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Influence of Language of Instruction Preference on Mathematics Learning Outcomes among Public Secondary School Students in Monduli District, Tanzania

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Abstract: *This study examined the influence of language of instruction preference on mathematics learning outcomes among public secondary school students in Monduli District, Tanzania. Specifically, it compared mathematics outcomes between students preferring Kiswahili and English and determined the extent to which language preference influenced achievement. Cummins' Linguistic Interdependence Theoryguided the study. A quantitative approach employing a correlational research design was used. The target population comprised 10,728 Form Three and Form Four students from 16 public secondary schools. A sample of 384 students was selected through stratified and systematic sampling, while 376 completed questionnaires were returned, producing a 97.92% response rate. Data were collected using a structured questionnaire and document analysis schedule. Instrument validity was established through expert review, while reliability coefficients for the two questionnaire scales were 0. 872 and 0.889. Data were analyzed using frequencies, percentages, means, standard deviations, an independent-samples t-test and simple linear regression in SPSS. Ethical principles of informed consent, confidentiality, anonymity and voluntary participation were observed. Findings showed that students who preferred English recorded a higher mean mathematics score of 33.66 than those preferring Kiswahili, whose mean was 26.28. The difference was statistically significant, $t\ (84.976) = -3.127$, $p = .002$. Regression results further showed that language preference significantly predicted mathematics achievement, $\beta = .525$, $F\ (1,374) = 142.313$, $p < .001$. The study concluded that language preference meaningfully shapes mathematics learning outcomes. It recommended effective bilingual instructional support, gradual strengthening of academic English and greater use of Kiswahili for clarification.*

Keywords: *language, mathematics, students, Language of instruction, learning outcomes, Tanzania*

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1. Introduction

Learning outcomes in mathematics have been a persistent concern globally, particularly in multilingual societies where the language of instruction differs from students' home or first language (Jiménez-Silva et.al., 2025). Unfamiliar instructional language suggestively contributes to lower achievement in mathematics among learners in many multilingual countries (Sharma, 2023). This means that the students spend much time strugglingto understand mathematical word problems when the language of instruction differed from their home language**.** This leads to

lower assessment scores in both external and internal assessment tasks.

Evidence from developed countries highlights the influence of instructional language on mathematics learning outcomes. In Germany, for example, migrant and multilingual students have been found to achieve lower mathematics outcomes when their home languages are ignored in teaching and assessment (Krause et al., 2022). This underperformance is largely attributed to difficulties in understanding mathematical instruction delivered in a second language, rather than a lack of mathematical ability. Similarly, in the United States, students tend to score lower in mathematics when assessments rely heavily on linguistically complex language, which creates additional cognitive demands unrelated to mathematical competence (Cracia & Kleifgen, 2020). In the United Kingdom and other European countries, multilingual students often underperform when academic English dominates classroom instruction, limiting their ability to access mathematical meaning (Moschkovich, 2019). According to CECD (2022), lower mathematics scores in multilingual education systems, including Spain, are more closely linked to language of assessment than to students' actual mathematical ability.

In Asian contexts, where many students learn mathematics in a language different from their home language, language barriers often hinder understanding and reasoning, leading to lower assessment scores (Ting et al., 2023). Even when active learning strategies are used, students may still struggle if instructional language and assessment tools are linguistically demanding, reducing their ability to demonstrate full mathematical understanding (Lo & Leung, 2022). In Content and Language Integrated Learning (CLIL) settings, teachers' inability to distinguish between students' mathematical knowledge and second language proficiency can result in hidden underperformance and underachievement (Prediger et al., 2019; Ramazan et al., 2023). This shows that language barriers in preference to cognitive limitations explain many observed gaps in mathematics achievement.

Many students learn mathematics in colonial or official languages including English or French, which are not their first languages, making comprehension and problem solving more difficult (Tshuma, 2026). When mathematical problems are presented in a second language, students may misinterpret meanings even when they understand the underlying concepts. For example, the study from rural South Africa shows that students struggle when textbooks and teaching materials are written in non-local languages, making mathematics learning particularly difficult in early grades (Essien, & Adler, 2025). This suggests that the low achievement in mathematics among students in Africa may be attributed to language of instruction. Countries including Kenya, Uganda, and Rwanda often adopt English or French as the medium of instruction from upper primary or secondary school, even though most students speak local languages such as Luganda, Kinyarwanda, or Kikuyu at home (Brock-Utne, 2025). This mismatch creates a linguistic gap that reduces students' ability to accurately interpret mathematical concepts and solve problems, resulting in lower test performance compared to tasks presented in their home languages (Njoroge, 2024). Students frequently underperform on word problems and abstract reasoning questions when assessed in English or French, despite demonstrating stronger outcomes when similar tasks are explained in local languages (Niyibizi and Kazinyirako, 2026).

In Tanzania, the Education and Training Policy of 2014, revised in 2023, recognizes Kiswahili as the language of instruction in primary schools and English in secondary schools, At the Standard Seven Primary School Leaving Examination (PSLE) level, where Kiswahili is the medium of instruction, mathematics pass rates have remained relatively higher and more stable. These statistics are presented in table 1.

