Creating Dialogues in Whole Class Teaching in Multilingual Classrooms: Language Practices and Policy Imperatives

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Abstract Teaching science or indeed any subject in a language that learners are not proficient in is difficult even for the best of teachers. In South Africa, the situation is compounded by various contextual issues including a long tradition of the dominance of transmission methods and teacher talk. The result is poor achievement in science as learners simply memorise and regurgitate concepts in examinations. Yet, one of the guiding principles of South Africa's National Curriculum Statement is to achieve "Active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths" (Department of Education, The National Curriculum Statement (NCR): Curriculum and Assessment Policy Statement Grades 10–12 Physical Sciences, Department of Education, Pretoria, p. 4, 2012). Thus, the curriculum explicitly discourages uncritical learning. Recent research has explored small group work as a potential strategy to promote active learner engagement. However, the uptake of group work remains low. Teachers are not confident in managing group work while teaching the content-heavy curriculum to often very large classes in the challenging contexts of multilingualism. In this chapter, I draw on (Mortimer & Scott, in *Meaning making in secondary science classrooms*. McGraw-Hill Education, Berkshire, UK, 2003) framework to illustrate the potential for whole class teaching to create dialogic discourse that enables the active learner engagement anticipated in the South African curriculum. I discuss some of the tensions that such an approach raises in the current South African language policy context, in particular the implications for leveraging the linguistic resources of the classroom to optimise learner participation.

Keywords Dialogic discourse · Whole class teaching · Multilingual policy · Monolingual science classrooms

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1 Introduction

One of the guiding principles of South Africa's National Curriculum Statement is to achieve learner active involvement in their own learning. This desire has been articulated in different ways both in the curriculum documents and the various forums for its implementation including teacher education, professional development interventions as well as research communities. In fact, the National Curriculum Statement states "Active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths" (Department of Education, 2012, p. 4). Thus, the curriculum explicitly discourages rote learning and transmission methods (uncritical learning). Education research in South Africa has addressed this principle through the adoption of learner-centred teaching approaches. In Mathematics and Science education, research has focused on small group work as a preferred method towards learner-centredness. Group work is deemed suitable to address curriculum goals by providing "support for the construction of … meaning …, since it allows more time and space for … talk and activity" (Brodie, 2000, p. 9). Group work became the focus of much research that aims to address the long history of traditional teacher-centred methods and teaching to the test. Yet, literature on classroom-based research in South Africa like elsewhere in the world reports the persistence of traditional transmission methods and prevalence of teacher talk. Small group work remains a challenge for South African teachers not only because it requires specific skills to plan the tasks and manage the group work, but also because they find it difficult to sequence and time the lesson progression to be able to cover the rather content-heavy syllabus adequately. Also, learners have been observed to shift to using their home languages when they are placed in small groups. Teachers worry that learners may not stay on task if allowed to work on their own in small groups, especially when they engage in their home languages. The large class sizes and overcrowded classrooms only exacerbate the problem. Generally, there are many genuine reasons why teachers find it difficult to use small group discussions in science teaching. Hence the persistence of whole class teaching in many South African science classrooms. Thus, in spite of the many interventions in the past two decades to change pedagogical practices to learner-centeredness, there is still very little learner talk and activity in South African classrooms and science classrooms are not different. Classroom interaction continues to be largely through whole class mode characterised by recitation and memorisation.

While small group work is espoused as the best approach to get learners talking and transform classrooms to learner-centred, the classroom context in South Africa does not seem to be conducive to small group activities. Meanwhile, research elsewhere shows that whole class teaching has the potential to create the kind of learner interaction anticipated in the South African curriculum. According to Lyle (2008), whole class discussions can develop into collaborative dialogic talk creating dialogic rather than the current prevalent monologic discourses. Dialogic talk according to Lyle creates spaces for learner voice, allowing learners to ask questions, explore each other's ideas and change their minds. In many ways, this is what is anticipated in

the South African curriculum and small group interactions. However, in multilingual classrooms, the challenge with achieving such dialogic classroom interaction is not just the infrastructure or teacher preparation. The challenge is also language. English is the preferred LOLT for many in South Africa and yet it is a second, third or even fourth language for the majority. Thus, many learn science in a language that they are not sufficiently proficient in. It has been established that English second language learners (ESLs) struggle to build registers for the language of instruction (Lyle, 2008; Milligan & Tikly, 2016). Their first hurdle is just to be able to talk in English. And only then can they make sense of the content. For science teachers of ESLs then the task is both to enable talk and then to mediate the talk for meaningful science learning. This may explain the difficulty of achieving in whole class teaching the dialogic discourse that is required for effective learning to happen. In fact, research shows such difficulties in classrooms where learners are taught in their home language. How then can whole class teaching achieve the anticipated dialogue in classrooms where learners are taught in a foreign language?

