PROMOTING CRITICAL THINKING IN MULTILINGUAL MATHEMATICS CLASSES THROUGH QUESTIONING: ARE TEACHERS TRULY CULTIVATING IT?

Clemence Chikiwa
Education Department, Rhodes University
South Africa
c.chikiwa@ru.ac.za

Marc Schäfer
Education Department, Rhodes University
South Africa
m.schafer@ru.ac.za

ABSTRACT

Over the past three decades, research has increasingly been done on language related factors and how they directly influence successful conceptual teaching and learning of mathematics in South Africa's multilingual classes. This study explores how teacher questioning was used to foster critical thinking during instruction of grade 11 multilingual mathematics classes in the Eastern Cape Province. A mixed method design was used to collect and analyse both qualitative and quantitative data through classroom observations and interviews of three purposively selected grade 11 mathematics teachers during their teaching of trigonometry and analytical geometry. The study was guided by Vygotsky's sociocultural theory and Bloom's revised taxonomy. The study found that teachers in these multilingual classes used lower order levels questioning according to Bloom's taxonomy when formulating questions during teaching. Higher order questions, which research has shown have the potential of promoting critical thinking, was scantly used during teaching. The paper concludes that while all the categories according to Bloom's taxonomy are important, the ones that are crucial in promoting critical and higher order thinking required at grade 11, were not adequately used. To promote effective teaching and meaningful learning in mathematics, teachers of multilingual classes are urged to make conscious and deliberate steps to include all forms of questions in their mathematics teaching.

Key Words: Multilingual, Questioning, Critical Thinking.

1. INTRODUCTION

Oral questioning is crucial in the teaching and learning environment. Teacher questioning may be used as a teaching strategy in its own right or as part of any other strategy during instruction. Teacher questioning plays a critical role in mathematics classes as it is used for various purposes that includes cultivating critical thinking skills and thereby fostering deeper learning. Most South African mathematics classes are multilingual which presents additional challenges associated with language uses during teaching. The majority of learners in rural and township schools are taught in a language that is neither their first nor one that is commonly spoken in the communities these learners live in. The language of teaching and learning (LOLT) is in most cases not developed to a level which these learners can comfortably use as a medium of instruction (Chikiwa & Schäfer, 2016). This presents teachers with a dual task of teaching mathematics in the LOLT and translating some concepts to the learners' first language in ensuring these learners grasp the mathematical concepts.

Teachers thus ask questions in two or more languages through code switching which is defined as the alternate use of two or more languages in the course of a single utterance, conversational exchange or speech event (Gardner-Chloros, 2009; Gumperz, 1982). In cases where the LOLT is not the learners' home language, many researches in the field of mathematics education refute the assumption that the learners' home language is not necessary and should be ignored in multilingual classes (Setati, 2008). Some studies, for example Cummins (2000), proposes that learners who can converse in two or more

languages and are permitted to use them during learning will perform better than their peers who do not. “The goal of education is for learners to ultimately think critically, learn, analyze, criticize and develop skills to solve familiar and unfamiliar problems. This implies that questions that encourage critical thinking should be part of the instructional repertoire of all teachers of mathematics” (Sillivan & Lilburn, 2002, p. 1). Thus, teacher practices that provoke student-thinking leading to deeper conceptual understanding of concepts are vital for promoting meaningful engagement and learning in mathematics classrooms.

The need to use learners’ home language to ask questions that promote deeper conceptual learning, long lasting understanding and critical thinking, needs to be looked at more closely. Over the past three decades, research has increasingly been done on language related factors and how they directly influence successful conceptual teaching and learning of mathematics in South Africa’s multilingual classes (Chikiwa & Schäfer, 2016; Setati, 2008). In an era where various societal and educational sectors are advocating visible transformation and quality decolonised education, language related factors in teaching and learning at school level are paramount. Components that entail day-to-day functions of a mathematics class need to be investigated in promoting effective teaching and meaningful learning in mathematics in today’s secondary school mathematics classroom. Thus in the wake of the teachers’ use of pupils’ first language in South African’s mathematics classrooms, this paper focuses on how teacher questions posed in pupils’ home language through code switching fostered critical thinking during teaching. We thus sought to address the following questions: **What teacher questions are prevalent in multilingual mathematics classroom? What forms of thinking do multilingual teacher questions promote? How can teachers use questions to promote critical thinking in multilingual classrooms?**

2. BACKGROUND

2.1 Critical Thinking

Critical thinking is a way of making reasoned decisions or judgements about whether a claim, statement or any phenomenon posed is false, true or partially true. In the teaching of content subjects like mathematics, critical thinking enhances creative problem solving options as it encourages learners to seek new strategies (Paul & Elder, 2008).