Table 1: Mathematics Pass Rates at PSLE and FTNA Levels in Tanzania, 2019–2023

Year	PSLE Mathematics Pass Rate (%)	FTNA Mathematics Pass Rate (%)
2019	52	32
2020	50	30
2021	49	29
2022	48	28
2023	49	27

Source NECTA (2019 – 2023)

The data in table 1 show a range of performance in mathematics, 2019 – 52%, 2020 – 50%, 2021 – 49%, 2022 – 48%, 2023 – 49% (NECTA, 2024). In contrast, at the Form Two National Assessment (FTNA) level, where English is the language of instruction, mathematics scores are consistently lower: 2019 – 32%, 2020 – 30%, 2021 – 29%, 2022 –28%, 2023 – 27% (NECTA, 2024). This leaves questions on whether the language of instruction is the big debate on mathematics assessment scores. Recent studies confirm this trend: (Kissima, et.al., 2024) show that Tanzanian learners perform better in mathematics when assessed in Kiswahili compared to English, while (Mmbaga, 2025), argues that the language transition weakens fairness in mathematics achievement, particularly for rural students with limited exposure to English outside school. These results show the need for bilingual support or gradual transition strategies to align language policy with reasonable mathematics learning outcomes because the

language of instruction differed from the Tanzanians home languages**.**

1.1 Research Questions

The following research questions guided the study:

i. How do mathematics learning outcomes differ based on language of instruction preference among public secondary school students in Monduli District?
ii. What is the influence of language of instruction preference on mathematics learning outcomes among public secondary school students in Monduli District?

2. Literature Review

This study was guided by Cummins' Linguistic Interdependence Theory (1979), developed by Jim Cummins, a Canadian researcher in bilingual education and language acquisition.

2.1 Cummins' Linguistic Interdependence Theory

The theory states that proficiency in a learner's first language (L1) provides a strong foundation for acquiring a second language (L2), because the underlying cognitive and academic skills are transferable across languages. Cummins distinguishes between Basic Interpersonal Communicative Skills (BICS), which refer to everyday conversational fluency that can be acquired relatively quickly, and Cognitive Academic Language Proficiency (CALP), which refers to the ability to use language in academic contexts and takes much longer to develop(Cummins, 1979). The theory argues that while students may appear fluent in a second language through BICS, they often lack CALP, which is essential for success in subjects like mathematics that require interpreting word problems, reasoning, and expressing abstract concepts.

2.1.1 Strengths of the Theory

The Cummins' Linguistic Interdependence Theory in relation to this study has the ability to clearly explain why language of instruction directly influences mathematics achievement among students in multilingual contexts such as Monduli District. By distinguishing between Basic Interpersonal Communicative Skills (BICS) and Cognitive Academic Language Proficiency (CALP), the theory provides a strong framework for understanding that students may appear fluent in English conversationally but still lack the academic language proficiency required to succeed in mathematics(Espinas et al., 2022). This made the theory particularly powerful for the study, as it highlights that underperformance in mathematics assessments often reflect linguistic barriers rather than cognitive deficiencies, thereby validating the investigation into language preference and its influence on learning outcomes.

2.1.2 Application of the Theory in the Current Study

Cummins' Linguistic Interdependence Theory (1979) in this study remains a valuable framework because it is based in its ability to explain how students' proficiency in their first language influences their acquisition of academic skills in a second language, particularly in mathematics. Since the theory distinguishes between Basic Interpersonal Communicative Skills (BICS) and Cognitive Academic Language Proficiency (CALP), it provided a strong foundation for understanding why students in Monduli District, transition from Kiswahili in primary schools to English in secondary schools, often struggle with mathematics assessments(Essien and Adler, 2025).

2.2 Empirical Review

The study reviewed empirical studies that aligned to the themes generated from research questions.

2.2.1 Performance Differences in Mathematics in Bilingual Contexts

Bernhofer, (2022) conducted a study on the effect of the language of instruction on students' academic performance in a bilingual university context. The purpose of the study was to examine how taking examinations in a second language influences students' grades. The study used administrative data from the Free University of Bozen-Bolzano and applied student fixed-effects models as well as an identification strategy based on course language assignments in standard study plans. The study found that taking an exam in a second language led to a grade loss of approximately 9.5% and increased the number of failed attempts, indicating clear performance differences linked to language of instruction.

Bermejo, (2021) conducted a study on how the language of instruction influences the development of mathematical thinking among early bilingual learners. The purpose was to determine whether learning mathematics in a second language affects the acquisition of early formal mathematical concepts. The study employed analysis of variance (ANOVA) and multiple regression techniques to compare learners taught in their mother tongue and those taught through a second language within Content and Language Integrated Learning(CLIL) programmes. The study found that students whose language of instruction matched their mother tongue performed better in solving daily life mathematical problems, revealing performance differences in bilingual contexts. Hentati, (2024) conducted a study on the relationship between language of instruction and academic achievement among primary school students in the United Arab Emirates. The purpose was to explore differences in mathematics and science achievement between students instructed in English and those instructed in classical Arabic. The study used Trends in International

Mathematics and Science Study(TIMSS) standardized test data and applied propensity score matching techniques to estimate performance differences (TIMSS 2019). The findings indicated that students receiving instruction in English had lower odds of achieving higher scores in mathematics, suggesting that second-language instruction negatively affected performance.

Bacan, (2025) conducted a study on the role of mother tongue-based multilingual education (MTB-MLE) in mathematics instruction in the Philippines. The purpose was to explore teachers' experiences regarding the benefits and challenges of using the mother tongue in mathematics education. The study adopted a qualitative phenomenological design and collected data through Key Informant Interviews, which were analyzed thematically. The findings revealed that using the mother tongue enhanced students' attentiveness, participation, comprehension, and confidence in mathematics learning, although challenges such as limited instructional materials were reported.