In South Africa, this question has to take into account the prevailing language in education policy debates. South Africa presents a multilingual policy context with monolingual classrooms by choice. By this, I mean that the Language in Education Policy (Government of South Africa, 1997) allows for any of the eleven official languages as recognised by the South African constitution to be used as a language of learning and teaching, LOLT or medium of instruction (MI) beyond the first three years of schooling. Thus, teaching is in the learners' home language until primary year 3 (Grade 3) at which point each school is free to decide on a LOLT according to the local School language policy. The majority of South African schools choose English as the LOLT (Howie et al., 2008). The language education community and policymakers are divided on whether or not Grade 3 is too early for the transition to the English medium of instruction (EMI). Some argue that the persistently poor literacy levels nationally are a consequence of this early transition together with poor teaching of languages generally (see for example, Howie et al., 2008; McKinney & Tyler, 2019; Sibanda, 2017). This situation is not unique to South Africa, most Sub-Saharan African children do not meet the minimum proficiency standards in reading (Trudell, 2016).

Poor language preparation in the lower levels has implications for what is possible in later grades where the teaching and learning of specialist subjects happens in English which is neither the teachers nor the learners home language or language of proficiency. In science, this has implications for the desired learner engagement for meaning-making whether in small group work or whole class teaching (Msimanga & Lelliott, 2014; Probyn, 2016). The challenge to achieve the dialogic discourses alluded to earlier is even bigger in South African science classrooms where learners are not always proficient in the LOLT. How then might science teachers be able to create opportunities for learner talk and engagement in whole class teaching in these multilingual contexts?

In this chapter, I illustrate how two South African teachers attempt to create dialogic discourse in whole class interaction in their multilingual science classrooms. I demonstrate how they leverage the linguistic resources of their classrooms to create opportunities for learner talk. While debates in the context of South African curriculum change tend to pitch teacher centredness (as seen in traditional transmission whole class teaching) and learner-centredness (implied in group work approaches) in tension, with the former viewed as old and undesirable and the latter as new and preferable, I argue that whole class teacher guided approaches have potential to be dialogic rather than transmission so as to achieve meaningful learner talk and engagement. I draw on Mortimer and Scott's (2003) framework for analysing teacher–student interaction in science classrooms to illustrate how the two teachers were able to create such teacher-led dialogic whole class interaction. I also discuss some of the tensions that this raises in the current South African language policy context.

2 Mortimer and Scott's Framework for Analysing Interaction in Science Classrooms

Mortimer and Scott's model categorises teacher–student talk along the dialogic-authoritative and the interactive–non-interactive continuums, recognising four possible teacher communicative approaches during a science lesson; the interactive/dialogic (ID), the non-interactive/dialogic (NID), the interactive/authoritative (IA) and the non-interactive/authoritative (NIA) approaches (Fig. 1).

In the Interactive-Dialogic (ID) communicative approach the teacher engages students in dialogue as s/he explores their ideas; in the Non-Interactive-Dialogic (NID) approach while the teacher is no longer engaging the students interactively s/he continues to review or refer to their ideas elicited during the ID phase; in the Interactive-Authoritative (IA) approach the teacher engages the students usually in a question and answer session, guiding the talk towards a specific scientific view; finally, in the Non-Interactive-Authoritative approach (NIA) the teacher takes an authoritative approach in which only the scientific view is expressed through the voice of the teacher alone, quite akin to the "transmission" mode. According to Mortimer and Scott (2003) dialogic discourse draws learners in, exposes their views and legitimises their talking and thinking—it opens up for genuine learner talk and involvement. Thus, dialogic discourse creates extended interaction which can provide opportunities for learner meaning-making (Scott et al., 2006). The more strictly teacher-controlled authoritative discourse on the other hand is useful in maintaining focus on the scientific story. Successful science teaching must create and draw from both the authoritative and the dialogic discourses (Scott & Mortimer, 2005). This speaks to the tension between the nature of science as an authoritative discourse and the need to engage student ideas as well as create the social interaction (talk) necessary for construction of scientific meaning. Thus, whole class teaching has

