Novelty Journals

ISSN 2394-9686

International Journal of Novel Research in Education and Learning
Vol. 9, Issue 1, pp: (26-38), Month: January - February 2022, Available at: www.noveltyjournals.com

The Impact of Using Mother Tongue as Instructional Language in Teaching and Learning of Mathematics in Rural Primary Schools (A Case Study of four selected Schools in Sefwi Akontombra District, Ghana)

[1]Abraham Karikari, [2] Emmanuel Opoku Kumi, [3] Ellen Afia Achiaa, [4] Juliet Adu

[1]School of Management, Jiangsu University, Zhenjiang, P. R. China
[2]University of Tasmania, Australia
[3]Ghana Education Service, Ghana
[4]University of Electronic Science and Technology of China

Author Email: *[1]karikariabraham88@gmail.com, [2]opokukumiemmanuel@gmail.com, [3]afiachiaaellen@gmail.com, [4]goodwillslowcj@gmail.com*

Abstract: **Unsatisfactory performance of mathematics at all levels in Ghana's schools has been a source of concern to stakeholders in the education sector. This is because mathematics is one of the compulsory subjects that one must pass to progress to the next level. The problem is worse in the rural areas where schools encounter many challenges including a low fluency level of English which serves as the only medium of instruction from primary four upwards. Teaching primary schools mathematics using the mother tongue of the pupils enables active participation which is extremely important for building knowledge. This stems from the fact that primary school children in rural areas of Ghana can communicate effectively in their mother tongue. Ghana Education Service language of instruction policy which does not allow mother tongue usage in upper primary schools is doing more harm than good in the teaching and learning of mathematics in rural areas of Ghana. This study examined the impact of mother tongue as the language of instruction and pupils' achievement in mathematics in rural upper primary classes in Sefwi Akontombra District of Ghana.**

The correlational study conducted indicated that there is a positive relationship between mother tongues usage as a medium of instruction and mathematics achievement at [$\beta = 0.92$; $p = 0.00$]. Also, Mother tongue utilization impacts positively on effective communication at [$\beta = 0.88$; $p=0.00$]. A quasi-experiment was also conducted in three classes in an attempt to confirm the claims by the teachers who were respondents for the correlational study. The controlled group (A) was taught in only English as required by the Ghana Education Service language of instruction policy whereas the experimental group (B) was instructed in mother tongue (Twi). The mean scores were as follows: Primary 4, A=3.33, and B=8.2, Primary 5, A=2.00 and B=8.00 and Primary 6, A=2.36 and B=7.18. Both studies revealed beyond doubt that the impact of using mother tongue as a medium of instruction in rural upper primary classes is substantially positive on mathematics achievement. It is therefore imperative for policymakers to take a second look at the language of instruction policy and make it flexible for teachers to use pupils' mother in teaching and learning of mathematics in rural upper primary classes to boost mathematics performance and build a stronger foundation of the subject in the pupils.

Keywords: **mother tongue, language of instruction, mathematics achievement, effective communication.**

International Journal of Novel Research in Education and Learning
Vol. 9, Issue 1, pp: (26-38), Month: January - February 2022, Available at: www.noveltyjournals.com

1. INTRODUCTION

Imagine being taught mathematics in a language you do not understand at the upper primary school level. You would certainly be confused, bored, and have no interest in the subject. This is the exact challenge confronting pupils in upper primary schools in rural areas of Ghana. The current policy on language of instruction (LOI) states that the medium of instruction from Kindergarten to Lower Primary should be Ghanaian Language (L1) and English (L2), but English should be the only medium of instruction from Primary four and beyond (Ansah, 2014). This means that teachers must teach mathematics at all levels starting from primary four using the English language as the sole medium of instruction. The situation has created a huge obstacle to the teaching and learning of mathematics in rural primary schools due to the low level of English language fluency in these communities. Recent research has demonstrated that a mismatch between the language of instruction and the language that students speak and understand best can hamper effective teaching and learning (Jiang, Zhang, & May, 2019). Thus, it is critical to understand the language of instruction policy and linguistic context of a country when trying to improve learning outcomes in the early grades, as this can be a potential barrier to gains in pupils' achievement (Tackie-Ofosu, Mahama, Vandyck, Kumador, & Toku, 2015).

Available literature indicates that the use of mother tongue in the teaching of mathematics in primary schools enhances pupils' achievement. According to (Matang, 2003), to gain interest in mathematics and make meaning out of what children are learning, their culture needs to be embedded in mathematics. Mother tongue is a major aspect of a child’s culture and therefore cannot easily be ignored if good results are expected. According to (Oginni Omoniyi & Owolabi Olabode, 2013), children understand mathematics better when they are taught using their mother tongue. Learning using mother tongue also helps to develop mathematical vocabularies that could be easily used and remembered by students. Niesche (2009), sees the need to embed children's culture in teaching mathematics. From his research in Western Australia, he found out that children performed better when the native language (Kriol) was used instead of English to teach mathematics to the children. He realized that using children's mother tongue in teaching mathematics can become a powerful tool for learning mathematics. Few studies from poor countries have looked at the influence of numeracy programs in elementary school (Piper, Zuilkowski, Dubeck, Jepkemei, & King, 2018) , and even fewer have looked at the impact of mother-tongue programs on mathematics learning outcomes.

