

Between the old and the new: A study of a mathematics teacher's changing practices in South Africa

Karin Brodie, University of the Witwatersrand, South Africa
Stanford University, USA

This paper raises the issue of teacher change and development as teachers attempt to take on new curricula and pedagogies. Through a case-study of one teacher's changing practices over three years it documents the tensions, contradictions and possibilities of her changing practices, in relation to the mathematics that she is trying to teach and social interaction in the classroom. Against a backdrop of the hopes and dreams of creating a new curriculum (and through it a new society) in South Africa, the paper argues that moving between the "old" and the "new" is a developmental process that must take time, and that premature evaluations of teachers' change should be avoided.

Introduction

South Africa is in the midst of attempts to fundamentally transform teaching and learning in schools, as are many other countries internationally. In South Africa, this transformation is explicitly linked to the transformation from an apartheid to a post-apartheid society, and therefore is imbued with hopes and dreams possibly not expressed in other countries. A new curriculum, which has been developed over the past five years and is currently being implemented in schools, is often presented as a complete break from the past, as the antithesis of the apartheid curriculum (see table 1).

OLD	NEW
passive learners	active learners
rote-learning	critical thinking, reasoning, reflection and action
syllabus is content-based and broken down into subjects	an integration of knowledge; learning relevant and connected to real-life situations
textbook/worksheet bound and teacher-centred	learner-centred; teacher is facilitator; teacher constantly uses group work and teamwork
teachers responsible for learning; motivation dependent on the personality of the teacher	learners take responsibility for their learning; pupils motivated by constant feedback and affirmation of their worth.
content placed into rigid time-frames	flexible time-frames allow learners to work at their own pace

(Department of Education, 1997:6-7)

Table 1: The old and the new according to Curriculum 2005

Table 1 presents a dichotomous picture of classrooms, they are either of one type or the other. It is not surprising that most teachers prefer the image of the new, particularly when the old is presented as a manifestation of apartheid.

What is seldom acknowledged is that it is unlikely that any one classroom will be describable in the dichotomous terms of the table. In particular, the “new” is not often seen, even in well-resourced countries, where school reform movements have been promoting these ideas for many years (Sugrue, 1997; Darling-Hammond, 1997; Cuban, 1993; Edwards and Mercer, 1987). Moreover, if teachers are working in ways described by the “old”, then shifting towards the new must happen in relation to the old in some way. In learning and development, including teacher learning and development, it is not possible to make a complete break with the past. The ways in which the past influences the present and the future are crucial in understanding teacher change.

In this paper, I am interested in trying to understand the textures and complexities of change more deeply. I will present an analysis of the changing practices of a mathematics teacher over three years, together with the conflicts and struggles that these changes brought up for her. I will argue that her practice and thinking shifts between old and new visions of teaching, and that to take up the new is a task that requires substantial time and developmental shifts.

The setting

Ms Sibasa (a pseudonym) teaches Grade 7 mathematics at a primary school in the Northern Province of South Africa. Her school is located in a township just outside the main town. The school draws learners from a variety of backgrounds, some are immigrants or refugees from neighbouring Mozambique, some are from poor rural or township families, and some are children of an emerging middle-class in the area. All of the learners and teachers in the school are black. The school is relatively well-resourced (in South African terms) with electricity in each classroom, enough desks for learners and teachers, and enough space in classrooms (few classes have more than 40 learners). There are toilets for staff and students, although, since the water often does not work, these are not always functional. There are no laboratories, no library and no staffroom in the school.

The school has a good reputation in the area and strong leadership. The principal and some of Ms Sibasa’s colleagues are supportive of further study and new ideas in the classroom. Ms Sibasa attends professional development workshops and uses the ideas she learns about in her lessons. Ms Sibasa enrolled on a Further Diploma in Education programme at Wits University in 1996 in order to further her professional development. The data that will be discussed here were collected as part of a research project on the influences of the programme on teachers’ changing practices (Adler and Reed, in press).