Elder and Paul (1994: p. 34) state that "critical thinking is best understood as the ability of thinkers to take charge of their own thinking." Such a skill helps learners to think of adequate support to any claim, or belief they might have about mathematics. Students who are taught to think critically take charge of their own thinking and are able to monitor it. According to Paul (1990) critical thinking is “thinking about your thinking while you’re thinking, in order to make your thinking better” (p. 91). Presented with various mathematical situations, a critical thinking learner will always monitor his/her own thinking, making sure that no premature conclusion or solution is provided.

As argued by Duron, Limbach and Waugh (2006), critical thinkers raise vital questions and problems, they formulate these questions clearly to gather and access relevant information they would use to base their judgements. Bloom’s (1956) work that identifies six levels within the cognitive domain forms the primary base on which some critical thinking theory rests. The last three levels, analysis, synthesis and evaluation, focus specifically on what learners require to think critically.

One way to promote critical thinking is to ask appropriate questions framed at the right cognitive level in the teaching and learning of mathematics. Critical thinking is characterized by a readiness to question all assumptions, an ability to recognize when it is necessary to question, and an ability to evaluate and analyse (Duron, Limbach & Waugh, 2006). Critical thinking has been widely recognized and encouraged in education for many years, and using questioning techniques is one way that teachers can inspire critical thinking.

2.2 Questioning

Questioning is indispensable and all-important in the teaching and learning process. Thinking is largely driven by questions and not solutions. Questions are mostly essential for driving thinking during teaching

and learning. Paul (2007, no page) argues that "if you have very few questions, you have very little to think about." While there are many strategies teachers may use to influence learners' thinking, Clasen and Bonk (1990) posits that teacher questions have the greatest impact. For learners to think through their work or rethink their solutions to given tasks, they must be asked questions that stimulate thought. The level of learners' thinking was found by Clasen and Bonk (1990) to be directly proportional to the nature and level of questions teachersask.

Questions that demand critical thinking drive thought processes to look beneath the surface of things. In the context of the mathematics classroom, critical thinking encourages teachers and learners to delve beyond the surfaced definition of a mathematical concept, for example and unravel and deal with the all the complexities of a mathematical concept. Paul and Elders (2008) observe that unfortunately some teachers are themselves not generators of critical questions and answers of their own. This can result in superficial engagement, thinking and reflecting on their own teaching of mathematics. Paul and Elder (2008) assert that many teachers are purveyors of questions and answers of others-usually those of a textbook and other materials developed by others, not themselves. This makes teaching and learning an impoverished exercise that may not result in intended objectives such as producing learners who are capable of thinking critically.

2.3 Bloom's Taxonomy

In this study, we used Bloom's taxonomy to analyse teacher language in questions asked. Bloom and others developed this classification in 1956, which has since been revised by a number of other authors. Below is Bloom's Taxonomy as revised by Anderson and Krathwohl (2001) with modified terms and emphases. This adapted Bloom's model has changed *knowledge* to *remembering* and the highest level of development is *creating* (synthesis) rather than *evaluating*.

A strength of Bloom's Taxonomy, in our view is its ability to distinguish between higher- and lower-order thinking skills. This assisted in raising awareness of the need to foster critical thinking during teaching and learning. It must be emphasized that Bloom's categories are not in themselves independent but are very much interdependent (Paul & Elder, 2008).

Figure 1: Revised Bloom's Taxonomy Adapted from Anderson and Krathwohl (2001).

