traditional play-based activities increased pupil participation and engagement in early mathematics classes.

The study also proved that games with cultural themes improved pupils' understanding of mathematical ideas. The findings showed that 16 (22.9%) strongly agreed and 28 (40.0%) agreed, meaning that 44 (62.9%) teachers that cultural games improved pupils' understanding of mathematical principles. However, 18 (25.7%) respondents had opposing views: 8 (11.4%) were unsure, 8 (11.4%) disagreed, and 10 (14.3%) strongly disagreed. The favourable impression was supported by the mean score of 3.46 (SD = 1.42). The findings corroborate the Ethno-mathematics Theory, which holds that when training incorporates learners' indigenous knowledge and daily cultural activities, mathematical comprehension improves. Abstract mathematical ideas become tangible and simpler to understand through well-known games. These findings are in line with those of Osei and Antwi (2021), who discovered that learners' mental grasp of addition and subtraction was greatly enhanced by traditional Ghanaian counting games.

The findings showed that 44 (62.8%) respondents thought that cultural games increased pupils' addition skills, with 12 (17.1%) strougly agreeing and 32 (45.7%) agreeing. On the other hand, 17 (24.3%) respondents did not agree with the statement, with 9 (12.9%) remaining unsure, 9 (12.9%) disagreeing, and 8 (11.4%) strongly disagreeing. The average score of 3.44 (SD = 1.26) indicated that most respondents agreed that cultural games are useful for teaching addition abilities. The Cultural Relevance Theory, which holds that effective learning happens when classroom instruction reflects students' cultural backgrounds and experiences, is consistent with these findings. By incorporating well-known games into arithmetic classes, students are able to relate mathematical concepts to real-world situations. The findings are consistent with a study conducted in Uganda by Nankya (2023), which showed that indigenous play activities improved pupils' maths performance and classroom engagement.

Additionally, the findings demonstrated that games with cultural themes improved pupils' subtraction abilities. In particular, 44 (62.8%) respondents agreed with the statement, with 11 (15.7%) strongly agreeing and 33 (47.1%) agreeing. However, 15 (21.4%) respondents held opposing views, with 11 (15.7%) being unsure, 8 (11.4%) disagreeing, and 7 (10.0%) strongly disagreeing. With a mean score of 3.47 (SD = 1.20), the statement demonstrated comparatively high respondent agreement. The findings support the Ethno-mathematics Theory, which contends that learners acquire mathematical competence through meaningful contexts provided by indigenous cultural practices. Subtraction seems to be transformed from an abstract operation into a useful task that is integrated into pupils' everyday experiences through culturally inspired activities. Mwangangi (2023), who found that culturally relevant games greatly increased numeracy achievement among lower primary learners in Kilifi County through contextualised learning experiences, supports these findings.

In terms of problem-solving abilities, Table 1 showed that 15 (21.4%) strongly agreed and 30 (42.9%) agreed. As a result, 45 (64.3%) respondents admitted that pupils' problem-solving abilities had increased following their participation in cultural games. On the other hand, 18 (25.7%) respondents did not agree, with 7 (10.0%) being unsure, 10 (14.3%) disagreeing, and 8

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(11.4%) strongly disagreeing. With a mean score of 3.49 (SD = 1.32), the statement demonstrated a generally positive perception. These findings align with Vygotsky's Social Constructivism Theory, which describes how peer and teacher interaction during collaborative learning activities promotes higher-order thinking and problem-solving. Thru games with cultural themes, pupils worked together to develop mathematical understanding, explore techniques, and discuss solutions. Ole Saitoti (2022) discovered that traditional Maasai games greatly enhanced pupils' problem-solving and arithmetic skills in lower primary schools.