The first year: 1996

In 1996, Ms Sibasa was observed teaching addition and subtraction of mixed numbers. She used diagrams to illustrate conceptual equivalence between mixed numbers and improper fractions. She used the diagrams to develop the

language of whole and part, and to try to scaffold the equivalence concept. She then went through an example of how to add fractions step-by-step on the chalkboard. Ms Sibasa's style of teaching was to conduct a whole class "discussion", in the traditional Initiation-Response-Evaluation format (Edwards and Mercer, 1987), with the teacher strongly controlling each move and the pupils chorusing answers. Such interaction functions to maintain the teacher's control, rather than to allow learner ideas into the lesson. The following extract provides an example of the typical style of interaction in the classroom [T=teacher; P= 1 pupil; Pp = many pupils]:

- T: This square has been divided into four parts. Can I again divide this square into 4 parts?
- Pp: (chorus) Yes
- T: Very good, let me divide it into four parts.
(silence as she divides it into 4 parts)
- T: Can I also divide this one into four parts?
- Pp: (chorus) yes
- T: Good
(silence as she divides it into 4 parts)
- T: Right, all of them have been divided into ...
- T/Pp: (chorus) four parts
- T: What do you think I can shade here, even though I have divided it into 4 parts, to bring me, to bring this one? (hands go up)
- T: Yes (pointing at a student)
- P: the whole square
- T: I must shade the ...
- Pp: (chorus) whole square
- T: I shade the whole square, I shade the whole square.

After the whole-class interaction, learners worked on examples of addition and subtraction of fractions in groups. Ms Sibasa circulated among the groups but did not interact with the pupils about the mathematics. After this, each group presented its solution on the board and Ms Sibasa corrected these where appropriate.

Thus in 1996, Ms Sibasa's practice could be described as predominantly traditional, or as the "old" in the table in Figure 1. Although the learners did participate, they did so in a form of passive participation. Her view of mathematics was predominantly algorithmic and procedural – she explained, and the pupils did examples following her method. Some elements of new practices were becoming evident in her practice, namely groupwork, and her attempts to provide some conceptual illustration of the mathematics. However, she did not interact substantively with the learners in groups, and the conceptual aspects of the mathematics became proceduralised through her teaching style.

Ms Sibasa's rationale for using groups came from an NGO (non-government organisation) workshop she had attended:

... they were teaching us not to teach children; we must not tell children everything. They said we as teachers think that children are empty-minded, they

do not have anything that they know. It is better for us to find out something from them; children learn better if they learn on their own.

In the above we see a combination of views which help to explain some of Ms Sibasa's practices in relation to group work. Since "children learn better if they learn on their own" and "we must not tell children everything", it makes sense not to intervene as pupils work together in groups. In addition, Ms Sibasa explains below that it is easier for her when pupils work in groups; she no longer has to repeat herself as much:

Before the FDE it caused me a great stress because I had to explain and then again repeat, explain and then repeat. But since I know this method, I thank the method ... you must pose a problem to the children so the children must discuss on their own. And then now I just give them a problem, they discuss on their own, they teach each other, and thereafter, I don't have stress now.

Ms Sibasa finds group work a welcome relief from the pressures of whole-class teaching. This is contrary to much evidence which suggests that working with groups is more demanding for teachers, since they need to attend to more pupils and more ideas at once.

Ms Sibasa's comments and her practices suggest that she is trying to craft some new ideas and practices onto her old practices. The two sit together side-by-side; she is not yet co-ordinating them. However, some of her comments suggest that she is beginning to co-ordinate some ideas, and is critiquing some of the new ideas through the lens of her old practices. For example:

There are new methods or approaches, that children should not learn to know things by heart, they must not learn to know tables by heart, like what we used to do in the past. This makes a ... the teaching of mathematics to drag a little bit because children when they come in contact with five times six ... That is why today you saw they were taking a long time because they don't know the multiplication tables People think "oh its an old method" so introducing an old method, maybe I will not be doing the right thing because they say children must not be drilled, drilled and then cram the numbers. But knowing them to me it's very important.

The second year: 1997

In 1997, Ms Sibasa was observed teaching geometry. She divided the lesson into three activities. In the first activity one pupil was invited up to the teacher's desk and asked to arrange spherical sweets "next to each other so that they touch one another". Then groups of pupils came up to look at the arrangement with the instruction to look and see if they "cover the whole space" and to talk about this in their groups. The teacher then asked the whole class what they discussed, and "what makes it (the whole space) not to be covered". Most groups provided the answer she expected, that the shapes were round and therefore would not cover the area. However, one pupil answered "the corners" and Ms Sibasa told him that he was not correct. She did not comment on his idea, nor asked him to explain further.

