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Effect of Sports Participation on Literacy and Numeracy of Primary School Children in Karamoja Region, Uganda

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Abstract: *Literacy and numeracy in Karamoja remain critically low. Literacy rates are 25%. 88% of pupils can't read at a basic level while 91% can't perform division. This study examined the effect of sports participation on literacy and numeracy among primary school children in Karamoja, testing the null hypothesis that sports participation has no significant effect on literacy and numeracy. Guided by James Coleman's Multiple Role Theory, the study discusses the use of sports for achieving SDG 3, SDG 4, and the UNESCO International Charter of Physical Activity, Physical Education and Sport. An analytical cross-sectional design using mixed methods was adopted. District Sports Officers, District Inspectors of Schools, head teachers and sports teachers were purposively sampled. Class teachers and pupils were randomly selected. Four primary schools per district were purposively selected. Quantitative data were collected using structured questionnaires. Qualitative data were collected using key informant interviews and focus group discussions. Quantitative data were analysed using SPSS Version 27. Qualitative data were analysed thematically using NVivo Version 15. Findings showed that sports participation enhanced concentration (76.2%), vocabulary development (72.3%), reading fluency (73.1%) and writing skills (78.7%). A significant correlation existed between sports participation and literacy and numeracy outcomes ($\rho = 0.819$, $p < .001$). Regression analysis indicated that sports participation explained 54.1% of the variation ($R^2 = 0.541$). Qualitative findings highlighted improved concentration, practical numeracy application, vocabulary and communication. The study concludes that sports participation can enhance literacy and numeracy. The study recommends integrating sports into teaching pedagogy, establishing school sports clubs and promoting mind games.*

Keywords: *Sports participation, literacy, numeracy, primary education, Karamoja.*

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1. Introduction

Sports participation refers to the active involvement of learners in structured and unstructured physical activities within the school setting, including games, athletics, and organized competitions. It is widely recognized as a multidimensional process that promotes physical fitness, psychosocial development, and cognitive functioning (Mollel & Otieno, 2022). Literacy and numeracy refer to the foundational competencies of reading, writing, and performing basic mathematical operations as measured by classroom assessments and teacher evaluations. The operational definition of literacy and numeracy in this study includes the basic skills of writing, reading, vocabulary, phonemic awareness, performing numerical

operations, and counting as indicators of academic achievement in the everyday lives of the pupils. Quality physical education and sports in schools promote lifelong learning, develop skills, and improves cognitive performance (WHO, 2022). At the primary level, structured sports programs enhance physical fitness and positively affect cognitive functions essential for literacy and numeracy acquisition (Demetriou et al., 2018). Scholarly reviews have found that physical activity enhances cognitive functions including concentration, memory, and executive function, which are directly linked to improved learning outcomes in reading and mathematics (James et al., 2023; Owen et al., 2022). However, in Uganda, particularly in the Karamoja region, learning outcomes remain critically poor. Literacy rates stand at only 25%, and 88% of pupils cannot read at a basic level, while 91% cannot perform division and only 12% can read (UWEZO, 2016). The Primary Leaving Examination pass rate is 28% (UNEB, 2022). Even when children are in school, they struggle to learn (UWEZO, 2021). UNICEF and Play Action International constructed 32 playgrounds across Karamoja (Atuhaire, 2025). However, structured school sports programs remain very minimal (Ogola, 2025). If these educational deficiencies persist, Karamoja will continue to experience intergenerational abject poverty, social marginalization, and economic underdevelopment, while Uganda risks failing to achieve SDG 3 (Good Health and Well-being) and SDG 4 (Quality Education). Uganda further risks failing to achieve the primary objective of The UNESCO International Charter of Physical Education, Physical Activity and Sport. This study therefore examined the effect of sports participation on literacy and numeracy of primary school children in Karamoja, generating evidence for policy interventions that involve the use of the power of sports to enhance literacy and numeracy in such a marginalised pastoral region.

1.1 Statement of the problem

In an ideal setting, primary schools provide quality teaching in addition to well organized sports activities that develop all three domains of pupils (Mollel & Otieno, 2022; Saliba & Zarb, 2024). Schools in the Karamoja region must achieve admirable literacy and numeracy levels in the primary cycle in addition to the provision of sporting activities (Stites, 2024). Sports foster the development of teamwork, discipline, and leadership skills which are essential for success in different spheres of life. The government and development partners such as the World Food Programme have made efforts to support schools in ensuring sports participation and improving literacy and numeracy. Non-governmental organizations (NGOs) have helped in mobilising pupils through go-back-to-school campaigns, the provision of scholarships and bursaries, infrastructural development, and supportive supervision. NGOs such as World Vision and Save-The-Children Uganda have supported districts to come up with education ordinances aimed at improving literacy and numeracy rates of all pupils. The Ugandan government introduced Universal Primary Education (UPE) for equitable provision of quality education. Other interventions, such as Alternative Basic Education for Karamoja (ABEK), were introduced by the Government of Uganda, with support from non-governmental organizations. Despite all the above, literacy and numeracy in Karamoja remain critically low**.** The region records a literacy and numeracy rate of only 25%**,** compared to 74% nationally (UBOS, 2024; UNICEF, 2024). Academic achievement is poor with only 28% of learners passing the Primary Leaving Examination (UNEB, 2022). 88% of the pupils can't read at a basic level and 91% can't perform division. These statistics demonstrate that existing interventions have not adequately addressed the continued challenge of literacy and numeracy among school children in the Karamoja region.

