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A Cultural-historical Pedagogical Model as a Potential Developmental Tool in Schools

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ABSTRACT

South Africa consistently lags behind other nations on international benchmarking tests of literacy, mathematics and, especially, science as illustrated in the low achievement outcomes on the Progress in International Reading Literacy Study (PIRLS) and Trends in International Mathematics and Science Study (TIMSS) tests. Research in the 21st century has shown that learning science at an early age is a predictor of scientific literacy later in life. The low science achievement in South Africa is impacted by several variables, however, one important aspect of students' failure to acquire science reasoning skills lies in how they are taught science. Drawing on the work of Vygotsky, Hedegaard, Freire, and Feuerstein, this paper reports on an intervention using a novel pedagogical model to teach science in grade two classrooms. A comparative case study is presented where one teacher is trained in the novel pedagogical model and one is not trained to use this model. Both teachers teach in the same school and the demographics of the children in the two separate classes studied are similar. Findings indicate that where the novel pedagogical model is used, the teacher uses more scientific, abstract concepts in her lesson; she links the abstract to the children's everyday concepts and, perhaps most significantly, she illustrates to students why they must learn the content she is teaching them.

Keywords: everyday concepts, pedagogy, scientific concepts, teacher talk.

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I. Introduction

Although it has been a democratic country for 27 years, South Africa's apartheid legacy continues to resonate in schools today, which see South African school children performing poorly in international benchmarked tests. The Progress in International Reading Literacy Study (PIRLS) results indicate that in 2016 78% of Grade 4 learners in South Africa cannot read to retrieve explicit information from a text, which is the lowest attainment benchmark of the PIRLS test. Even children operating in the home language of English or Afrikaans at a grade 5 level achieved poorly with only 63% able to read for meaning. PIRLS is not without its criticisms (see for example, Janks, 2011), however, there does appear to be a serious issue with teaching and learning in South African schools as measured on international benchmarking tests. This low attainment is visible too in relation to achievement in mathematics and science as measured by the Trends in International Mathematics and Science Study (TIMSS), which in 2019, indicated that only 37% of students who undertook the TIMSS test were capable of doing basic mathematics while only 28% indicated that they had achieved basic knowledge of science (Spaull, 2015; Howie 2012). In fact, news reports claim that South African students measured on TIMSS have the lowest attainment in science in the world (Daniel, 2020). Clearly, there is a need to develop scientific literacy at a minimum, and scientific thinking, in South African schools. The question, or challenge, underpinning this is how to intervene in such a manner that children will develop scientific thinking?

There is a growing body of knowledge that indicates that learning science, specifically, at younger grades is implicated in how children come to think and reason as they progress through school (Morris *et al*., 2016; Egan, 2002; MacDonlad *et al*., 2020). The extremely low attainment in science knowledge then, is cause for concern. Research over the past 40 years suggests that children can think in abstract ways at younger ages than previously assumed (Winkler-Rhoades *et al*., 2013; Haynes & Murris, 2012). The need for explicit instruction in science early in schooling, then, is backed up by a growing body of evidence that children are not only able to acquire abstract concepts but that the acquisition of these concepts is crucial to their subsequent development (Fragkiadaki *et al*., 2022). The question facing teachers is how best to teach abstraction in a manner that facilitates acquisition. This is the concern of the current paper, which seeks to illustrate how a cultural- historical model of pedagogy is well positioned to do this. The questions posed in this research paper are:

1. What does research indicate is the best way to teach in classrooms?

2. Can training in a cultural-historical pedagogical method impact on a teacher's teaching? If so in what ways does this happen?
3. Is there a difference in pedagogical praxis between a teacher trained in this novel pedagogical method and one who is not trained in this method? What are these differences?