In the second activity, Ms Sibasa gave each group an envelope containing a set of flat shapes (rectangle, triangle, other polygons), and asked them to “put them together” so that they form a square. The pupils worked on this task in their groups and the teacher walked around the classroom, occasionally intervening in the group work. Her interventions did not deal with the task directly, but rather asked pupils if they were helping each other, if they were all working etc. After most groups had managed to make the square, Ms Sibasa conducted a whole class discussion asking: “what do you think made them to fit each other completely”, “with no space”, “unlike the round ones” [the sweets from the previous activity]. She accepted the answers: “because they have straight lines” and “they are polygons”. Again, she did not accept the answer: “because they have corners”. She then asked: “where can we use these shapes at home or at school?” The pupils referred to the shapes themselves and gave a range of answers. For example one pupil said that the shapes are used in cooldrink cans. Ms Sibasa did not engage with their responses, but explained that the shapes can be used as *tiles*, which suggests that she was looking for a particular response rather than to understand her pupils' ideas or help them to make links. She ended the episode by comparing “straight” and “round” shapes with regard to their “fitting each other” and “covering the whole space”.

The third activity involved pupils working from a worksheet with the title Tessellations which Ms Sibasa had obtained from a workshop. The worksheet had four shapes on it - a triangle, a trapezium, an L-shape and a diamond - and it asked the pupils to “make tessellations of each of the following”. The pupils worked in pairs. Ms Sibasa circulated, occasionally intervening with regulatory comments as she did earlier. Her comments did not significantly change the ways in which the pupils interacted with each other, or with the subject matter.

Thus in the second year of the study, and about one and a half years into the programme, Ms Sibasa had shifted some of her practices significantly. She chose a wider range of mathematical tasks, which were more investigative and open to learner exploration. She sequenced the tasks to try to build a sense of tessellation for her pupils. While there were some mathematical problems with the sequencing of the tasks and with Ms Sibasa's interpretation of tessellations, she did find tasks which engaged a number of learners. Group work was more necessary for the tasks and more structured, although Ms Sibasa still did not interact mathematically with the groups. After each activity, Ms Sibasa conducted a whole-class discussion to emphasise the key learning points. There was no chorusing in these discussions. Ms Sibasa asked slightly more open questions than in 1996. However, her reactions to some of the pupils' responses suggested that she expected particular answers, and was not able to not hear others. Thus she closed down the discussion even as she attempted to open it up.

In talking about what she had learned from the Further Diploma Programme, Ms Sibasa said:

The one thing the FDE taught me is to let children talk. At first we did not allow children to talk to each other. We thought maybe it's the thought of making noise, but now I can see they can realise things on their own and come up with their ideas.

This is slightly different from her statement in 1996, in that it posits learners interacting and talking among themselves, rather than merely working in groups. We see that Ms Sibasa set up tasks to enable this interaction. However, she still did not position herself as the teacher in relation to this interaction. In fact she echoes her previous position on her own role in group work:

It lessens the burden of talking too much in the classroom. Where you find that you can talk and then your head ends up aching, you see. Now that you can just give directions. They are going to do this and then they get started. If you see that they are, they do not know what to do, you intervene, give them directions, what can they do thereafter. So you just listen, its better than talking too much.

Ms Sibasa did not express the same doubts about the new approaches that she expressed in 1996. When asked what she does when pupils have difficulty understanding she said:

I just supplement, supplement by telling them what to do. If I see that they do not want to give things of their own, I supplement, more especially to those who I see that, they are not confident to do it. ... Those kids they need more time, I think they need more time.

Thus Ms Sibasa seemed more comfortable with telling pupils things, whereas she had worried about it previously. She was doing less rote teaching than previously, suggesting that she had co-ordinated some of her previous conflicts and understandings into new forms of practice which were aligned with the new curriculum.

The third year: 1998

The day before the 1998 lesson, Ms Sibasa had asked the pupils to bring garbage to class. The lesson began with a bundle of garbage on the floor in front of the class, and the teacher giving instructions as to how they would sort the garbage. As she gave the instructions, she also gave some categories by which they might sort the garbage: tins; papers; enamel; and fruit-waste. A pupil came up to sort the garbage and when he was finished, another two pupils came up to make some changes in his sorting. After this the teacher called up four pupils to count the number of pieces of garbage in each pile, and she wrote on the board: Plastics = 20, Tins = 13, Fruit waste = 58, Papers = 9. Once the teacher had the amounts written on the board, she told the class that they should draw the graph and explained some of the rationale for this activity. As she spoke, the pupils stood around the classroom, not seated in their desks. There was hardly any pupil chusing in this lesson, in fact there was hardly any pupil talk at all. The pupils were either sorting, counting, or watching their classmates.