Category	Generic Skills	Sample Verbs
Remembering **Recalling information**	The learner is able to recall, restate and remember learned information.	Choose, Cite, Enumerate, Group, Label, List, Listen, Locate, Match, Memorize, Name, Outline, Quote, Read, Recall, Recite, Record, Relate, Repeat, Reproduce, Review, Select, Show, Sort, State, Underline, Write
Understanding / Comprehension **Explaining ideas or concepts**	The learner grasps the meaning of information by interpreting and translating what has been learned.	Account for, Annotate, Associate, Classify, Convert, Define, Describe, Discuss, Estimate, Explain, Express, Identify, Indicate, Interpret, Observe, Outline, Recognize, Reorganize, Report, Research, Restate, Retell, Review, Translate
Applying **Using information in another familiar situation**	The learner makes use of information in a new situation from the one in which it was learned.	Adapt, Apply, Calculate, Change, Collect, Compute, Construct, Demonstrate, Dramatize, Draw, Exhibit, Generalize, Illustrate, Interpret, Interview, Make, Manipulate, Operate, Paint, Practice, Sequence, Show, Sketch, Solve, Translate

Analyzing (Critical Thinking) Breaking information into parts to explore understandings and relationships	The learner breaks learned information into its parts to best understand that information in an attempt to identify evidence for a conclusion.	Analyze, Appraise, Arrange, Calculate, Categorize, Compare, Contrast, Criticize, Debate, Detect, Diagram, Discriminate, Dissect, Distinguish, Examine, Experiment, Group, Infer, Inquire, Inspect, Investigate, Order, Probe, Question, Relate, Research, Scrutinize, Separate, Sequence, Sift, Subdivide, Summarize, Survey, Test
Evaluating (Critical Thinking) Justifying a decision or course of action	The learner makes decisions based on in-depth reflection, criticism and assessment.	Appraise, Argue, Assess, Choose, Compare, Conclude, Criticize, Critique, Debate, Decide, Deduce, Defend, Determine, Differentiate, Discriminate, Evaluate, Infer, Judge, Justify, Measure, Predict, Prioritize, Probe, Rank, Rate, Recommend, Revise, Score, Select, Validate, Value
Creating / Synthesis (Critical Thinking) Generating new ideas, products, or ways of viewing things	The learner creates new ideas and information using what has been previously learned.	Act, Assemble, Blend, Combine, Compile, Compose, Concoct, Construct, Create, Design, Develop, Devise, Formulate, Forecast, Generate, Hypothesize, Imagine, Invent, Organize, Originate, Predict, Plan, Prepare, Propose, Produce, Set up

Dori and Herscovitz (1999) argue that the questions teachers ask reflect the level of thought entailed required from the learner to answer them. They can therefore be ranked. Both Bloom's earlier and revised taxonomy of cognitive objectives is useful in formulating and planning questions that require low to high-level thinking. The levels include, remembering/knowledge, comprehension, application, analysis, synthesis and evaluation (Figure 1). Teacher questions that elicit responses in the knowledge, comprehension, and application domains are frequently considered lower-order questions, while questions in the analysis, synthesis, and evaluation categories are considered higher-order questions. Teachers who create learning environments in which learners interact in the upper three levels are exposing their learners to critical thinking (Limbach & Waugh, 2010). While lower-order questions are equally important, higher- order questions elicit deeper and critical thinking, thus, teachers are encouraged to ask questions in these domains as well.

Using Bloom's taxonomy, the analysis level requires teachers to formulate questions that demonstrate an ability to determine internal relationships, ability to visualize patterns, to question, classify information, concepts and theories into component parts. Teacher questions at the synthesis level require students to demonstrate abilities to relate knowledge from several areas within and outside a given curriculum to create new or original concepts or ideas.

In this study, we are not claiming that once teachers incorporate questions that call for analysis, synthesis and evaluation, then, they are teaching learners to think critically. Rather, we are suggesting that teachers who at least use such questions during teaching are to a significant extent promoting critical thinking more than those who do not. It is widely acknowledged that lower order questions limit learners' critical thinking and deep understanding of any subject matter including mathematics (Qashoa, 2013; Schneider, 2001).