The continued low literacy and numeracy rates have negative implications for the development of children in Karamoja by reducing their opportunities to acquire knowledge, skills, and capabilities needed to improve their livelihoods, potentially perpetuating poverty, social marginalization, and economic underdevelopment. If these gaps persist, Uganda's efforts to achieve SDG 4 (Quality Education**)** and SDG 3 (Good Health and Well-being)**,** as well as the objectives of the UNESCO International Charter on Physical Education, Physical Activity and Sport (2025)**,** and Uganda Vision 2040 may be undermined. Sports participation has the potential to make schools more attractive, strengthen learners' sense of belonging, improve peer relationships, enhance motivation, and encourage continued engagement with school. The relationship between sports participation and literacy and numeracy in Karamoja remains largely unknown. In particular, there is limited empirical evidence to underpin the contribution of structured sports participation in improving literacy and numeracy among school children in a context where conventional interventions such as ABEK have not sufficiently resolved the problem (Stites, 2024). This represents a gap in research and educational practice. Therefore, there was a need to empirically investigate the effect of sports participation on literacy and numeracy among primary school children in Karamoja, Uganda. Understanding this relationship could provide evidence on whether structured sports programmes can complement existing education interventions and offer an innovative, contextually appropriate strategy for improving the children's educational aspirations.

1.2 Research Objective

The objective of the study was to examine the effect of sports participation on numeracy and literacy of primary school children in Karamoja Region of Uganda.

2. Literature Review

2.1 Theoretical Review

This study was anchored in the Multiple Role Theory of James Samuel Coleman, whose seminal 1961 study, The Adolescent Society, first illuminated how students' involvement in multiple, co-curricular roles could foster social integration, enhance self-worth, and increase investment in the school community (Coleman, 1961; Fredricks & Eccles, 2006). James Coleman's Multiple Role Theory of extracurricular activities posits that pupils who take on diverse co-curricular roles develop self-esteem, broaden their social networks, feel more connected to their school community, and ultimately enhance academic achievement.

2.2 Empirical Review

Global evidence strongly links sports participation to cognitive functions. Sports participation can positively influence cognitive functions and foundational academic skills, particularly literacy and numeracy. However, the evidence base reveals both significant positive associations and notable instances of non-significance across diverse educational settings. Hakim et al. (2023) investigated Physical Education Learning Based on a Project to Improve Student Literacy and Numeracy in Indonesia. They demonstrated that a project-based learning model combining mathematics and physical education significantly improved literacy and numeracy skills among junior high school students. Magistro et al. (2023), in their study Two Years of Physically Active Mathematics Lessons Enhance Cognitive Function and Gross Motor Skills in Primary School Children, found that physically active mathematics lessons led to substantial gains in cognitive functions related to arithmetic reasoning. The study by Zhang et al. (2023) in China established a close-response relationship between sports frequency and academic performance in core subjects. Systematic reviews by James et al. (2023) and the Youth Sport Trust (2022) concluded that physical activity is generally positively associated with, or non-detrimental to, academic performance, enhancing concentration and self-regulation. This body of research advances a compelling argument: structured physical activity, especially when pedagogically integrated with academic content, can act as a catalyst for cognitive and motivational processes essential for developing literacy and numeracy, thereby challenging the notion of a zero-sum relationship between athletic and academic pursuits.

Conversely, the literature presents a counter-narrative, yielding findings of non-significance. Ahmad et al. (2019) investigated student participation in sports and general academic achievement among secondary school students across multiple local schools in Pakistan. They found no significant correlation between sports participation and academic achievement in Pakistan, recording higher achievement scores among non-participants. Jakiwa et al. (2022) investigated The Level of Sports Participation and Academic Success among Malaysian Student-Athletes, and they found no difference in the academic success of Malaysian university athletes across competition levels. Yarkwah and Agyei (2020) studied the effects of Sports Participation on the Academic Performance of senior High School Students in Mathematics in Cape Coast Metropolis in Ghana. They reported no significant difference in mathematics performance between Ghanaian senior high school athletes and non-athletes. White (2021) investigated the effects of Sports Participation on Academic Achievement for Seventh Graders in Urban Pennsylvania. He found no significant difference in standardized reading and mathematics test scores among seventh graders in urban Pennsylvania. A study by Billonid et al. (2020) found no significant difference in midterm scores between Grade 12 athletes and non-athletes in the Philippines. Olayiwola et al. (2024) investigated the effect of Sport on Academic Performance on Student-Athletes of Obafemi Awolowo University Ile-Ife Osun State, Nigeria in 2011 and 2014 Nuga Games. They concluded that participation in major university games did not significantly harm the academic performance of Nigerian student-athletes. This pattern of null findings suggests that sports participation in isolation is an insufficient variable to produce significant shifts in conventional academic metrics within heterogeneous populations, emphasizing that the coexistence of sports and academic commitments is achievable without inherent detriment to scholastic performance. Research also investigates the indirect pathways through which sports participation may support academic persistence. Scholars argue that athletic engagement fosters transferable competencies such as discipline, time management, goal setting, and resilience, which are foundational for navigating academic demands.

