Exploring the Intersection of the English Language as the Medium of Instruction and Inclusive Pedagogy in Primary Mathematics Classrooms in Ghana

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To cite this article: Abenyega, J., & Davis, E. K. (2015). Exploring the Intersection of English as an Instructional Language and Inclusive Pedagogy in Primary Mathematics Classrooms in Ghana. ***International Journal of Whole Schooling, 11*****(2), 45-64.**

Abstract

Conceptualising how English as the instructional language responds to difference is prerequisite to orchestrating inclusive pedagogy, whole schooling, and effective teaching and learning of mathematics. The purpose of this study was to explore the intersection of English as an instructional language and inclusive pedagogy in two mathematics classrooms in two primary schools in Ghana. Through classroom observations and interviews with teachers and primary school pupils across two primary schools in Cape Coast in the Central region of Ghana, we explored and presented case examples of how English as the instructional language interlinked with ineffective teaching excluded the majority of pupils during mathematics lessons. We concluded that teacher professional learning for mathematics teaching that incorporates inclusive pedagogy and addresses instructional language use can prepare teachers to incorporate a whole schooling perspective and be responsive to pupils' learning needs in a more effective way, enabling them to become effective problem solvers in mathematics.

Key words: Ghana, inclusive pedagogy, instructional language, mathematics

Introduction

The purpose of this study was to explore the intersection of English as an instructional language and inclusive pedagogy in mathematics classroom in two primary schools in Ghana. We focused on mathematics because it is a compulsory subject from primary school to university in Ghana. This means, irrespective of the course one intends to pursue at University, it is impossible to access university education in Ghana without a pass grade in Mathematics.

A challenge for teachers who are involved in developing pupils' foundation knowledge in mathematics has been the linking of equity and whole schooling with inclusive pedagogy to ensure that instructional language does not become an excluding tool in mathematics achievement (Davis, 2010). Equity refers to every student's right to participate in all aspects of school community life, including non-discriminatory teaching practices that ensure individuals have what they need to demonstrate their learning capabilities. Along with resource issues, instructional language has been found to play a crucial role in inclusive pedagogy, student learning and acquisition of mathematical concepts (Munro, 2015; Pagliano, & Gillies, 2015; UNESCO, 2007). Instructional language is the official medium of communication through which pedagogy is delivered (Davis & Agbenyega, 2012) and can be conceptualised as a social practice. Understanding and mastering learning skills and related concepts are closely linked to a learner's familiarity with the instructional language (EENET, 2008; UNESCO, 2007).

In Ghana, children speak various languages at home including Twi, Ewe, Fante, Dagbani and Frafra, however, mathematics books at all levels of schooling in Ghana are written in English. The Ghanaian government policy on education requires that instruction for all subjects in public schools from grades 1-3 be conducted in the local language so as to enable all pupils access the curriculum and build foundation knowledge and in grade 4 onwards, English language be used as the medium of instruction except during Ghanaian languages teaching. It is assumed that by grade 4 pupils might have developed basic understanding of the English language and have less difficulty making sense of concepts taught in English. A UNESCO paper on enhanced learning argues that when instructions and concepts taught to children are based in language and culture that are unfamiliar to learners; enhanced learning and inclusivity cannot be achieved, leading to exclusion (UNESCO, 2007). Teaching children mathematical concepts in English language that the pupils are not proficient in can make learning pervasively difficult and lead to disengagement and exclusion from meaningful participation.

The Intersection of Instructional Language, Inclusive Pedagogy and Whole Schooling

Pedagogy that strives for inclusion must recognise the place of instructional language in pursuit of equity. A whole school perspective must be accepted in the adoption of instructional language. A whole schooling perspective creates spaces for all, is democratic in that every child has opportunity to participate, includes all, establishes a learning community, supports all learners and partners with others including use of relevant assessment processes to evaluate and support learning (Lancaster, 2014; Spratt & Florian, 2014). Inclusive pedagogy, instructional language and whole schooling are inextricably linked. Inclusive pedagogy is "the art of teaching and its attendant discourse" with equity at its core that recognises individual student's learning needs (Alexander, 2004, p. 11). Inclusive learning is the involvement and participation of all students and the meaning making that result from

effective teaching (Klibthong, 2013). Exclusion in this study context is disengagement and lack of understanding with what is going on within a lesson as a result of the nature of instructional language use and pedagogy (Agbenyega & Klibthong, 2014).

According to Florian (2009), and Florian and Black-Hawkins (2011), inclusive practices are so complex and varied that the practices that count as inclusion are not well articulated in the literature. Inclusive pedagogy is concerned with teaching activities and programs that "respect as well as respond to student differences in ways that include learning in, rather than exclude them from what is ordinary available" in everyday class classroom practice (Florian and Black-Hawkins, 2011, p. 814). For this reason instructional language must take into account student diversity within classrooms (Harwood, 2010). Instructional language and ineffective pedagogy significantly exclude millions of children from meaningful learning when children, especially those from ethnic minority groups, who use a different language at home from that used in school (Davis & Agbenyega, 2012; EENET, 2008, UNESCO, 2007). In other words, the use of language and instructional approaches that children do not understand lead to barriers for learners as well as limit the progress children would make in learning (EENET, 2008; Munro, 2015; Pagliano, & Gillies, 2015). According to Barwell, Barton and Setati (2007) "language and multilingualism in particular, interacts with learning mathematics" (p. 115). This is reiterated by Moschkovich (2007) that it is a complicated task to learn mathematics in a language one is not proficient in, implying that language can simultaneously hinder the development of mathematics skills and mathematics communicative capacity.