2.4 Vygotsky's sociocultural theory

Sociocultural theory emphasizes the importance of language use in social interactions and development. According to Vygotsky (1986) learners' cognitive development, evolve through the internalization of interactions with more able individuals in their immediate social environment. In such interactions, Vygotsky's work concentrated on the manipulation of language as a crucial characteristic of formal schooling and the development of scientific concepts (Moll, 1990). Tools and signs of which language is the 'tool of tools' (Vygotsky, 1986) mediate human learning at both the social (external) and the individual

(internal) planes. From a Vygotskian perspective, critical thinking skills are taught through speech interactions between the teacher and learners in the classroom. Vygotsky advocates that humans do not act directly on the physical world without the intermediary of tools such as language. Thus, language used for questioning by teachers should ultimately scaffold, mediate and foster important lifelong skills such as critical thinking.

3. SAMPLE AND RESEARCH PROCESS

This study used a case study approach that enabled the researchers to gain a detailed view of teacher language used during questioning when they were teaching geometry in multilingual classrooms. Three grade 11 mathematics teachers from three districts in the Eastern Cape Province of South Africa were purposively selected to participate in this study. The LOLT of all the three classes was English and the home language of the majority of learners was isiXhosa. Each teacher and his/her class constituted a case. Data were obtained through observing five consecutive lessons per participating teacher.

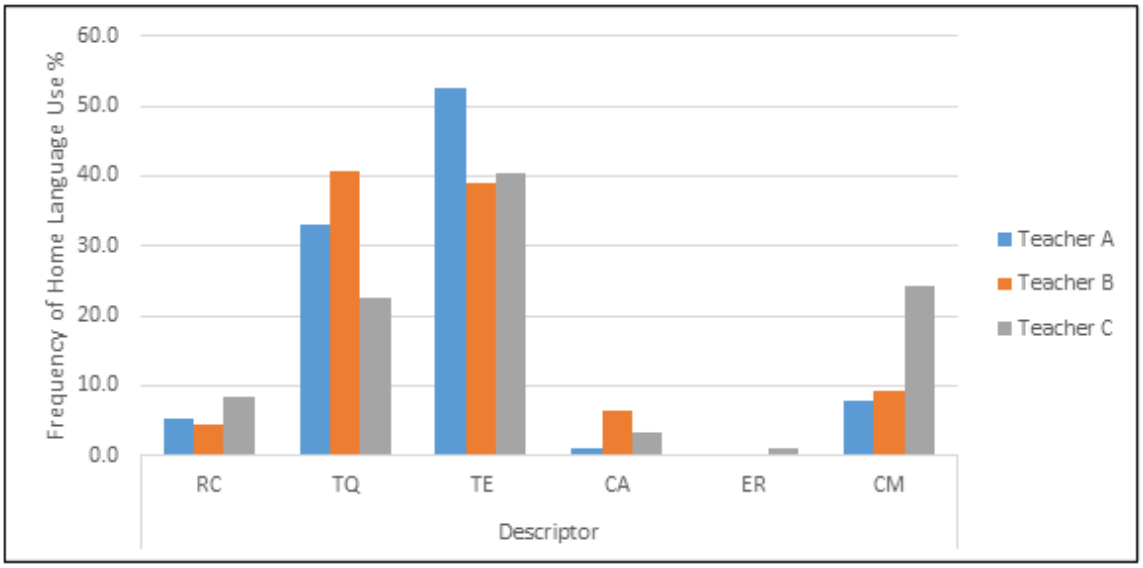
These three teachers were identified as Teacher A, Teacher B and Teacher C. Each teacher was observed for five consecutive one-hour daily lessons in a week teaching trigonometry and analytical geometry. Lesson observations were used to identify teacher language used to formulate questions during teaching. Lessons were video recorded focusing only on the teacher and the language used. At the end of each lesson, each teacher was interviewed following up on the language teachers had used during the lesson. Thus multiple sources of data were used.

The videos were transcribed and analysed in two stages. First, quantitative analysis was done to identify the frequency of home language used across various lesson categories. These lesson categories were developed from Gumperz's (1982) and Mercer's (1995) work. These lesson categories were responding to student Contribution (RC), teacher questioning (TQ), teacher explanations (TE), classroom assessment (CA), evaluative remarks (ER) and classroom management (CM). This was followed by the qualitative analysis using Bloom (1956) taxonomy as revised by Anderson and Krathwohl (2001). Trends and patterns that emerged during the quantitative analysis were followed up during the qualitative data analysis process. Use of mixed methods in the collection and analysis of data enhanced validity of results.

