CHAPTER 4

OTHER ELEMENTS IN THE ZOOM: THE SCHOOL SETTING
AND THE LESSONS AT UMHLANGA

INTRODUCTION

In this chapter, I narrow the scope of my focus towards a particular ‘empirical setting’ (Brown and Dowling, 1998:10) Umhlanga Secondary School or Umhlanga. Firstly, I provide a description of the school, learners and classrooms in which observations for this study were done. Secondly, I discuss all the mathematics lessons observed in a Grade 8 class in order to identify lessons appropriate for my study. As a result, this chapter is descriptive in nature and unavoidably elaborate. It nevertheless, provides the larger picture within which the lessons were observed.

The school setting and classroom events are complex entities characterized by a maze of systematic and unsystematic processes. In order to delineate a coherent account appropriate for my research interest, I drew on my research questions and theoretical framework. In particular, Bernstein’s construct, classification, pointed towards the lessons I needed to focus on. These are lessons characterized by a blurred boundary between mathematics and the everyday: weakly classified lessons, in Bernstein’s terms. Classification, however, is an abstract term whose use is not only limited to the boundary between mathematics and the everyday, but to a degree of boundary maintenance between specified contents (Bernstein, 1996:159). I will extend the use of this construct to describe the connections made between different lessons. My particular interest will be on whether contents of two consecutive lessons stand in an ‘open’ or ‘closed’ relationship. The significance of this aspect for my study is that it will help describe the phasing in of the everyday from one lesson to the other. As a result, it will be possible to highlight whether the everyday was sporadically introduced throughout the lessons or whether there was a particular theme which informed a movement from one lesson to the other.
Within each lesson, I focus on how the teacher treats the everyday and affords discussions about it. What the teacher legitimizes and the space he/she creates for learners to engage the everyday influences the learners’ views and therefore perspectives on its role in mathematics. What I will thus also be exploring, within each lesson, is the pedagogic relationship between the teacher and learners. This relationship (between the teacher and learners) is captured by Bernstein’s notion of framing. Frame, as Bernstein asserts, “refers to the strength of the boundary between what may be transmitted and what may not be transmitted in a pedagogic relationship” (1982:159). In other words, as highlighted in Chapter 2, it may be viewed as the extent to which the teacher makes explicit the legitimate text i.e. what is acceptable in class.

The discussion in this chapter will be based on two main themes:

1. Description of the school; in order to provide the physical and social setting within which the school operates.
2. Description of the lessons observed; in order to identify the everyday-based lessons, explore the connection made between lessons and the context in which the lessons take place.

In Chapter 2, I argued that the everyday is multifaceted. Therefore, it will be possible to determine, from a description of lessons, the type of everyday incorporated in Umhlanga; which is a concern of research question 1. There are other aspects in this chapter, like the school’s physical and social setting, whose influence on the learners’ views on the incorporation of the everyday is not obvious. However, these aspects serve as “other elements which come into focus throughout the zoom” (Lerman, 1998: 67) and thus provide the broader context within which learners and their engagement with tasks are located.

4.1 DESCRIPTION OF UMHLANGA SECONDARY SCHOOL

Location, infrastructure and personnel: Umhlanga is located in Umlazi township, a township situated about twenty kilometers south of Durban city in the Kwazulu-Natal
province. A township is a legacy of apartheid and refers to a single-race residential area intended for non-white South Africans and strategically located close to a city in order to supply non-white labour. In order to access the school one had to negotiate an uneven and un tarred road with many potholes, which snaked through parts of an informal settlement located close to the school. Movement in and out of the school is controlled and monitored by security personnel.

The school itself is an electrified double-story building school with a total of twenty classrooms. The administration building, which is detached from the classrooms, houses the staff-room, the Head of Departments’ offices, the principal’s office and the secretary’s office. On the walls of the administration block’s corridor hung different certificates highlighting the school’s achievements in sports and academic activities. The principal’s office has a locker room in which we stored some of the data-collection equipment. The reception area at this school was manned by a secretary.

The school had a total of about 1 000 learners and 35 teachers. All learners and teachers were African. The only staff member of a different race was the secretary, who was Indian. The school offered tuition to learners from Grade 8 to Grade 12. Data at this school were collected during the month of October, Tuesday (09/10/2001) to Thursday (25/10/2001). For a township school, Umhlanga is adequately-resourced and stands in stark contrast with the impoverished informal settlement surrounding it.