Abdul (2024) conducted a study on the effects of mother tongue instruction on students' mathematical achievement in Ghana. The purpose was to examine whether teaching mathematics in twin, English, or a combination of both influences students' academic performance. The study used a quasi-experimental design involving two experimental groups and one control group and analyzed pre-test and post-test scores using t-tests. The findings showed that using mother tongue as an additional medium of instruction significantly improved students' mathematics achievement compared to exclusive use of either language. However, the study was conducted in a single school with a small number of classes, limiting the generalizability of the findings. This limited sample scope may have affected the robustness and representativeness of the results. The current study filled this gap by involving 384 students from four secondary schools in Monduli District and applying inferential statistical techniques to enhance representativeness and strengthen the validity of conclusions regarding performance differences in mathematics.

2.2.2 Influence of the Language of Instruction Preference on Mathematics Outcomes among Students

Espinas, (2022) conducted a study on the influence of language of instruction on mathematics development with the purpose of examining how language outlines mathematical performance. The study employed a literature review of cross-sectional, longitudinal, and experimental research to analyze associations between language structures, language ability, and mathematics outcomes. The findings revealed that variations in language structure and targeted language of instruction significantly influence students' mathematics achievement, confirming a strong linguistic pathway in mathematical development.

Turan (2022) conducted a systematic review on mathematical language and preschool mathematical abilities to determine how understanding and exposure to mathematical language influence mathematics achievement. Using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, the authors reviewed 18 methodologically sound studies focusing on preschool children and analyzed both correlational and intervention-based evidence. The study found that comprehension and exposure to mathematical language positively correlate with and directly improve mathematical performance. Subandiyah et al. (2025) conducted a study on the influence of differentiated instruction in Bahasa Indonesia learning with the purpose of examining its effect on student engagement and academic achievement. The study used a quasi-experimental mixed-methods design involving 180 students divided into experimental and control groups, employing post-tests, classroom observations, and teacher interviews. The findings showed that differentiated instruction significantly improved academic performance and learning behavior, demonstrating that instructional language strategies influence achievement outcomes.

Siregar (2024) conducted a study at UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan to analyze the influence of learning interest and creativity on Calculus achievement. The study employed an ex post facto correlational design with 30 students selected through simple random sampling and used questionnaires alongside achievement tests, analyzed through multiple regression. The findings indicated that affective and cognitive engagement significantly influenced Calculus performance. Although the study did not directly focus on language of instruction, it demonstrates that internal learning factors significantly affect mathematics achievement. Makupe and Machaba (2024) conducted a study on English as a language of preference in mathematics learning among high school learners in South Africa, aiming to identify learners' preferred language of instruction and its contribution to mathematics achievement. The study employed a non-experimental quantitative descriptive survey design with 101 learners using a self-administered questionnaire analyzed through descriptive statistics. The findings indicated that English was the preferred language for mathematics instruction and was perceived as crucial for mathematics achievement due to pedagogical, social, and economic factors. However, the study relied solely on descriptive statistics without inferential analysis, limiting the ability to determine the strength and significance of relationships between variables. The current study filled this gap by employing inferential statistical analysis within a correlational design to establish the significance and magnitude of performance differences associated with language of instruction preference among secondary school students in Monduli District, Tanzania.

3. Methodology

The study adopted a correlational design under the quantitative approach. According to Cohen et al., (2021), a correlational design examines the relationship between two or more variables as they occur naturally without manipulation. In the current study, this design was used to examine the relationship between students' preference for the language of instruction in mathematics classrooms (English or Kiswahili) and mathematics learning outcomes. The design allowed the researcher to analyze associations between variables using measurable data while maintaining objectivity in the analysis process. The population of 10,732 for this study included 5526 form four students and 5202 form three students from 16 public secondary schools in Monduli district (MoEST, 2026). Form three and four students were included in the population because they are the direct recipients of mathematics instruction in public secondary schools. These students have already experienced the use of language of instruction in mathematics classrooms for several years and were therefore able to express their preferences regarding the language used during lessons. The sample size of 384 respondents for the study included 192 form four students and 192 form three students. This sample size was determined using the Cochran formula which is given by;

$$n = \frac{Z^2.P.(1-P)}{e^2}$$

n - sample size
Z - Z-Score
P - Estimated proportion of the population
e- Margin of error

$$n = \frac{(1.96)^2.0.5.(1-0.5)}{(0.05)^2} \quad n = \frac{3.8416 \times 0.5 \times 0.5}{0.0025}$$

$$n = \frac{0.9604}{0.0025} \quad n = 384.16$$

$n \approx 384$ respondents.

Simple random sampling was used to select the schools so that every public secondary school had an equal chance of inclusion. Stratified sampling was first used by dividing students into two class-level groups, namely Form Three and Form Four. This ensured that both classes were represented in the study. From the total sample of 384 students, 192 students were selected from Form Three and 192 students from Form Four. Since four schools were involved, 96 students were selected from each school. This study employed questionnaires and document analysis schedule. The use of multiple instruments enabled triangulation and strengthens validity.

Questionnaires were administered to students to collect quantitative data concerning language of instruction preference and mathematics learning outcomes. Document analysis involves reviewing written records in order to obtain relevant information that supports the objectives of the study (Bowen, 2020). In this study, the document analysis schedule guided the examination of school academic records related to students' mathematics learning outcomes. The researcher reviewed documents such as mathematics examination results, continuous assessment records, and other relevant school academic reports for form three and form four students. The validity of the questionnaires was ensured through an expert review.