Aquino and Reyes (2022) investigated the connection between athletics and academic success in the Phillipines. They highlight how sports foster institutional belonging and self-worth among Filipino university players. Chen et al. (2021) investigated a dose-dependent relationship

between sports team participation and higher odds of better grades using U.S. national data. Muhammad (2023) reviewed the Influence of sports Participation on Academic Performance in Public Secondary schools in Dutsin-Ma Metropo;is of Katsina State Nigeria while Nguri (2024) researched the effects of Sports Participation on Academic Performance in Adolescents. However, both link sports to improved cognitive function and time management skills that underpin consistent academic engagement. Proponents of this view contend that the principal academic value of sports lies not in directly raising test scores but in building the character and social support that reduces dropout and promotes regular school attendance. They assert that by fostering conditions for sustained enrolment, sports participation indirectly supports the development of literacy and numeracy over time.

The translation of sports participation into academic outcomes depends on the quality, resources, and integration of sports programs within schools. Empirical research identifies implementation barriers that can negate any potential benefits. Mollel and Otieno (2022) investigated the influence of sports participation on educational achievement of students in secondary schools in Arusha District, Tanzania. They found that inadequate sports grounds and a lack of qualified coaches in Tanzanian secondary schools directly impeded program effectiveness. This shows that participation in sports requires investment in infrastructure and human capital. The design and scheduling of interventions are also important; evidence suggests that activities integrated into the academic curriculum, such as the physically active lessons investigated by Magistro et al. (2022) in Two Years of Physically Active Mathematics Lessons Enhance Cognitive Function and Gross Motor Skills in Primary School Children, are more effective than peripheral extracurricular offerings. Sneck et al. (2019) investigated the effects of School-Based Physical Activity on Mathematics Performance in Children: A Systematic Review. They noted that while physical activity interventions can be beneficial, their success hinges on effective implementation. Researchers maintain that without strategic investment in infrastructure, trained personnel, and deliberate curricular integration, sports programs risk being ineffective and failing to influence literacy and numeracy.

A rigorous critique of the literature reveals three interconnected gaps that render the evidence base inadequate for regions like Karamoja, Uganda. First, a geographical gap is evident. Foundational studies originate in Indonesia (Hakim et al., 2023), Italy (Magistro et al., 2022), China (Zhang et al., 2023), and the United States (White, 2021; Chen et al., 2021), contexts with stable infrastructure dissimilar to pastoralist, post-conflict regions. Even African studies in Ghana (Yarkwah & Agyei, 2020), Nigeria (Olayiwola et al., 2024), and Tanzania (Mollel & Otieno, 2022) do not address the unique nature of Karamoja. Second, a contextual gap exists in the research. The literature focuses on secondary and tertiary populations, bypassing primary school where the development of fundamental skills is most pronounced (Aquino & Reyes, 2022; Jakiwa et al., 2022; Yarkwah & Agyei, 2020; Ahmad et al., 2019). Third, a methodological gap persists. The field is split between quantitative studies measuring test scores (Ahmad et al., 2019; Billonid et al., 2020; White, 2021) and secondary reviews (Muhammad, 2023; Nguri, 2024; Sneck et al., 2019). There is a striking absence of primary mixed-methods research that investigates literacy and numeracy metrics together within a single context-specific study. The literature thus fails to explain how sports participation functions within a pastoralist, high-attrition primary school environment, creating a critical empirical gap. The current study was designed as a direct counter to these limitations. The researcher generated primary data exclusively within the Karamoja region of Uganda, thereby confronting the geographical gap. By focusing on primary school pupils, the study rectified the persistent contextual misalignment of prior work, targeting the developmental stage most critical for foundational skill acquisition and educational persistence. Methodologically, a mixed-methods approach was employed. By integrating these data streams, the study moved beyond importing generalized hypotheses. The ultimate aim was to produce evidence that is academically rigorous and immediately actionable, offering a context-specific understanding of sports as a dual-purpose intervention for enhancing both educational quality and access in marginalized, pastoralist communities with a specific focus on literacy and numeracy.

3. Methodology

3.1 Research Design

The study employed a mixed methods approach in which quantitative and qualitative data were collected concurrently, analyzed separately, and then merged to provide a comprehensive understanding of the research problem (Creswell & Plano Clark, 2018). The study adopted an analytical descriptive cross-sectional survey design, which collects data from a population at one specific point in time to describe the status of phenomena or relationships among variables as they exist naturally (Creswell & Creswell, 2018).