**Learners and the classroom:** Most of the learners are drawn from Umlazi township and pay school fees of R200 per year, an amount which not all learners could afford. This figure and the observation that it was not affordable to some learners indicate the low socio-income group from which the majority of these learners are drawn.

All learners were expected to wear a school uniform: grey or black trousers (for boys and girls) or grey or black skirts (for girls), white shirts and yellow ties with grey stripes (for

---

*As I noted in the previous chapter the principal had sent some learners home during our visit at the school, for not having paid school fees.*
both). The Grade 8 mathematics class in this study consisted of 34 learners, all of them Black and isiZulu speaking: 10 boys and 24 girls. We learned, during interactions with learners, that some of them had been to Model C schools (these are schools which drew the majority of learners from economically-advantaged Blacks). Learners who had been to Model C schools often had a better command of the English language and the confidence to speak it. Thus, fluency in English amongst learners was varied. The Grade 8 learners’ whose mathematics classes we observed were familiar with some aspects of the new curriculum and its terminology.

Girl learners took turns to tidy the classroom. For the mathematics lesson, desks were arranged in a U-shaped group discussion format. In this way, the arrangements of desks in the classroom announced the type of pedagogy which supported group work amongst learners. Some of the electrical plugs in the classroom were non-functional; therefore we had to run one of the electrical cords from a neighbouring classroom. Two of the windows in the class were broken. Meighan (1986:86) suggests that space influences pupils’ behaviour and the ‘learning message’. In a class where desks are set in rows facing the front, then “the learning message is ‘sit and listen’: a lecture or instructional approach is implied. This style is appropriate for some of the time; but if the teacher desires general discussion or group discussion then the furniture arrangements are opposed to it” (Meighan, 1986:86).

Description of Umhlanga suggests that within a context of compromised classroom resources (like broken windows), furniture arrangement in the classroom announced a preference for group work and shared responsibility in responding to worksheet items.

The teacher: Ms Bulelwa Cuga, whose grade 8 lessons we captured, was head of the mathematics department. Her formal qualifications were a B.Sc degree with Mathematics and Statistics majors, Higher Diploma in Education and a B.Ed (Honours) degree, all obtained from the University of Durban Westville. In August 2002 she joined the LPS (SA) research group whilst pursuing a Master’s degree. She also resigned as Head of Department in 2003 and joined the University of Durban-Westville (UDW) as an
academic staff member. Her move to UDW took place after data had been collected. Because of our many interactions as members of the LPS (SA), Ms Guca and I felt at ease to address each other on first name basis. It is in this respect that I refer to her as Bulelwa.

Bulelwa was very enthusiastic about the new curriculum and was willing to try out some of the ideas in her own class. For example, her worksheets were written in OBE terminology specifying the *phase organizer* (or theme) and the mathematics *programme organizer* (or focus). What made this use of terms like ‘programme organiser’ and ‘phase organiser’ by Bulelwa notable is the observation that the majority of teachers found them confusing and thus could not use them confidently (Jansen, 1999). Regarding the incorporation of the everyday in mathematics, Bulelwa pointed out, during the interview that:

…It’s not that we learn mathematics in isolation. Just like when we started [at the beginning of the year], we had an outbreak of cholera. I brought some statistics from the department; you know …the actual statistics from the department. So I taught them at the time how to get a table, a statistical table and analyse information. So it was the learning of mathematics, but with something that was happening at the time.”

[Umhlanga, Teacher interview, line 16]

Thus, she argued in favour of blurring of boundaries between the mathematics and the everyday.

### 4.2 OVERVIEW OF LESSONS 1 TO 9

A total of nine lessons were observed for a three-week, thirteen-schooldays period. No mathematics lessons were time-tabled for Fridays (so none took place on Friday 12/10/01 and 19/10/01). On Thursday (11/10/01) learners took a national mathematics assessment as a pilot school and on Thursday (25/10/03) students whose school fees were outstanding were instructed to vacate the school premises. Each lesson was scheduled for forty-five minutes. However, Bulelwa often exceeded this forty-five minute limitation.

---

* The use of new terminology and complex language is cited by Jansen (1998:147) as one of the ten reasons why the new curriculum will fail. The terminologies, phase organizer and programme organizer, were ultimately dispensed with (as outlined in chapter 1) following recommendations of the Review Committee.
The following table provides a summary and global view of topics or events that took place in the mathematics class during the period of our observation.