In Ghana, pupils' mathematics performance in rural schools is low and decreases annually (Bariham, Saviour, Edmond, & Social Scinces, 2017). However, due to a long history of focusing on urban schools in Ghana, policymakers do not rely on empirical research to develop teaching strategies in remote schools (Acheampong, Gyasi, & Training, 2019; Atherton & Kingdon, 2010). The LOI policy in Ghana assumes that by the time a child is in primary four he/she would be fluent enough in the English Language but that is true for pupils in urban schools and not rural primary schools where even Junior High School children find it extremely difficult to express themselves in the English. This study aims to determine the impact of L1 as a medium of instruction on mathematics achievement in rural upper primary pupils in Ghana. The study would also seek to discover the challenges confronting teaching and learning mathematics in rural primary schools using mother tongue.

Problem Statement

The instructional language policy in upper primary schools’ mandates that teaching and learning of mathematics should be solely in English but the majority of pupils in the rural parts of Ghana are not fluent in the second language. This is having a devastating effect on the pupils’ achievement and many are calling on the government to make the policy flexible as in lower primary where teachers are at liberty to use either L1, L2, or both depending on the fluency level of the pupils.

Objectives

(1) To reveal the challenges involved when using L1 as a language of instruction in mathematics in rural primary schools.

(2) To discover the relationship of L1 as instructional language and mathematics achievement of rural upper primary school pupils.

(3) To examine the relationship between using L1 as instructional language and effective communication during mathematics lessons of rural upper primary schools’ pupils.

Significance of the study

The outcome and recommendations of the study would help Ghana Government to make instructional language policies to improve teaching and learning of mathematics, especially in remote areas primary schools. The policy would be based on the fluency level of the pupils in L2 and not generalize. The outcome of the study would add up to the existing knowledge on the topic. The study would also serve as reference material for researchers interested in similar topics globally.

2. LITERATURE REVIEW

Njoroge (2017) investigated the usefulness of Mother Language in the teaching of mathematics and science in Kenyan elementary schools. In primary school grades 4,5 and 6, an experimental testing approach was implemented. Class one was designated as the experimental group, whereas class two was designated as the regulated group. The experimental group received training in their original language (L1), while the control group received instruction in English (L2). Pre-test and post-tests were conducted for mathematics and science. Elementary students who were immersed in a learning scenario in which their mother tongue (first language) was used showed significant improvements in their classroom performance as compared to those who were exclusively learning in English. Njoroge went on to say that learning in one's native tongue aids in the development of mathematical vocabulary that is easy to recall. In the context of LOI and mathematics achievement, (Moschkovich, 2002) claimed that a learner's first language can be used as a resource to help them communicate numerically. Furthermore, he stated that the capacity to communicate is critical to studying mathematics in school. The languages of children and the languages of education must be connected. Also, most research on mathematics instruction that has looked at multilingual classrooms supports the use of L1in primary schools (Setati, 2008). Despite research-based support for the use of L1 in teaching subjects like mathematics and other curriculum areas, the preference for English as a medium of instruction remains strong among parents, students, and the entire educational institution.

According to (Elliott & Paton, 2018), mathematics and science might be taught directly in the mother tongue. Using a familiar grammatical structure and terminology, for example, is likely to improve student comprehension of new content (Clegg & Simpson, 2016). In Cambodia,(Lee, Watt, & Frawley, 2015) looked at the benefits of a bilingual program on learning outcomes in Khmer (the second language) and mathematics in a group of bilingual schools versus other schools that solely taught in Khmer. The findings of the Early Grade Reading Assessment (EGRA) found no statistically significant effects on literacy in Khmer, however other measures revealed effects on mathematics learning. Even though the study did not specify whether the treatment groups were chosen at random or assigned at random, and the treatment group was limited to 50 schools, this is the best evidence in the published literature that a mother-tongue program can have an impact on other subjects.

Vygotsky & Cole (1978) work heavily impacted social constructivism, which proposed that knowledge is first formed in a social environment and then taken up by people (Eggen, Kauchak, & Garry, 2007). Vygotsky claimed that in social constructivism interactions, teachers actively assist the learner in developing his or her understanding of the topic. The value of a child's mother language is emphasized, as it aids in mental development and the application of cultural ideas to improve performance. The importance of language in the process of creating mathematical knowledge in the classroom has long been recognized (Gorgorió & Planas, 2001). These indigenous children will need to be able to negotiate the foundational and linguistic assumptions that drive classroom mathematics to improve their educational outcomes and performance. In addition, they need to be able to fully participate and engage in other aspects of the project, such as group work, intellectually challenging tasks, and reporting back. All of these activities place an enormous strain on the students' capacity to fully engage with these aspects of classroom learning. Cognitive development stems from social interactions from guided learning within the zone of proximal development as children and their partners co-construct knowledge. This implies that the improvement of the pupils' performance is very noticeable from their entry to exit and that in the teaching of Mathematics it is vital to use the mother tongue-based. When pupils' local language is used in the classroom, they understand the concepts of the lessons better (Effiong, 2013). This means that learners' culture must be embedded in the teaching of mathematics for the learners to increase their interest in the subject and make learning more meaningful. According to (Stößlein & Changchun, 2009), vital constructivist learning principles in learning is an active process and student needs input. The local knowledge for teaching in terms of using local resources may support, engaging students in meaningful tasks and activities making lessons interesting and cognitively graspable by the students (Acharya, Kshetree, Khanal, Panthi, & Belbase, 2021). Findings from a study conducted by (Ercikan et al., 2015) in Australia, Canada, the United Kingdom, and the United States specified an established interdependence between language mastery and attainment in mathematics