The findings in Table 1 also showed that learners' confidence in mathematics was improved by games with a cultural element. In particular, 41 (58.6%) respondents thought that culturally themed activities boosted pupils' confidence in learning mathematics, with 14 (20.0%) of the teachers strongly agreeing and 27 (38.6%) agreeing. Nonetheless, 18 (25.8%) respondents had opposing views, with 11 (15.7%) being unsure, 9 (12.9%) disagreeing, and another 9 (12.9%) strongly disagreeing. Although a sizable percentage voiced concerns, the mean score of 3.40 (SD = 1.37) indicates that teachers generally thought culturally themed activities increased pupils' confidence. These findings corroborate the Cultural Relevance Theory, which holds that when classroom instruction reflects pupils' cultural identities and life experiences, pupils gain self-assurance and positive attitudes. When well-known games are included in mathematics classes, pupils are more inclined to engage and try mathematical problems without worrying about failing. These findings are in line with those of Booker and Goldman (2022), who found that learners' confidence and willingness to engage in arithmetic learning were enhanced by culturally sustaining games.

The findings also showed that games with a cultural element helped pupils remember mathematics topics. According to Table 1, 16 (22.9%) strongly agreed and 28 (40.0%) agreed, meaning that 44 (62.9%) respondents thought mathematics principles were kept longer when taught through games. However, 16 (22.9%) respondents had negative opinions; 10 (14.3%) were unsure, 7 (10.0%) disagreed, and 9 (12.9%) strongly disagreed. With the highest mean score of 3.50 (SD = 1.36), the statement showed comparatively high respondent agreement. These findings support Ethno-mathematics Theory (D'Ambrosio, 1985), which contends that because learners connect mathematical concepts to well-known social activities, culturally relevant learning experiences improve comprehension and long-term retention. The findings support those of Yamamoto and Kato (2021), who found that counting games with cultural context improved pupils' understanding and long-term recall of basic mathematics concepts.

Table 1 showed that respondents' assessments of learners' speed and accuracy in mathematics activities were quite moderate. In particular, 37 (52.8%) respondents thought cultural games increased learners' speed and accuracy, with 11 (15.7%) strongly agreeing and 26 (37.1%) agreeing. Nevertheless, 21 (30.0%) respondents held opposing opinions, with 12 (17.1%) being unsure, 14 (20.0%) disagreeing, and 7 (10.0%) strongly disagreeing. The mean score of 3.29 (SD = 1.29) was the lowest of all the assertions, indicating that while most teachers agreed that cultural games have a good influence, longer exposure and regular practice may be necessary to enhance speed and accuracy. Vygotsky's Social Constructivism Theory, which emphasises that mastery emerges gradually through frequent guided practice and social interaction, supports these findings.

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Similar findings were reported by Osei and Antwi (2021), who found that while traditional games greatly enhanced arithmetic proficiency, automaticity and processing speed required ongoing instructional support.

The final statement asked teachers if they thought playing instructional games with a cultural subject enhanced pupils' arithmetic proficiency. According to the findings, 13 (18.6%) strongly agreed and 29 (41.4%) agreed, resulting in 42 (60.0%) respondents who confirmed that culturally themed activities increased students' overall arithmetic ability. On the other hand, 19 (27.2%) respondents did not agree, with 8 (11.4%) being unsure, 10 (14.3%) disagreeing, and 9 (12.9%) strongly disagreeing. The average score of 3.39 (SD = 1.35) indicates that most respondents thot culturally themed educational games had good learning outcomes. These findings validate the Ethno -mathematics Theory, which holds that learners can improve their performance by connecting abstract mathematical concepts to real-world experiences through culturally responsive mathematics training. The findings are consistent with those of Mwangangi (2023), who revealed that lower primary pupils' mathematics performance in Kilifi County was enhanced by culturally contextualised games. Positive teacher opinions on the educational benefit of culturally themed games were further supported by mean scores ranging from 3.29 to 3.50. The Cultural Relevance Theory, which promotes instructional strategies that link learning to pupils' cultural backgrounds to increase engagement and achievement, is in line with these findings. Similarly, Nankya (2023) found that because culturally familiar activities encouraged pupils to actively participate in class, indigenous play-based learning greatly improved students' mathematical achievement.