Table 4.1 Dates and lesson titles at Umhlanga

<table>
<thead>
<tr>
<th>LESSON</th>
<th>DATE</th>
<th>TOPIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>09/10/2001</td>
<td>Number systems in Ancient Societies</td>
</tr>
<tr>
<td>2</td>
<td>10/10/2001</td>
<td>Lesson 1 continued</td>
</tr>
<tr>
<td>None</td>
<td>11/10/2001</td>
<td>Learners take a national pilot study test.</td>
</tr>
<tr>
<td>None</td>
<td>12/10/2001</td>
<td>No Mathematics lesson timetabled.</td>
</tr>
<tr>
<td>3</td>
<td>15/10/2001</td>
<td>Number patterns exercise</td>
</tr>
<tr>
<td>4</td>
<td>16/10/2001</td>
<td>Number patterns generated by students</td>
</tr>
<tr>
<td>5</td>
<td>17/10/2001</td>
<td>Using calculators to complete number patterns</td>
</tr>
<tr>
<td>6</td>
<td>18/10/2001</td>
<td>Lesson 5 continued</td>
</tr>
<tr>
<td>None</td>
<td>19/10/2001</td>
<td>No mathematics lesson time-tabled</td>
</tr>
<tr>
<td>7</td>
<td>22/10/2001</td>
<td>Number patterns in nature (World population and Aids sufferers population used as a context)</td>
</tr>
<tr>
<td>8</td>
<td>23/10/2001</td>
<td>Lesson 7 continued</td>
</tr>
<tr>
<td>9</td>
<td>24/10/2001</td>
<td>Patterns in nature (Flowers used as a context)</td>
</tr>
<tr>
<td>10</td>
<td>25/10/2001</td>
<td>Teacher interview and administration of IBT** to learners.</td>
</tr>
</tbody>
</table>

The main theme used to structure and organize lessons is number patterns. For contents of the lessons, Bulelwa drew from both everyday endeavors or interests which are non-mathematical and mathematics content. In the first two lessons (as I shall elaborate below), no calculations were required. It was only in Lessons 3,4,5 and 6 that Bulelwa introduced tasks that required some form of calculation, pattern recognition and pattern description. In Lessons 7,8 and 9, pattern recognition and description are based on the everyday context of AIDS, world population and flower petals. Thus, Lessons 3,4,5 and 6 may be seen as providing necessary mathematical skills for lessons 7,8 and 9. Even though Lessons 1 and 2 on the one hand and 7,8 and 9 on the other are weakly classified, the motivations for incorporating the everyday seem different.

** IBT stands for International Benchmark Test. It is a test administered to all learners who participated in the Learners’ Perspective Study.
An overview of Lessons 1 and 2

Overview of Lesson 1: During the first lesson learners were provided with worksheets containing information on number systems developed in ancient Babylon, China and India, Egypt and Greece. Each of the seven groups was assigned only one of the ‘four’ countries to read about and summarise. Following group discussions, a group ‘spokesperson’ was to present to the whole on class and respond to questions on behalf of the group. Figure 4.1 below contains information that Bulelwa gave to learners during this lesson.

Figure 4.1 An extract from worksheet handed out in Lesson 1

**PHASE ORGANISER: CULTURE AND SOCIETY**
**PROGRAMME ORGANISER: NUMERICAL PATTERNS**

**ACTIVITY 1**

Since the beginning of time people have used different numbers and numerical patterns. Different cultural groups around the world developed number patterns relevant to their environment and needs. Most of these numerical patterns were developed more than 2 000 years ago, although the way it was written down was very different.

In groups of six, you are going to discuss some of the number patterns developed around the world.

1. Choose a topic together involving number systems developed by the following groups Babylonians, Egyptians, Geeks, Chinese, Indians, etc.
2. Use the material given to you to discuss the development of number patterns by the group you have chosen.
3. Write down about one page of interesting information on your topic.
4. Present the information orally to the class for about 5 minutes.

**ASSESSMENT:** The presentation for each group will be assessed by both learners and Educator.
1. Note the understanding of the topic given.
2. Presentation- whether it is audible
3. Did the audience understand information delivered?