Inclusive pedagogy and equity recognise the need for children to learn in their own language for five to six years (Clarke, 2009; Siraj-Blatchford & Clarke, 2000) before they gradually transition to a second language as the main medium of instruction. It is a right enshrined in the Convention on the Rights of the Child (Article 30, 1990) to maintain the first or home language at this level.

Yet in Ghana, children have to learn mathematics in their second language almost as soon as they start primary school in grade 1 (Davis & Agbenyega, 2012). According to EENET (2008), children learn academic content more expediently in the language they understand best and cope better with learning a second language if they are educated in their own language first. The lack of mastery of instructional language can make learners confused (Bourdieu, Passeron & de Saint Martin, 1994), by translating back and forth between local and official instructional languages. For example, Jorgensen and Sullivan's (2010) study of mathematical learning among Indigenous students in remote parts of Australia confirmed that their poor performance was greatly exacerbated by mathematics instruction and concepts being taught in English within a cultural framework which was unfamiliar to the Indigenous people. In Bourdieu et al.'s (1994) view, this is a *symbolic violation*. He further argues:

> To fully understand how students from different social backgrounds relate to the world of culture, and more precisely, to the institution of schooling, we need to recapture the logic through which the conversion of social heritage into scholastic heritage operates in different class situations (Bourdieu et al. 1994, p. 53).

Symbolic violation in this sense refers to the subordinate effects on people with unique cultures that produce and maintain social domination in covert ways (Colaguori, 2010). Bourdieu's views as exemplified above show that the nature of pedagogy has the power to construct class positioning, for example, when pedagogy is delivered through foreign language that privileges some children and exclude others. van Kraayenoord (2015)

notes that language plays a very important role in our interactions with others and in constructing our thoughts, and influencing learning. This implies that a number of difficulties students experience in learning and in mathematics reasoning are language related. van Kraayenoord (2015) reiterated that "one of the pervasive problems in mathematics is associated with the language of mathematics" (p. 270). Inclusive pedagogy and equity recognise the valued membership of every student (Pagliano & Gillies, 2015). Two key components of inclusive education are access and participation. Everyone is to have a right to language that gives them full access and effective participation in the curriculum, to develop and learn effectively. It is argued that when instructional language and cultural backgrounds are valued as resources, pupils can be empowered to access and fully participate in the curriculum (Cummins, 2000). Munro (2015) reiterated that a key factor that will determine how well a student will benefit from an inclusive program is their language ability. In this way instructional language is critically associated with inclusive pedagogy and equity because it forms the building block of understanding.

Theoretical framework

We framed our study in Vygotsky's Cultural Historical Theory, particularly the aspects that focused on language as a tool for making sense of social practices and cognitive development (Vygotsky, 1978). Language serves as a psychological tool for children's intellectual development within their society (Boyle, 2015). In mathematics classrooms, language serves as a mediator in facilitating the overall development of an individual's concept formation (Davis & Agbenyega, 2012). As language is identified as a "highly personal and social process amongst human beings" (Vygotsky, 1978, p.126), there is need for social interaction to enable learners to engage in dialogical process, using language to facilitate conceptual understanding of subject matter. Language exists in many different forms, verbal, gestural and symbolic. Similarly, mathematics has its own verbal gestural and symbolic language forms that learners need to understand in order to be effectively included in mathematics learning (Munro, 2015; Zevenbergen, Mousley & Sullivan, 2004). Children can use language to communicate mathematical ideas, needs and expectations. In this way, the different forms and uses of language that have been created by all human cultures can be regarded as cultural tools, as they enable people to think and share ideas that may be unique to that group (Bodrova & Leong, 2007).

Boyle (2015) argues that students benefit emotionally and cognitively when they are included in the social dynamics of the classroom and instructional language serves as a tool for initiating interactions with others (Vygotsky, 1962). Using language that is foreign to children's home language as an instructional can leave some children confused and disengaged (Jorgensen & Sullivan, 2010; Zevenbergen, Hyde & Power, 2001). Mastering mathematical language in its various forms is powerful for children's intense interactions, to listen and reply to one another's ideas, extend and develop their own understanding (Bodrova & Leong, 2007; Zevenbergen, Mousley & Sullivan, 2004).