Quantitative findings point to a significant improvement in pupils' acquisition of arithmetic skills when culturally themed educational games are incorporated into lower primary mathematics instruction. Teachers acknowledged the pedagogical value of culturally responsive instructional approaches in facilitating meaningful mathematics learning, as evidenced by the preponderance of agreement across the ten statements. The idea of Ethno-mathematics Theory; that mathematics is best comprehended when taught within learners' sociocultural environments; is supported by the favourable impressions of engagement, conceptual understanding, confidence, retention, and arithmetic performance. The findings also suggest that in order to improve pupil interest and performance, teachers should be encouraged to include native games in regular mathematics classes. Generally, the study supports Ole Saitoti's (2022) recommendation to incorporate culturally grounded games into mathematics instruction since they preserve and value indigenous cultural knowledge while strengthening learners' fundamental numeracy skills.

According to the Heads of Institutions' interviews, educational games with a cultural theme were universally acknowledged as successful teaching methods for improving pupils' acquisition of mathematics abilities in lower primary classrooms. Teachers who regularly incorporated traditional games, songs, storytelling and local counting exercises into mathematics classes reported higher pupil participation, confidence and conceptual comprehension, according to the head teachers. Head of institutions 1 also noted, "because the exercises are comfortable and entertaining, students become more animated and cooperative throughout maths classes." However, due to insufficient training and instructional resources, some Heads of Institutions

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admitted that some teachers continued to favour traditional teaching methods. One Head of Institution remarked,

> When teachers use traditional games like counting with shells, stones, sticks, or local songs, learners become more active and enjoy arithmetic lessons. Since the activities are similar to what youngsters encounter at home and in the community, they hardly ever fear making mistakes. Teachers should embrace culturally responsive teaching because it aligns well with the CBE and improves learners' participation and mastery of basic arithmetic skills (HOI 3, Personal Communication, July 24, 2026).

These perspectives show that educational games with cultural themes foster learner-friendly settings that encourage participation, self-assurance, and significant learning. According to the comments, including indigenous knowledge into classroom education helps pupils make connections between mathematical ideas and well-known cultural experiences, which improves the development of arithmetic skills. These findings document those of Booker and Goldman (2022), who found that game-based learning that is culturally sustained greatly increases students' participation in class and their fluency in mathematics.

In a similar disposition, the SCDE observed "Competency-Based Education promotes learner-centred and culturally sensitive pedagogies, successful implementation necessitates ongoing teacher capacity building and sufficient instructional support". The Ethno-mathematics Theory by D'Ambrosio (1985), which highlights the significance of incorporating pupils' cultural experiences into mathematics training, support these findings. The results are also in line with Mwangangi's (2023) findings showing lower primary students in Kilifi County considerably improved their numeracy skills through culturally contextualised instructional methodologies. The SCDE stated:

> The Competency-Based Education encourages teachers to relate arithmetic lessons to pupils' cultural experiences and everyday activities. When pupils are exposed to mathematics in real-world contexts, they have a deeper understanding of the subject and feel more comfortable using their mathematical knowledge outside of the classroom. However, in order to successfully apply these strategies, teachers need ongoing professional assistance (SCDE Personal Communication, July 23, 2026).

According to this response, meaningful learning and the practical application of mathematical abilities are improved by culturally contextualised training. The findings validate Ethno-mathematics Theory (D'Ambrosio, 1985) and are in line with the findings of Mwangangi (2023), who discovered that lower primary pupils in Kilifi County considerably improved their numeracy skills through culturally contextualised instructional methodologies.

