Rethinking Proficiency in the Language of Teaching and Learning (LoTL) as a Pillar in the Learning of School Mathematics

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DOI: 10.56201/ijelcs.v7.no1.2022.pg63.75

ABSTRACT

Although English has become the preferred language of instruction in most classrooms, including those of mathematics across the world today, it will still remain a second language (L2) to many students and their teachers for a long time to come. In mathematics language research, the attention so far given to the role of English as the Language of Teaching and Learning (LoTL) has been with the regard to the impact of levels of student proficiency in the language. This perhaps explains why those who learn in English as their first language (L1) are perceived as proficient in mathematical language, while L2 learners have to attain a level of proficiency in English first. This is in spite of the current absence of clear benchmarks for satisfactory proficiency in English for successful general learning in school mathematics. The poignant question remains: must L2 learners learn mathematics in English given the double jeopardy they face? This paper presents a critical analysis of findings of students' interpretation of lexical vocabulary common in mathematics texts and in the classroom language typical of mathematics students in L2 contexts, to highlight the general difficulty of this language (English) to the mathematics learners. The main study from which the paper is extracted employed multiple-case study design to examine Mathematical Language (ML) usage and learners' conceptual understanding of mathematics in secondary schools in Kenya. Data were collected by questionnaires, classroom observations and interviews. The findings of the paper indicate that a majority of L2 students have low proficiency in LoTL; socio-economic background is a factor of proficiency in the LoTL, and mathematics teachers were not aware of the importance of language in learning mathematical concepts. The main conclusion of the paper is that interpretation of mathematical concepts is language dependent which is a challenge to learners not versed in the LoTL. The paper recommends rethinking of LoTL mathematics which L2 learners are versed in to raise levels of conceptual understanding of mathematics.

Key words: *First language, Second language, lexical vocabulary, Language of Teaching and Learning.*

INTRODUCTION

The purpose of language is to communicate. Vanessa (2019) asserts that learning can take place in learner's first language or second language. Countries world over have different LoTL for instance English in Kenya, Kiswahili in Tanzania up to junior secondary school (Ordinary level), Xhosa, Zulu, Afrikaan and English in South Africa, Chinese in China and German in Germany, just to mention but a few. In Kenya, for instance, there are 42 local languages which have a wide linguistic distance even though students are required to be proficient in the academic language- English.

Freeman (2018) citing American Education Research Association (2011) defines proficiency as academic language which includes vocabulary used beyond social conversation and includes vocabulary required to communicate effectively and comprehend materials in academic content area. Guerrero (2014) argues that academic language is the language of communication in the classroom which takes place at the level of discourse and that the discourse associated with different subject areas has unique features that an L2 learners must come to use and understand. Solomon (2015), for instance, maintains that the academic language must be understood as a special register associated with various content areas at the level of discourse. Consequently the mathematical language entails linguistics aspects such as grammatical and textual levels that may differ from other disciplines (Samo, 2019).

Empirical studies so far reviewed pertaining to the use of LoTL in mathematics classrooms fall in three categories. Firstly, research inquiry has been carried out in multilingual classrooms where a learners chooses a preferred LoTL, usually their home language or native language (Molefe, 2006; Vanessa, 2019). The second category has previous studies focusing on social factors and proficiency in home language, and learning mathematics concepts in bilingual classrooms, where home language is one of the two languages used as LoTL (Meyer, Prediger, Kuzu, Wessel & Redder, 2019). The third category has research on monolingual classrooms where learners have exposure to LoTL at early years of schooling (Prediger, Wilhem, Buchter, Gursoy, & Benholz, 2018). In Kenyan public schools, the context of the study, LoTL is one (English), with two official languages namely English and Kiswahili. None of the two official languages is the home language of majority of learners especially those in sub-county schools which get students within the locality and whose native language is indigenous language. These learners transit from local public primary schools where they speak the native language of that locality outside classrooms