II. THEORETICAL FRAMING

A. Mediation in the ZPD

Over half a century of research has shown that the kind of pedagogy that is most effective in developing a child's thinking is what some call 'constructivist' pedagogy (Richardson, 2005; Kyriacou, 2010; Gundus & Hersen, 2015; Bada & Olusegun, 2015). Unfortunately, the word 'constructivism' has become extremely popular and has lost much of its foundational epistemic coherence. In this paper, for clarity, constructivism is viewed as based on the theories of Piaget (1976) and Vygotsky (1978). The defining feature of constructivism in this understanding is that a child is an active cognising agent who constructs knowledge through transacting with his/her environment. This transaction can be achieved in action but is more obviously achieved through verbal communication, with children interacting with others to co-construct meaning. However, what exactly constructivism should look like in a classroom is often vaguely recontextualised from the works of Piaget and Vygotsky, leaving a gap, I argue, in how teachers can use this theory to develop children cognitively. This is the impetus behind this paper; what can constructivist pedagogy, that develops children cognitively, look like in a real classroom? This issue arises in large part because neither Piaget nor Vygotsky were instructional theorists; they were, rather, psychologists interested in how children developed. This has led to several interventions loosely based on these theorists that have failed to adequately transfer the psychological basis of development into classroom praxis. What we are aware of in pedagogy is that pacing should be geared towards the child's acquisition (Hoadley, 2018); that dialogical interaction is key in teaching (Matusov,2021); that exploratory talk (a form of dialogical interaction) leads to reasoning (Mercer & Littleton, 2007) and that power differentials in a classroom should not be so asymmetrical that a child is excluded from interacting with peers and the teacher (Hardman, 2019; 2021). These are useful findings and serve to add to this paper. However, it is the operationalisation of Vygotsky's work in particular, that this paper seeks to address with empirical evidence.

For Vygotsky, a child develops through mediation (structured guidance) with a more knowledgeable other through social interaction, very specifically, for him, through dialogue. Development happens in a social space, which Vygotsky terms the Zone of Proximal Development (ZPD) (Chaiklin, 2013). This is perhaps Vygotsky's most famous, or at least, most well-known concept. Unfortunately, as with most concepts that become popular, the actual meaning of the ZPD has begun to erode and some authors view this developmental space as a task specific one, where a child can be scaffolded to acquire knowledge. The unfortunate eliding of mediation with scaffolding has led at least some authors to (Wink & Putney, 2002; Far, 2014) present the ZPD as a scaffolded space in relation to a specific problem-solving activity. This fails to recognise the developmental aspect of the ZPD. This is not to suggest that scaffolding, a mechanism for problem-solving, is not useful. In relation to solving discrete tasks, scaffolding as outlined by Wood, Bruner & Ross (1976) is immensely useful in teaching. But scaffolding is geared towards the solution of a specific problem; mediation, on the other hand, in the ZPD is geared towards the acquisition of what Vygotsky calls scientific (abstract) concepts and this takes place over time. It is this abstraction, that Vygotsky called a scientific concept, that is acquired, or should be acquired, in schools.

B. Scientific and Everyday Concepts

Vygotksy (1986) distinguishes between spontaneous, everyday concepts and scientific, abstract concepts. For the purposes of this paper, scientific concepts refer to school concepts (Hedegaard, 1998) that, once acquired, develop a child's ability to think theoretically. Everyday concepts, on the other hand, are learnt through spontaneous interaction with the world and create richly meaningful, empirical knowledge for the developing child. While the meaning of abstract concepts is culturally embedded, and, importantly, shared amongst people, everyday concepts are more idiosyncratic and related to the child's lived experience. For an abstract, scientific concept to make sense to a child then, it must link with the everyday concepts that the child already possesses. The mechanism for this linking is elegantly elaborated in Marianne Hedegaard's (1998) 'double-move' in pedagogy.

C. The Double-move

While Vygotsky died before being able to articulate his notion of mediation in the ZPD in any concrete manner, Hedegaard has developed a mechanism for linking scientific and everyday concepts that she calls the 'double-move'. What this mechanism achieves, is in fact explicit in its actual name. This pedagogical move requires that the teacher move from the abstract to the concrete and back again during the lesson. For Hedegaard, the teacher guides the learning activity both from the perspective of general concepts and from the perspective of engaging students in "situated" problems that are meaningful in relation to their developmental stage and life situations. (Hedegaard, 1998, p. 120).