4. DATA ANALYSIS AND DISCUSSION

In the lessons observed, the three teachers were teaching trigonometry and analytical geometry. They were dealing with different concepts of these topics in the week they were observed. This paper focuses only on how teacher questioning was used to foster critical thinking during instruction of these lessons.

Figure 2: Teachers' Frequency of Home Language across Lesson Categories



Of the six lesson categories considered in this study, teachers used the home language more frequently during questioning and explaining (see Figure 2). The high frequency of questioning was important as supported by Paul (2007, no page) who argues, "At every point in class, at every moment of instruction, there is a question on the floor. Because if there is no question on the floor there is nothing to think about." At least 22% of the questions asked by the teachers in this study were presented in the home language. The learners' first language frequency used during questioning by these teachers is presented in Figure 2 (A- 33%; B- 41%; C- 22%). This implies that if such frequent use of home language is utilized in a manner that may not promote critical thinking, many opportunities are being missed by these teachers to inculcate in learners this essential skill. The ensuing sections focus on the qualitative analysis of some of the questions teachers presented to their classes.

4.1 Solving Triangles

Most of the questions Teacher A presented during solving triangles were those that required learners to recall information. In each case if the questions were phrased differently, they would have been classified in other domains of the taxonomy. An example is the third question in the extract below. If it was rephrased to "Why is this triangle a scalene?" then it would become an application question. Some examples are given in excerpt 1 below:

Teacher	Question asked	Cognitive level of the Question
A	Sazintoni kanene nge- (what do we know about an) isosceles triangle?	Remembering
A	U-BOD, can you see BOD, what type of an angle is BOD? */Silence/* BOD siyambona u-BOD, uyintoni u-BOD pha kula triangle (can you see BOD, what is BOD in that triangle)? Niyambona u- (can you see) triangle AOB, jonga kengoku u-BOD yena uyintoni kula- triangle (now look at BOD, what is BOD in that triangle)?	Remembering
A	Now we have a Scalene triangle siyayibona (can you see it), i-Scalene triangle kuthwani (what is it?)	Remembering
A	Siyayazi i- (do we know an) arc */yes/* yintoni i- (what is an) arc? Masijonge pha ebhodini, khanindi xelele i-arc pha (look at the board, what is an arc)? Yeyiphi i- (which one is the) arc?	Comprehension
A	Nizibona ngantoni eza angles zi-equal kula triangle (how can you identify the two equal angles in that triangle)?	Application
A	Uyintoni u- BOD pha kula- triangle (what is BOD in that triangle)? La- (that) angle uyintoni pha kula- triangle (what is that angle in relation to that triangle)? BOD uyintoni kula- triangle (what is BOD to that triangle)?	Comprehension
C	Singamfumana u-F lo, sisebenzisa eyiphi i-triangle (which tringle can we use to find F)?	Comprehension
C	Siyamfumana la-F (we can find that F) using which triangle?	Application

Excerpt 1

We found that questions presented in the learners' home language during learning were mainly reduced to recall. Very few were of the application level and other levels above. The words teachers used in some cases reduced the level of questions to just recall and remembering of facts. The teachers asked the "what" questions most of the time using words like ***ngubani, uyintoni, yintoni, sazintoni, kuthwani***. Not much thinking was thus required of students due to the nature of questions teachers presented during the teaching of how to solve triangles. Considering that these teachers were teaching Grade 11 classes, more of comprehension, application, analysis and synthesis questions were expected to be presented to these learners. In our observation, critical thinking was thus not adequately promoted in these classes during the teaching of this concept. Students were provided with little opportunities to think critically during their learning of how to solve triangles.

The questions asked in this section did not allow learners to come up with their own ideas. They were

mostly required to remember what they did in the previous lessons or just extract information from the given diagrams without much depth to promote critical thinking. If teachers give themselves opportunities to think carefully before the lesson about their language practices, they can use home language through code switching more productively formulating higher- order questions that will eventually lead to critical thinking. This will help curb over- use of remembering, recall and rhetoric questions that are less beneficial in aiding and promoting critical thinking.