Language influences thinking process and the kind of language we use influences our world view including mathematics (Meyer, Prediger, Kuzu, Wessel, & Redder, 2019; Wathen, Trinick, & Guerrier, 2021). Many learners across the world including Kenya, the context of the study, use a home language different from the academic language of instruction. The forms and constructions of many of those home languages do not always have exact synonyms in academic languages used at school. This mismatch in counterparts, according to linguistic relativity hypothesis (Whorf, 1956), suggest that learners face a dilemma of thinking in two different languages since the thinking process of one language differs from those of any other language, thus posing a challenge in learning mathematics. The central focus of language in mathematics is the ease of conveying a concept through language in order to be understood and articulated through the language.

Empirical evidence maintain that languages have ability to develop mathematical language because they evolve and develop grammatical systems through use (Finlayson & Madiba, 2002; Cooper, 1989; Bamgbose, 1999). Wathen, Trinick and Guerrier (2021) reason that it is easy to add nouns and verbs to a developing language but it is difficult to add pronouns and prepositions. From the foregoing argument, one conclusion is that language can be a facilitator and at the same time an impediment to learning mathematics. As a facilitator, language presents different ways of expressing mathematical ideas and as an impediment, some languages have ambiguities and misunderstandings although they can be developed with time.

Odhiambo and Gunga (2010) opine that mathematics and verbal language interact since mathematical language is expressed in a verbal language. Every language has a way of expressing mathematics operations. For instance mathematics across the world derives numbering from Arabic language which uses the common numerals such as 0, 1, 2, 3, 4,…9 to express quantity. Other languages such as Chinese and Roman have their unique way of expressing mathematics operations. Odhiambo and Gunga argue that mathematics seem to spring out of verbal language. Mathematics uses symbols for ideas (ideograms) such as ∑ read as "sigma" meaning summation and π (pi) which is numerical equivalent of 22/7. Idiograms make arithmetics possible and easier by giving mental pictures for communicating relationships between variables which are hidden in the verbal language. The authors studied aspects of the role of language in mathematics education using analytic method of philosophy. Among other aspects investigated was definition of terms in mathematics which utilises LoTL. Odhiambo and Gunga note that a definition of definiendum must not be exactly the same for all learners at different levels but should vary according to the conceptual capacity of the learners. For instance, parallel lines are defined as *lines that do not meet* in Primary school but in form four at secondary school level, parallel lines are defined as *a locus of two moving points equidistant from each other*. Elsewhere we talk of area of a rectangle in primary school but say area enclosed by a rectangle in secondary school (MOEST, 2002).

Prediger, Wilhelm, Büchter, Gürsoy and Benholz (2018) examined social and language background factors that have the strongest connection to mathematics achievement. The variables of the study were immigrant status, socio-economic status, age of first exposure to German language, reading proficiency and German language proficiency. The sample of 1495 students in Grade 10 of 19 comprehensive schools and 67 mathematics courses of the medium track in the metropole region of Ruhrgebiet in German participated in the empirical study. By employing mixed methods approach, data analysis is based on the evaluations of the teachers in the ZP10 high stakes exams written in 2012 and finally by an investigation of written student solutions and observations from students' videotaped working processes. The findings indicated that language proficiency has a stronger connection to mathematics achievement in the central examination than social factors. Given that data was collected during high stakes exams it was difficult to control interrater reliability and though mixed methods was used the study did not do in depth qualitative analysis of the language factor.

Larger (2016) investigated the linguistic challenges of algebra problems. He assessed 221 middle school students, both native speakers and ESL learners, comparing the correctness of their responses to other data, including terms they highlighted as being confusing. He found that some of the words that caused problems were not the one generally considered to be part of mathematical register, for example 'extension' and 'previous.' He comments that the complexity of learning mathematics requires a variety of linguistic skills the second language learners may not have mastered, hence a certain level of proficiency in language of instruction is required and necessary.