According to (Owu-Ewie, 2006) as an alternative to the English-only policy, he proposed late-exit transitional bilingual education as a modification to all English language policy in 2002. The transitional bilingual education (TBE) program proposed is based on the late-exit TBE model (Ramirez & Merino, 1990). Late-exit transitional bilingual education according to the authors allows for about forty percent (40%) use of the mother tongue in teaching and learning until the sixth year (Grade 6) of schooling. In the Ghanaian context, this means the mother tongue will be used as the medium of instruction from Primary 1 to Primary 4 while English is gradually introduced into the system as the medium of instruction from Primary 5 and finally becomes the medium of instruction from Primary 6 and above. The TBE model recommends that mathematics and integrated science are taught in the L1 until primary five because they are mainly abstract and need a familiar language for learners to understand and appreciate their value.

Table 1: Transitional Bilingual Education (Owu-Ewie, 2006)

Class	Ghanaian Language	English Language
Primary 1-4	All Core Subjects	English language
Primary 5	Ghanaian language and culture, Music and Dance, and Integrated Science, Mathematics	English language, P.E., Environmental studies, Religious/ Moral Education
Primary 6	Ghanaian language and culture, Music and Dance	English language, P.E., Environmental studies, Religious/ Moral Education, Integrated Science, Mathematics
Junior High 1,2 &3	Ghanaian language and culture, Second Ghanaian language	All Core Subjects

The above model in Table 1 is expected to bridge the gap between the home and the school to help children overcome initial social adjustment problems in school, make learners literate in both languages (Ghanaian language and English), give learners the needed exposure in the L1 to make them "balanced bilinguals" so that they can develop cognitively and academically and transfer the language skills acquired in the L1 to L2 and Make learners appreciate their culture so that they can understand and appreciate the culture of the L2 (Owu-Ewie, 2006).

In a study to find out the impact of mother-tongue based instruction in the Philippines, one of the researchers who is a teacher handling mathematics in grade two, was required to teach the subject using the L1 of the pupils, which is Tagalog. She noticed that children were seemingly interested in the subject but found difficulties in translating English terms to Tagalog (Keshavarz & Astaneh, 2004). She also encountered problems in finding instructional materials written in her mother tongue. This means that the usage of L1 in the teachings and learning of mathematics has a few bottlenecks but the enormous evidence provided in the literature clears all doubt that the benefits are huge.

3. METHODOLOGY

Two types of research namely correlational and quasi-experimental study are employed. A correlational study aims to determine whether a variable (independent) impacts another variable (s) (independent) and causes a change in the latter or not. Participants for the correlational study were selected based on a convenience sampling technique. Primary data was collected with a questionnaire that was distributed among 38 upper primary class teachers in the Sefwi Akontombra District. The questionnaire was made up of the demographics of respondents, the challenges teachers encounter when teaching mathematics in L1, and measures of the variables (instruction in L1, mathematics achievement, and effective communication). A 5-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree) was used to determine the extent of a participant's agreement to a statement relative to a particular variable in section. The reliability of the variables was 0.91,0.87 and 0.95 Cronbach's Alpha for L1 as a medium of instruction, effective communication, and mathematics achievement respectively.

This study used Kaiser–Meyer–Olkin (KMO) and Bartlett's test to measure sampling adequacy and ensure data suitability and construct validity). The value of the test was 0.80, which is over the acceptable 0.5 thresholds and at a significance level of 0.00. To confirm the strength of the items, a measuring model was created based on the factor pattern generated using the SPSS AMOS 23 pattern matrix model builder. The results obtained from this action indicate that the observed goodness of fit indices was CMIN/DF= 1.833 (1 to 3) (Awang, 2012), TLI= 0.971 (>0.90) (Diamantopoulos, Siguaw, & Siguaw, 2000), CFI=.985 (>0.90) (Gaskin, 2016) and RMSEA= 0.053 (< 0.08) (Hair, Black, Babin, Anderson, & Tatham, 2006). Also, according to (Hair et al., 2006) data is fit for the SEM if all the factor loadings of the measures are equal to or more than 0.6, this criterion again makes all the items fit for the model. The relationship between the three variables (use of L1, effective communication, and mathematics achievement) was computed using SPSS Amos.