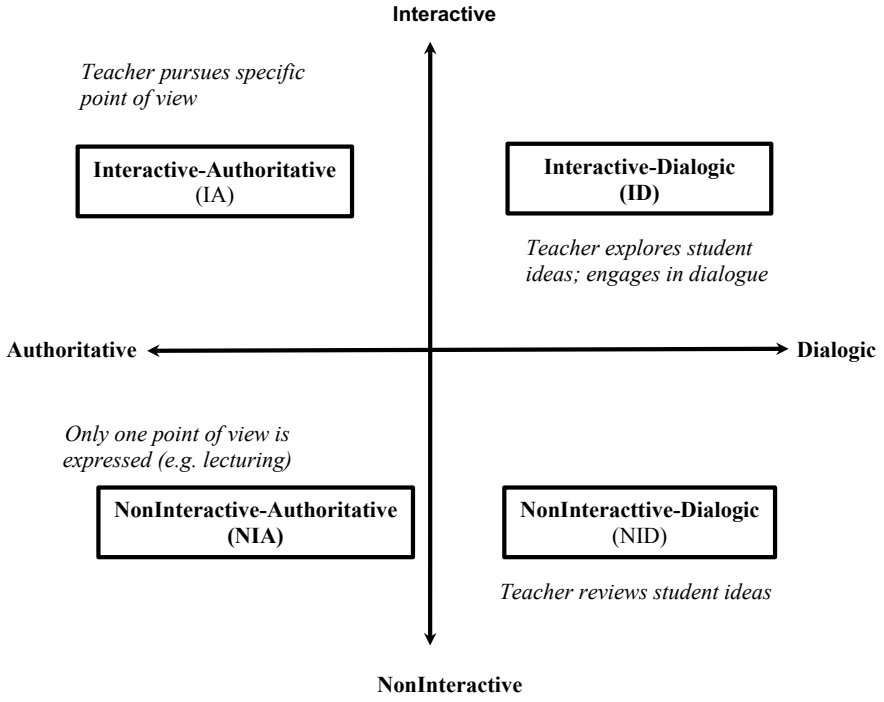

Fig. 1 My visual impression of Mortimer and Scott's (2003) categorisation of classroom talk along the two continuums (Adapted from Msimanga, 2013)

the potential to be both "transmission" (pursuing established science) and dialogic (exploring ideas, understandings and meaning-making).

For each teacher, I characterised the interactive discourse to determine the nature of learner participation resulting from either the IA or the ID teacher communicative approach. In interactive discourse the teacher involves learners in the classroom talk, guiding the discussion usually in a question and answer sequence. In many classrooms, such talk takes Mehan's (1979) traditional IRE (Initiation-response-evaluation) sequences, with mainly chorused, single syllable or yes/no answers. However, in more engaged classroom talk the teacher genuinely engages the learner in sustained IRFRFRF (Initiation-response-feedback) chains in which the F or feedback move speaks directly to learner responses. According to Aguiar et al. (2010) teacher probes (the P move) can open up the interaction closer to a true conversation by encouraging learner questions and through unsolicited learner ideas thus creating IRPRP…E closed chains and the IRPRP open chains. Like the traditional IRE, closed IRPRP…E chains culminate in teacher evaluation of the extended talk, which is typical of IA discourse while ID discourse is characterised by open IRPRPRP chains of genuine uptake of learner ideas without teacher evaluation or judgement. In the excerpts below I show how the two teachers were able to create both closed and open chains in their lessons.

3 The Teachers and Their Practices

3.1 Mrs. Thoba

Mrs. Thoba was an experienced Mathematics teacher with 15 years' experience at Grade 11 (16–17 years). She had also been teaching the chemistry component of the Physical Sciences for 5 years to all six Grade 10, 11 and 12 classes in the School. Mrs. Thoba's workload was quite high and while she felt that talking would help her learners engage with the science content and enhance their learning opportunities, she was also anxious about not having sufficient time to cover the content-heavy chemistry syllabus. She was particularly concerned about managing learner talk in a class of 50 learners. She argued that:

> It *(talk)*does provide for effective learning but the only thing is it takes time so if your learners are involved they may talk and talk and it's sometimes difficult to move on with the lesson then you fall behind the time frame to cover all the content in time for exams.