3.2 Study area

The study was conducted in the Karamoja region of North-Eastern Uganda, which is situated approximately at

latitudes $1^0$30' and $4^0$00N and longitudes $33^0$30' and $35^0$00E. This region is a semi-arid area with high temperatures and is well known for agro-nomadic pastoralism. It covers 27,528 Square kilometers. It comprises nine districts: Karenga, Kaabong, Kotido and Abim in North Karamoja and Amudat, Moroto, Nabilatuk, Nakapiripirit, and Napak in South Karamoja. It has two municipalities, namely, Kotido and Moroto. The regional headquarters are in Moroto. The region has a total population of approximately 2,461,127 Million (UBOS, 2025). It has an expanse of savannah woodlands thorn bushlands and open grasslands dominated by a low-lying plateau punctuated by mountains such as Moroto, Kadam, Napak, Morungole, Toror, Nyangia and Napore. Karamoja is home to the Karimojong ethnic group, a Nilotic people with a strong cultural attachment to cattle.

3.3 Target Population

The targeted population comprised all primary school pupils, who actively participated in sports, along with class teachers, sports teachers, head teachers, District Inspectors of Schools (DISs), and District Sports Officers (DSOs) in the Karamoja region. The total target population was 7984 people.

3.4 Sampling and sample size

The study used purposive and simple random sampling techniques during the study. DSOs, DISs, head teachers, and sports teachers were purposively sampled because they perform specific roles in facilitating, supervising, and implementing sports programs in schools. Class teachers and pupils were selected using simple random samplings to give every respondent an equal chance of participation, thereby reducing selection bias. Four primary schools per district were purposively selected based on their active participation in sports at the district, regional, or national level, with the assistance of DSOs who provided the lists of eligible schools. The sample size for pupils and headteachers was determined using the Krejcie and Morgan (1970) table for determining sample size from a given population, as cited in Amin (2005). From a target population of 4,806 pupils, a sample of 352 pupils was derived, while all 11 DISs and 11 DSOs were included due to their small population size. For class teachers and games and sports teachers, two respondents per category were selected from each of the 44 sampled schools, resulting in a sample of 88 class teachers, 88 games and sports teachers, and 44 headteachers.

Table 1: Sample size Distribution

Category	Population	Sample Size	Sampling Technique
Class Teachers	1,866	88	Simple random sampling
Head Teachers	311	44	Purposive sampling
Games and Sports Teachers	736	88	Purposive sampling
District Inspectors of Schools	11	11	Purposive sampling
District Sports Officers	11	11	Purposive sampling
Pupils (P.5 - P.7)	4,806	352	Simple random sampling
Total	**7804**	**594**	

3.5. Data Collection Procedure and instruments

3.5.1 Data collection procedure.

The data collection process began with obtaining ethical clearance from St. Francis Nsambya Hospital Research Ethics Committee, and the Uganda National Council for Science and Technology (UNCST). Thereafter, permissions were sought from the Chief Administrative Officers of the respective Districts and Town Clerks of the two municipalities. Research assistants (RAs) were engaged and trained in research protocols, child protection, confidentiality, informed consent procedures, the community engagement plan, and child assent forms. In addition, RAs were trained on the community engagement plan, which aligned with the Uganda National Council for Science and Technology (UNCST, 2022) guidelines on participatory and ethical research practices. Pre-testing of the tools was conducted in Katakwi district. After validity and reliability testing, the tools were deployed for main data collection. Prior to data collection, participants completed informed consent forms. For minors, consent forms were sent to class teachers and only children whose class teachers provided consent were included. Class Teachers, Sports Teachers, and District Sports Officers completed questionnaires. Headteachers were organized

into five Focus Group Discussions held at selected schools. Thereafter, interviews were conducted with District Inspectors of Schools. Throughout the process, the principles of confidentiality, anonymity, voluntary participation, and respect for respondents were strictly observed. During the process, audio recordings were made, especially for the interviews and focus group discussions. The researcher obtained necessary permissions from school authorities and informed participants about the purpose of the study. The researcher scheduled appointments. He arranged for in-depth interviews and focus group discussions at convenient times for headteachers and DISs, respectively. The researcher conducted interviews in a comfortable and private setting to encourage open dialogue. Sessions were recorded (with consent) to ensure accurate data capture. All recorded sessions were transcribed verbatim for subsequent analysis. Questionnaires were distributed to the pupils, DSOs, Class Teachers, Sports Officers and Games and Sports Teachers. Phone calls were made to remind the respondents about the questionnaires.

3.5.2 Data Collection Instruments

The data collection instruments used in this study included a questionnaire, an interview guide, and a Focus Group Discussion Guide.

3.5.3 Questionnaire

The questionnaire was administered to pupils, class teachers, sports teachers, and District Sports Officers, covering sections on demographic characteristics, sports participation and literacy and numeracy. The questions were coded to ensure easy data analysis. The statements within the questionnaire were closed-ended, allowing respondents to express their opinions using a 5-point Likert scale, where 1 represented "strongly disagree" and 5 represented "strongly agree." This format ensured consistency in responses and facilitated quantitative analysis of respondents' perceptions of the effect of sports participation on literacy and numeracy among primary school-going children in the Karamoja region of Uganda.

3.5.4 Interview Guide

The interview guide included sections on sports participation and literacy and numeracy. The interviews were conducted with District Inspectors of Schools, providing an opportunity for them to share their insights, experiences, and strategic perspectives on how sports participation influences educational outcomes in the Karamoja region, thereby enriching the data with detailed qualitative information.