Also, a quasi-experimental study using pretest-posttest homogenous group design was conducted in three classes of Bonwire D/A Primary School. The control group was exposed to mathematics instruction in English (L2) only, and the experimental group was exposed to instruction in Twi (L1) only. A teacher-made test was utilized to measure the students' achievement in mathematics at both pre-test and post-test levels. The pre-test instruments were also made by the teachers on topics that were previously taught solely in English as demanded by the language policy. The lessons for the experiment covered topics such as numbers, Algebra, and Data. Pupils' answers were classified as: 1-2 (very low), 3-4 (low), 5-6 (average), 7-8 (high), and 9-10 (very high) based on the scale of (Launio, 2015).The data obtained from the pre-test and the post-test results of each group were analyzed using SPSS version 23 with the Independent T-test technique.

Anonymity, confidentiality, and privacy of all respondents were observed in the conduct of this research. All participants were informed about the motive of the study before data was collected.

4. RESULT AND DISCUSSION

A total of 38 teachers responded to the questionnaire for the correlational study and 62 pupils for the Quasi-Experiment. There were 24 male and 14 female teachers as well as 41 and 21 pupils for boys and girls respectively. A total of 19 teachers were below 30 years, 15 were from 30 to 40 years whereas 4 were more than 40 years. None of the teachers were WASSCE holders, there were 5 diploma holders, 30 bachelor holders, and 3 graduate teachers.

Mother tongue as Language of Instruction, mathematics achievement and effective communication

The standardized covariance estimate(β) between L1 as the language of instruction and mathematics achievement is 0.92 which is highly significant(p) at 0.00. This means an increase in the use of mother tongue as LOI in mathematics by one unit leads to a 0.92 increase in achievement. It indicates that there is a very strong and positive relationship between L1 as LOI and mathematics achievement in rural upper primary classes. The result supports the evidence provided by (Effiong, 2013; Ercikan et al., 2015; Matang, 2003; Niesche, 2009) that L1 as LOI improves pupils' achievement in mathematics. It is extremely important to note that if a child does not understand the LOI it promotes low or no interest in what is being taught. Active participation of children in mathematics lessons helps to enhance understanding leading to highly improved scores in the various test. When the children get a better understanding, they can complete their homework with limited or no assistance. This is very important as most of the parents in these rural areas are mainly cocoa farmers who have either not attended school before or have no knowledge of the current curriculum to help their kids. The teacher must therefore adopt practices that would enhance a better understanding of the subject.

The relationship between L1 as LOI and effective communication is (β= 0.88) with (p=0.0). This confirms the assertion by (Moschkovich, 2002) that during the teaching and learning process, effective communication can never be sacrificed if high performance is to be achieved. The input of pupils in mathematics lessons is crucial for better knowledge building, better understanding, and easy recall. Thus children should be active participants of the teaching-learning process in mathematics to achieve the desired outcome (Stößlein & Changchun, 2009; Vygotsky & Cole, 1978). Pupils can ask questions and give answers confidently when they are fluent in the LOI. Asking questions helps to clarify the doubts of children during lessons. Giving oral answers enable the teacher to have initial feedback on the level of pupils' understanding. Effective communication also enhances peer teaching and group teaching. When children are taught in their mother tongue which they are more fluent in, they can share ideas among themselves and also explain concepts to each other with ease.

Effective verbal communication helps in building a strong teacher-student relationship which acts as a platform for strong cognitive development. Easy and effective verbal communication helps the teachers to get an insight into the child's thoughts whereas the students get knowledge of the teacher's expectations. This open environment lays a strong foundation for a healthy classroom environment based on mutual trust and respect (Rawat, 2016). Wigforss (1999) contends that human communication plays an important role in how you develop an intellectual mind.

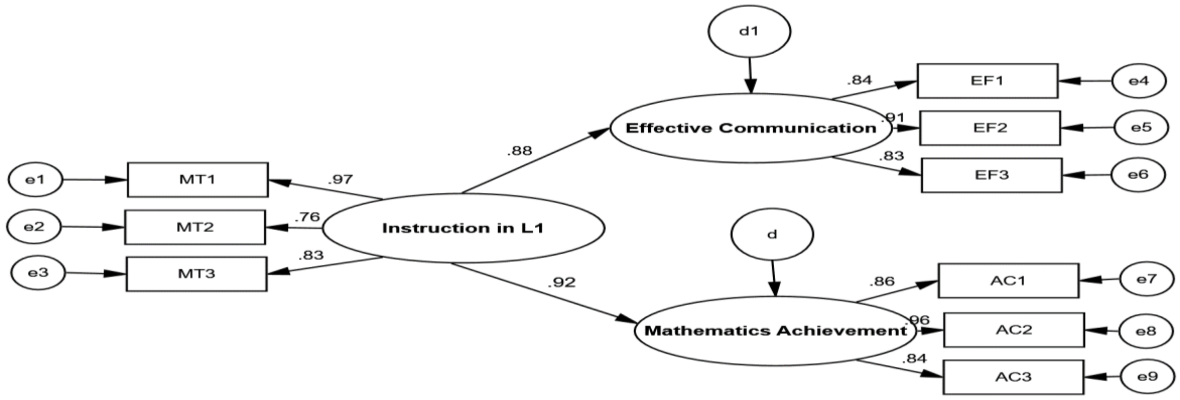

Figure 1: Structural Equation Modelling.