That is, the teacher elaborates the abstract concept and recruits a child's everyday concept to make sense of this abstraction, bringing the concrete everyday concept into the realm of the abstract. What is particularly interesting in the above quote is the understanding that one changes the child throughout development, but one also equips the child with a conceptual repertoire for them to change their own lived experiences; that is, the world. It is through the double-move that one ascends from the abstract to the concrete; that is, one begins with the abstraction and works towards making sense of this for the child by linking it with the concrete, everyday concept (Hedegaard, 2020). One works from the germ cell, the underlying, foundational abstraction underpinning the concept, to linking this with the everyday concrete concept the child brings to the lesson. This is important in conceptualizing what kind of knowledge needs to be taught

in school. I would argue that children need to acquire those conceptual tools that will enable them to deal with and solve the problems of the 21st century, such as climate change or poverty. The question remaining is how one can practically use the double-move in a classroom. For this we turn to the work of the Israeli psychologist Reuven Feuerstein (1981).

Feuerstein showed, in the latter half of the 20th century, that cognition was modifiable. Today, in the 21st century, the notion of neuroplasticity is well understood, but at the time that he was writing, Feuerstein's ideas about how one could shift and change cognition were novel. He indicated that for development to happen, a child would have to have access to Mediate Learning Experiences (MLE). While the notion of 'mediation' echoes Vygotsky's work, it is important to note that Feuerstein wasn't working with Vygotsky's theory but rather, was developing his own theory of mediated learning to illustrate how a child could be cognitively modified using MLE. Feuerstein's MLE provides a basis for understanding how internalization happens throughout development by outlining twelve parameters for MLE; the first three are universal and I deal with these here, namely, *mediation of intentionality and reciprocity*, *mediation of meaning*, and *mediation of transcendence* (Pressiesen & Kozulin, 1992). Mediation of intentionality underpins the teacher's desire to teach. It focuses the students on the object of learning. This is linked to reciprocity, which refers to the students' desire to learn and their receptiveness to the teacher's input. In this reciprocal learning/teaching space, meaning is constructed by students and teachers. Together, intentionality and reciprocity create a space for meaning making, another universal characteristic of MLE.

Echoing Freire's (2000) notion of dialogical pedagogy as relating to authentic social contexts, the mediation of meaning requires that tasks are related to the child's lived experience. The teacher achieves this by openly sharing his/her aims with the class and eliciting students' understandings of the topics under discussion. Here, the teacher makes explicit what underlies his/her pedagogy, and students are encouraged to ask *why* and *how* questions. This requires that the teacher can interrogate his/her own assumptions about what they are teaching. The final universal characteristic of MLE is the mediation of transcendence, where the child can bridge ideas across contexts. These three universal aspects of MLE can be used easily by a teacher in a classroom to develop meaningful interactions that lead to knowledge that transcends the immediate classroom. Taken together with the foundations of Vygotsky's educational theory that learning precedes development and occurs in the ZPD through the double-move, Feuerstein's MLE provides concrete pedagogical steps that can be taken to motivate students to develop creatively within a classroom.

III. Methodology

A. Research Design and Methods

THIS is a qualitative exploratory study that seeks to compare teacher pedagogy across two similar sites. A case study design was used to elicit thick descriptions of the data through 1) classroom observations and videotaping the classes; 2) collection of interviews from teachers and 3) demographic questionnaires given to students. This paper presents findings from transcribed videos. Ethical clearance was obtained to work with the school and children from our university and assent to the research was given by students. Consent for students to participate in the study was given by students' parents and/or caregivers.

IV. Participants

A. The School

SCIENCE is not an official subject in South Africa until grade 4 so the lesson presented in this paper is taking place under the topic of 'Lifeskills'. Within this broad topic, children in grade 1 to 3 are given access to science concepts in a one hour a week lesson which falls under the Life Skills curriculum called 'Beginning Knowledge'. As noted earlier in this paper, students in the Foundation Phase (grades 1-3) can acquire abstract concepts, and the need to do so at younger ages impacts on their successful interaction with science knowledge later in their schooling. (Morris et al, 2016). The school in this research is in an affluent area of Cape Town and charges school fees of around USD 3000 per annum. This is, therefore, a relatively high socio-economic demographic as the average cost of school fees in South Africa is around USD 900 per annum, for schools that charge fees[1].