Mrs. Thoba was also concerned about her learners' language abilities. She and her learners were not native speakers of English, the LOLT. They spoke mostly isiZulu and seSotho. Even the teachers hardly spoke to each other in English. However, in class Mrs. Thoba spoke only in English although she allowed her learners to code switch. She said this would help her learners practice English since their final examination are written in English. For her language was a barrier for learner talk in class:

27	Mrs. Thoba:	I have observed that outside class they talk a lot maybe it's because they talk in their own language
	Interviewer:	Do you sometimes allow them to speak in their own language?
30	Mrs. Thoba:	yes I do but then I have to translate for the rest of the class
	Interviewer:	You have so many learners with different languages do you understand all the languages?
	Mrs. Thoba:	No, like Tsonga I only understand a little. So I sometimes ask another learner to translate

3.2 Mr. Far

Mr. Far was an experienced Physical Science teacher with 28 years of science teaching He held a Master of Education degree in Science and Mathematics education. He taught Physical Science Mathematics to Grade 11–12 and was the head of both the Physical Sciences and Computer Technology departments.

Like Mrs. Thoba he taught in a township school and had a big workload but he was keen to use talk strategies in his lessons. He too taught large classes in overcrowded classrooms. For instance, he would have as many as forty-eight (48) Grade 11 learners in a laboratory designed for 25 learners. Most of his learners spoke Afrikaans but the

language of teaching and learning in his school was English. Both Mr. Far and his learners did not code switch in class. He spoke often about giving his learners access to a good education so that they could change their personal situations and break out of the poverty that was prevalent in their community. To this end, he incorporated the teaching of values into the teaching of science.

4 Characterisation of Teacher–Learner Interaction in Mrs. Thoba's Lesson

Like in many science classrooms, the main form of learner engagement in Mrs. Thoba's lessons was in response to her questions. However, as she probed and maintained high cognitive demand thinking questions while allowing her learners to use their home languages they began to ask questions and respond to each other's contributions. This was the case in the excerpt below taken from a lesson on bond energy. In this excerpt, the teacher was trying to get the class to resolve a misconception that had arisen from one of the learners, Tahari's answer to the teacher's question. All excerpts are transcribed verbatim in the language in which the utterances were made, written here in italics and an English translation is provided in brackets:

86	T:	When does a po…when does a negative charge form? When does an atom become negatively…?
	Owen:	When two atoms collide?
	T:	Hah?
	Owen:	When two atoms collide
90	T:	And?…
	Owen:	it becomes negative charged…they have one electron
	Tahari:	Eh Maam *manje angithi seziya kholay…seziyahlangana angithi…*(because now they are colliding…coming together)
	Class:	(shuffling and whispering)
	Owen:	That's what we think… *(laughing)*
95	T:	(pointing to Thinta) Let me give you a chance
	Thinta:	Madam I disagree with the statement coz Maam I think when the two (inaudible) the chemical potential energy will increase
	T:	Why…(inaudible)…why do you disagree with the statement?
	Thinta:	It's because Maam…when the…the…the two atoms Maam interact it's impossible for them to be negatively charged
	Tahari:	Maam didn't you say…
100	T:	Why?
	Thinta:	*Azikathintani* (they have not yet touched) Maam
	Class:	Yes…yes

Tahari: Maam didn't you say when they get closer to each other when they attract the potential energy it will decrease *angithi* Maam?
Thinta: Its like this… (holding pen and set square apart in each hand)
105 Tahari: It will decrease…
Thinta: *Azikathintani* (they have not yet touched) Maam

The excerpt opens with a question and answer session between the teacher and Owen who tries to answer Mrs. Thoba's question about the conditions in which a negative ion is formed. Tahari then joins the conversation and attempts to answer the question providing an explanation which Owen seems to support (turn 94). The teacher ignores both Tahari and Owen's contributions and points at another learner, Thinta to "give you a chance". The subsequent engagement is interesting for this chapter as it illustrates what I saw in a number of Mrs. Thoba's lessons. I refer to this as "ternary interactions" By this I mean that even though learner talk was still channelled through the teacher an interesting form of dialogic discourse emerges which involved the teacher and three learners, Owen, Tahari and Thinta. Instead of the traditional IRE, teacher–learnerX–teacher–learnerY pattern there emerges a teacher–learnerX–learnerY–learnerZ–teacher interaction in the form of an open IRRRR… chain. In this case, the chain spans utterances 97–106, a total of nine utterances where only two were the teacher's. That is, "Teacher-Thinta-Tahari-Teacher-Thinta(Class)-Tahari-Thinta-Tahari-Thinta". I view this as typical dialogic discourse between the teacher and not one but three learners. It is also significant that this dialogue plays out in two languages.