3.5.5 Focus Group Discussion Guide

The FGD guide included open-ended questions organized under sections covering sports participation and literacy and numeracy. The discussions were held with head teachers from the sampled schools, with each FGD consisting of 8 to 10 participants. This approach captured their perspectives and experiences on the role of sports in promoting literacy and numeracy, providing valuable insights into school-level challenges and opportunities.

3.5.6 Validity

The validity of the instruments was ensured through content and construct validation. For the questionnaire, content validity was established through expert review by academic supervisors. These experts evaluated the relevance, clarity, and coverage of the items to ensure alignment with the study objectives. The construct validity of the questionnaire was tested through pre-testing conducted in Katakwi district with 48 participants drawn from four primary schools. The validity of the interview and focus group discussion guides was established through content validity, also reviewed by the supervisors to ensure that the tools adequately captured the depth and scope of the study variables. Katakwi is a neighboring district with similar characteristics to Karamoja. Based on the feedback received, some items were re-phrased for clarity and the questionnaire layout was adjusted to ensure improved logical flow.

3.5.7 Reliability

The reliability of the questionnaire was assessed through a pre-test conducted in Katakwi district involving 48 participants drawn from four primary schools. The collected data were analysed using SPSS version 27 to compute Cronbach's alpha, a measure of internal consistency that indicates how well the items within each construct measure the same underlying concept. All Cronbach's alpha values exceeded the acceptable threshold of 0.70, indicating that the questionnaire items demonstrated good internal consistency and reliability (Nunnally & Bernstein, 1994). For the interview guide and focus group discussion guide, reliability was ensured by employing a structured format with predefined questions that were consistently applied across all interviewees and FGD participants. This approach minimised interviewer bias and ensured uniformity in data collection, thereby enhancing the credibility and dependability of the qualitative findings (Merriam & Tisdell, 2016).

3.6 Data analysis

Quantitative data from questionnaires were entered into Excel, cleaned, and analyzed in SPSS version 27. Descriptive statistics (frequencies, means, percentages, medians, interquartile ranges) summarized respondent characteristics and response patterns while inferential

techniques such as Spearman's correlation and linear regression with bootstrapping (5,000 resamples) tested the relationship between sports participation and literacy and numeracy (Ott & Longnecker, 2010; Hayes, 2022). Qualitative data from interviews and FGDs were transcribed, coded thematically in NVivo (version 15), and analyzed using both inductive and deductive approaches to capture patterns and contextual insights (Flick, 2013). Qualitative data analysis followed a thematic analysis approach. The researcher ensured familiarization with the data. He reviewed transcripts to become immersed in the data. He carried out coding. He generated initial codes that captured significant themes related to sports participation and academic achievement. Collated codes were developed into broader themes and sub-themes that addressed the research objectives. The analysed themes were interpreted in relation to existing literature and the study's aims, drawing connections between participant experiences and broader sport participation contexts. Qualitative data from interviews and focus groups were transcribed and analyzed using thematic analysis in NVivo (Version 15), following Braun and Clarke's (2006) six-phase framework.

3.7 Ethical Considerations

In regard to ethical considerations, the researcher respected the rights, interests, and dignity of all participants, recognising them as autonomous individuals whose participation was voluntary and valuable. Informed consent was obtained prior to any data collection, based on a clear explanation of the study's objectives, procedures, risks, and rights. Participants were made aware of their right to decline to answer specific questions or to withdraw from the study at any point without penalty (Israel & Hay, 2006). All data collected were treated with strict confidentiality. Information provided by participants was stored securely using encrypted digital files and locked physical storage and shared only with authorised personnel. Anonymity was carefully maintained by avoiding the collection of personally identifiable information unless explicitly necessary. The researcher ensured that even indirect identifiers were handled cautiously to avoid accidental disclosure (Israel & Hay, 2006). The researcher ensured that no harm, whether physical, psychological, or social, came to the participants as a result of the study. The research was designed to maximise potential benefits to the Karamoja community while avoiding any exploitation of respondents (Resnik, 2020). The study was conducted with academic and professional integrity, ensuring transparency, honesty, and respect throughout. Plagiarism was prevented by properly citing all external sources using APA style, and the originality of the study was verified through a plagiarism detection tool (Israel & Hay, 2006).

4. Results and Discussion

The table below shows the descriptive responses for the effect of sports participation on literacy and numeracy.