*Even though she refers to number patterns, the contents of the worksheet were more on Ancient practices and number systems.*
**ACTIVITY 2 (PROJECT –2 WEEKS)**
Investigate the number pattern in Southern Africa in early century. You could ask elderly people in your communities, use library or the internet (if possible).
Research about methods used by people in this region to count their livestock, crops, days, months, etc.
Write up about two pages of interesting information on your findings.
Use a poster to display information gathered.
Present your project orally to the class.

**ASSESSMENT**
Educator and your peers will assess your poster and oral presentation.
Note the amount and depth of your research.
Order and logically order your poster.
Whether your research is interesting.

Bulelwa revoiced the contents of the worksheet to learners. Learners were expected to discuss the contents of the worksheet and then choose one person to make an oral presentation to the rest of the class. Members of the class were to ask questions and evaluate each group with respect to audibility of the spokesperson as well as their clarity in presentation.

The ruling that Bulelwa stressed was that a group representative or spokesperson may not be assessed nor asked questions by members of his or her own group. Instead, members of the group were expected to assist their spokesperson in responding to the questions.
Bulelwa also gave out worksheets for a project that learners were to hand in two weeks time. Their assignment was to research the number systems developed in Southern Africa. They were advised to ask their elders how they used to count.

During this lesson, Group 1 and Group 2 (focus group) presented on Greece and Egypt respectively. The presenters used charts and posters to enhance their presentation. One learner protested that Group 1 presenter was not audible. Thus Group 1 was required to present for the second time. Group 2 was represented by Mpumi. She presented quite confidently and handled questions from the class without assistance from the other group members.
The period ended soon after the second presentation, I provide a detailed account of this presentation and the type of interaction that took place amongst learners in the next chapter (Chapter 5). The other 5 groups were to present in the following lesson.

**Overview of Lesson 2:** For this lesson, Bulelwa reminded the class that presentations were to continue. The first group that she called in for presentation was Group 5, the focus group for this day. The group, whose spokesperson was Khanyisile, presented its summary on Egypt. Khanyisile was quite confident and articulate, however, she did not sound confident in dealing with a question from one of the learners. (I will give details of this interaction in Chapter 6).

Group 7 followed with a presentation on Greece the spokesperson was quite confident and dealt confidently with questions from learners. Group 3 presented number development in China and India, the spokesperson for the group looked fairly nervous and was hardly audible. The last group to present was Group 6. Like Group 3, their presentation was on China and India. Learners in this group collaborated and responded to questions from the class as a group.

Bulelwa summarised the lesson by highlighting key observations regarding number systems in each of the countries, particularly the use or non-use of zero. She also pointed out that zero was absent in the Egyptian system, that Greeks had 24 symbols and that the Indians were the first to introduce zero. She gave learners a brief exercise on how to write 1013 using the Babylonian number system. She then gave out a new worksheet on number patterns. She asked learners to engage only one exercise in that worksheet as the period was about to end. The task required learners to complete the following pattern 1,3,5…; ….; …. One learner, Khanyisile (presenter for the focus group) offered a correct response (7,9,11) towards the end of the period. Engagement with the worksheet was to continue in the following lesson.

---

¹ Focus group is a group of students who were under observation for that particular day.
In sum, the overall activities in Lesson 1 and Lesson 2 were about reading and discussing the contents of the worksheet (on ancient number systems), reporting to the other learners, listening to the other presentations and assessing. The worksheet gives some insights into the way in which the teacher foregrounded and made explicit what she considered important for the lesson. Legitimizing all these processes presented the lesson as open. It was thus not clear what information, from the worksheet warranted more discussion or elaboration in this mathematics classroom. In other words, the ‘realization rules’ were not explicit.

The worksheets provided by the teacher highlighted, not only the different ways in which numbers were presented in different systems, but the different environments and periods during which these societies functioned as well as the type of materials used by some of these societies for writing. Therefore historical, non-mathematical aspects are also incorporated in these worksheets. Figures 4.2, 4.3, and 4.4 respectively provide the contents of each worksheets on Egypt, Greece, China and India.
Figure 4.2: A worksheet containing information on Egypt

Egyptians (c3000 BC)

Study the picture and find how many goats were taken from the enemy by this Egyptian king.

Mathematics developed in Egypt at almost the same time as in Babylon (around 3000 BC). The Egyptians wrote on papyrus, made from reeds found along the Nile River. Because of the dry climate, many scripts were preserved.

The pyramids of Egypt are well known and those at Giza date from 2600 BC. Advanced mathematics, especially geometry, was used to build these pyramids.