Earlier in the same lesson, the teacher had indicated to Tahari that it was alright for her to speak in her language. The learner's response is of interest to the argument being made in this chapter. The learner expressed reluctance to use her language. Unfortunately, she did not complete her sentence and there was no time to interview her after the lesson to understand from her the difficulty that she had. She was responding to a question, "What is the net force between the two atoms?" (the teacher had put a diagram on the board of two atoms with a line showing the distance between them):

53 Tahari: Because of there is no attraction…they are not…they are far distant…so they…they are…I can't explain Ma'am…
Teacher: say it in your language its fine
55 Tahari: In my language Ma'am …? Ma'am in my language its so…
Class: (Learners laugh)
Tahari: ok… fine Ma'am let me say it in my language…ok fine *Ma'am tinekule Ma'am atihlangananga ti* (inaudible) Ma'am but Ma'am l*oko tingahlangananga tahari* constant *tahari* net force *yatona tahari zero* and so *loko tita atrakthana loko setita hlangana tiya atrakhta ke yikhona tingataba…tingataba…*
Teacher: (Teacher finishes in English) The forces will then attract …

Tahari: Yes
Teacher: (Teacher translates) Ok what she means is…if they are apart then their potential energy is zero because there are no forces acting between the…two atoms

The excerpt opens with Tahari trying and failing to explain her understanding of the diagram in English. In turn, 54 the teacher then "grants permission" to "say it in your language its fine" to which the learner responds "In my language Ma'am …? Ma'am in my language it's so…".

The teacher's act of encouraging Tahari to give the explanation in her language signals that it is acceptable in her class for science to be discussed in a language other than English. In the context of an English-only school policy, the teacher's act was non-compliant and the learner's reluctance could also signal that she did not view this as appropriate practice in a science classroom. However, when she eventually engaged in her language she was able to explain her understanding of the concept and provide an acceptable answer to the question.

It would appear that Mrs. Thoba's open ended questioning techniques together with her openness to learner language use in her classroom created a conducive environment for both the ternary interactions in which learners shared the social space freely and the dialogic engagement that played out in this whole class discussion. Such a sophisticated approach to whole class discussion is not easy for teachers to enact and sustain. Research must document evidence of such practice and the conditions that support it. In turn, teacher education programmes must find ways to articulate and make available such approaches for inclusion in the new teachers' pedagogical toolkit.

In the next section, I illustrate how the other teacher, Mr. Far worked differently to achieve similar dialogic discourse in his multilingual classrooms.

5 Characterisation of Teacher–learner Interaction in Mr. Far's Lessons

Mr. Far questioned more than Mrs. Thoba and used more open questions often persistently probing the learner until he got a response. He often took learners' ideas and understandings seriously—although he ignored some learners' contributions he generally valued learners' ideas and used them to direct the course of the lesson. His interventions that produced the different teachers' communication styles were a mix of elaborative and evaluative teacher responses to learner contributions. Mr. Far responded more elaborately to learners' contributions most of the time. He encouraged learners to evaluate and critique their peers' ideas, often foregrounding learners' ideas for interrogation by their peers. This created the potential for increased student participation as learners gained confidence in evaluating each other's ideas. However, Mr. Far asked the majority of the questions himself soliciting some learner questions along the way.

The lesson illustrated in this chapter was an introduction to momentum and although teaching was in a normal classroom, Mr. Far had the learners conduct simulated collisions. This was typical of Mr. Far's practice. He invariably involved his learners in practical work, a practice that was not common in other township schools in Mr. Far's context. Mr. Far also did something else for his learners. He would often say "Why am I doing this again? Because I'm gonna come back to the molecule later …" and he always did. Thus he provided clear links for his learners between the different parts of the lesson and the different concepts being considered in the lesson. While this practice may not be specific to teachers of ESLs it becomes even more important for making the connections clear for learners who experience challenges with the language of instruction.