The school uses the Department of Basic Education's texts for both teachers and students and follows the Curriculum and Assessment Policy Statement (CAPS) curriculum. However, as this is an affluent school, teachers often bring their own teaching material to classes and are encouraged to do so to supplement curriculum content coverage. The school is co-educational and runs from grades 1 to 7. Students wear a prescribed uniform and sign a code of conduct that places moral interaction and kindness as core principles.

Two teachers and 50 students participated in this study. Although there are 53 students across the two classrooms, three students did not return the consent form for the study and were, therefore excluded from participation. One of the teachers, Mrs. Jenkins, has been trained to use the pedagogical model outlined above. She is a 32-year-old teacher who has taught for 10 years and has therefore, a solid base of experience. For four weeks, Mrs. Jenkins attended a course for 2.5 hours per week in which she was introduced to various concepts that have been discussed in this paper, such as mediation, scientific and everyday concepts, the germ cell, and the double-move. I am the primary lecturer on this course and therefore, in terms of ethical considerations, the data collected and discussed in this paper were analysed both by myself and by a colleague. Inter-rate reliability on the coding was 84%, which is satisfactory. The second teacher, Ms. Naidoo is 28 years old and has been teaching for six years. She too has a firm foundation of experience in teaching grade 2. Ms. Naidoo did not complete the course that Mrs. Jenkins did.

[1] Not all schools charge fees in South Africa. Students can attend no-fee paying schools.

One hour a week is devoted to the teaching of science content and concepts under the Lifeskills curriculum. These teachers were observed over the course of a topic (two and a half weeks) in which they taught about wild and farm/domesticated animals.

V. Procedure

A. Data Collection

The researcher and her research assistant video recorded 2 hours of teaching across a two-week period and this video data was transcribed by a transcription service within two days of being collected. As the researcher is both the trainer on the course Mrs. Jenkins studied as well as the researcher analysing the data, researcher reflexivity came into play. In order to ensure that interpretations of the data are valid, triangulation was used in the following ways: the researcher and her assistant (a PhD candidate) analysed the data separately using the codes described in this paper; secondly, the analysis of the data was given to the two teachers to check for coherence and validity and finally, use of multiple other research methods such as interviews and demographic questionnaires enabled a form of triangulation.

B. Analysis

THE analysis involved coding teacher talk as this is viewed as a primary mediating tool in classrooms (Hennessy, Rojas-Drummond., Higham, Márquez, Maine, Ríos, & Barrera 2016; Mercer & Littleton 2007). The focus of the comparative analysis was on how teachers taught and specifically, whether they linked scientific and everyday concepts. In Table I below, one can see the codes and examples of how talk was coded.

TABLE I: Coding Framework

Code	Definition	Examples	Teachers
ECE	Everyday Concepts Elaborated	"The men {lions}, the boys, yes they have manes"	Mrs Jenkins
ECNE	Everyday Concept Not-elaborated	"…or we call it the wild where they are free"	Ms. Naidoo
SCE	Elaborated Scientific Concepts	"So they are predators, they are hunters"	Mrs Jenkins
ST	Scientific Terms	"I'm a predator"	Mrs Jenkins
FE	Elaborated feedback	"Ok, so lions are large animals. They are big and house cats are smaller"	Mrs Jenkins
NEF	Non elaborated feedback	"Mr Lion is the King of the Jungle and he is the strongest animal"	Ms Naidoo
CQ	Closed question	"So this can be food, but food for what?"	Mrs. Jenkins
OQ	Open Question	"Why do you say that?"	Mrs Jenkins

Each utterance that was capable of being understood as spoken was coded as a single utterance. So, for example, if the teachers responds "Yes" in relation to a student's answer, this is coded as a single utterance.