The Egyptians had a number system developed. They used pictures to represent numbers. Different artists sometimes used different representations of the same object, thus causing confusion in the interpretation of numbers.

\[
\begin{align*}
1 & \quad 2 & \quad 3 & \quad 4 & \quad 5 \\
\text{I} & \quad \text{II} & \quad \text{III} & \quad \text{IV} & \quad \text{V}
\end{align*}
\]
They did not have a symbol for zero, but the system was less confusing than the Babylonian one.

Astronomers of the time preferred the Babylonian number system because it was easier to do calculations with fractions.

The Egyptians used the theorem of Pythagoras to measure the levels of the Nile River.

Greeks.

Greek mathematics flourished during the 600 years before the birth of Christ. The Greeks had a number system based on the Greek alphabet, which had 24 letters.

\[ \text{e.g. } 589 = \text{ lambda } \]

They did not have a symbol for zero, as a number or as a placeholder.

Mathematicians of the time included Thales, Pythagoras, Euclid, Archimedes and Plato. A great deal of the mathematics that we learn at school and university today was developed during that time. Pythagoras, famous for the theorem named after him, also studied numbers. He and his followers discovered that \( \sqrt{2} \) is not a rational number. They tried to keep it secret because it was contradictory to their number theory.

\( \pi \) is one of the irrational numbers that we often use. The value for \( \pi \) is 3.1415926535

In 1973 this value was extended to 1 million decimal places. With modern computers it can be extended even further.

The emphasis shifted towards GEOMETRY and geometry dominated the western mathematical world for many centuries. PLATO had the following inscription above the door to his school:

"Let no one ignorant of Geometry enter this door."

Another critical time in the development of mathematics, was the 19th century when other geometries, such as spherical geometry, hyperbolic geometry and projective geometry were discovered. These geometries
China and India were almost isolated from the western world and developed their mathematics on their own. Much of it centred around the development of a calendar. Their dependence on agriculture made the correct prediction of the monsoon winds and rains important. The emperor controlled this process. It was said that:

"In China it is forbidden under pain of death to study mathematics, without the emperor's authorisation."

In China they wrote on narrow bamboo strips, which explains the vertical way of writing. Later they wrote on silk but it faded easily. The problem was solved by developing the first paper sheets. Paper was used in China as early as 105 AD. It was only used in Egypt during the 10th century and in Spain as late as the 12th century.

It took people a long time to see the need for a symbol to denote NOTHING. The Arabs and Hindus were the first to use it this way. Mahavira (India, 9th century) wrote:

"A number multiplied by zero, is zero."

Bhaskara (India, 12th century) wrote that division by zero results in 'infinity'.

Much later

The modern way of writing fractions was first used by the Arabs in the 11th century.

The symbols + and - were first used in the 15th century.

The Greeks called 6 a perfect number because the sum of its divisors, 1, 2 and 3, add up to 6. After 6, the next perfect number is 28.

The word 'million' first appeared in Italy during the 13th century.
Overview of Lessons 3 & Lesson 4

The focus of these two lessons was number patterns. In particular, learners were required to describe and complete the number patterns in lesson 3 and were required to generate and complete number patterns in lesson 4.

Overview of Lesson 3: At the beginning of the lesson, Bulelwa reminded learners of the project to be submitted in a week’s time (the one she gave out during lesson number 1). She then directed them to a task for Lesson 3. This is the same task that learners had already begun in Lesson 2. She revoiced the instructions in the task. She particularly highlighted the need for learners to describe the patterns in words. The following figure 4.5 provides contents of the worksheet that Bulelwa used for this lesson.

Figure 4.5: Worksheet used by Bulelwa in Lesson 3

Number patterns exercises

- Do this activity in pairs
- Look at the following number patterns. Fill in the missing numbers.
- Write a sentence describing each pattern