Studies have looked into ways of scaffolding mathematics learners to gain proficiency in LoTL mathematics. The study by Sepeng (2010) explored influence of discussion and argumentation techniques in helping learners learn LoTL in South African mathematics classrooms in the Eastern Cape Province of South Africa where learners are native isiXhosa speakers but are taught in a language which is L2 (English) to both teachers and learners. The results of the study suggested that the introduction of discussion and argumentation techniques in the teaching and learning of mathematics word problems had a positive effect on learners 'ability to consider reality during word problem-solving in bilingual classrooms.

Breton (2016) argues that teachers don't have specific pre-service and in-service training with respect to teaching practices for teaching mathematics in English to L2 learners. He asserts that the curriculum puts emphasis in English since globalization has created the need to communicate effectively in English in matters of trade, politics, governance, and sports (Skolverket, 2010). In attempt to mitigate the gap, Department for Education and Skills in London developed a dictionary of mathematics term in in the year 2000 (Morgan, 2005) although the dictionary has glaring shortcomings. Morgan analysed the definition of *two-dimensional shape* in the classroom transcript and found that student-teacher talk constructs a multi-faceted notion of *dimension* beyond the formal definition of the concept given by mathematical dictionary, being: "*the number of measures needed to give the place of any point in a given space, the number of coordinates needed to define a point in it*" (p.104). Learners and even teachers may not find such definition useful for learning mathematics for conceptual understanding.

The concern of this paper is the use of LoTL in mathematics and meaning construction of lexical words common in secondary mathematics curriculum in Kenya. By identifying the challenges students face when using LoTL, we hope that classroom teachers will be better equipped with the knowledge that they need to provide more explicit instruction to promote learning mathematics for conceptual understanding.

THEORETICAL FRAMEWORK

A perspective which greatly influenced the understanding of the study was Vygotskian Socio-Cultural Theory (SCT) which emphasises the importance of using a language in social situations, as a necessary herald to individual learning (Vygotsky, 1987). Vygosky's perspective on the role of language in learning can be explained in two ways: First, language accommodates a medium of learning. This means that learning can basically take place in a social context and social interaction is the essence of learning. Second, language is an instrument that assists a learner to think. A learner conceives and perceives a mental picture through a familiar language before it is verbalised or expressed in signs. In the case of learning mathematics, native speakers of a language of teaching and learning are assumed to have advantage over their peers, L2 and L3 because they already have the register of the language and hence can visualise a variety of mental pictures easily. SCT posits that when a learner is familiar with the academic language s/he can learn individually through interaction with peers and even by reading text books. It becomes apparent that language of mathematics (which comprises of both technical and non-technical words) is pivotal as a channel of mediation on both social level and individual level. Vygostsky strongly claims that concepts cannot be acquired in conscious form without language and a child cannot have a conscious understanding of concepts before they are explained in a related context using language (Vygotsky, 1978). SCT has been applied by Huang and Normandia (2007) in a study to examine linguistic features of students' written discourse in secondary school mathematics in Central New Jersey in United States of America. Similarly, Semeon and Mutekwe (2021) applied SCT to explore Perceptions about the use of language in classrooms in South Africa. The Vygotskian socio-cultural approach to classroom promotes effectiveness in teaching and learning and it is for this reason that this study will adopt the socio-cultural perspective as the theoretical framework.

METHODOLOGY

The empirical enquiry employed a multiple-case study. The context for this study was form three mathematics classes in three secondary schools in Bungoma South Sub-county, Bungoma County in Kenya. Data were collected through classroom observations, teacher and student interviews and questionnaires.

Sample

The sample of the study comprised of 1100 form three L2 students drawn from SCS (565), CS (335) and ECS (200) with fourteen (14) teachers, two each from ECS and CS and 10 from SCS.