The reliability of the student questionnaire was assessed using Cronbach's alphamethod and perceived mathematics performance in English compared with Kiswahili recorded 0.872. The scale assessing the influence of language of instruction preference on mathematics achievement obtained the highest coefficient of 0.889. These results indicate strong internal consistency among the items included in each scale. Therefore, the questionnaire was considered reliable and suitable for collecting data for the main study (Zakariya, 2022; Doval et al., 2023). Permission was also sought from the heads of the sampled schools before meeting students. Since the study involved students, the purpose of the study was clearly explained to the school authorities and participants before data collection started. Students were also informed that participation was voluntary and that no student would be forced to participate. This ensured that the data collection process started only after the required approvals had been granted. During data collection, the researcher treated all participants with respect and fairness. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize students' preferences and performance levels. Inferential statistics involved the use of independent sample t-test and linear regression. The data from document analysis schedule was analyzed using descriptive statistics to generate mean scores and standard deviations. For ethical considerations, no names of students or schools were disclosed in the report. All sources used in the dissertation were properly acknowledged to avoid plagiarism. These ethical safeguards strengthened the credibility, trustworthiness and integrity of the study.

4. Results and Discussion

The discussion follows the order of the research objectives, beginning with descriptive statistics and then inferential statistics used to test relationships, differences, and influence among the study variables.

4.1 Students' Perceptions of Mathematics Performance in English Compared to Kiswahili

Objective one aimed at examining whether students in public secondary schools in Moduli District perceive themselves as performing better in mathematics when taught and assessed in English compared to Kiswahili. To achieve this, students were provided with a Likert scale

consisting of 10 items reflecting mathematics performance in relation to language of instruction. They were asked to indicate their level of agreement or disagreement with each statement. Their responses were quantified to generate frequencies and mean scores, as presented in Table 2.

Table 2: Students' Perceptions of Mathematics Performance in English Compared to Kiswahili (n= 376)

Statement s	SA		A		N		D		SD		M
	f	%	f	%	f	%	F	%	f	%	
I can score higher in mathematics tests in English than in Kiswahili	33	8.8	73	19.4	46	12.2	110	29.3	114	30.3	2.47
I can solve mathematics problems correctly in English than in Kiswahili	38	10.1	79	21.0	48	12.8	117	31.1	94	25.0	2.60
I can complete mathematics exercises faster in English than in Kiswahili	43	11.4	63	16.8	58	15.4	117	31.1	95	25.3	2.58
I understand mathematics test questions better in English than in Kiswahili	45	12.0	75	19.9	44	11.7	114	30.3	98	26.1	2.61
I can perform better in mathematics assignments in English than in Kiswahili	45	12.0	54	14.4	58	15.4	113	30.1	106	28.2	2.52
I understand classroom examples better in English than in Kiswahili	50	13.3	79	21.0	56	14.9	99	26.3	92	24.5	2.72
I can explain mathematics answers more clearly in English than in Kiswahili	44	11.7	61	16.2	46	12.2	120	31.9	105	27.9	2.52
I can perform better during mathematics class exercises in English than in Kiswahili	44	11.7	70	18.6	48	12.8	104	27.7	110	29.3	2.56
I feel more confident during mathematics tests in English than in Kiswahili	60	16.0	58	15.4	52	13.8	92	24.5	114	30.3	2.62
I can achieve higher mathematics grades in English than in Kiswahili	39	10.4	62	16.5	41	10.9	102	27.1	132	35.1	2.40

Source: Field data (2026)

The data for mathematics test performance indicate that respondents disagreed that English improved mathematics test performance, with a mean score of 2.47. The mean score implies that learners regarded Kiswahili as more supportive in enhancing mathematics test performance during assessment situations in schools. In relation to the objective comparing mathematics learning outcomes, the evidence shows stronger achievement when Kiswahili is used as the instructional language in classrooms. These findings agree with Makupe and Machaba (2024), who reported that learners prefer familiar languages during mathematics learning activities in classroom settings. The agreement implies that using a familiar language strengthens understanding, accuracy, and confidence when students attempt mathematics test questions. English instruction therefore introduces difficulties that lower performance effectiveness during mathematics assessment situations among learners.

Regarding mathematics problem solving, the findings revealed that respondents disagreed that English improved problem solving, with a mean score of 2.60. The mean score implies that learners associate Kiswahili with stronger ability to solve mathematical problems during classroom learning activities. When aligned with the objective comparing mathematics learning outcomes, learners demonstrated better problem-solving performance under Kiswahili-based instruction. These findings are supported by Le Xiu (2024), who observed improved learner performance when familiar language structures are used in mathematics learning contexts. The agreement suggests that linguistic familiarity improves interpretation of mathematical instructions and enhances accuracy in solution development processes. English instruction tends to reduce clarity in problem interpretation, thereby weakening correctness in mathematical reasoning tasks. Consequently, Kiswahili proves more effective than English in supporting mathematics problem solving.

In examining understanding of classroom examples, the low mean score of 2.72 shows that the respondents disagreed that English improved understanding. This implies that learners understood mathematical examples better when

Kiswahili was used during instruction in classrooms. In relation to the objective comparing mathematics learning outcomes, classroom learning was stronger under Kiswahili instruction. These findings align with Morata (2024), who reported that language preference influences clarity in classroom mathematical communication. The agreement suggests that learners grasp examples more effectively when explanations are delivered in familiar linguistic forms. English instruction complicates interpretation of examples, reducing conceptual clarity during classroom demonstrations. Thus, Kiswahili enhances understanding of classroom examples and improves mathematics learning outcomes.