It is possible that the use of English and the nature of mathematics instruction in Ghanaian primary schools may be excluding many young learners from understanding and forming basic concepts that are needed for further learning. It is therefore important to explore the intersection of the English language as a medium of instruction and inclusive pedagogy in mathematics classrooms in two primary schools in Ghana by focusing on the question: *How are English as the instructional language and nature of instruction contributing to pupils' access and effective participation in Mathematics learning in the Ghanaian primary classrooms?*

Methods and Design

We employed a qualitative exploratory method (Creswell, 2012), to investigate how the English language as the language of instruction is contributing to inclusion or exclusion of pupils in mathematics instruction in primary school. The purpose of using an exploratory approach is that the problem of the English language as a medium of instruction, and inclusive pedagogy in mathematics classrooms in Ghana have not been clearly investigated.

Participants and Procedure

Two public primary schools, a rural (School A) and an urban (School B) were randomly selected from a list of primary schools in the Cape Coast metropolis of Ghana.

Ghanaian schools in rural areas often attract pupils from families who have very poor socioeconomic status as compared to the schools in urban areas. Pupils in rural schools often have very little opportunity to use the English language outside the school premises and struggle with spoken and written English. Hence, the use of the rural and urban contexts provided the opportunity for the researchers to investigate the issues across two very different school contexts. In each of the schools, primary six pupils and their teachers were purposively selected for the study for two reasons. Firstly, according to the Ghanaian language policy we assumed that primary six pupils might have developed basic understandings of the English language since they had previously learnt through this medium for three years, and secondly, primary six is the transition between the primary school and secondary school in Ghana and students require strong foundation in mathematics before they transition to secondary school. Both of the schools were co-educational. In all, two male teachers and 79 pupils (54 from School A and 25 from School B) were observed in mathematics class (see Figures 1 and 10). Following the observation, the second author interviewed 10 pupils from School A (five who took active part in the lesson and five who did not), and six pupils from School B (three who were actively involved in the lesson and three who did not speak in the class during the lesson). Active participation in this sense, is pupils' contributing to classroom discussion and responding to questions asked by the teacher.

Permission was sought from the Cape Coast Metropolitan Education Office, the participating schools and pupils and their parents before they were invited to participate in the study. Data was collected with the support of two trained research assistants. In each of the lessons, the researchers recorded the classroom interactions and compared their observations for agreement regarding consistency of the data reflecting the classroom interactions. The transcript of the observation record was given to the teachers for them to confirm that it reflected what transpired in their classrooms during the lesson. Thematic analysis of the data collected through classroom observation and interviews produced three important themes: Access, Approach and Responsibility. We present the results under these combined themes with illustrative examples. The teacher participants are coded as SAT=School A teacher, and SBT= School B teacher. Participant pupils from the rural school are coded as PR1, PR2….PR54 and those from the urban school as PU1, PU2…PU25.

Results

The main findings that emerged from the study were related to access, approach and responsibility which we presented and discussed as nested themes.

Access, Approach and Responsibility

Important components of inclusive pedagogy are access to learning by all students, approach to teaching that recognises individual needs and responsibility to each student that demonstrates their value in the classroom (Author, et al., 2014; Klibthong, 2013; Pagliano & Gillies, 2015). In this study, the results from schools A and B showed that although the classroom depicted a heterogeneous ensemble of pupils with varying levels of competency in the instructional language (English), ineffective teaching made the learning of mathematics accessible to few pupils. For example, in a 70 minutes mathematics lesson with 54 pupils in School A on the topic, "Transaction with money", only 46% of the class had some level of participation, and more than 50% of the pupils were rendered onlookers. School A had 54 pupils seated in eight rows during the mathematics class. Classroom observations showed that the majority of the pupils in School A (54%) did not have access to the lesson because of the teacher's instructional approaches and lack of responsibility to all the pupils in the class. Throughout the lesson the teacher stood in from of the class lecturing and often ignore children who answered his questions in the local language. Instead he used the English language to draw their attention to the topic.

Teacher SAT began the lesson by saying, "This morning we are going to learn something new." He wrote, "Transaction with money'' on the chalkboard and asked the pupils to read and explain what the topic meant. PR54 explained in local Fante language, "Edzi sika reto biribi" (using money to buy something). The teacher repeated in English, "Transaction with money." He then asked, "How many 10p will make 100p?" PR53 answered, "Ten". The teacher then wrote ten 10p = 100p and asked, 100p will make how much in cedis? The pupils answered (in chorus) one cedi. The teacher then said, "Riddle, riddle, a woman sells one bunch of *kontobire* (local vegetable) for 50p. Another woman buys one and gives three cedis, what change will she get?" The pupils responded (in chorus) "Two cedis fifty pesewas (2.50p)." The teacher went on to say, "For transaction with money it involves two things, one deals with profit and the other loss". He then defined cost price as "The cost at which an item was bought and selling price as the price at which an item is sold". He asked the pupils to repeat cost price and selling price after him (three times). He then asked the class, "What is the formula for finding profit?" He repeated the question in Fante (local language) when children did not get the understanding in English. Pupil 53 (PR53) answered the teacher's question saying, "Cost price minus selling price". PR35 also said "Selling price minus cost price". The teacher asked the whole class to tell him the formula. At this point, PR17, PR31, and PR27 each said cost price minus selling price but the rest of the class said (in chorus) selling price minus cost price. The teacher then said, "The majority carries the vote". He wrote the formula as Profit = SP - CP and told the class, "Let me give you a problem so that we try our hands on it" and wrote the following example on the chalkboard:

> *Q1: "A man bought 5 oranges at two Ghana cedis and sold it for two Ghana cedis fifty pesewas"*

Teacher read the question and asked the pupils, "Did the man make a profit or loss?" He then asked PR22, PR51, PR50, PR16, PR45 and PR28 to answer the question but each of them was not able to tell whether the man made a profit or loss. He asked the pupils to stand as punishment for not being able to answer the question correctly. PR36 gave the correct answer as "He made profit". The teacher then asked "What is the profit?" and invited PR26 to answer but PR26 was not able to answer the question (what is profit), so he asked her

(PR26) to stand and later invited PR44 to answer the question. PR44 was also not able to answer therefore, the teacher asked him to also stand up. The use of standing up as punishment for not knowing the correct answer disenfranchised the students in terms of making them shameful before their peers. When the pupils could not answer the question, teacher explained the question in Fante and presented the solution on the chalkboard as shown below.

"CP = 2.00; SP = 2.50p,

P = 2.50p - 2.00=0.50".

The teacher gave a second example as follows:

Q2: "Mr Kumah sold his car for GH1000.00.If he bought it at 982, find the profit made."

He read the question aloud to the whole class and invited PR4 and PR20 to the chalkboard to solve the question. He informed the pupils that they had to finish solving the question within three minutes and asked the rest of the class to try the questions in their books. After three minutes he asked pupils to stop work PR4 and PR20 presented their solution as shown below.

Table 1.
Presentation of solution to Q2 by PR4 and PR20

PR4	PR20
SP-CP P=SP 1000 + CP =982 =1000 + 982	P=1000 P=982 P= SP-CP P-S= 1000 – 982 P =[1000- 912]

The teacher took the class through the solutions presented by PR4 and PR20 and evaluated each as being wrong. He invited PR11 to solve the question on the chalkboard. PR11 presented his solution as: P= S.P – C.P; P= 1000 – 982; P=GH18. The teacher asked PR11 whether he had finished. PR11 answered yes, he queried again, "Are you sure?" PR11 stood quietly and confused. The teacher afterwards took the pupils through the solution to Q2 as shown below. Teacher wrote the formula "Profit = Selling Price – Cost Price" on the chalkboard and wrote: =SP-CP. The Teacher gave the sale price and asked what the cost price was, to which, P12 answered, nine eighty-two. Teacher then substitute the values of SP and CP in the formula and solved for the profit as: 1000 – 982; P=GH18.

The teacher explained that PR11 did not quote the formula "Profit = Selling price – Cost Price" therefore it was difficult to tell from PR11's solution what SP and CP meant, and asked pupils to pose their own question involving profit but the pupils sat quietly, and none could pose a problem involving profit. The teacher posed a third question on the chalkboard as follows:

Q3*: A box of chalk was sold for 98p. If it was initially bought at 72p, find the profit made.*

He read the question to the whole class and invited PR29 and PR48 to the board, and asked the rest of the class to solve the problem in their books. He then wrote C.P = 72 and S.P= 98p on the chalkboard. P29 and P48 presented their solutions as shown in Table 2.

Table 2.
PR29 and PR48's solutions to question 3

P29	P48
S.P =98p C.P= 72P P= S.P- C.P = 98 – 72 =26p	P= S.P-C.P = 98p – 72p =14p

He asked the two pupils to go and stand at the back of the class as a form of punishment. He then asked the class, "Any problem with PR29's solution?" The pupils answered (in chorus) "No sir". He then asked the class, "Any problem with PR48's solution?" Pupils answered (in chorus) "Yes sir". PR10 said the answer was not correct; PR12 said the answer should have been 26. The teacher asked the class whether there was any question on profit. The pupils responded in chorus "No sir". He then asked the class, "What is the formula for finding profit?" and invited PR17, PR31, and PR27 to answer but none could answer. PR53 answered saying "P = SP – CP". The teacher then asked "What is the formula for finding loss" and invited PR43 to answer but he could not attempt the question. PR8 provided the correct answer saying loss = selling price minus cost price. The teacher wrote the formula "Loss = CP – SP" on the chalkboard and explained that to find loss, if you know how to find profit, just replace profit with loss and interchange the position of the cost price and the selling price. He then posed the question below on the chalkboard:

Q4: Eight crates of eggs were bought at GH 2000. Later due to hardship it needs to be sold for GH1, 820. Find the loss made.

The Teacher read the question and told the class that the question carried three marks. He further said that the first person to stand in each row would solve the question on behalf of the row. None of the pupils stood up but the teacher invited PR40 from the 7th row to present the solution to Q4 on the chalkboard. PR40 declined to solve the question, the teacher explained the meaning of the question to him but he still declined to solve it. PR39 offered to solve the question for the third row while PR11 also offered to solve the question on behalf of the first row. PR39 and PR11 presented their solution on the chalkboard as shown in Table 3.