Pre-Test

The independent T-Test was performed to compare the mean of the scores of the controlled and the experimental groups at the pre-test and post-test levels. The mean scores of both groups were all low in Primary 4 and very low in Primary 5 as well as Primary 6. The mean scores of P4 (A= 3.8, B=3.7), P5=(A=2.4,2.2), and P6(A=1.9, B=2.0) which is in line with (Njoroge,2017) who posits that pupils underperform when mathematics and science are taught in L2 at the elementary school level. The result also indicated there was no significant difference between the mean scores of both groups in all the three classes because all the significant levels were above the critical level of 0.01. The significance level of P4, P5, and P6 was .408,.407, and .550 respectively. This attests that when both groups are taught in L2, there would not be a significant difference between their mean scores. Levene's test indicates that the variances are equal and insignificant (p> .01) across the groups thereby establishing the homogeneity of both groups which is important to avoid bias in sampling.

Table 2: Independent T-Test (Pre-Test)

Class	Group	N	Mean	Std. Deviation	Std. Error Mean	t	Sig. (P)
Primary 4	A	9	3.7778	.97183	.32394	.849	.408
	B	10	3.4000	.96609	.30551		
Primary 5	A	11	2.3636	1.36182	.41060	-.173	.407
	B	10	2.2000	.91894	.29059		
Primary 6	A	11	1.9091	.70065	.21125	-.609	.550
	B	11	2.0909	.70065	.21125		

International Journal of Novel Research in Education and Learning
Vol. 9, Issue 1, pp: (26-38), Month: January - February 2022, Available at: www.noveltyjournals.com

Post-Test

Table 3 indicates that the mean score of the Primary 4 controlled group (A) is 3.33 which is low but the experimental group (B) who were taught in only L1 recorded a mean score of 8.20 which is high. This confirms the response by the teachers that L1 as LOI in mathematics in rural primary schools enhances achievement. The standard deviations for both groups were almost the same hence it is confirmed that both groups were chosen from the same population.

Table 3: Group Statistics

Class	Group	N	Mean	Std. Deviation	Std. Error Mean
Primary 4	A	9	3.3333	1.00000	.33333
	B	10	8.2000	1.13529	.35901

Table 4 indicates that Levene's Test for Equality of Variances for Primary 4 indicates an F value of .058 which is insignificant at p=.812 establishing that the test of homogeneity of variance of assumption is held. This points to the fact that the two groups were sampled from the same population hence having confidence in the t and p values. The independent sample test table for Primary 4 again demonstrates that there is a statistically significant relationship between the two means of the two groups at t= -9.864 and p=0.00. This result again gives the 95% confidence interval of the mean difference as -4.86667 between -5.90755(lower) and -3.82578 (upper). This indicates that regardless of the level of increase or decrease in the mean scores of any group, there is 95% confidence that there would be a statistically significant difference between the groups. This is because, on a scale of 1 to 10, a difference of 5.90755(lower) and -3.82578 (upper) are never negligible.

Table 4: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Primary 4	Equal variances assumed	.058	.812	-9.864	17	.00	-4.86667	.49335	-5.90755	-3.82578
	Equal variances not assumed			-9.934	16.996	.00	-4.86667	.48990	-5.90028	-3.83305

Table 5 shows that the average score of the Primary 5 controlled group (A) is 2.00 which is low but the experimental group (B) who were taught in only L1 recorded a mean score of 8.00 which is high. This confirms the response by the teachers that L1 as LOI in mathematics in rural primary schools enhances achievement. The standard deviations for both groups were almost the same hence it is confirmed that both groups were chosen from the same population.

Table 5: Group Statistics

Class	Group	N	Mean	Std. Deviation	Std. Error Mean
Primary 5	A	11	2.0000	.77460	.23355
	B	10	8.0000	1.15470	.36515

From Table 6 Equal variance assumed results are reported because Levene's Test for Equality of Variances indicates an F value of .774 which is insignificant at p=.390 indicating that the test of homogeneity of variance of assumption is held. This shows that the two groups were sampled from the same population hence having confidence in the t and p values. Again, the output shows that there is a statistically significant relationship between the two means of the two groups at t= -14.108 and p=0.00. This result again gives the 95% confidence interval of the mean difference -6.00000 between -6.89012 (lower) and -5.10988 (upper). This indicates regardless of the level of increase or increase in the mean scores of any group, there is 95% confidence that there would be a statistically significant difference between the groups. This is because, on a scale of 1 to 10, a difference of -6.89012 (lower) and -5.10988 (upper) are never negligible.

Table 6: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Primary 5	Equal variances assumed	.774	.390	-14.108	19	.000	-6.00000	.42528	-6.89012	-5.10988
	Equal variances not assumed			-13.842	15.531	.000	-6.00000	.43345	-6.92113	-5.07887

Table 7 shows that the mean score of the Primary 6 controlled group (A) is 3.33 which is low but the experimental group (B) who were taught in only L1 recorded a mean score of 8.20 which was high. This confirms the response by the teachers that L1 as LOI in mathematics in rural primary schools enhances achievement. The standard deviations for both groups were almost the same hence it is confirmed that both groups were chosen from the same population.