For confidence during mathematics tests, respondents disagreed that English increased confidence, with a mean score of 2.62. by implication, learners felt more confident when Kiswahili was used during examinations. In relation to the objective comparing mathematics learning outcomes, confidence levels were higher under Kiswahili instruction. These findings are consistent with Sampa and Musonda (2025), who reported that familiar language enhances learner confidence and engagement. The agreement suggests that reducing language barriers lowers anxiety during assessment situations among learners.

Students were then requested to indicate how they thought their performance in mathematics would be if Kiswahili was used as the medium of instruction instead of English. Their responses were quantified and categorized into five performance levels. This was done to establish students' perceived mathematics performance under Kiswahili-based instruction. The responses were converted into percentages for clear presentation, as shown in Figure 1.

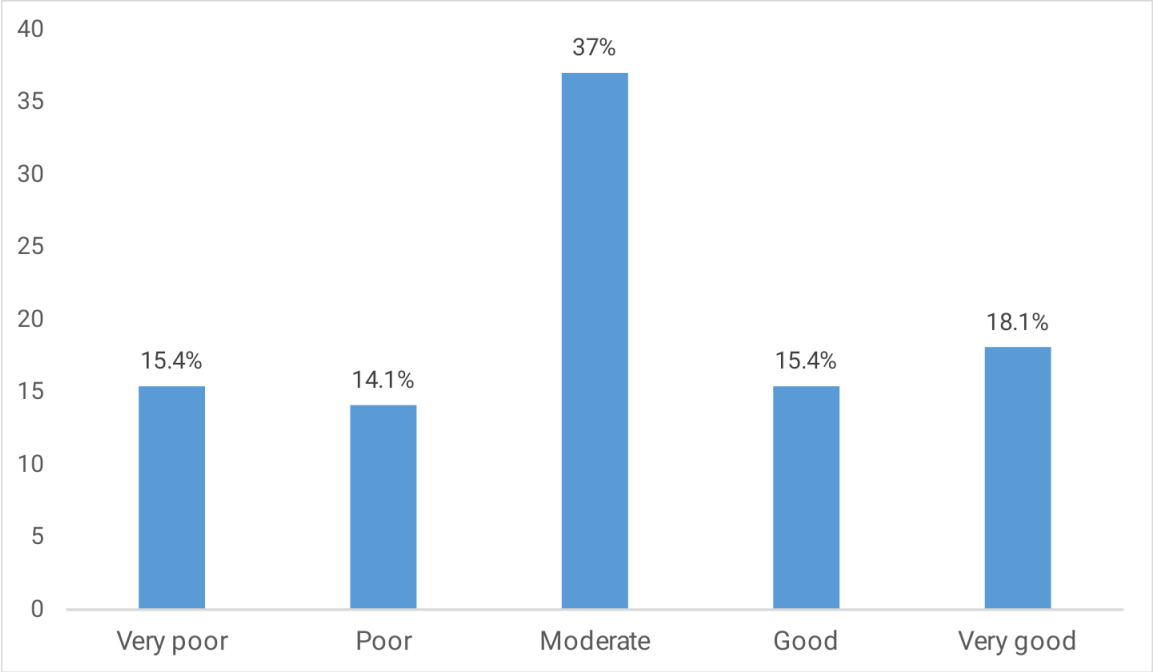

Figure 1: Students' Perceived Mathematics Performance if Kiswahili Was Used as the Medium of Instruction

Source: Field data (2026)

The data show that 18.1% of students expected very good performance if Kiswahili was used in mathematics instruction. This was higher than 15.4% who expected very poor performance under the same language condition. The difference indicates that more students believed Kiswahili could improve rather than weaken their mathematics performance. It also suggests that learners associate Kiswahili with better understanding of mathematical concepts and instructions. These findings agree with Espinas (2022), who reported that language structures influence mathematics performance. Turan (2022), supported by reporting that mathematical language exposure improves conceptual development. The small gap between very good and very poor responses also shows that students' opinions were not completely uniform. Therefore, Kiswahili was viewed positively by more students, although some still doubted its effect on performance.

To determine the difference in students' mathematics performance according to their preferred language of instruction, students were categorized into two groups. The first group included students who preferred Kiswahili as the medium of instruction. The second group included students who preferred English as the medium of instruction. Their corresponding mathematics scores were then compared

using descriptive statistics. The descriptive results are presented in Table 3.

Table 3: Group Statistics for Mathematics Performance by Preferred Language of Instruction

Language Preferred	N	Mean	Std. Deviation	Std. Error Mean
Kiswahili	309	26.2816	14.39184	0.81872
English	67	33.6567	18.10789	2.21223

Source: Field data (2026)

The data in Table 3 show that students who preferred English recorded a higher mathematics mean score of 33.66. This was higher than students who preferred Kiswahili, who obtained a mean score of 26.28 in mathematics performance. Since the official language of instruction for mathematics is English, students who preferred English were more likely to understand test instructions, mathematical terms, and classroom explanations. This implies that their preference aligned with the language used during teaching and assessment. These findings are partly supported by Morata (2024), who argued that language preference can influence clarity in mathematical communication. This is further supported by Le Xiu (2024), who reported that learners perform better when instructional language supports comprehension. Therefore, students who preferred English may have performed better because their language preference matched the instructional and assessment language.