4.2 Transparent Code Switching and Critical Thinking

A form of code switching termed transparent code switching, used by Chikiwa and Schäfer (2016) in their study emerged strongly in this study. This is where isiXhosa terms posed no translation problems because of their familiarity to both the teacher and the pupils to formulate questions. In this section, we focus on some of the questions in which transparent terms were used. Of interest in this section was to see if teachers provided opportunities for critical thinking when they code switched transparently. These are discussed below.

Teacher	Question asked	Cognitive level of the Question
A	BC intersect with DC at G, BC and DE niyabona (can you see) iphi i-intersection idibanaphi (where is the intersection, where do they meet) zidibana apha (they intersect here) let say ngu- (it's) G siyabona (can you see) right.	Remembering
B	Niyambona u- (can you see) AC apho kudibana khona u- AC lo-FG (where AC and FG intersect) siyabona (can you see)	Remembering
A	U-B ngubani (what is B) usezantsi komgca (it is below the line).	Remembering
B	I-scale sala straight line sithe ngubani (what did we say the scale of the straight line is)?	Remembering

Excerpt 2

In the excerpt 2 above, 'intersection' used by Teacher A, is translated to ***dibana***. Teacher B also used this translation in his questioning when referring to intersection. ***Dibana*** is an everyday word, which teachers use to mean meet, intersect, or add. The use of ***dibana*** was transparent in this case for both teachers. The only challenge is that teachers reduced their questions to recall by adding other words like ***siyabona*** and ***niyabona***. The first question in the extract above provided more than enough information for the learners. In this case, Teacher A asked a question that seemingly did not need learner's response. In the process, she thus answered it on her own.

In the excerpt 3 below, the transparent word for 'calculate' that teachers used was ***bala. Bala*** is an everyday word that teachers and pupils use in and outside the classroom. It is also a word that pupils are introduced to in their early years of learning mathematics. Teacher B formulated a question at the synthesis level using ***bala***. The question requires learners to build up a solution using whatever way they deem fit. It is not prescriptive of the method they are to use. Nevertheless, in the next question, the same teacher asked a recall question using the same word.

Teacher	Question asked	Cognitive level of the Question
B	Masiyibale kaloku, yibale ujonge uba uzawufumana bani (calculate it and then check what you will get as an answer) Nifumene bani (what did you get)?	Synthesis/ Analysis
B	Teacher B: Wabala i-gradient, yangubani (You calculated the gradient, what did you get)?	Remembering
C	Then wabala i-value ka α yangubani (You calculated the value of α, and what did you get)?	Remembering
B	Itheni i-gradient (what's wrong with the gradient)?	Analysis
B	Kutheni ingafumaneki ngoku, kutheni ingafumaneki ngoku i-gradient (why can't you find it now, why is it that you cannot find the gradient now)?	Analysis/ Comprehension
C	Simfumene kengoku u- (so now we've found) A, what else?	Comprehension
C	Yeyiphi esiyifunayo (which one are we looking for) Umfumene u-A nabani omnye nabani (we've found A and what else)?	Remembering
B	I-tan ye-(of the) angle of inclination ilingana nantoni (what is it equal to)?	Remembering
B	U-DR ulingana nabani (What is DR equal to)?	Remembering
C	Ulingana nabani (what is it equal to)?	Remembering

Excerpt 3

Teacher B asked two analysis questions about the gradient. Such a mix of questions is to be encouraged in the teaching of mathematics. We argue that questions that span across all domains/categories are necessary for a quality teaching process. While synthesis and analysis questions were evident in some of the teachers' language, they were practiced at minimal levels. All the teachers in this study frequently asked questions that mainly required learners to remember information. Even in circumstances where these teachers could pose higher order questions, the use of home language in some cases unfortunately reduced their questions to lower order.

While teachers used terms that were transparent to formulate questions of a higher order, they also used some transparent terms to formulate lower order questions. Opportunities to encourage critical thinking were thus limited in these circumstances.

4.3 Leading Teacher Questions

One aspect that became very evident in teacher questioning was the use of leading questions. These are questions phrased by participating teachers that suggested, prompted or encouraged the answer intended or desired by these teachers.