Language

In Kenya, the context of the study, English is the school academic language and is taught as a core subject for eight years at primary school level (age 6-14 years) and four years at secondary school level (age 14-18 years). School academic language differs from everyday language in three aspects namely lexical, syntactical and discursive aspects. Lexical aspect comprises specialised vocabulary, composite or unfamiliar words, and specific connectors while syntactical aspect is characterised by long and syntactically complex sentences, passive voice constructions, and long noun phrases and prepositional phrases. Discursive aspect involves arguing and explaining why, practices that are rare in low socio-economic families (Heller & Morek, 2015).

Instruments

Data were collected through classroom observations, teacher and student interviews and questionnaires. A total of 17 lessons of 40 minutes in length were observed and the researcher took field notes during classroom observation. Observations helped the researcher to get a feel of how students use mathematical language in general and capture the context in which learning took place. This paper focusses on use of LoTL in mathematics and meaning construction of lexical words common in secondary mathematics curriculum in Kenya

RESULTS AND DISCUSSIONS

The findings indicate that participants in Sub-County School (SCS) had scanty knowledge of the meanings of vocabulary items commonly used in both mathematical and non-mathematical contexts since they scored at least 50% correctly in three vocabularies only, namely 'departure' (52.4%), 'simultaneously' (52.2%) and 'displaced' (70.6%), as illustrated in table 1. There was a strong correlation (0.720) between mathematical meaning (correct) and symbols (correct). In the case of CS students scored at least 50% correctly in 18 out of 25 items with a correlation of 0.286 between lexical meaning (correct) and symbolic representation (correct). Details of scores is given in table 2. In ECS the least correct score was 75.5% on vocabulary 'remainder' and none of the 200 participants left any item blank depicting high level of proficiency in lexical vocabulary. There was a strong correlation of 0.884 between lexical meaning (correct) and symbolic representation (correct) as demonstrated by findings in table 3. In all the three cases, results reveal direct relationship between proficiency in mathematical vocabulary and conceptual understanding of mathematics.

Most students in SCS, 70.6% (398 out of 565) scored correctly on the vocabulary 'displaced' as presented in table 1. The terminology 'displaced' is used in the topic of Volume and Capacity (Form 1) and Volume of Solids (Form 2) in the secondary mathematics curriculum. The same term is also used in Form 2 Physics of which all the students in the sample did. A typical example of correct response was: "Put stone inside of full water. *Volume displaced* [sic] pours" (student's response, August 22, 2022). Though the statement has grammatical flaws the meaning of the vocabulary is conspicuous. From this result the study can claim that frequent use of lexical vocabulary across disciplines enhances understanding and retention due to correspondence of the meaning.

TABLE 1
Students' Level of Proficiency in the Use of Lexical Vocabulary (SCS)

S/N	List of Vocabulary	Lexical meaning of vocabulary			Mathematics symbolic representation		
		Correct	Confused	Blank	Correct	Confused	Blank
1	Descending	40.2	9.2	50.6	80.5	1.5	8.0
2	Altogether	45.0	13.2	41.8	90.5	2.3	7.2
3	Remainder	20.5	52.5	27.0	2.5	81.5	16.0
4	Increase	30.1	1.6	68.3	90.8	1.0	8.2
5	Reverse	36.0	4.4	59.6	55.2	7.2	37.6
6	Initial	8.6	1.7	89.7	64.6	1.7	33.7
7	Substitute	32.4	9.6	58.0	12.0	78.0	10.0
8	Proportionately	2.6	15.1	82.3	14.1	69.1	16.8
9	Respectively	4.0	9.6	86.4	11.0	68.5	20.5
10	Intersect	5.0	23.3	71.7	30.9	14.0	55.1
11	Vary	1.5	18.7	79.8	12.8	79.2	8.0
12	Equal	3.7	9.3	87	15.1	35.8	49.1
13	Less	33.6	6.8	59.6	49.7	19.1	31.2
14	Complete	42.6	13.2	44.2	79.8	4.1	16.1
15	Displaced	70.6	8.8	22.6	80.2	1.4	18.4
16	Accommodate	48.9	4.9	46.2	93.5	2.6	3.9
17	Departure	52.4	17.3	30.3	83.4	4.1	12.5
18	Constant	33.2	64.3	2.5	81.3	1.6	17.1
19	Maintain	4.0	53.4	42.6	2.8	72.6	24.6
20	Simultaneously	55.2	9.7	35.1	90.8	2.2	7.0
21	Vertical	38.2	22.9	38.9	55.2	15.2	29.6
22	Corresponding	48.3	18.7	33.1	29.8	13.1	57.1
23	Adjacent	11.8	29.9	58.3	12.0	52.4	35.6
24	Direct	39.5	6.9	53.6	29.0	5.1	65.9
25	Eliminate	18.7	35.1	46.2	11.9	36.8	51.3