The data further indicate that the English preference group had a standard deviation of 18.11 compared to 14.39 for Kiswahili. This means that mathematics scores among students who preferred English were more spread than those of Kiswahili preference students. The wider variation suggests that English preference included both high and low performing students in mathematics assessment. This finding shows that language preference alone may not fully explain differences in mathematics learning outcomes. These findings agree with Makupe and Machaba (2024), who noted that familiar language supports mathematical engagement. The findings are also consistent with Sampa and Musonda (2025), who observed that language familiarity strengthens learner confidence and task completion. Therefore, although English preference was associated with higher mean performance, Kiswahili may still support understanding for many learners.

To determine whether the observed mean scores between students who preferred Kiswahili and those who preferred English were statistically different, an independent samples t-test was conducted. The test was performed at a 95% confidence level and 0.05 level of significance. This analysis was important because the descriptive statistics showed that students who preferred English had a higher mean score than those who preferred Kiswahili. Therefore, the independent samples t-test helped to establish whether the observed mean difference was statistically significant or occurred by chance. The inferential statistics are presented in Table 4.

Table 4: Independent Samples Test for Mathematics Performance by Preferred Language of Instruction

Mathematics Performance	**Levene's Test F**	**Sig.**	**T**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**
Equal variances assumed	11.26	0.09	-3.621	374	0	-7.37516	2.03686
Equal variances not assumed			-3.127	84.976	0.002	-7.37516	2.35887

Source: Field data (2026)

The data in Table 4 show that Levene's test was significant, $F = 11.26$, $p = 0.001$. This means that the assumption of equal variances between the two language preference groups was not violated. The t-test result showed a significant difference in mathematics performance, $t(84.976) = -3.127$, $p = 0.002$. These findings agree with Morata (2024), who noted that language preference influences clarity in mathematical communication. They are also supported by Le Xiu (2024), who reported that instructional language affects learners' comprehension of mathematical tasks. Therefore, the observed difference in mathematics scores was statistically significant and related to language preference.

The findings further show that the mean difference was -7.38 between students who preferred Kiswahili and those who preferred English. This indicates that students who preferred English performed significantly better than those who preferred Kiswahili. Since mathematics is officially taught and assessed in English, students preferring English may have understood instructions more easily. These findings are consistent with Makupe and Machaba (2024), who found that familiar instructional language improves mathematics engagement. This is further supported by Sampa and Musonda (2025), who reported that language familiarity strengthens confidence and task completion.

4.2 Influence of Language Preference on Mathematics Learning Outcomes

The second objective of this study aimed at determining the extent to which language preference influences students' mathematics learning outcomes in public secondary schools in Moduli District. To address this objective, students were provided with a Likert scale consisting of 10 items reflecting their perceptions of how English versus Kiswahili affects their motivation, participation, accuracy, reasoning, and overall performance in mathematics. They were asked to indicate their level of agreement or disagreement with each statement. Their responses were quantified to generate frequencies and mean scores, as presented in Table 5.

Table 5: Influence of Language Preference on Mathematics Learning Outcomes (n=376)

Statements	SA		A		N		D		SD		M
	f	%	f	%	f	%	F	%	f	%	
My mathematics outcomes improve when lessons are in English than in Kiswahili	47	12.5	65	17.3	41	10.9	113	30.1	110	29.3	2.54
I understand new mathematics topics faster in English than in Kiswahili	35	9.3	73	19.4	44	11.7	112	29.8	112	29.8	2.49
I feel motivated to learn mathematics in English than in Kiswahili	36	9.6	67	17.8	66	17.6	112	29.8	95	25.3	2.57
I participate more in mathematics activities in English than in Kiswahili	47	12.5	61	16.2	54	14.4	110	29.3	104	27.7	2.57
I complete mathematics tasks more accurately in English than in Kiswahili	52	13.8	61	16.2	53	14.1	103	27.4	107	28.5	2.60
I understand mathematical reasoning better in English than in Kiswahili	38	10.1	56	14.9	57	15.2	116	30.9	109	29.0	2.46
I explain mathematics solutions better in English than in Kiswahili	41	10.9	64	17.0	51	13.6	119	31.6	101	26.9	2.53
I learn new mathematics concepts more easily in English than in Kiswahili	46	12.2	66	17.6	46	12.2	110	29.3	108	28.7	2.55
I solve complex mathematics problems better in English than in Kiswahili	45	12.0	57	15.2	53	14.1	107	28.5	114	30.3	2.50
Language preference influences my mathematics performance in English than in Kiswahili	36	9.6	55	14.6	55	14.6	114	30.3	116	30.9	2.42

Source: Field data (2026)

A strong pattern emerging from responses indicates disagreement that English improves mathematics outcomes among secondary school students in Monduli District. The mean score of 2.54 implies learners generally perceive

Kiswahili as more supportive for mathematics achievement improvement processes. Most respondents selected disagreement options, showing stronger understanding of mathematical content when Kiswahili is applied during instruction sessions. These findings agree with Espinas (2022) who reported language structures strongly influence mathematics performance across learning environments. The agreement implies that familiarity with instructional language strengthens confidence, engagement, and problem-solving ability during mathematical learning activities. English terminology appears to introduce interpretation challenges that reduce effective understanding of mathematical concepts during classroom instruction sessions. Therefore, language preference significantly determines mathematics achievement outcomes across learning contexts.