C. The Lesson Content – The Germ Cell

THE content of the observed lessons was domesticated/farm animals and wild animals. The germ cell, the basic unit of abstraction that relates to the relevance behind learning this, lies in the impact that domestication can have on ecosystems and, more basically, the relationship between animals and nature. Because this case study plays out in the Western Cape which is water scarce it is relevant, therefore, for Western Cape pupils to know about the impact that say, domesticated plants can have on an ecosystem. When the British colonised this tip of Africa, they planted pine trees all along Table Mountain. Pine trees are alien to the Western Cape and sap the water table. The plantations are slowly being eradicated because there is simply not enough water to sustain these aliens. Harnessing this everyday example in a lesson, therefore, would help a child to understand why it's important to learn about the differences between wild and domesticated plants and animals and their relationship to nature. The scientific methods students will learn in this class are the notion of comparison and how to research comparisons.

D. Findings and Discussion

FOR the purposes of this paper, a 'wild' animal is defined as:

1. In its natural state, untamed, animals *ferae naturae* (Harper-Collins 2009:2370).

2. growing and living without human aid or intervention and

3. related to or resembling corresponding domestic animals.

A 'domesticated/farm' animal is:

1. any animal that has been domesticated by humans to breed and live outside of a wild habitat.

2. generally requiring human intervention to survive in the habitat that the human selects for it. (Morris 1992).

In Table II below, a summary of the differences in talk between both teachers is given to orient the discussion that follows.

TABLE II: Comparison between Two Teachers' Talk when Teaching Science in Grade 2

Code	Mrs Jenkins % of teacher talk	Ms Naidoo % of teacher talk
Everyday Concept Elaborated	17	6
Everyday Concept Not Elaborated	0.4	22
Scientific Concept Elaborated	16	2
Scientific Term	8	1
Feedback Elaborated	22	-
Non-Elaborated Feedback	17	33
Closed Q	18	36
Open Q	2	-
Total	100%	

What we can see in Table II is that both teachers do elaborate everyday concepts, with 17% of Mrs. Jenkins' talk focused on this and 6 % of Ms. Naidoo's talk. In Table II we can see that Ms. Naidoo makes very little reference either to

scientific terms (ST-1%), or scientific concepts (SCE 2%). This picture shifts in relation to Mrs. Jenkins who elaborated scientific concepts in 16% of her talk. Ms. Naidoo's talk is dominated by closed questions (CQ-36%) followed closely, as one would expect in an IRE sequence, by feedback (33%). Note, however, that this feedback is not elaborated and generally takes the form of "That's right" or "Yes". While Ms. Naidoo makes use of everyday concepts, these are predominantly not elaborated on (ECNE-22%).

In contrast, we see that Mrs. Jenkins not only uses more scientific terms (ST-8%) than Ms. Naidoo, but importantly, she elaborates scientific concepts (SCE-16%) relatively often. The extent to which she links the scientific and everyday concepts is investigated later in this chapter in relation to the qualitative data. Note also that although 18% of Mrs. Jenkins' talk is taken up with closed questions (CQ), 22% of her talk is aimed at elaborating on feedback she received from the class. The use of closed questions in an Initiate Respond Evaluate sequence (IRE) is well established in research as a didactic technique (Sinclair & Coulthard 1975). While there is serious criticism levered against an IRE sequence in developing students' understanding of concepts, the use of the IRE sequence can only be adjudicated in relation to the evaluation move the teacher makes. Where evaluation is elaborated, then the IRE sequence I more useful for learning than when it is not elaborated. Where feedback is not elaborated on, the sequence becomes merely an exchange of questions with known, closed responses. In extract 1 below, we can see how Mrs Jenkins uses feedback to elaborate on what the children are learning -the difference between wild and domesticated animals and their relationship to nature. Mrs Jenkins is teaching them this topic by developing their thinking in relation to similarities and differences between the different types of animals. That is, as we shall see, she is not only intent on teaching content in the lesson, but also on teaching the form of thought that allows for comparisons between members of different classes.