When variables in table 1 were correlated using Pearson correlation (two-tailed), the results showed that there is a strong positive correlation (0.720) between lexical meaning of vocabulary (CORRECT) and Mathematics symbolic representation (CORRECT). From this result the study cannot claim that being proficient in everyday language (English) guarantees that a student understands mathematical concept since other variables, that is, specialised and mathematics words have to be considered too.

It worth noting that students scored at least 50% correctly in three vocabularies only, namely 'departure' (52.4%), 'simultaneously' (52.2%) and 'displaced' (70.6%). This indicated that most students had difficulties in interpreting lexical vocabulary used in secondary mathematics curriculum and which is a sub-set of the LoTL. The low performance on lexical vocabulary could be attributed to low form one entry behaviour as most students had between 90 and 150 marks out of 500 indicating low performance in the five subjects which includes English, the LoTL. Research studies aver that learners should use a language they are familiar with in the social context to facilitate understanding of concepts (Molefe, 2006).

Classroom observation in SCS revealed that the context plays a big role in learning lexical vocabulary common in secondary mathematics. In one of the lessons that was observed, the class was revising Term Two end term exams on the first day of third term. As part of extra practice, the teacher gave the question shown in figure 2.

The teacher wanted to confirm if there was any question and so a student raised a pertinent issue as displayed in the excerpt of classroom talk.

T: any question?
S: What is windscreen by wiper?
T: That windscreen of a car and wiper. The principal's car has windscreen and wiper. You get it?
S: Yes (Reluctantly).
(Classroom observation, September 26, 2022)

From the classroom talk depicted in the excerpt, the words 'windscreen' and 'wiper' were not common among the students hence they had a challenge in forming mental pictures of the object. Interestingly the teacher was not conscious of the learner's struggle in trying to get the concept of 'windscreen and wiper' hence the short response. Even though the student would work out the solution to the question, the whole process would not be interesting and sensible. The student may not relate the work to real life situation given that the background of the catchment area of the school was a remote village where vehicles are rarely seen. A study by Rani (2013) demonstrated that drawing illustrations and metaphors from contexts farmiliar to learners help them see mathematics as meaningful hence enhances conceptual understanding of mathematics rather than doing mathematics as a herculean task masked with irrelevancies (Eidelwein & Mottin, 2021).

The shaded region in figure 12.3 shows the area swept out on a flat *windscreen by a wiper* [sic]. Calculate the area of this region. (MoE, 2004, p.169).