The quantitative findings were further supported by the focus group discussions with pupils in lower grades. Because the exercises were entertaining, interactive, and simple to grasp, the

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majority of pupils stated that they enjoyed mathematics classes whenever their teachers used culturally themed games. Compared to sessions that just used textbooks, they explained that counting with stones, bottle tops, sticks, seeds, shells, and other locally accessible items made addition, subtraction, grouping, and sharing easier for them to understand. Additionally, a number of students reported that learning thru games helped them collaborate, share ideas, and retain mathematical concepts for extended periods of time. However, several students noticed that these activities weren't always utilised in mathematics classes, which led to variations in learning outcomes between classrooms. These findings are consistent with Vygotsky's Social Constructivism Theory, which holds that learning is a socially constructed process that is promoted by interaction and teamwork (Vygotsky, 1978). They also agree with Nankya (2023), who discovered that indigenous play-based activities improved lower primary pupils' mathematical achievement and learner engagement. During focus group discussions, some one of the pupils explained:

"I enjoy mathematics when our teacher lets us count with shells and stones because it becomes like playing at home," said one pupil in one of the groups. Answering problems is simpler, and even after the session, I can still recall the figures." Another pupil said, "When we play number games with our friends, we help each other, and I understand addition and subtraction faster." These answers show that educational games with cultural themes not only made mathematics classes fun but also encouraged group learning, self-assurance, and long-term memory of mathematical ideas. The experiences of the pupils support the idea that culturally responsive teaching methods help pupils acquire arithmetic abilities in a meaningful way by bridging the gap between classroom education and real-world experiences.

The responses of the questionnaire shown in Table 1 were generally corroborated by the data from the observation guide. Observations in the classroom showed that during arithmetic classes, a number of teachers used educational games with cultural themes, such as traditional counting, grouping, and object-manipulation exercises. Pupils engaged fully in these exercises, exhibiting confidence, teamwork, and excitement while completing mathematics problems. The findings that 43 (61.5%) teachers agreed that they used culturally themed educational games and 43 (61.4%) agreed that such games improved learner participation were substantiated by the researcher's observations that pupils were more inclined to respond to questions and engage with their peers whenever culturally familiar games were incorporated into instruction. The views of 18 (25.7%) and 17 (24.3%) teachers who disagreed that culturally themed games were often employed or encouraged active participation were supported by the fact that some classrooms relied mostly on traditional teacher-centered techniques with little utilisation of cultural games.

In a similar vein, while there were some clear discrepancies, the document analysis guide supported the findings of the questionnaire. A number of teachers had included culturally appropriate games and locally accessible learning materials into their mathematics instruction, according to the examined professional records, lesson plans, schemes of work and CBE class notes. Exercise books for pupils also demonstrated better performance in counting, addition, subtraction, and problem-solving exercises connected to familiar cultural situations, confirming the favourable opinions expressed by the majority of teachers. However, even though teachers

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reported using indigenous games, the researcher found that documentation of culturally themed instructional activities varied throughout schools, with some lesson plans making little to no specific mention of them. This helps to explain why between 15 (21.4%) and 21 (30.0%) of respondents said they were unsure or disagreed with some statements, indicating that while culturally themed games were becoming more popular, their documentation and implementation had not yet become consistent across all public primary schools.

Conclusions

The study concludes that the educational games with cultural themes have great potential in improving the acquisition of basic arithmetic skills among lower grade pupils in public primary schools in Malindi Sub-County. These games connect mathematical concepts with children's cultural experiences, traditional practices and familiar activities, and foster active participation, conceptual understanding and meaningful learning. The study concludes that culturally responsive approaches are a good alternative to abstract and teacher-centered mathematics instruction, which allows pupils to gain confidence and apply arithmetic knowledge in practical situations. Successful implementation, however, depends on teachers' readiness, availability of appropriate learning resources, and the degree to which culturally themed games align with curriculum goals.

Recommendations

The study suggests that culturally themed educational games be incorporated into lower grade mathematics instruction to assist in the development of basic arithmetic skills and improve pupil engagement. It is advised that Ministry of Education and curriculum stakeholders provide guidelines, training and resources to empower teachers with skills to design and implement culturally responsive mathematics activities. Public primary schools should promote the use of locally available cultural materials and community knowledge to enhance mathematics learning experiences. Teacher professional development programs should be designed with an emphasis on the relationship between cultural practices and mathematical concepts to ensure meaningful implementation. Future research should also examine effects of culturally themed educational games on pupils' mathematics achievement over longer periods of time in different educational environments.

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