As they worked in their groups, the teacher realised that they were not keeping the units equidistant on the y-axis. She explained:

The distance of the points must be equal. This distance must be equal to the other one. If you want to, to use two centimetres of the ruler, ne, two centimetres it means from, you have got one, two, you say two centimetres its equal to one centimetre, do you understand? (A few kids say yes). If you want to take three distances, this one, this one and this one (points to cm on ruler), you will say, three centimetres is equal to one, one centimetre. You have three centimetre with one centimetre. The distance which you like is allowed, any distance which you want to use.

Although the teacher's explanation had incorrect mathematical statements and had the potential to confuse the pupils (for example, "two centimetres its equal to one centimetre"), what is significant here is that she is trying to explain something to the pupils. She had monitored their work in groups, found something that they did not understand, and made a substantive, mathematical intervention.

So Ms Sibasa has maintained some of her practices from 1997. She used an interesting mathematical task, which allowed for exploration and investigation. The classroom atmosphere was relaxed and less formal, and there was significantly reduced chorusing. The pupils participated more in whole class activities and in their groups. One substantial change in Ms Sibasa's teaching was that she monitored difficulties in the group work and responded to them. Her responses were generalised, and directed at the class as a whole – she still did not engage with individual learners' ideas. However, her responses did constitute some form of intervention into group work which was not seen before.

Her comments on group work were less positive than in 1996 and 1997. She still thinks it is a useful practice, but she expresses more concern about pupils possibly not learning in groups:

Because they will also rely on the person maybe who can write for them, and then the time when you need them to write, they are unable to even start writing. ... Those who understand will participate and others who do not even see a way, will play around, will just look at what the others are doing.

This might explain her willingness to intervene mathematically. Ms Sibasa also spoke more articulately about her views of learning in 1998:

Yes it happens, because children they've got their own minds, and their own thinking, and I've got mine, and how I take things you see. ... It means that children give it a meaning in their own way. And then I have to see that that is what they understood with it.

This understanding is one specifically developed in the Further Diploma Programme, and suggests that she might be thinking more about what pupils are learning, than focusing on her teaching approaches. However, Ms Sibasa still does not hold conversations with her pupils, nor engage in their conversations with each other. However, she is beginning to work with their ideas, even

though she does it in a traditional way, telling or explaining. It may be that Ms Sibasa is coming to a new understanding of learning and at the same time has developed new ways of teaching. These are two different aspects of her practice that still have to be fully co-ordinated in order for her to work with them simultaneously and seamlessly.

Conclusions and implications

I have argued that Ms Sibasa has made substantial changes in her teaching practices and in her understandings of her practices over the three years of the study. In 1996, her practice was predominantly traditional, yet we saw elements of new practices. She expressed some doubts, about some of her readings of the new ideas she was learning. She was predominantly in the old, trying to craft on some of the new. In 1997, there were major shifts in her practice. She was clearly trying out new ideas. She had reconciled some of her earlier doubts and critiques, and expressed more comfort with “telling” things to pupils, even though we did not see this in her practice. In this year, Ms Sibasa was moving between the old and the new, drawing from both as was appropriate for her. In 1998, Ms Sibasa’s practices looked quite similar to 1997, except that she talked and explained more to pupils. It could be argued that she is moving back towards the old. However, a different interpretation might be that she is beginning to move more substantively towards the new, and in doing so needs to draw on some of her old resources – explaining mathematical concepts.

So Ms Sibasa seems to be in a developmental process, and at different points in this process draws on the old and the new in different ways. At times they sit in tension, at times they contradict, and sometimes they are reconciled. She has not yet fully integrated the more difficult ideas and practices into her teaching, particularly the idea of working with pupils’ mathematical meanings. It would be fascinating to follow this teacher further over the next few years, as she seeks out new learning opportunities and continues to develop her practice. Her case raises the important question of how long it takes to significantly change practice, and whether we need to conduct longer-term studies if we really want to capture the complexity of teacher development.

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