EXTRACT 1: MRS. JENKINS AND IRE

Line	Talk	Analysis Code
1	Teacher: I want you to tell me what you think the connection is? You're going to laugh at me. What is the connection between his stuff here (*points to cat food tin in her hand)* and that Jane? *(There is a picture of a zebra on the board. The teacher is pointing to the zebra and holding a tin of cat food. What she is looking for, which she will explain throughout the lesson, is similarities and differences between wild and domestic animals~~).~~*	CQ
2	Jane: There's stripes on the cat	NFE
3	Okay, that's a brilliant one, stripes.	
	So, they have stripes in common, they share stripes.	FE
	But that's not quite what I am looking for, Stan? *Stan has his hand up.*	CQ
4	Stan: Food.	
5	Teacher: Ha, food.	FE
	Stan, explain it?	CQ
	You're right but explain what you mean.	FE

While a traditional IRE sequence can be quite restrictive in terms of developing concepts, this depends very much on the evaluation, or feedback move that the teacher makes during the sequence. In extract 1 we can see how Mrs Jenkins uses closed questions to open a discussion through elaborating her feedback. This indicates that what she is looking for goes beyond what the children are offering as responses. In line 4, note how she uses the abstract notion of 'common' and immediately defines this word with a word children will understand: 'share'. While a relatively large amount (16%) of Mrs. Jenkins' talk elaborates scientific concepts and everyday concepts (17%), in her lesson she goes beyond merely elaborating the content of the concepts, by discussing how one can think in relation to these concepts. I distinguish between the content and form of thinking, by indicating that the contents of thought are 'subject content' facts, whereas the forms of thinking are 'cognitive functions. In the extract below, this is illustrated when Mrs. Jenkins begins to discuss the task that the children are required to work on in the lesson. In this instance, the task requires that children draw a mind map ('bubble map') *comparing* wild and domestic animals. This is a high-level task requiring that children can distinguish similarities and differences between the animals.

EXTRACT 2: MAKE WAY FOR THE QUEEN

	Dialogue
1	**Students:** Make way for the queen.
1	Make way for the queen. *The teacher (referred to as 'the queen' by her students) has stood up from her desk*
2	*and walked towards the blackboard).*
3	**Mrs Jenkins:** So, we're going to do a bubble map.
4	*Draws two intersecting circles on the board. Labels the one circle 'wild' animals and the other circle*
5	*'domestic' animals.*
6	On this side is the things that are only belonging to
7	the lions, and this side only the cat, and the middle, the two joining, things that they can both do.
8	Right, Sadie? *Sadie has her hand up*.
9	It's something in the middle.
10	**Sadie:** They have very sharp claws.
11	**Mrs. Jenkins:** They've got sharp claws**.**
12	That's perfect, Sadie,
13	Sharp claws.
14	Love it.
15	Okay, they both have those.
16	**Students:** And they [over talking].
17	**Mrs Jenkins:** They're both?
18	**Students:** Predators.
19	**Mrs Jenkins:** Yes, they are predators.
20	Can you explain what the word predator means?
21	**Kyle**: It means they both hunt.
22	**Mrs. Jenkins**: So they are predators, they are hunters.
23	Let's put predators in here. Pre...*Writes in the*
24	*centre, shared space of the bubble map.*

In Extract 2 above, the teacher is beginning to illustrate how children can compare wild and domesticated animals by focusing on what they have in common and what differentiates them. She does this by means of a bubble map where two bubbles intersect each other with a space in the centre where similarities are recorded. What is interesting about this extract is how the teacher links the abstraction of comparisons, to a concrete, everyday bubble map that children can empirically interact with. What we have here is what Feuerstein would call the mediation of meaning; the recruitment of students' everyday knowledge to make sense of the abstraction being taught. Note too how she links the everyday concepts of 'hunting' with the abstract notion of 'predation', thereby giving the word 'predator' a meaning that students can share with her. What we have in Extract 2, then, is the teacher providing a what Gallimore and Tharp (1994) call cognitive structuring to enable children to compare animals. A cognitive structure is a structure for thinking that enables the children to adjudicate where certain

content belongs. In this instance, in relation to a bubble map. The pedagogy enacted here is graphically illustrated in Fig. 1 below.

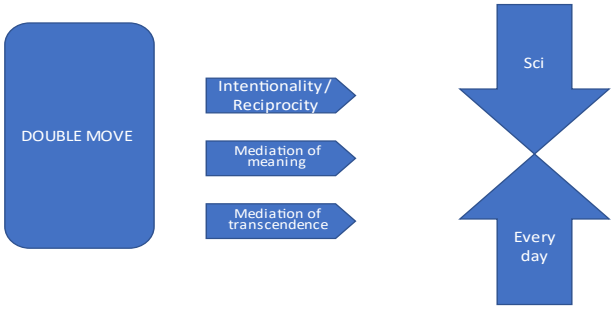

Fig. 1. Pedagogy in practice.