The excerpt below illustrates these characteristics of Mr. Far's practice. The lesson started with a session to "… just refresh quickly":

3	Teacher:	according to eh the definition of momentum it can be regarded as a measure of the product of the mass and the velocity. Now Kelvin if you think about mass and velocity think about mass in terms of the quantity can we regard mass as a vector quantity or is it a scalar quantity?
	Class:	*(learners shouting)* vector … scalar… scalar … vector
5	Teacher:	now I will say that again think about it carefully
	Class:	*(talking among themselves)*
	Teacher:	think about mass where do we find mass because she has used the words mass and velocity
	Len:	scalar Sir
	Teacher:	why?
10	Kelvin:	because yah the mass is got size
	Ben:	yah its …
	Martin:	mass is got size
	Teacher:	so why am I asking this? Because our biggest problem that we encounter is that most of us cannot distinguish between this and that *(pointing to the words scalar and vector)*. So let's just refresh quickly. Len you said this is scalar why are you saying its scalar?
	Sisa:	because it has size only and no direction …
15	Teacher:	thank you very much so we only have size which is also …
	Busi:	magnitude
	Teacher:	magnitude. So here we have size or magnitude
	Busi:	no direction
	Teacher:	so this is what we are having we are having a scalar quantity which is mass and velocity a vector. Now remember what is momentum in real sense? We wanna make it simple in our heads coz we are labelling this thing. What can you describe momentum as? A simple word?

The teaching purposes in this episode were mainly to introduce the topic of the day, starting with a review of prior knowledge of key concepts like scalar and vector quantities. The teacher's predominant interventions were elicitation and evaluation with mostly closed and some open questions in an IRE/F discourse with the occasional IRPRPE closed chain. For example, in the first IRE triad in turns 3–5 the teacher opened the discussion with a closed question to Kelvin as to whether mass was a vector or scalar quantity (I), to which he got a mixed reaction from the class in general, with some learners shouting "vector" and others shouting "scalar" (R). The teacher's evaluative feedback (E) in turn 5, "I will say that again think about it carefully" was seemingly interpreted thus by the class who then engaged in private discussions among themselves to "think about it carefully". The teacher followed this with a clue about mass, which served as an initial move for an IRPRRRE chains. I see later you do refer to "probe" (p. 8, para 2) but perhaps clarify when you first use it.) discourse between Mr. Far and five learners, Len, Kelvin, Ben, Martin and Sisa in turns 7–14. The chain stopped when the teacher made an evaluative statement in turn 15 thanking (and affirming) Sisa for her answer, thus indicating the end of the discussion. The evaluation was followed by a summary in turn 19 and a new initiate move for a discussion to find a simple word to describe momentum.

The next 15 min of the lesson were spent with learners simulating collisions with various objects and the teacher talking them through their observations. The following short excerpt from the practical activity illustrates again how Mr. Far had the learners not only make their own observations but they had to explain and write down their observations:

67	Teacher:	Now this is what I want you to do. Take out anything you have in your pocket. Either you have two pens in your pocket take it out you have two coins whatever you have take it out put it in front of you. This is the task you need to have those two objects that you have in front of you make a collision make a collision then if you do that you have to look what type of collision you have whatever you have in front of you. So I will just walk around and see if you are with me. So put your objects two of them and then you collide those objects and look at the type of collision. *(walks around)*
	Nikitha:	*(inaudible)*
	Teacher:	Nikitha Nikitha is asking why do we need two?
	Nikitha:	*(inaudible)*
	Teacher:	yes just throw it just let it collide Nikita
	Teacher:	money money throw your money and remember always what do we need to do? We need to *write down isn't it so*? what we are seeing or what we are observing then we work from there. Right? its a small experiment

Mr. Far created what he called "a small experiment", asking learners to throw whatever they had and observe the type of collision. He walked around and instructed learners to write down what they saw (Turn 72). The nature of the practical activity in itself was conducive to learner participation as each learner had to conduct his/her own "small experiment" and observe. Also the fact that the teacher walked around as he talked the learners through the activity ensured that all participated. This was a highly interactive and dialogic lesson. Learners together with the teacher engaged in exploring learners' ideas about collisions and together negotiated understandings of the terms as they talked about each of them in turn.