Table 7: Group Statistics

Class	Group	N	Mean	Std. Deviation	Std. Error Mean
Primary 6	A	11	2.3636	.80904	.24393
	B	11	7.1818	1.07872	.32525

From Table 8, Levene's Test for Equality of Variances gives an F value of 2.075 which is insignificant at p= .165 indicating that the test of homogeneity of variance of assumption is not violated. The independent sample test table for Primary 6 again demonstrates that there is a statistically significant relationship between the two means of the two groups at t= -11.851 and p=0.00. This result again gives the 95% confidence interval the mean difference -4.86667 between-5.66625 (lower) and -3.97012 (upper). his indicates regardless of the level of increase or increase in the mean scores of any group, there is 95% confidence that there would be a statistically significant difference between the groups. This is because, on a scale of 1 to 10, a difference of -5.66625 (lower) and -3.97012 (upper) are never negligible.

International Journal of Novel Research in Education and Learning
Vol. 9, Issue 1, pp: (26-38), Month: January - February 2022, Available at: www.noveltyjournals.com

Table 8: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference: Lower	Upper
Primary 6	Equal variances assumed	2.075	.165	-11.851	20	.000	-4.81818	.40656	-5.66625	-3.97012
	Equal variances not assumed			-11.851	18.546	.000	-4.81818	.40656	-5.67053	-3.96583

Challenges of teaching mathematics in L1

It is important to note that the many advantages of the use of L1 in teaching mathematics do not mean teachers do not go through challenges when adopting the practice. There are a few challenges that need to be addressed to fully benefit from the utilization of L1 in the teaching and learning of mathematics. Table 9 shows that 12 teachers representing 31.6% of the respondents stated that lack of adequate vocabulary was a major hindrance in the use of L1 in teaching mathematics. Teachers find it difficult to get exact vocabulary for the mathematical words which are written in the English Language therefore becomes hard to translate from English to Twi. In a study in the Philippines, (Lartec et al., 2014) identified the lack of adequate vocabulary in the mother tongue for translation as a major obstacle in the use of L1 as LOI in mathematics. There is a lack of a wide range of terms or phrases used in explaining the lesson in the mother tongue. As a result, the process of educating youngsters becomes a problem.

Teacher training of mathematics tutors in Colleges of Education is purely based on the use of English as a medium of instruction. It is therefore not surprising that 8(21.0%) stated that they are not used to the practice as they were not trained in it. Due to a lack of teacher preparation, teachers are unprepared to educate their students using their mother tongue as the medium of instruction. Dutcher (2003) asserts that teachers need to be trained in utilizing the first language in the classroom and that materials must be acceptable, available, and engaging to the students, as well as well used. The majority of respondents 15(39.5%) claimed that the lack of written mathematics textbooks makes it difficult to teach the subject in L1. This is the situation in which there are no textbooks or dictionaries in the mother tongue that are required to meet the demands of learners of various mother tongues. The respondents stressed the importance of having books written in their mother tongue to successfully utilize L1(Tainio, 2012).Two teachers stated the issues of fear of not respecting the Government's policy and the other disagreement with parents.

Table 9: Challenges of L1 Usage as LOI in Mathematics

	Frequency	Percent	Valid Percent	Cumulative Percent
Lack of adequate vocabulary	12	31.6	31.6	31.6
Lack of teacher training	8	21.0	21.0	52.6
Lack of written textbooks in L1	15	39.5	39.5	92.1
Other	3	7.9	7.9	100
Total	38	100	100	

5. CONCLUSION AND RECOMMENDATIONS

Every country must develop a practicable LOI policy suitable for all levels of its formal education system. The policy should be based on the Language which the pupils easily communicate in and not a strict uniform language for the entire country. In Ghana, pupils' fluency level in English normally depends on the type and location of the school. Pupils attending private basic schools in the city become fluent in L2 as early as primary two as opposed to their counterparts in public schools. Also, a child schooling in an urban area is likely to be proficient in English earlier than those in the rural areas because they are exposed more to the L2. An educational policy should not be a demotivator to a child's academic achievement. From the studies, mathematics achievement was extremely higher when lessons are taught in L1 and very low when LOI is English in rural upper primary classes.

In dealing with the LOI policy for upper primary children in rural areas of Ghana, it would be important to consider the late-exit bilingual policy proposed by (Owu-Ewie, 2006). According to Owu-Ewie, mathematics should be taught in only the mother tongue from Primary1 to Primary 4 and in both mother tongue and English in Primary 5. According to his model, only English only policy should start from class 6. The outcome of this study supports his mother tongue only as LOI from Primary 1 to Primary 4 but the results make it obvious that in rural areas using English must be delayed at least Junior High School 1 level and should not be introduced in Primary 5.

Based on the results of the study it is strongly recommended that government allow teachers to teach mathematics in pupils ‘mother tongue only and gradually introduce English as language of instruction at the Junior High School level in the rural areas. This would enable pupils to grasp the basics of the subject and develop an interest in it by actively participating in the knowledge-building process through effective communication.