What we see in Fig. 1 is how the double move is animated by the mediated learning experiences in linking the abstract and the everyday.

E. When the Textbook Is the Only Resource

While Mrs. Jenkins has brought additional resources to her classroom, such as pictures and a mind map, Ms. Naidoo relies entirely on the textbook for teaching. What follows is the beginning of the lesson on wild and domesticated animals.

EXTRACT 3: MS. NAIDOO – OLD MACDONALD AND HIS FARM

1. **Teacher:** Huh-uh, huh-uh, huh-uh I'm gonna point it out. I, we'll sing it together. Ok. Face the front. Don't look at the camera. Don't look at the camera. One, two…
2. [Students sing along with Teacher]
3. Old MacDonald had a farm,

   E-I-E-I-O.
4. And on the farm he had a dog

   E-I-E-I-O.
5. And a woof, woof here,

   …sings the entire song going through: Birds, ducks, cats and sheep.
6. **Teacher:** Can you tell me name me some animals that's where you get in our homes.
7. An animal that you get in the home. Ollie?
8. **Students:** A dog.
9. **Teacher:** A dog. …
10. **Teacher:** And where do you get a pig?
11. **Students**: In the farm.
12. **Teacher:** Yes, he is certainly on the farm.
13. But the farm, you see why do we get it on the farm is because a farm has space.
14. A farm is a little house, then they have big land hey where the animals can go on.
15. But we also call it domestic animals.
16. We also call it a home animal. Ok. Right.

The lesson begins with the teacher and students singing the nursery rhyme, Old MacDonald. As a scaffolding 'hook' to recruit students' attention, the singing of this song lets the children know that they will be learning about the farm. However, it does not make clear what the teacher's intention behind the song is, nor does it necessarily capture students' attention because as grade two students, they may not be that interested in singing a nursery rhyme that they know very well. The textbook Ms, Naidoo is using begins this section with the song, Old MacDonald's farm and the teacher sticks strictly to this in her lesson.

In Extract 3 above, we see that sticking very closely to the textbook does not aid Ms. Naidoo in developing the scientific notion of what a farm animal is. In fact, she is trying to get students to understand the notion of farm animals as domesticated, which is a key distinction between wild and farm animals. Yet nowhere in the extract, or in the lesson, does she elaborate or define what a farm is or what a domesticated animal is. This echoes what is in the textbook she is using.

No definition of the essential attributes of domesticated animals is provided and the only feature of a farm that the teacher mentions is space. However, this is not what distinguishes a farm from the wild, as space is available in the wild too. However, in lines 14 to 16 the teacher begins to attempt to define farm animals in terms of their domestication. While she does not explicitly define domestication, she likens it to a 'home' animal, presumably a pet. The children in this school are relatively affluent and many have pets, so their everyday concept of a pet is a useful concept to harness to define domestication. The scientific concept of 'domestication' is linked here to the child's everyday understanding of his or her own pet. Unfortunately, there is a missed opportunity to make this high-level concept more meaningful in relation to what kind of animals live on farms. While one may indeed have pets on a farm, it is unlikely that a cow, for example, is seen as a pet in the same way that a dog might be. Moreover, the opportunity of making the term 'domestication' useful and meaningful in a child's lived experience is not fully developed as domestication is linked in this extract only to pets, rather than more broadly. In extract 5 below, we see how Mrs. Jenkins achieves this transcendent leap from the classroom to the wider world that children live in.

F. The Double-move as Geared towards Authentic, Lived Experience

AS discussed earlier in the paper, the double-move requires a linking between the scientific and everyday concept in such a way that the concept acquired can be used beyond the confines of the classroom. In Extract 4, Mrs. Jenkins attempts to make the work the children are learning relevant to their everyday lives.