Table 3.
PR39 and PR11's solution to Q4

P39	P11
L= CP –SP L =CP GH200 L =SP GH1820 L =GH2820	L = CP –SP L =2000 – 1820 L =GH180

The Teacher scored PR39 and PR11's solutions as shown in Table 4.

Table 4.
Scoring of PR39 and PR11's solution to Q4

PR39	PR11
Awarded a ½ mark for first step and 1 mark for row 3. Marked remaining steps as being incorrect	Awarded a ½ mark for first step Awarded a ½ mark for the 2nd step Awarded 1 for the final stage

The teacher posed the question below and asked pupils in rows two and four to solve it.

> *Q6: A bag was sold for GH50 if it was bought at GH70, find the loss made.*

He asked the pupils in rows two and four to solve Q6 in two minutes. As researchers, we felt that giving pupils such a limited time to solve a word problem can lead to undue pressure and copying instead of developing systematic problem solving skills. The pupils solved the question, and PR19 offered to present solution on behalf of row two while PR54 offered to present the solution on behalf of the fourth row. The presented solutions are shown in Table 5.

Table 5.
PR19 and PR54's solution to Q6

PR19	PR54
Loss = Cost price – Selling price CP –SP = 70-50 =GH20	Loss=Cost price – Selling price Loss = CP –SP right Loss=CP=70 wrong Loss=SP=50 wrong Loss=GH20 right

The teacher went through the solutions of PR19 and PR54 and awarded three marks for PR54's solution and 2 ½ marks for PR19's solution. He then recorded the score for each of the rows in a table on the chalkboard as shown in Table 6.

Table 6.
Scores obtained by rows in the class in Q5 and Q6

Row 1	Row 2	Row 3	Row 4
3	2 ½	1	3

The teacher finally ended the lesson by asking the class prefect to take out pupils' exercise books from the cupboard and share them. He then wrote the following exercise on the chalkboard and asked the pupils to do them in their exercise books:

1. *A pack of chewing gum was sold for 100p. If it was bought at 83p. Find the profit made.*
2. *If a television set was bought at GH250 and later sold for GH193. Find the loss made.*

Similarly, in School B mathematics class on the topic, "Sharing a quantity in a given ratio", out of a total number of 25 pupils, less than half (48%) had some level of participation while the rest did not participate. The approach to teaching demonstrated by the class teacher in School A was the same in School B.

The classroom we researched in school B contained 25 pupils seated in seven rows. The teacher (SBT) introduced the lesson by asking the pupils; "If six apples cost 24 Ghana Pesewas (GP), what is the cost of eight apples?" He invited PU16 to tell the class how to solve the problem. PU16 said "Let *x* represent the cost of eight apples." The teacher wrote "6 apples = 24 GP, 8 apples =?" He then asked the class "What do we put in place of cost?" PU15 said "*x*". The teacher ignored PU15's response and wrote "8 apples =?" on the marker-

board. He then said, "OK let "*x*" represent the cost of eight apples, what is next? PU16 said, "Sir we write 6: 8". The teacher wrote 6:8 = 24: x on the whiteboard and said "What is next?" PU17 said, "Divide six by eight (6/8)". Teacher wrote 6/8= 24/x on the marker-board and invited PU6 to tell the next step. PU6 said, "Cross multiply". The teacher wrote "$6\times x = 8\times 24$" on the whiteboard and asked, "What is $6 \times x$" PU1 responded "Six x [6x]" The teacher then wrote "6x = 8x24" on the whiteboard and said, "In order to find x what do we do?" He then provided the answer to the class by saying, "We have to remove the 6, and in order to remove 6 let's divide both sides by 6" and wrote, "X = $\frac{8\times 24}{6}$" on the board.

The teacher asked PU8, "What is the next step?" PU8 responded that "Six will cancel twenty-four four times" Teacher said, "Good; yes, what is next?" PU11 put up the hand and said, "You will multiply eight by four" and the teacher asked the class, "What is eight times four? What is the conclusion?" The pupils responded in (chorus), "Therefore eight apples cost thirty-two Ghana Pesewas". PU1 explained the answer saying "Six divides twenty-four four times, four times eight is thirty-two, therefore eight apples cost thirty-two Ghana Pesewas".

The teacher then asked the class "What is a quantity?" PU1 responded by saying, "Amount of something." The Teacher then asked, "What is the quantity of the class?" The pupils remained silent. The teacher told the class, "The quantity of the class is the number of people in the class. He then asked the class:

Q1: "If Benedict and Ayisha shared 15 apples, in the ratio of 2:3, find their share."

He then asked the class, "What do we do?" The pupils responded in chorus, "Sir solution", the teacher asked the class "In the ratio, what is the portion for Ayisha and Benedict?" PU14 answered, "Sir two for Ayisha" and the whole class followed (in chorus), "Three for Benedict". The teacher presented the solution as shown below.

Quantity = 15; Ratio = 2:3, sum of ratios =2x3=5

As researchers we were aware that this expression is not mathematically accurate or well-expressed but we did not interrupt the teacher as this may cause embarrassment. The teacher went on to write, Benedict's share is 2/3x15=2x3=6, "Therefore Benedict's share is 6 apples."