Teacher A used leading question during her teaching to seek confirmation of progress. The commonly used phrases were ***'siyavana sonke', 'siyayibona sonke', 'nhe'*** and this is shown in the excerpt 4 below:

Teacher	Question asked	Cognitive level of the Question
A	So this is a right angles isosceles triangle siyavana sonke nhe (do you all understand)? /**yes**/.	Remembering
A	Siyabona mos i-vertex ka (we can all see the vertex of) angle C? It lies on the circle, siyabona sonke nhe (can we all see it right)?	Remembering
A	Nanku u- (here is your) Z-shape siyayibona sonke (can you also see)? This is angle C2 siyayibona sonke (can you all see)? Therefore angle A = angle C2 siyijongile (are you paying attention)?	Remembering
B	Siyayibona nhe, siyibambile nhe (can you see that, do you understand)?	Remembering
B	Niyayibona nhe, niyibambile nhe (can you see that, do you understand)?	Remembering
B	Iyavakala (do you understand)?	Remembering
C	You also have an arc, arc AD niyabona mos? La-A lowana siyabona nhe (that A, can you see)?	Remembering
C	We are told that this angle is 22 degrees akunjalo (isn't that so)?	Remembering

Excerpt 4

During Teacher B's teaching, commonly occurring words that he used to formulate leading questions included ***'siyibambile', 'niyibambile', 'siyayibona' 'iyavakala'***. In all these cases, questions phrased using these words solicited chorus answers. The pupils' chorus responses in these particular cases were then interpreted by the teacher as confirming students' understanding of the concepts. This is also evident in some of the other extracts taken from his lessons as given above. Teacher C did not use these terms as frequently as Teachers A and B. He used his own term '***akunjalo***' together with '***niyabona***' and '***siyabona***' that other teachers also used.

Teacher B used statements like 'We all got the same thing, right?' In response to this, the class would give a chorus 'yes' except in one case cited below where one student was brave enough to respond differently. Teachers A and B used '***nhe'*** and ***'mos'*** in their questions and to end some of their questions changing these words, or omitting them would transform the question to a higher order questions. While these questions might have been meant to serve other purposes, they did not, in our analysis help much in improving and enhancing critical thinking during the teaching of Analytical Geometry.

5. SUMMARY OF FINDINGS AND CONCLUSIONS

In this study, teachers spent 20% of their teaching time asking questions in IsiXhosa, the learners' home language. The majority of the questions were of the lower order level according to Bloom's taxonomy. Such questions did not allow learners in these multilingual classes to come up with their own ideas that they could analyse and evaluate during learning. Thus, opportunities were missed to provide for learners in these classes to think critically.

Teachers in this study mostly asked recall and leading questions that did not give learners enough opportunities to think critically and find solutions on their own. A few questions that required comprehension and application, that is, those that required understanding and ability to use learned materials, were least asked in this study. Questions that only required remembering and application were responded to correctly without thinking and understanding. These questions ultimately promoted critical thinking the least during our observations. Questions that encourage learners to do more than just remembering and recalling known facts have a potential of stimulating critical thinking and deeper reasoning (Sillivan & Lilburn, 2002). Students should not be taught mathematics to only recite mathematical formulas or following algorithms and procedures, but to think critically and mathematically.

In this study, teachers formulated questions using some transparently code switched terms that were familiar with their learners. While this practice is commendable, it was not widely practiced. In some cases, it was used in such a way that it reduced the level of questions to a lower level, which did not encourage learners to think critically. Teachers are encouraged to plan their questions in advance to ask those questions that will help learners to think deeply and critically about mathematical concepts presented to them. Teachers should also be trained to plan how to formulate questions in their home language that will encourage critical and deeper thinking. Such training should be encouraged and incorporated in all structured pre-service and in-service teacher professional development programs.

The main advantage of questions that seek critical thinking is that they in themselves present an invitation to learners to engage in thinking. They cannot be successfully answered without one being largely involved in focused and deeper thinking. Critical thinking skills are essential to every aspect of mathematics learning, this is because a learner who can think critically will be a better reader, writer, test-taker, and student inside and outside of the classroom (Schneider, 2001).Teachers are thus encouraged to use words in both languages that encourage critical thinking in multilingual classrooms. Huinker and Freckmann (2004, p. 355) acknowledges, "By choosing our words carefully and using intentionally designed questions, we can engage and transform another person's thinking and perspective."