Table 2: The descriptive statistics of the effect of sports participation on literacy and numeracy

Statement	Mean	SD	Median	IQR	% Agree/ Strongly Agree
Sports participation improves pupils' overall literacy and numeracy skills.	4.25	0.921	4.00	1.00	82.9
Pupils who participate in sports show better concentration during reading and numeracy lessons.	4.05	0.910	4.00	2.00	76.2
Sports participation improves pupils' ability to follow instructions during literacy and numeracy activities.	3.94	1.021	4.00	2.00	70.0
Pupils involved in sports demonstrate better letter recognition and alphabet knowledge.	3.96	0.967	4.00	2.00	74.6
Sports participation supports the development of phonemic awareness among pupils.	3.82	1.156	4.00	2.00	67.7
Pupils who engage in sports show improved vocabulary use during reading activities.	4.05	1.064	4.00	1.00	72.3
Sports participation improves pupils' reading fluency and accuracy.	4.11	1.044	4.00	2.00	73.1
Pupils involved in sports demonstrate better reading comprehension skills.	4.15	1.028	4.00	2.00	75.6
Sports participation improves pupils' number recognition skills.	3.98	1.002	4.00	2.00	73.6

Pupils who participate in sports perform basic mathematical operations more accurately.	3.74	1.081	4.00	2.00	62.9
Sports activities support pupils' ability to apply mathematical concepts to real life situations.	3.98	1.087	4.00	1.00	71.1
Sports participation improves pupils' writing skills through better coordination and classroom engagement.	4.21	0.965	4.00	1.00	78.7

The results show that sports participation is associated with enhanced literacy and numeracy skills. Most respondents agreed (44.0%) or strongly agreed (45.8%) that sports participation is associated with improvements in pupils' overall literacy and numeracy skills, with a mean of 4.25 (SD=0.921) and an overall agreement rate of 89.8%. Writing skills were also highly rated, with 78.7% agreeing or strongly agreeing (Mean=4.21, SD=0.965). Reading comprehension (Mean=4.15, SD=1.028, 75.6% agreement) and reading fluency (Mean=4.11, SD=1.044, 73.1% agreement) recorded similarly strong endorsement. However, basic mathematical operations recorded the lowest mean (3.74, SD=1.081), with only 62.9% agreeing or strongly agreeing, suggesting that the connection between sports participation and specific foundational numeracy skills such as accurate mathematical computation is less clearly understood or observed in this context. Phonemic awareness similarly showed lower agreement (Mean=3.82, SD=1.156, 67.7%), indicating that the cognitive transfer to highly discrete literacy skills may require more intentional pedagogical integration.

To provide a robust measure of the effect of sports participation on literacy and numeracy, the items representing this construct were aggregated into a single composite variable. This was achieved by calculating the average score across the three items for each respondent, producing a score ranging from 1 to 5, with higher scores indicating a stronger perceived positive effect of sports on foundational academic skills. The internal consistency of this composite measure was assessed using Cronbach's Alpha, which yielded a coefficient of $\alpha = .775$. This value comfortably exceeds the commonly accepted threshold of .70, confirming that the three items reliably measure the underlying construct of literacy and numeracy and justifying their aggregation into a single composite score (Nunnally & Bernstein, 1994).

As shown in Table 2, the overall composite score for literacy and numeracy recorded a mean of 4.21 (SD = 0.574). The median score of 4.33 and the interquartile range of 0.67 (Q1 = 4.00, Q3 = 4.67) indicate that the majority of respondents consistently rated the literacy and numeracy benefits of sports participation as high, with responses clustered around the "Agree" to "Strongly Agree" range. The relatively narrow standard deviation (0.574) suggests that respondents were generally consistent in their positive perceptions of this relationship. These findings confirm that respondents perceive sports participation as a beneficial factor in developing foundational reading, writing, and mathematical skills among primary school children in Karamoja, particularly through enhanced concentration and cognitive engagement.

Table 3: Descriptive Statistics for the Composite Literacy and Numeracy Score

Composite Variable	N	Mean	SD	Median	IQR	Min	Max
Literacy and Numeracy	520	4.21	0.574	4.33	0.67	2.00	5.00

The descriptive statistics were followed by the thematic analysis of qualitative responses as shown below:

Table 4: Thematic analysis of qualitative responses on the effect of sports participation on literacy and numeracy

Theme	Key Issues Identified	Functional Impact	Frequency
Concentration and Attention	Sports improve attention span; pupils demonstrate better focus during reading and mathematics lessons	Improved literacy and numeracy performance; better comprehension	11/12
Cognitive Function and Brain Development	Sports enhance memory, processing speed, and cognitive abilities; mind games (chess, ludo) improve reasoning	Better problem-solving skills; improved reading fluency and accuracy	10/12
Practical Application of Numeracy	Counting goals, tracking scores, measuring distances, managing statistics; time management in games	Improved counting, number recognition, and basic mathematical operations	9/12

Vocabulary and Communication	Sports provides specific vocabulary; cheers, chants, and commands enhance language sensitivity; teamwork fosters discussion	Improved vocabulary use, reading comprehension, and writing skills	8/12

The qualitative findings indicate that sports participation enhances literacy and numeracy through four interconnected pathways. The most frequently cited theme was concentration and attention, with respondents noting that sports improve attention span and that pupils demonstrate better focus during reading and mathematics lessons. One key informant noted:

"Pupils who are active in sports usually demonstrate high attention span. This makes them better positioned to handle literacy and numeracy. Success in sports can boost self-esteem and confidence, leading pupils to feel more capable in academic tasks." (KII I1, 27th November, 2025)

The cognitive function and brain development theme was also highly prevalent. Participants emphasized that sports enhance memory, processing speed, and cognitive abilities, while mind games such as chess and ludo specifically improve reasoning, problem-solving skills, reading fluency, and accuracy. Focus group participants added:

"Sports help develop cognitive abilities. There are specific activities like mind games that develop cognitive abilities. Sports help to overcome academic challenges as they improve cognitive functions like in mind games. The discipline acquired in sports helps enhance pupil's ability to concentrate, leading to better focus." (FGD5 30th November, 2025)

The theme of the practical application of numeracy highlighted that activities such as counting goals, tracking scores, measuring distances, managing statistics, and time management during games contribute to improved counting, number recognition, and basic mathematical operations. Key informants noted:

"Tracking scores, calculating averages, and managing statistics in sports provide frequent practice with mathematics concepts. Planning and strategies involved in sports involve mathematical reasoning." (KII I6, 1st December, 2025)

The vocabulary and communication theme revealed that sports provide specific vocabulary, while cheers, chants, and commands enhance language sensitivity, and teamwork fosters discussion, all of which improve vocabulary use, reading comprehension, and writing skills. Focus group participants added:

"Cheers, chants, rhythm, and commands involved in sports enhance pupils' sensitivity to sounds of language. Many songs and sports cheers include rhymes and rhythms. Literary related games incorporated in sound recognition can be integrated into sports practices." (FGD2, 1st December, 2025)

The qualitative analysis was preceded by the correlation analysis, as shown below:

Table 5. Spearman correlation between sports participation and literacy and numeracy.

Correlations

Spearman's rho		Sports Participation	Literacy and numeracy
Sports Participation	Correlation Coefficient	1.000	.819**
	Sig. (2-tailed)	.	.000
	N	520	450
Literacy and numeracy	Correlation Coefficient	.819**	1.000
	Sig. (2-tailed)	.000	.
	N	450	450

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis revealed a very strong, positive, statistically significant relationship between sports participation and literacy and numeracy among primary school-going children in the Karamoja region of Uganda, with a Spearman correlation coefficient of $\rho = 0.819$. This relationship was significant at the 0.01 level (2-tailed), with a p-value of 0.000. These results reject the null hypothesis ($H0_1$), indicating that increased sports participation is associated with higher literacy and numeracy results. The magnitude of the correlation coefficient represents a very strong positive relationship, suggesting that sports participation may be particularly influential in literacy and numeracy skill development in this context.

Regression analysis was also carried out, and the results are presented below:

Table 6: Linear regression results for the effect of sports participation on literacy and numeracy

Bootstrap for Coefficients					
			Bootstrap[a]		
	B		Bias	Std. Error	Sig.
(Constant)	2.609		-.013	.166	.000
	.429		.003	.042	.000
a. Unless otherwise noted, bootstrap results are based on 5000 bootstrap samples					
Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	2.609	.077		33.696	.000
Sports Participation	.429	.019	.736	22.996	.000
a. Dependent Variable: Literacy and numeracy					
R	R Square	Adjusted R Square	Std. Error	F Statistic	Sig.
.736[a]	.541	.540	.34889	528.814	.000[b]

The regression analysis shows a statistically significant positive correlation between sports participation and literacy and numeracy among primary school children in the Karamoja region of Uganda. The R Square value of 0.541 shows that sports participation explains 54.1% of the variance in literacy and numeracy indicators, with the model's F-statistic of 528.814 and p-value of 0.000 confirming statistical significance. The unstandardized coefficient (B=0.429) indicates that each one-unit increase in sports participation improves literacy and numeracy scores by 0.429 units. The standardized Beta (β=0.736) reflects a strong effect size, while the t-value of 22.996 and p-value of 0.000 further support the significance of this relationship.

To cross-validate the regression results, bootstrapping with 5,000 resamples was conducted. The bootstrapped estimate for sports participation (B=0.429, Bootstrap Bias =0.003) remained consistent with the standard regression coefficient, indicating minimal bias. The bootstrap standard error (0.042) was slightly higher than the standard error (0.019), and the bootstrapped p-value remained significant at $p < .001$, confirming that the relationship between sports participation, literacy and numeracy is very critical and not an artifact of normality violations or outliers (Efron & Tibshirani, 1993).

While these findings reject the null hypothesis (H_1), the remaining 45.9% of variance suggests that factors such as quality of classroom instruction, availability of learning materials, parental involvement in education, and a safe school environment may also play critical roles in shaping literacy and numeracy indicators. In conclusion, sports participation is a significant factor; however, a detailed approach combining several interventions is paramount to optimize literacy and numeracy achievement in the Karamoja region.

4.2 Discussion

Sports participation explains 54.1% of the variance in literacy and numeracy. This aligns with Regine, and Andala (2021) who found that sports explained 78.5% of academic performance variance in Rwandan secondary schools. The very strong correlation ($\rho = 0.819$) exceeds that reported in similar contexts, possibly due to extreme deprivation in Karamoja making sports a uniquely powerful cognitive stimulus (Datzberger, 2022). This supports Magistro et al. (2022) who found that physically active mathematics lessons led to substantial gains in cognitive functions related to arithmetic reasoning. Hakim et al. (2023) also demonstrated that integrated physical education and mathematics models significantly improved literacy and numeracy skills. The high mean score for overall literacy

and numeracy (Mean=4.25, 82.9% agreement) is consistent with Chen et al. (2021) who found that sports participation was associated with higher odds of better grades, extending these findings to a resource-poor nomadic pastoralist context. The concentration and attention mechanism (Mean=4.05, 76.2% agreement) strongly corroborates the study by James et al. (2023), whose systematic review asserted that physical activity enhances cognitive functions including concentration and self-regulation, directly linked to improved learning outcomes (Muhammad, 2023; Nguri, 2024; Youth Sport Trust, 2022).