The teacher then asked the pupils to take their notes book and solve the share for Ayisha and went round to mark pupils' work. The teacher on his rounds, realised that PU18 was struggling but did nothing to help. Teacher asked the whole class to tell what Ayisha's share was. The pupils responded (in chorus) "nine." He stopped going round and said, "If you know you did not get nine then it means something is wrong [with your solution]". The teacher copied question 2 on the marker-board as: *"Ken and Ben shared GH₵160 in a ratio of 5:3. Find their share."*

He said to the class, "Let's solve together". He then wrote the solution on the whiteboard as, "Amount = GH□160, Ratio = 5:3, Sum of ratio = 5+3 = 8." He then asked PU18 whether he had understood what was written on the board. PU18 answered, "Yes sir." The teacher then said to PU18, "Watch you will come to the board to do the second problem." He wrote, "Ken's share = $\frac{5}{8}\times$1,600" on the whiteboard and asked the class, "What is the next step?" PU9 said, "Eight goes into one hundred and sixty ..." PU22 continued, "Eight goes into itself one and sixteen, two." The teacher said to the class, "Clap for PU22; if

you look at it you will see that eight goes into sixteen two times" and presented the solution on the whiteboard as, "Ken's share = $\frac{5}{8} \times 1600$, = 5×200, =1000" and explained 1000 as "five by two and add two zero's." The teacher then invited PU18 to the board to work the next example. PU18 presented his solution as "$\frac{3}{8} \times 1000$, $3\times 2 = 6$." The teacher then invited PU25 to the board and asked PU18 to go to his seat without telling him why he was wrong. PU25 presented the solution as "Ben's share = $\frac{3}{8} \times 1600$, = 3×200, = 600, Ben's share = 600." The teacher reminded PU25 not to forget to bring the Ghana cedis and said, "Even mine [the teacher's presentation on Ken's Share] I[he] did not bring the Ghana cedis." The teacher ended the lesson by asking pupils to take out their exercise books and do the following exercises:

Q1. Ama and Joe shared GH□4800 in a ratio of 3:5. Find their share
Q2. Ibn Aziz won the presidency award by a ratio of 4:3. If a total of 63000 votes was cast:
    i. How many votes did Aziz receive?
    ii. The opponents receive?

Making Sense of Access, Approach and Responsibility

Interviews with the teachers and pupils who did not have access to and contribute to the lesson or struggled to understand the lesson in School A and B including those who have minimal participation, provided insight into accessibility issues in relation to teaching approaches and teacher responsibility. Some of the pupils indicated that they did not participate in the lesson because the lesson was not accessible to them as it was difficult to understand the teacher's questions and topic:

> *I did not understand his question because he used big words (PR16)… I did not understand the topic and work in the sentence (PR50)… Sir the work was difficult (PR2)… I did not want to put up my hand, because the explanations were not clear to me (PR13).*

Others claimed that instructional language use made the lessons inaccessible to them:

> *We did not understand the topic because maths is difficult and the teacher was using difficult language (PR50)…all mathematics topics use difficult terms (PR2)…my difficulty is, understanding the language the teacher is using to explain the maths (PR50)…the mathematics was not difficult but the English" (PR16)…sir [referring to interviewer] we don't understand English. When he [teacher] asks question in English we don't understand it. Some of the questions I understand, others I don't. Generally I do not know maths because of the words the teacher was using (PR17)…English is the major problem for us in understanding mathematics. We know some of the mathematics topics but the English especially when the problem is written in sentences some of the English words in maths are too big for us, some of the language is all right, we understand but others are too difficult to understand (PR50).*

The pupils suggested that a blend of Fante (local language) and English would have helped them to understand the lesson:

> *If teacher teaches maths in English and Fante it will help (PR17)…some of the English terms are difficult to understand, so if the teacher mixes English with Fante it will help us to understand. If he mixes Fante and English we can put up our hands and contribute to class discussion (PR13)…I speak Fante often so if he had used it I would have understood the lesson" (PU15)…I would have understood the lesson if he had used Fante, I speak Fante at school always" (PU21).*

Interviews with the pupils who contributed to the class discussion in some way also reported language difficulties.

> *We can do it but sometimes we find the language difficult to understand (PR11)… I could do it that was why I put up my hand but when I don't follow the English I don't participate (PR39)…I was paying attention but sometimes I don't get it too (PR54)… Some of us took it serious, while he was teaching but others were playing (PR20)…He had already taught the topic so it was a revision but many did not understand the terms when he first taught the lesson because they don't know English (PR4).*

Some other pupils said that mathematics would have been more accessible to them if the language of instruction is easy to follow.

> *I don't think mathematics is that too difficult…it is the language teachers use to teach which prevents pupils from contributing to the lesson (PR4)…for me I like maths but it is the language that the teacher uses that makes it difficult for me sometimes (PR54).*

Some pupils opined that the teachers' teaching approaches limited their access to mathematics learning.