REFERENCES

[1] Acharya, B. R., Kshetree, M. P., Khanal, B., Panthi, R. K., & Belbase, S. (2021). Mathematics Educators' Perspectives on Cultural Relevance of Basic Level Mathematics in Nepal. *Journal on Mathematics Education, 12*(1), 17-48.

[2] Acheampong, P., Gyasi, J. F. J. A. J. o. E., & Training. (2019). Teacher Retention: A Review of Policies for Motivating Rural Basic School Teachers in Ghana. *5*(1), 86-92.

[3] Ansah, G. N. (2014). Re-examining the fluctuations in language in-education policies in post-independence Ghana. *Multilingual education, 4*(1), 1-15.

[4] Atherton, P., & Kingdon, G. J. I. o. E., University of London. (2010). The relative effectiveness and costs of contract and regular teachers in India. 256-276.

[5] Awang, Z. (2012). *Research methodology and data analysis second edition*: UiTM Press.

[6] Bariham, I., Saviour, A., Edmond, A. J. G. J. o. A., Humanities, & Social Scinces, 8. (2017). Education Inequality with Emphasis on School Dropout among Girls in Basic Schools: A Case Study of Tamale Metropolis in Northern Ghana. *24*.

[7] Clegg, J., & Simpson, J. (2016). Improving the effectiveness of English as a medium of instruction in sub-Saharan Africa. *Comparative Education, 52*(3), 359-374.

[8] Diamantopoulos, A., Siguaw, J. A., & Siguaw, J. A. (2000). *Introducing LISREL: A guide for the uninitiated*: Sage.

[9] Dutcher, N. (2003). Promise and perils of mother tongue education. *Washington, DC: Center for Applied Linguistics*.

[10] Effiong, M. (2013). *Factors influencing foreign language classroom anxiety: An investigation of English learners in four Japanese universities.* University of Southampton.

[11] Eggen, P. D., Kauchak, D. P., & Garry, S. (2007). *Educational psychology: Windows on classrooms*: Pearson/Merrill/Prentice Hall.

[12] Elliott, R. W., & Paton, V. O. (2018). DDD journal homepage: www. elsevier. com/locate/ijedudev. *International Journal of Educational Development, 61*, 1-4.

[13] Englis, T. P., & Boholano, H. B. (2021). Mother Tongue–Based Instruction in Teaching Elementary Mathematics. *Solid State Technology*, *64*(2), 4032-4039.

[14] Ercikan, K., Chen, M. Y., Lyons-Thomas, J., Goodrich, S., Sandilands, D., Roth, W.-M., & Simon, M. (2015). Reading proficiency and comparability of mathematics and science scores for students from English and non-English backgrounds: An international perspective. *International Journal of Testing*, *15*(2), 153-175.

[15] Gaskin, J. (2016). X2 Difference. *Stats Tools Package. http://statwiki. kolobkreations. com*.

[16] Gorgorió, N., & Planas, N. (2001). Teaching mathematics in multilingual classrooms. *Educational studies in mathematics*, *47*(1), 7-33.

[17] Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). SEM: confirmatory factor analysis. *Multivariate data analysis, 6*, 770-842.

[18] Jiang, L., Zhang, L. J., & May, S. (2019). Implementing English-medium instruction (EMI) in China: teachers' practices and perceptions, and students' learning motivation and needs. *International Journal of Bilingual Education and Bilingualism*, *22*(2), 107-119.

[19] Keshavarz, M. H., & Astaneh, H. (2004). The impact of bilinguality on the learning of English vocabulary as a foreign language (L3). *International Journal of Bilingual Education and Bilingualism*, *7*(4), 295-302.

[20] Lartec, J. K., Belisario, A. M., Bendanillo, J. P., Binas-o, H. K., Bucang, N. O., & Cammagay, J. L. W. (2014). Strategies and Problems Encountered by Teachers in Implementing Mother Tongue-Based Instruction in a Multilingual Classroom. *IAFOR Journal of language learning, 1*(1), n1.

[21] Launio, R. M. (2015). Instructional medium and its effect on students' mathematics achievement. *Int J Multidiscip Curr Res*, *3*, 462-465.

[22] Lee, S., Watt, R., & Frawley, J. (2015). Effectiveness of bilingual education in Cambodia: a longitudinal comparative case study of ethnic minority children in bilingual and monolingual schools. *Compare: A Journal of Comparative and International Education, 45*(4), 526-544.

[23] Matang, R. (2003). The cultural context of mathematics learning and thinking in Papua New Guinea. *Education for 21st century in Papua New Guinea and the South Pacific*, 161-168.

[24] Moschkovich, J. (2002). A situated and sociocultural perspective on bilingual mathematics learners. *Mathematical thinking and learning*, *4*(2-3), 189-212.

[25] Niesche, R. (2009). The use of home language in the mathematics classroom. *Crossing divides*, 704-707.

[26] Njoroge, M. C. (2017). The Efficacy of Using Mother Language in the Teaching of Mathematics and Science in Primary Schools: Evidence from Grade One Classrooms in Kenya.

[27] Oginni Omoniyi, I., & Owolabi Olabode, T. (2013). Effect of mother tongue and mathematical language on primary school pupils performance in mathematics. *Journal of Emerging Trends in Educational Research and Policy Studies*, *4*(3), 542-546.