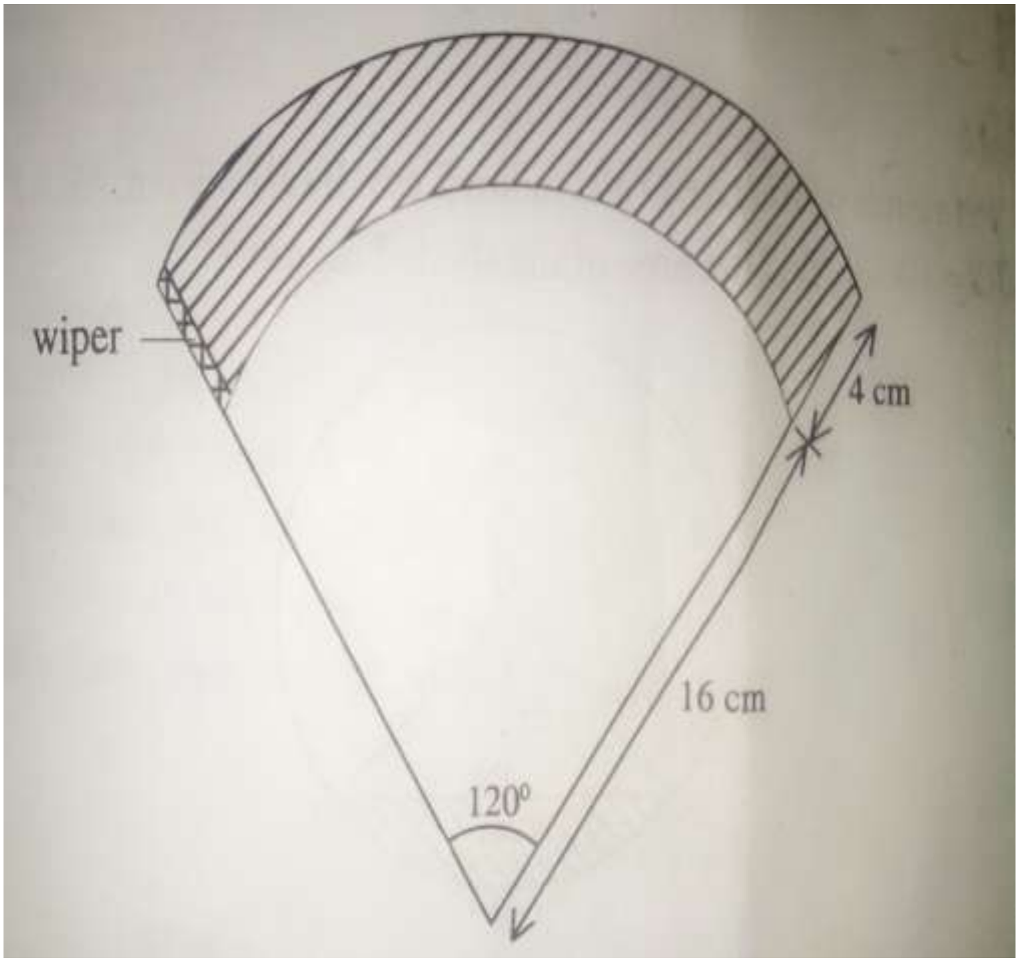

Figure 2: *area swept out on a flat windscreen by a wiper.*

An interview with the teacher revealed two critical issues in learning school mathematics. Firstly, the teacher was not conscious of the pivotal role of language in learning mathematics. Secondly, there was internal school policy of language usage requiring students to use English at all times except in Kiswahili lessons. The excerpt of the teacher interview:

Researcher: What language do you prefer to use in mathematics class?
Teacher: It is not a question of preference. Here in school we use English. And mathematics is set in English.
Researcher: How do you help learners who have challenges in talking in English to participate in class discussions?
Teacher: (Grinning). What can I do? The policy is clear. I have to follow it.
(Teacher interview, September 30th, 2022).

The most confused vocabularies were 'constant' and 'remainder' with scores of 64.3% and 52.5% respectively while the least attempted item was initial with 89.7% of participants leaving it blank. Students stated that constant means '*standing*' while others stated '*one*' (students' responses, August 23, 2022) both of which are misconceptions. A common example of the word constant given by students was equation of a straight line y=mx+c, where c is a constant. None of the students mentioned m as a constant. While it is true that c 'stands alone' in the equation, both c and m are constants, and the lexical meaning of the term is "occurring continuously or a situation that does not change" (Deuter, Bradbery & Turnbull, 2015). This kind of example points to understanding that could result from learning of concepts where instances of the concept are not distinguished from non-instances causing learners to form misconceptions (Kissane & Hurst, 2017). Examples given for 'remainder' such as 'small' and 'little' (students' responses, August 23, 2022) equally depict misconception of the word 'remainder'.