> *Some of my friends have made up their mind that they will never understand maths because the teacher does not provide practical activities they can understand. It is like memorising everything, which they cannot do (PR39)…some of them do not like maths because they have to memorise the formulas so they do not want to learn (PR11)…they don't care when the teacher is teaching, not all of the pupils like maths the way the teacher goes about it (PR4). Teacher's approach to teaching does not encourage pupils to contribute in the lesson, they are afraid that if they slip or make mistake in the language teacher will punish them and classmates will laugh at them (PR4).*

Teacher responsibility also featured in the ways the pupils perceived their accessibility to mathematics learning.

> *Teacher used big words to communicate in English when teaching maths but he did not explain the lesson well (PR39)…When I learn I don't understand it but the teacher does not support me (PU21)…I did not understand it, I need more explanation (PU18)…I did not follow the steps the teacher used in teaching the topic, he was moving too fast (PU15)…when they teach I don't understand it because it is like he is rushing us (PU21).*

Further comments from the pupils showed that they expected extra support from the teacher to enable them access the lesson.

> *It was a new topic if he gives us more support we can do it (PU1)… if a pupil does not understand they need to be helped…I didn't like mathematics because you don't get help … I need help with the language to feel happy with mathematics (PU25). If I can't speak English well I can work with other friends in a group to contribute to the lesson. But teacher will not agree…we have to do everything on our own…so what happens, those who are good at Fante, sit quietly, the class becomes quiet, sir [the class teacher] will say so you understand (PU16).*

> *Then I will ask question, when he ask [sic] the question in Fante you will see a lot of hands up (PU1)… we want the teacher to teach in English but use the Fante Language together with the English in order to enable all pupils to participate in lessons (PU16).*

The teacher in schools A also mentioned language as a contributing factor that affected the level of contribution of pupils in their mathematics lessons.

> *Pupils do not have the confidence to ask questions when they have difficulty because they find it very difficult to express themselves in the English Language. That deters them from asking questions in class. The mathematics terms are in English and the children finds it difficult to understand especially word problems (SAT).*

The teachers in school A and B appeared to shift responsibility to the pupils, complaining that some of their pupils did not participate in the mathematics lessons because of their weak background in mathematics, class size and absenteeism.

> *Some of the pupils have the four basic operations very well, addition, subtraction, division and multiplication but I do have pupils with weaker foundation… The class size is too large, I have sixty-three pupils in the class, and paying attention in the progress of each student becomes very difficult. Again pupils do not come to school consistently, therefore when they miss class they find it difficult to follow the next lesson (SAT).*

> *Pupils have varied abilities in maths. Most of them are not good. Those who did not participate are not good in maths. It is not an issue of language at all. Every child and his/her own IQ. Most of them are not good at calculation because of poor foundation (SBT).*

Although the teachers mention pupils' weak foundation in mathematics as inhibiting their comprehension and participation, the results demonstrate that the pupils limited participation in the mathematics lessons were link to the intersection of ineffective pedagogy and pupils' limited proficiency in English as the instructional language.

Discussion

The results have shown that within the two classroom spaces, access to learning was limited to few pupils who were used by the teachers during the initial development of the lessons. There is clear evidence to suggest that a number of pupils were being excluded from developing mathematical concepts necessary for further learning due to lack of effective inclusive pedagogy and pupils' limited proficiency in English as the medium of instruction in both schools. While inclusive pedagogy framed in whole schooling perspective uses teaching approaches that acknowledge, "respect as well as respond to student differences in ways that include learning in, rather than exclude them from what is ordinary available" (Florian and Black-Hawkins, 2011, p. 814), the pedagogical landscape in both schools appeared to be poorly delivered. While some pupils' comments showed how their low competency levels in the instructional language detached them emotionally and cognitively and excluded them from the social dynamics of the classroom we also believed that the teachers have little skill regarding how to make mathematics classrooms stimulating for all pupils in a large class. Skilled teachers would have used instructional language as a tool for initiating interactions with others for enhanced learning (Boyle 2015; McMaster, 2015). Surprisingly, the teacher's pedagogical approaches added to language barriers to deny the pupils opportunity for active engagement with other learners. Using language to dialogue with others in a learning process facilitates conceptual understanding of subject matter (Vygotsky, 1978).

In each school context pupils who struggled to understand the lesson as a result of the English language which was different from the language spoken at home were blamed by the teachers as lacking the cognitive skills necessary for mathematics learning. In School A for example, pupils PR17, PR31 and PR27 who were not able to give the formula for finding profit after the teacher had taught this concept were not given any additional support, rather the teacher went ahead to teach another concept, loss. Similarly, in School B, PU18 who could not find Ben's share during the ratio lesson was left without any help to understand the lesson. It appears from both lessons that the teachers' main aim was to cover the topic not necessarily to teach for the pupils to understand. This study has demonstrated that ongoing initiatives aimed at implementing inclusive pedagogy for enhanced quality of learning and promotion of inclusive education must involve a careful consideration for English as the instructional language in Ghanaian primary schools because language drives cognition (Bodrova & Leong, 2007).