When examining speed of learning, respondents indicated disagreement that English helps students understand new mathematics topics faster than Kiswahili instruction. The mean score of 2.49 implies learners achieve better conceptual understanding when Kiswahili is applied during teaching processes. Majority responses clustered around disagreement, suggesting slower understanding when English is used for introducing new mathematical concepts. These findings are supported by Turan (2022) who found mathematical language exposure improves conceptual development and learning outcomes significantly. The agreement implies familiarity with instructional language enables faster interpretation and smoother internalization of mathematical ideas among learners. English instruction often requires repeated clarification, which slows cognitive processing of new mathematical knowledge during classroom teaching sessions. Consequently, language preference strongly determines the pace of mathematics concept acquisition.

Respondents disagreed that English has stronger influence on mathematics achievement than Kiswahili instruction methods. The mean score of 2.42 implies Kiswahili is perceived as more effective for improving overall mathematics performance outcomes. A majority selected disagreement response, indicating limited effectiveness of English instruction in enhancing academic achievement levels. These findings agree with Makupe and Machaba (2024) who linked language preference with mathematics achievement outcomes. The agreement implies effective learning occurs when instructional language aligns with learners' linguistic and communication backgrounds.

Students were further asked to indicate the extent to which the use of English as the language of instruction influenced their mathematics achievement. Their responses were quantified and classified into five levels, ranging from very low to very high extent. This was done to determine students' perceptions of how English influenced their understanding, problem-solving and performance in mathematics. The responses were converted into percentages for clear presentation, as shown in Figure 2.

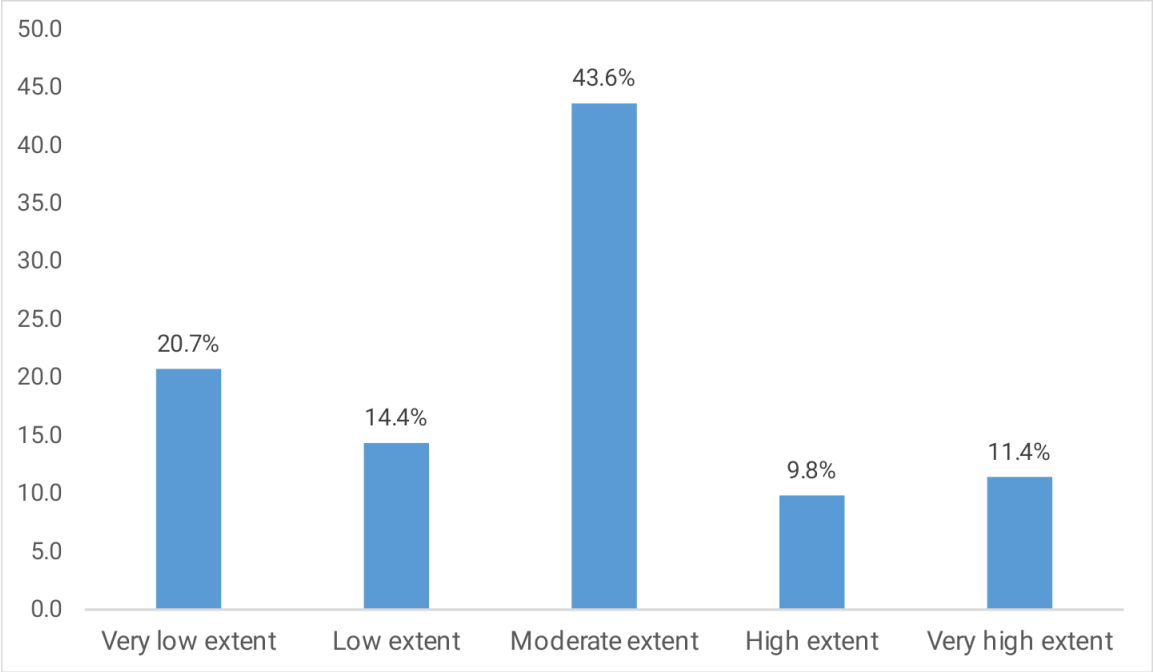

Figure 2: The Extent to Which English Language of Instruction Influences Mathematics Achievement
Source: Field data (2026)

The data in Figure 2 show that most students reported a moderate extent at 43.6%. This indicates that many learners felt English influenced mathematics achievement, but not at a strong level. The results also show that 20.7% reported a

very low extent, while 14.4% reported a low extent. This suggests that a considerable proportion of students felt English had limited influence on their mathematics achievement. These findings agree with Espinas (2022), who reported that language structures affect mathematics performance across learning contexts.

To determine the influence of language preference on mathematics achievement outcomes, a simple linear regression was conducted. The analysis was performed at a 95% confidence level and 0.05 level of significance. This analysis helped to establish the extent to which language preference accounted for variation in students' mathematics achievement. It was also useful in showing how strongly language preference contributed to differences in mathematics performance among learners. The results of the model summary are presented in Table 6.

Table 6: Model Summary for the Influence of Language Preference on Mathematics Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.525	0.276	0.274	13.08714

Source: Field data (2026)

The Results in Table 6 show that the R Square value was 0.276. This means that language preference accounted for 27.6% of the variation in students' mathematics achievement. The value indicates that language preference made a meaningful contribution to differences in mathematics performance among learners. It also means that 72.4% of the variation was explained by other factors beyond language preference. These findings agree with Espinas (2022), who reported that language structures influence mathematics performance across learning environments. The findings are also supported by Turan (2022), who observed that mathematical language exposure improves conceptual development and learning outcomes. Therefore, the R Square value confirms that language preference is an important predictor of mathematics achievement, although it does not explain performance alone.