The column of symbols shows that students performed well as they scored at least 50% in 12 vocabularies where in 10 of the vocabularies they scored above 64.6%. The most confused vocabulary was remainder as already discussed the scores on BLANK was lower than in definition. The findings indicate that students faced difficulties in expressing themselves in writing but at least they had some idea of the vocabulary. The idea is the concept which is represented by mark or label as asserted by Suweken, Waluyo and Okassandiari (2017). From this result alone the study cannot claim that proficiency in vocabulary is not necessary for conceptual understanding. There is possibility that teachers may have given lexical elaboration of some vocabularies in a language other than English and so the challenges of expressing meanings. The use of Kiswahili or a language other than English in mathematics classrooms is not so significant since the examinations students take rarely demands writing so emphasis is put on algorithms as evidenced from teacher interview.

In table 2, it shows that students in CS performed better in lexical vocabulary than their counterparts in SCS (table 1) given that the former scored at least 50% in 18 items compared to three items scored by the latter. The same trend of scores is depicted in the column of symbols. The study observed that the least entry mark to form one in CS was 245 marks suggesting that most students were familiar with the LoTL. The most confused vocabulary was remainder (50%) and the vocabulary that most students didn't attempt was adjacent with 21.9% of students (123) leaving it blank. Details of the scores are portrayed in table 2.

TABLE 2
Students' Level of Proficiency in the Use of Lexical Vocabulary (CS)

S/N	List of Vocabulary	Lexical meaning of vocabulary			Mathematics symbolic representation		
		Correct	Confused	Blank	Correct	Confused	Blank
1	Descending	82.4	10.2	7.4	84.1	3.4	12.5
2	Altogether	84.5	14.1	1.4	83.0	14.1	2.9
3	Remainder	45.0	50.3	4.7	54.3	3.0	2.7
4	Increase	61.3	36.1	2.6	86.0	3.9	10.1
5	Reverse	66.0	34.0	0	81.9	14.0	4.1
6	Initial	68.2	27.5	4.3	4.0	89.6	6.4
7	Substitute	73.4	16.8	18.2	91.7	3.8	4.5
8	Proportionately	46.2	35.6	18.2	58.3	20.0	21.7
9	Respectively	74.0	19.3	6.7	36.9	25.7	37.4
10	Intersect	55.1	32.0	12.9	18.5	59.3	22.2
11	Vary	25.9	69.0	5.1	34.2	23.8	42.0
12	Equal	47.3	38.7	14	17.0	55.6	27.4

13	Less	66.3	29.8	3.9	86.3	6.1	7.6
14	Complete	50.0	14.0	36	91.4	6.2	2.4
15	Displaced	75.4	8.3	16.3	32.6	61.3	6.1
16	Accommodate	51.8	9.2	39	92.7	5.0	2.3
17	Departure	74.0	23.1	2.9	66.3	25.9	7.8
18	Constant	42.3	54.4	3.3	66.1	23.0	10.9
19	Maintain	28.4	54.3	17.3	41.6	48.0	10.4
20	Simultaneously	82.5	11.9	5.6	55.3	30.2	14.5
21	Vertical	58.3	29.2	12.5	62.7	21.5	15.8
22	Corresponding	49.8	37.8	12.4	49.4	35.7	14.9
23	Adjacent	38.1	40.0	21.9	39.8	50.1	10.1
24	Direct	56.5	29.6	13.9	63.6	29.1	7.3
25	Eliminate	68.6	28.1	3.3	74.9	22.4	2.7

Students' interview presented opportunity to investigate salient issues in the use of language in mathematics classes as the following excerpt illustrates:

R: What language do you use in mathematics classes?
S7: Both English and Kiswahili.
R: Do you define mathematics vocabulary in your lessons?
Chorus: Yees!
R: If the teacher explains words in a language that you understand like Kiswahili, then what makes mathematics hard?
S9: We learn in class but we do not do practice when we are alone.
S10: So much excitement in an exam that makes me to forget the concepts,
S11: We are not doing it over and over again so it is easier to forget.