EXTRACT 4: 'COW FARTS' AND GLOBAL WARMING

1. **Mrs. Jenkins:** So, uh, so Shane, why do you think it's important to learn about wild and domesticated animals?
2. **Shane**: Lions can kill you and eat you!
3. **Mrs Jenkins**: yes, yes they can.
4. But I'm thinking of something else.
5. Who's heard of global warming?
6. Hands up, no shouting. *8 hands go up*
7. Felix?
8. **Felix:** It is um, it gets very hot and there's fires like the fires on the mountain.
9. **Mrs Jenkins**: It gets hot.
10. Yes, it gets hot.

11. Well, I read this story in the newspaper about how cows gas makes it get really hot. *children laugh at the word 'gas'.*
12. Hey ok, it's very funny.
13. Yes Iris?
14. **Iris:** Farts *laughing. children start laughing loudly*
15. **Mrs Jenkins**: Yes, farts. And that fart has something in it it's called methane gas.
16. This gas makes the climate hotter.
17. **Shane:** From farts?
18. **Mrs. Jenkins**: Yes Shane, I know it's funny but it's also very serious.
19. It makes the planet hotter and that's not good for us to live in, is it?

Extract 4 above is of interest because we can see Mrs Jenkins making a link between the heat of summer and global warming. This she relates to cows and their 'gas'. While she doesn't go further to illustrate how domesticating animals can have severe climatic effects, she has opened the relevance of why children should be learning about wild and domesticated animals. Quite simply, this topic is of interest to their lives in a very real way. In this move, she is providing a bridge between the classroom and the outside world, what Feuerstein would call the mediation of transcendence.

In relation to the data presented in this paper, one gets a sense of two teachers who teach quite differently. As noted earlier, Mrs. Jenkins has been trained to teach using the double-move and has learnt Vygotsky's pedagogical principles, while Ms. Naidoo has not. A cursory glance at the empirical data suggests that these teachers do indeed teach quite differently. In education, it is impossible to isolate a single variable when discussing the cause of teaching/learning because classrooms are populated with a variety of different 'heads', each with his/her own history, culture, and social embeddedness. However, we can tentatively suggest that given that the study was carried out in one school, in one grade and that the teachers had access to similar students and classroom context, the differences between the pedagogical praxes may speak to the differences in the teachers' training regarding this pedagogical model.

One cannot generalise this finding to other classes because, as I have noted, schools and classrooms in South Africa are incredibly different, with children drawn from many different cultural groups. All that we can say in relation to this study is that for Mrs. Jenkins and Ms. Naidoo, there is a difference between how they use talk in their grade 2 classrooms. We know that Mrs. Jenkins has been trained to use the double-move and has a firm grounding in Vygotskian principles so we can say that there is a possibility that the training she has received has influenced her pedagogical practice. More research, with a larger sample, is required to make any further statements about the impact of the double move in pedagogy.

VI. Conclusion

THIS paper set out to illustrate how someone who is trained in a cultural historical pedagogical model, drawing on Vygotsky, Hedegaard, Freire and Feuerstein, to teach in a grade 2 science lesson. Effective pedagogy, for Vygotsky, is that pedagogy that moves beyond what a child can do on their own. It is a form of praxis that aims at developing the developmental 'buds' in the child. Two teachers in a single school formed the subjects of this study with the aims being to investigate whether teacher talk would differ between a teacher trained in the double move versus a teacher not trained in this. Findings indicate that Mrs Jenkins, trained in the pedagogical principles illustrated in this paper elaborated more scientific and everyday concepts than Ms. Naidoo who did not have this training. Further, while much of Ms. Naidoo's talk featured closed questions and unelaborated feedback, Mrs Jenkins' use of closed questions is generally followed by elaborated feedback, aimed at developing the child's idea of the topic under discussion. A brief caveat is in order, however. This study took place in a relatively affluent school with well trained teachers and a relatively affluent student body. The findings here cannot be generalised outside of these two classrooms. What we can conclude though, is that this case study provides tantalising evidence of the possibilities of the double-move in pedagogy as capable of developing scientific concepts in the ZPD.

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Conflict of Interest

There is no conflict of interest.

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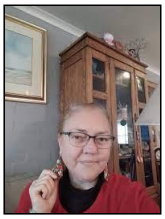

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