[28] Owu-Ewie, C. (2006). *The language policy of education in Ghana: A critical look at the English-only language policy of education*. Paper presented at the Selected proceedings of the 35th annual conference on African linguistics.

[29] Piper, B., Zuilkowski, S. S., Dubeck, M., Jepkemei, E., & King, S. J. (2018). Identifying the essential ingredients to literacy and numeracy improvement: Teacher professional development and coaching, student textbooks, and structured teachers' guides. *World Development*, *106*, 324-336.

[30] Ramirez, J. D., & Merino, B. J. (1990). Classroom talk in English immersion, early-exit and late-exit transitional bilingual education programs. *Language distribution issues in bilingual schooling, 61*, 103.

[31] Rawat, D. (2016). Importance of communication in teaching learning process. *Scholarly Research Journal for Interdisciplinary Studies, 4*(26), 3058-3063.

[32] Setati, M. (2008). Access to mathematics versus access to the language of power: The struggle in multilingual mathematics classrooms. *South African Journal of Education*, *28*(1), 103-116.

[33] Stößlein, M., & Changchun, P. (2009). *Activity-based Learning Experiences in Quantitative Research Methodology for (Time-Constrained) Young Scholars-Course Design and Effectiveness.* Paper presented at the POMS 20th Annual Conference, Orlando, Florida. USA.

[34] Tackie-Ofosu, V., Mahama, S., Vandyck, E., Kumador, D. K., & Toku, N. A. A. (2015). Mother Tongue Usage in Ghanaian Pre-Schools: Perceptions of Parents and Teachers. *Journal of Education and Practice, 6*(34), 81-87.

[35] Tainio, L. (2012). The role of textbooks in Finnish mother tongue and literature classrooms. *Skriftpraktiker hos barn och unga*.

[36] Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*: Harvard university press.

[37] Wigforss, E. (1999). The role of communication in learning technologies*:* : Citeseer.

APPENDIX 1: Mother Tongue as Instructional Language Questionnaire (MTILQ)

SECTION: A

Age

(A) below 30 (B) from 30 to 40 (C) 40+

Gender

(A) Male (B) Female

Educational qualification

(A)SHS (B) Diploma (C) Bachelor (D) Graduate

SECTION: B

Which of the following is a major challenge in teaching mathematics in L1?

(A) Lack of adequate vocabulary

(B) Lack of teacher training

(C) Lack of written textbooks in L1

(D) Other…………………

SECTION: C

Please indicate your opinion by marking the appropriate box on the five-point Likert scale where (*1 = Strongly Disagree (SD), 2 = Disagree (D), 3= Neutral (N), 4 = Agree (A), 5 = Strongly Agree (SA)*

SN	Statement	SD	D	N	A	SA
MT1	Children understand better when lessons are taught in Twi only					
MT2	I use less time to explain concepts when instruction is in Twi.					
MT3	Pupils actively participate in the lessons when lessons are taught in Twi					
EF1	Pupils confidently ask questions when lessons are in Twi					
EF2	Pupils can answer questions when lessons are in Twi					
EF3	Pupils can explain learned concepts to the teacher when lessons are in Twi					
AC1	Pupils get high scores in class tests with Twi as language of instruction					
AC2	Pupils' complete homework correctly without much or no assistance with instruction in Twi					
AC3	Pupils are able to solve daily problems with mathematics when lessons are taught in Twi.					

International Journal of Novel Research in Education and Learning
Vol. 9, Issue 1, pp: (26-38), Month: January - February 2022, Available at: www.noveltyjournals.com

APPENDIX 2: Factor Loadings

	Component	
	1	2
MT1	.931	
MT2		.865
MT3		.620
EF1		.726
EF2	.622	
EF3	.794	
AC1	.915	
AC2	.904	
AC3	.807	

Extraction Method: Principal Component Analysis.

APPENDIX 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.004	66.707	66.707	6.004	66.707	66.707	4.527	50.300	50.300
2	1.028	11.425	78.132	1.028	11.425	78.132	2.505	27.831	78.132
3	.718	7.979	86.111						
4	.491	5.450	91.562						
5	.298	3.315	94.876						
6	.218	2.427	97.304						
7	.184	2.047	99.351						
8	.045	.499	99.851						
9	.013	.149	100.000						

Extraction Method: Principal Component Analysis.

APPENDIX 4: Teacher Made Test

Primary: 4

(1) Find the highest common factor of 12 and 30

(2) Find the highest common factor of 14 and 21

Primary: 5

Simplify basic algebraic expressions by grouping like terms.

(1) 9 w – 4 – 10 w

(2) – m + 9 + 5 m

Primary: 6

Abu traveled on a bicycle to buy food; the table shows how far (in kilometers) he was away from the house.

Time (minutes)	0	5	10	15	20	25	30
Distance (km)	0	3	3.5	4	4	2	0

(a) How far was Abu from the house at 30 minutes?

(b) What was the distance of the food joint from the house?

(c) How many minutes did he take to arrive at the food joint?

(d) Where was Abu after 30 minutes of travel?