In the next two excerpts, Mr. Far's teaching purpose shifted from exploring learners' ideas and allowing them to explore their own ideas to develop the scientific story. His communicative approach changed from fully interactive-dialogic to alternating between ID and IA communicative approaches:

77	Walter:	Sir my observation Sir I had a two rand in one hand Sir
	Teacher:	yes different objects
	Walter:	so when I collide them the one rand went away which means the two rand is heavier than the one rand
80	Teacher:	now describe to me exactly what you mean going away
	Walter:	the two rand pushes the one rand away Sir
	Teacher:	so someone else …. (inaudible)
	Alan:	equal masses I had two pens
	Teacher:	you had two pens of equal masses so we have one scenario different masses then we have the second scenario with same Masses
85	Alan:	… *(inaudible)* different direction
	Teacher:	so you had *(inaudible)* this way and then it went different direction. Any other person? Yes P?
	P:	… same as this
	Teacher:	how can it be same like this? How is it possible
	P:	*(inaudible)*
90	Teacher:	ok
	P:	and they had the same mass …*(inaudible)*
	Teacher:	right *(in raised voice)* he is saying he's doing this and I actually like this he says this might be his two pens throw them together they collide and they went opposite direction. Do you all see this?
	Class:	yes
	Teacher:	now describe this type of collision this type of collision *(teacher hits his fists together and moves them in opposite directions)*

95 Class: *(inaudible)*
Teacher: this type of collision
Altus: elastic
Teacher: now give me your definition of elastic
Altus: of elastic Sir?

In the episode above the learners were now reporting back on their observations of simulated collisions. The excerpt started with the teacher checking that the learners had finished writing their observations and then Walter describing what he had done and seen when he made a one-rand coin and a two rand coin collide. The teacher adopted a mix of IA and ID communicative approaches, eliciting learner ideas, questioning, probing and evaluating some but accepting others without evaluation. An IRFRPR open chain discourse ensued between him and Walter in turns 77–82. This open chain discourse resulted from an ID communicative approach commenced with an initiate move by the teacher (I) asking Walter to give a report, to which Walter responded in turn 77 (R) with a description of the coins that he had used, interrupted by the teacher in turn 78 with elaborative feedback (F) "Yes different objects". In that statement, the teacher affirmed Walter's report with "yes" and then elaborated on it pointing out the fact that the objects were different. This would serve to mark the idea suggesting to Walter and the rest of the class that the difference was significant and would shift the talk from dialogic to authoritative creating the tension that Mortimer and Scott (2003) argue must exist if the teacher has to explore learners' ideas while pursuing the scientific story. In this case the teacher was indeed exploring learners' ideas about their own collision but also pursuing the teaching purpose of developing the scientific story on the basis of those ideas.

When Walter explained that his one-rand coin "went away" because the two rand coin was heavier (response, R) the teacher probed (P) for an explanation of "going away" and then accepted the explanation (R) without evaluating it, moving on to solicit other learners' reports (Turn 82). Alan's response in turn 83 confirmed that he had noted and taken up the teacher's point about the fact that Walter's coins were different. He started his report, "Equal masses I had two pens" and the teacher communicated his agreement by revoicing Alan's opening statement, elaborating on it, "we have one scenario different masses then we have the second scenario with same masses" (Turn 84). The teacher again took up and elaborated on Alan's next point that his pens went in different directions after the collision, again marking and foregrounding the idea. Finally, in response to a third learner, P who is giving his report gestured with his hands to illustrate the movement of the objects, the teacher raised his voice and called the attention of the class to P's gestures.

In turn 92, the teacher made several interventions that finally linked his two teaching purposes, to elicit learner ideas and to develop the scientific story. He affirmed P, "Right *(in raised voice)* he is saying he's doing this and I actually like this …", then he repeated P's gestures while paraphrasing P's contribution, marking the idea as important, "and then he says this might be his two pens throw them together

they collide and they went opposite direction. Do you all see this?" The teacher then took up P's idea (the gesture) and used it to get the class to think through and name the collision. Finally, Altus gave the correct scientific name for that type of collision as "elastic" (Turn 97). The teacher's next turn inevitably opens up a new episode to define an elastic collision. This kind of interaction continued throughout the lesson as the class identified the different types of collisions, the different energy changes and finally defined momentum itself. To end the lesson the teacher engaged the class in a non-interactive session taking an NIA communicative approach to pull together the different concepts covered and to get them to start thinking about the forces involved in the collisions.