This study concludes that if teachers of mathematics multilingual classes in township schools continue to use predominantly lower order question in their pupils' first language, they are depriving their learners'

opportunities to meaningful and beneficial engagement with mathematical concepts. In the process, they unintentionally and unconsciously, perpetuate inequalities associated with use of the second language in the teaching and learning of mathematics. Teachers are thus urged and prompted to ask and incorporate a multitude of higher order questions that require learners to analyze, synthesize and evaluate their own thinking and procedures whilst code switching. Such practices will create rich teaching and learning environments that fosters critical thinking in multilingual mathematics classrooms.

6. REFERENCES

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational objectives: Complete edition.* New York: Longman.

Bloom, B. (1956). *A taxonomy of educational objectives. Handbook 1: Cognitive domain.* New York: McKay.

Chikiwa, C., & Schäfer, M. (2016). Teacher Code Switching Consistency and Precision in a Multilingual Mathematics Classroom. *African Journal of Research in Mathematics, Science and Technology Education (AJRMSTE), 20*(3), 244-255.

Clasen, D. R., & Bonk, C. (1990). *Teachers tackle thinking.* Madison, WI: Madison.

Cummins, J. (2000). *Language, Power and Pedgogy: Bilingual Children in the Crossfire.* Clevedon: Multilingual Matters.

Dori, Y. J., & Herscovitz, O. (1999). Question Posing Capability as an Alternative Evaluation Method: Analysis of an Environmental Case Study. *Journal of Research in Science Teaching, 36*(4), 411-430.

Duron, R., Limbach, B., & Waugh, W. (2006). Critical Thinking Framework For Any Discipline. *International Journal of Teaching and Learning in Higher Education, 187*(2), 160-66.

Elder, L., & Paul, R. (1994). Critical thinking: Why we must transform our teaching. *Journal of Developmental Education, 18*(1), 34-35.

Gardner-Chloros, P. (2009). *Code-switching.* New York: Cambridge University Press.

Gumperz, J. J. (1982). *Discourse strategies.* London: Cambridge Univerisity Press.

Huinker, D., & Freckmann, J. L. (2004, March). Focussing conversations to promote teacher thinking. *Teaching Children Mathematics, 10*(7), 352-357.

Limbach, B., & Waugh, W. (2010). Developing Higher Level Thinking. *Journal of Instructional Pedagogies, 3*, 1-9.

McClung, C., & Hoglund, R. (2009). *Using Questions to Promote Critical Thinking.* ASQ Primary and Secondary Education Brief.

Mercer, N. (1995). *The guided construction of knowledge: talk amongst teachers and learners.* Clevedon: Multilingual Matters.

Moll, L. C. (Ed.). (1990). *Vygotsky and education.* Cambridge: Cambridge University Press.

Paul, R. (2007, July). Critical Thinking in Every Domain of Knowledge and Belief. *The 27th Annual International Conference on Critical Thinking. July 23, 2007.* Berkeley, CA: Center for Critical Thinking.

Paul, R., & Elder, L. (2008). The Miniature Guide to Critical Thinking, Concepts and Tools. *28th Annual International Conference on Critical Thinking: Near University of California at Berkeley July 19 – 24, 2008.* California: The Foundation for Critical Thinking Press.

Qashoa, S. H. (2013). Effects of Teacher Question Types and Syntactic Structures on EFL Classroom Interaction. *The International Journal of Social Sciences, 7*(1), 52-62.

Schneider, V. (2001). *Stepping Stones: A Path to Critical Thinking, Volume 1.* Pittsford, NY: Castle Rock.

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

Sillivan, P., & Lilburn, P. (2002). *Good questions for math teaching: Why ask them and what to ask.* Sausalito, CA: Grades K-6 Math Solutions.

Vygotsky, L. S. (1986). *Thought and Language.* (A. Kozulin, Ed.) London, England: The MIT Press.