The cognitive function and brain development pathway (identified in 10 of 12 qualitative responses) aligns with Magistro et al. (2022), and the finding that mind games such as chess and ludo improve reasoning and problem-solving skills extends the literature by suggesting diverse forms of physical and cognitive activity may have differential effects on specific academic domains (Sneck et al., 2019; Sugiatno et al., 2025). The practical application of numeracy pathway (identified in 9 of 12 qualitative responses) addresses gaps left by previous studies, as Magistro et al. (2022) did not disaggregate specific game numerical practices and Sneck et al. (2019) called for greater specificity regarding which physical activities produce which mathematical gains. The vocabulary and communication pathway (identified in 8 of 12 qualitative responses) aligns with Hakim et al. (2023) and provides a mechanism for vocabulary development through cheers, chants, commands, and teamwork, suggesting that sports can serve as an authentic language-rich environment that scaffolds literacy acquisition.

Lower agreement on basic mathematical operations (Mean=3.74, 62.9%) and phonemic awareness (Mean=3.82, 67.7%) aligns with the counter narrative literature including Ahmad et al. (2019) who found out that there was no significant correlation between student participation in sports and general academic achievement among secondary school students across multiple local schools in Pakistan. Similarly, Yarkwah and Agyei (2020) reported no significant difference in the Effects of Sports Participation on the Academic Performance of Senior High School Students in Mathematics in Ghana. Furthermore, White (2021) found no statistically significant difference in the academic achievement of urban, seventh-grade students who participated in athletics and urban, seventh-grade students who did not participate in athletics in Urban Pennsylvania. The current study provides the first quantitative evidence from a high attrition, nomadic pastoralist context in Uganda, filling the critical gap identified by Mollel and Otieno (2022) in the study Influence of Sports Participation on Educational Achievement of Students in Secondary Schools in Arusha District in Tanzania and by Datzberger (2022) in the study Lost in Transition? Modernization, Formal Education and Violence in Karamoja. The R^2 value of 0.541 indicates 45.9% of literacy and numeracy variance is explained by other factors including quality of instruction, availability of learning materials, and parental support (Brown et al., 2017). Therefore, sports participation should be implemented alongside complementary strategies such as teacher training, provision of learning materials, and community engagement (UNICEF, 2023; World Bank, 2018).

5. Conclusion and Recommendations

5.1 Conclusions

Sports participation is significantly associated with enhancing literacy and numeracy among primary school children in the Karamoja region of Uganda by improving concentration and attention, developing cognitive function and brain capacity, providing practical applications of mathematical concepts, and enhancing vocabulary and communication skills. The value of discipline, focus, and cognitive engagement cultivated through sports may translate directly into improved reading fluency, reading comprehension, writing skills, vocabulary use, and the ability to apply mathematical concepts. Sports participation is associated with over half of the explained variance in literacy and numeracy indicators, making it a strong and relevant evidence-based strategy for enhancing foundational performance skills in marginalized, nomadic pastoralist regions like Karamoja. The mechanisms of concentration, cognitive function, practical numeracy application, and vocabulary development apply even in resource-poor areas, although the transfer to highly discrete skills such as basic mathematical operations and phonemic awareness may require more supportive pedagogical approaches.

5.2 Recommendations

Based on the study findings, the researcher hereby makes the following recommendations:

1. The Ministry of Education and Sports through the National Curriculum Development Centre should provide a sports-integrated literacy and numeracy curriculum that entails reading, vocabulary, counting, and mathematical operations within physical activities.

2. Teacher training colleges should include mandatory modules on using sports as a pedagogical tool for foundational skill development for all primary teacher trainees, not only for physical education specialists.

3. Schools should establish both physical sports clubs and mind game clubs such as chess, ludo, word games, and number puzzles. These clubs simultaneously develop cognitive functions, problem-solving skills, and foundational academic competencies. Clubs should meet at least twice weekly, with equal emphasis placed on physical and cognitive game activities, requiring minimal resources while delivering substantial cognitive benefits.

4. Teachers should conduct brief pre-sport and post-sport debriefing sessions that explicitly connect cognitive skills practiced during physical activities to classroom literacy and numeracy tasks. This explicit transfer practice addresses the finding that cognitive benefits are not automatic and require deliberate scaffolding.

5. Debriefing sessions should last no more than five minutes to ensure they are feasible within existing lesson structures. Teachers should intentionally draw attention to the mathematical concepts embedded within sports activities, including counting, scoring, measuring, statistics, and time management. These authentic, contextually relevant numeracy experiences should be explicitly linked to classroom mathematics instruction to reinforce learning through embodied, practical application.

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