(Student interview, September 2, 2022).

From the classroom talk, students aver that they use both English and Kiswahili and that they understand better when concepts are explained in Kiswahili than English. However the scores under the column in symbols shows confusion and blanks in each and every vocabulary indicating that even with the use of Kiswahili they still don't attain conceptual understanding. The students further give reasons such as lack of practice (S9) and (S11) which could explain why Kiswahili does not assist much in conceptual understanding. It should be understood that the CS where the data was collected was a day school hence the challenges of luck of sufficient time for study.

Correlation of variables between the meaning of vocabulary (correct) and symbolic representation showed a weak relationship (0.286) between variables implying moderate influence of variables. The finding imply that there could be other contextual factors affecting conceptual understanding of mathematics in CS experience.

Performance of students in ECS outshone performance of their counterparts in CS and SCS in all variables as depicted in table 3.The most notable feature in students' level of proficiency in the use of lexical vocabulary is that none of the 200 participants left any item blank as shown in table 10. The least score was 75.2% on the vocabulary 'remainder' which is higher than the highest score in the same category in SCS of 70.6%. Performance on symbols in ECS averaged 95.3%.

TABLE 3
Students' Level of Proficiency in the Use of Lexical Vocabulary (ECS)

S/N	List of Vocabulary	Lexical meaning of vocabulary			Mathematics symbolic representation		
		Correct	Confused	Blank	Correct	Confused	Blank
1	Descending	95.8	4.2	0	100	0	0
2	Altogether	96.0	4.0	0	100	0	0
3	Remainder	75.2	24.8	0	89.9	10.1	0
4	Increase	97.1	2.9	0	100	0	0
5	Reverse	96.0	4	0	99.0	1.0	0
6	Initial	98.5	1.5	0	99.2	0.8	0
7	Substitute	87.3	12.7	0	98.0	2.0	0
8	Proportionately	86.7	13.3	0	97.9	2.1	0
9	Respectively	94.8	5.2	0	98.6	1.4	0
10	Intersect	95.7	4.3	0	98.8	1.2	0
11	Vary	95.9	4.1	0	98.7	1.3	0
12	Equal	68.3	31.7	0	80.0	20.0	0
13	Less	96.4	3.6	0	97.9	2.1	0
14	Complete	90.0	10	0	95.0	5.0	0
15	Displaced	95.4	4.6	0	95.2	4.8	0
16	Accommodate	91.8	8.2	0	94.9	5.1	0
17	Departure	97.4	2.6	0	100	0	0
18	Constant	83.4	16.6	0	96.0	4.0	0
19	Maintain	78.2	21.8	0	93.0	7.0	0
20	Simultaneously	98.0	2.0	0	100	0	0
21	Vertical	98.3	1.7	0	100	0	0
22	Corresponding	98.4	1.6	0	100	0	0
23	Adjacent	98.1	1.9	0	100	0	0
24	Direct	96.5	3.5	0	98.0	2.0	0
25	Eliminate	96.8	3.2	0	97.0	3.0	0

The least entry marks to ECS in the sample was 330 implying that all students were familiar and proficient in the LoTL (English) hence giving them advantage in understanding the lexical vocabulary used in secondary school mathematics curriculum. Correlation between variables indicate a strong relationship of 0.884 implying direct dependence of variables.

CONCLUSION

The study sought to examine mathematical language usage and learners' conceptual understanding of mathematics in secondary schools in Kenya. On the basis of a foregoing findings, the study concluded that proficiency in mathematical language is necessary for interpretation of mathematical concepts.

RECOMMENDATION

The study recommended as follows further research to look into bilingual teaching of mathematics where the national academic language is used in classrooms alongside a language that if familiar to a majority of learners in attempt to attain conceptual understanding of mathematics in secondary schools in Kenya.

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