We found that not only did instructional language limit the pupils' understanding and participation in the mathematics lessons but also large class size and unresponsive teaching led to disengagement. But we are particularly drawn to the English language and how it is being used to teach pupils in the primary school because instructional language holds potential for positively impacting school learning processes and creating congenial whole school context for dialogue in learning. According to UNESCO (2007), "the language used in

teaching is of central importance for enhancing learning. It is necessary to bridge home and school experiences by using the children's mother tongue (s) as the medium of learning and teaching in the school" (p.19).

Therefore, using language that the pupils do not understand can produce pedagogical struggles within classrooms leading to pupils' difficulty in understanding and solving mathematical problems (Munro, 2015; Pagliano, & Gillies, 2015). Although the teacher from School B did not perceive language as having influenced his pupils' foundation knowledge and participation in the lesson, the interviews with the pupils showed that the use of English language as the medium of instruction affected their foundation knowledge and participation in the lesson and their understanding of the lesson as echoed in PU15's statement; "I speak Fante often so if he had used it, I would have understood the lesson". While the foundation knowledge of pupils is important in the study of mathematics, we believe the issue of the English language and effective teaching are the most important factors in building this foundation. Durkin (1991) explained that "mathematics education begins in a language, it advances and stumbles because of language, and its outcomes are often assessed in language" (p. 3). Pupils need to understand both the English language (the medium of instruction) and the language of mathematics in English (Mathematics register in English) (Pimm, 1987; Zevenbergen, Mousley & Sullivan, 2004) in order to understand school mathematics. Weakness in mathematics has serious implications for further education in Ghana because progression from one level of education to another in Ghana requires a pass in mathematics. Students, irrespective of their courses, cannot access university education in Ghana if they do not have a pass grade in mathematics at the high school leaving certificate examination. It is possible that pupils who are struggling with mathematics because of limited proficiency in the English language such as PR3, may eventually drop out of school in grade nine or pass through the cracks and ultimately, fail to make their final secondary mathematics grades if they do not receive extra support. Therefore, urgent attention must be directed to Ghanaian teachers' development on how to use the English language as well as implement effective teaching strategies when teaching mathematics. Effective teaching is link to young children building the foundation needed in basic mathematics concepts, particularly when the local language becomes part of the instructional language.

Implications and Conclusion

The implications that can be gleaned from this study are that first, the classroom teachers do not appear to understand how inclusive pedagogy recognises the valued membership of every student therefore, they taught to only few students (Pagliano & Gillies, 2015). Knowledge of inclusive pedagogy should have enabled the teachers to be conscious and reflective of their use of English as the instructional language including using authentic resources to facilitate the lessons. Secondly, the use of language that is foreign to the children's home language as an instructional language in primary grades amounted to practising foreign culture, which can lead to early academic mortality (Jorgensen & Sullivan, 2010; UNESCO, 2007). Thirdly, pupils who lacked deep understanding of English as the instructional language were limited in forming conceptual understanding of what was being taught. This can result in long standing problems that may compromise their future learning and job prospects.

Without rigorous intentional efforts to develop and implement effective *inclusive pedagogy* in the early acquisition of mathematical concepts and skills, many students will continue to be excluded from developing fundamental mathematical concepts and skills needed for further learning (Zevenbergen, Mousley & Sullivan, 2004). Teacher professional

learning for mathematics teaching that incorporates inclusive pedagogy and ways language is used to function as communication and cultural practice, can prepare teachers to be responsive to pupils' learning needs in a more effective way, enabling them to become effective problem solvers in mathematics (Gray & McBlain, 2012; Jorgensen & Sullivan, 2010). We conclude that effective teaching and use of pupils' familiar language hold promise for the development of mathematical concepts for further learning (Zevenbergen, Hyde & Power, 2001). Proficiency in language and effective teaching are powerful for pupils' intense interactions, to listen and reply to one another's ideas, extend and develop their own understanding (Bodrova & Leong, 2007; Zevenbergen, Mousley & Sullivan, 2004). Finally, for mathematics teaching to be inclusive of every pupil at the primary level there is need to use pupils' mother tongue to enable them get access to mathematics conversation, which have a high amount of symbolic capital (Bourdieu, 1991) in Ghanaian society at large. This in turn will enhance pupils' status as effective learners. There is a lot to gain when pupils' first language is used for teaching and learning mathematics, particularly at the primary level in the Ghanaian classroom because first language will enable communication in a mathematical learning situation, drawing on their cultural and social backgrounds as tools for thinking, reasoning and mediation in developing new concepts and ways of understanding mathematics as cultural activity.

Limitations and Suggestions for Future Research

This study solely focused on two classroom practices at the upper primary to understand how use of the English language as a medium of instruction, and inclusive pedagogy intersect in terms of access and participation in mathematics learning. Examining the case in lower primary classrooms across many primary schools may provide a better understanding into the issue as it is at the lower primary level that the Ghanaian language policy-practice dichotomy is most prevalent. Future research can examine, on a large scale, the extent to which instructional language is contributing to a lowering standard in mathematics achievement in the Ghanaians primary schools.

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