Mr. Far took a dialogic approach to encourage learner participation and thinking by involving them in practical activities. He would then switch to an authoritative style to develop the scientific story and explain new terms to the learners. His interventions tended to be evaluative resulting in mostly IRF triads and some closed IRPRP…E chains typical of authoritative communication. Mr. Far always made the connections clear; showing how the concepts were linked; showing links between and within the lesson to illustrate continuity as well as providing affirmations to promote learner emotional engagement. He always had his learners write and he often engaged in meta-talk. Mr. Far also made the most "small talk" with his learners. He created the kind of classroom environment described by Bishop and Denley (2007) where science learning was fun, and both teacher and learners dared to do things differently. In my view, he was able to open up classroom interaction for non-English learners to experience the kind of learner-centred classroom anticipated by the curriculum. Although he and his learners did not code switch or draw on their common language, Afrikaans, he managed to engage with language in ways that created opportunities for non-English learners to learn science.

6 Discussion and Conclusions

Teaching science or indeed any subject in a language that learners are not proficient in is difficult even for the best of teachers. However, having to do so in the constrained teaching and learning environments that prevail in many low socio-economic contexts is an even bigger challenge. In the South African context, the situation is compounded by the many historic factors including a long tradition of much teacher talk and no learner talk, predominant transmission methods and teaching to the test. The result is poor achievement in science as learners simply memorise and regurgitate concepts in examinations. Thus, small group work has been advocated by many to create opportunities for learners to engage and make sense of the science content for themselves. However, the uptake of group work has remained low due to large classes, overcrowding, teacher anxiety about insufficient time to cover the curriculum

and the challenge of working in multilingual classrooms. Hence the persistence of whole class teaching. This chapter has provided evidence that whole class teaching has potential to meet the objectives of learner involvement, learner-centredness as espoused in the South African curriculum. This data illustrates what I see as pockets of success with whole class teaching and how teachers can and do leverage learner languages to involve learners in the discourse of the classroom.

Mortimer and Scott's framework enabled a nuanced understanding of the nature of learner engagement when teachers open up the classroom talk for genuine learner interaction. The framework distinguishes between the two teachers' practices and how they worked in ways that were similar in some respects but different in others. For instance, both Mr. Far and Mrs. Thoba were able to engage the learners in co-constructing the scientific story through whole class dialogic talk as they directly responded to their contributions and wove these into the scientific explanation. An important difference was how Mrs. Thoba encouraged learners to express ideas in their home language while Mr. Far engaged his learners in multimodal activities including writing and practical activities to enable meaning-making in an unfamiliar language. While the data illustrates how these teachers, particularly Mrs. Thoba worked with learner languages not as a barrier but as a resource in learning science, her practices are not unproblematic in the current language policy context in South Africa. While the multilingual provisions of the Language in Education Policy provide impetus for Mrs. Thoba's practices, the realities of the monolingual policy context at the local school level render such approaches "illegal" and hence Tahari's question on the appropriateness and/or efficacy of her home language in a science discussion. Yet, research evidence abounds on the value of learners' languages at least for engaging with difficult concepts in science classrooms.

In the current policy context in South Africa teachers often find themselves having to choose between what they know about the pedagogical benefits of using their learners' languages and the school policy requirements on language use in the classroom. Thus, teacher efforts as illustrated in this chapter remain uncelebrated, poorly documented and not available to others especially to beginner teachers to adopt as part of their toolkit. In other words, current policy requirements stifle teacher agency towards achieving the very learner-centred methods espoused by the curriculum. Current policy debates on language in education and on language teaching in general must include how to enable context-informed choices on language use in the teaching and learning of specialist subjects like science. Future research must explore the nature of support required by teachers who do open up their classrooms for genuine multilingual engagement. Likewise, teacher education programmes must prepare teachers to manage classroom interaction in ways that create the desired dialogic discourse. More importantly both research and teacher education must address both teachers and policymakers concerns about the perceived repercussions of using learners' home language in teaching and learning on learner success in national exit assessments which are administered in English for the majority of South African learners.

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