To determine whether the regression model was statistically fit for explaining mathematics performance through language preference, ANOVA was conducted. The analysis examined whether language preference provided a meaningful explanation of variation in mathematics achievement among secondary school students. This was important because the model summary had shown the proportion of variation explained by language preference. Therefore, ANOVA was used to test whether the overall regression model was useful in predicting mathematics performance. The results are presented in Table 7.

Table 7: ANOVA for Language Preference and Mathematics Performance

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	24374.37	1	24374.37	142.313	0.000
Residual	64056.18	374	171.273		
Total	88430.55	375			

Source: Field data (2026)

The dara in Table 7 show that the regression model was statistically significant, $F(1, 374) = 142.313$, $p = 0.000$. This means that language preference provided a meaningful explanation of students' mathematics performance. The regression sum of squares was 24374.374, showing the amount of variation explained by language preference. The residual sum of squares was 64056.179, indicating that other factors also contributed to mathematics performance. These findings agree with Espinas (2022), who reported that language structures influence mathematics performance across learning environments. They are also supported by Turan (2022), who observed that mathematical language exposure improves conceptual development and achievement outcomes. Therefore, the significant ANOVA result confirms that language preference is a useful predictor of mathematics performance.

The findings further imply that students' mathematics performance cannot be separated from the language used in learning and assessment. Since the model was significant, language preference had an important role in explaining differences in mathematics achievement. This suggests that students who preferred a language aligned with instruction and assessment could perform better in mathematics tasks. These findings are consistent with Otieno & Saiteu (2023) who found that familiar language improves subject engagement and communication.

To determine how much students' mathematics performance changed for each unit increase in the predictor, regression coefficients were examined. This was important because it showed the size and direction of change in mathematics performance. The analysis was done by interpreting the unstandardized coefficient, standard error, standardized beta, t-value, and significance value as presented in Table 7.

Table 8: Regression Coefficients for Mathematics Performance

Model	Predictor	B	Std. Error	Beta	t	Sig.
1	Constant	6.733	1.875		3.592	0.00
1	Language preference	7.891	0.661	0.525	11.929	0.00

Source: Field data (2026)

The data in Table 8 show that the unstandardized coefficient for the predictor was 7.891. This implies that increasing language preference by one-unit increased students' mathematics performance by 7.891 units. The implication is that increasing learners' alignment with the language used in instruction and assessment improves mathematics achievement. In classroom terms, learners performed better when the language condition supported understanding, interpretation, and assessment demands. These findings agree with Subandiyah et al. (2025), who found that responsive instructional language improves learner participation and classroom engagement. Therefore, strengthening language support can improve mathematics performance among secondary school students.

Further findings show that the standardized beta value was 0.525, with $t = 11.929$ and $p = 0.000$. This indicates that the predictor made a strong and statistically meaningful contribution to mathematics performance. The beta value shows that its influence was not weak when compared with the outcome variable. The result suggests that mathematics achievement was closely linked to how learners related to the language used in learning and assessment. These findings are consistent with Espinas (2022), who observed that language structures affect mathematics performance across learning environments.

5. Conclusion and Recommendations

5.1 Conclusion

Based on the study findings, the following conclusions were made.

The studyconcludes that language preference and measured mathematics achievement do not follow the same pattern. Although most students preferred Kiswahili, students who preferred English obtained significantly higher recorded mathematics scores. This occurred because mathematics teaching, textbooks, terminology and examinations were mainly presented in English. Students whose preference aligned with the official instructional and assessment language were therefore better positioned to demonstrate their mathematical knowledge. Consequently, lower scores among Kiswahili-preferring students may partly reflect language barriers rather than mathematics ability alone.

The study also concludes that language of instruction preference is an important predictor of mathematics achievement. It explained more than one quarter of the observed variation in mathematics scores and produced a statistically significant regression model. Language preference therefore affects students' access to instructions, concepts, word problems and assessment tasks. Nevertheless, language preference cannot independently explain mathematics performance because most score variation was associated with other educational, individual and contextual factors. Improving achievement requires both language support and attention to teaching quality, learning resources, student preparation and school conditions.

In answering the research questions, Kiswahili was the language most students preferred for learning mathematics, while English-preferring students achieved higher examination scores. Language preference significantly influenced mathematics achievement because performance improved when students were comfortable with the language used during teaching and assessment. The central conclusion is that the mismatch between students' preferred language and the official language of instruction creates a learning and assessment disadvantage. Mathematics education should therefore strengthen students' academic English while strategically using Kiswahili to support conceptual understanding.

5.2 Recommendations

Based on the conclusion, the study recommended the following:

1. The Ministry of education, science and technology should strengthen the transition from Kiswahili-medium primary education to English-medium secondary education. Bridging programmes should teach academic English, mathematical vocabulary and interpretation of mathematics questions before students encounter advanced secondary content.
2. Curriculum developers should prepare approved bilingual mathematics glossaries and supplementary materials. These resources should present mathematical terms in English together with clear Kiswahili explanations to support understanding without removing exposure to examination language.
3. Mathematics teachers should explicitly teach the language of mathematics, including command words, technical vocabulary, symbols and common sentence structures used in word problems. Students should practice translating verbal information into mathematical expressions.

4. Teachers should create opportunities for students to discuss solutions, ask questions and explain their reasoning using accessible language. They should then guide students to express the same reasoning accurately in English. While students should be encouraged to strengthen academic English while continuing to use Kiswahili as a resource for understanding mathematical concepts. They should practice mathematics vocabulary, word problems and written explanations regularly.

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