(a) 1; 3; .5; 7;--;--;--;--;--;
(b) 10; 20; 30; 40;--;--;--;--;
(c) 5;10;--;40;--;--;--;--;
(d) 2; 4; 6; 4; 2; 4;--;--;--;--;
(e) 1; 4; 4; 9; 16;--;--;--;--;
(f) 350; 300; 250;--;--;--;--;
(g) 265; 745;264;700; 263;655;--;--;--;--;
(h) 1;1;3;3;5;5;7;--;--;--;--;
(i) 128; 64; 32;--;--;--;--;
(j) 10; 5; 2½; ¾;--;--;--
(k) 0; ¼; ½; ¾;--;--;--;--;
(l) 2/3; 4/9; 8/27;--;--;--;--;
(m) 2.97; 2.98;2.99;--;--;--;--;
(n) 25;35;30;40;35;45;40;50;45;--;--;--;--;
(o) 4; 5½; 6½;--;--;--;--;
(p) 2;6;12;20;30;42;--;--;--;--;
(q) 1;8;27;--;--;--;--;
1;3;7;13;21;--;--;--;--;
As learners engaged the worksheet, Bulelwa indicated that the main content for Lesson 3 was number patterns. She mentioned Fibonacci, as one of the mathematicians who observed number patterns in nature. She then illustrated and explained the Fibonacci sequence.

Bulelwa then instructed learners to work in pairs on the worksheets she gave out on Wednesday (10/10/01). The focus group struggled for about 25 minutes to find the worksheets. Thus, these students spent less than half the time allocated on task. Bulelwa moved around from one group to another, assessing the learners’ progress. She finally arrived at the focus group and reprimanded them for being ‘careless’ before giving them a new worksheet. In the last 5 minutes, Bulelwa went through the worksheet with the learners and took note of a number of typographical errors. The period ended at a stage during which she was discussing the worksheet.

**Overview of Lesson 4:** At the beginning of the lesson, Bulelwa indicated that each group of learners should generate 3 sequences or patterns. In other words, each group would act as a ‘pattern generator’. Each group would then give an incomplete pattern to another group to complete as an exercise. In return, each group would also be receiving a task on which they would act as pattern completers themselves, from a different group. As a result, each group would act both as pattern generators and pattern completers.

The task of the pattern completers was to study the pattern in the sequence and then complete it. On completion, the pattern was to be handed back to the pattern generators for assessment. Bulelwa then gave out a worksheet to guide learners in this regard. Figure 4.6 provides contents of the worksheet that Bulelwa handed out to learners.
Figure 4.6: Worksheet used by Bulelwa in Lesson 4

PHASE ORGANISER: Culture and Society
PROGRAMME ORGANISER: Number Patterns

ACTIVITY 5

GAME

- Work in groups to create three sequences that follow a number pattern.
  Check that the sequence follows a pattern
- Give your sequences to the next group to complete it and write the describing sentences. If possible they should try to use mathematical language to describe the pattern.
- Once the other group has finished completing and describing the sequence, they should give the sequences to the original group
- The original group should assess the work given back to it by:
  (1) marking the sequences
  (2) filling in the assessment grid provided below
- The group that will win should:
  (1) give accurate answers of the number pattern
  (2) be able to assess other group’s work

PRIZE
A trip to the library in town to research about number systems developed in Southern Africa long time ago by different cultural groups.

ASSESSMENT
A scale of 1-5 will be used to assess groups’ performance on generating their own number patterns.

<table>
<thead>
<tr>
<th></th>
<th>WEAK</th>
<th>FAIRLY</th>
<th>AVERAGE</th>
<th>STRONG</th>
<th>EXCELLENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original idea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding of patterns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy of answers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describing sentence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teamwork</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bulelwa walked around as learners engaged these tasks, consulting and monitoring progress. A group which generated the most interesting pattern was promised a trip to the library. For this particular lesson, the focus group was deemed by the teacher to have
generated the most interesting pattern: \( \frac{2}{3} ; \frac{6}{16} ; \frac{12}{64} ; \frac{24}{256} \). Bulelwa wrote this pattern on the board and together with the rest the of the class completed it … \( \frac{48}{1024} ; \frac{96}{4096} \). The discussion continued about this pattern and the exercise continued even after the end-of-period has been signaled by the siren.

Thus far, it is apparent that the move from Lessons 1 and 2 to Lessons 3 and 4 is characterized by a disjuncture: from working with ancient number systems to completion of number patterns.

*Overview of Lessons 5 and 6*

**Overview of lesson 5:** Bulelwa handed out worksheets to learners. She orientated learners to the worksheet, highlighting the key points. The first key point was that learners should complete the worksheet with the aid of a calculator; the second key point was that they should predict and describe the patterns in words. The worksheet is attached below as Figure 4.7

**Figure 4.7 Worksheet used by Bulelwa in lessons 5 and 6**

PHASE ORGANISER: Culture and Society
PROGRAMME ORGANISER: Number Patterns

In this worksheet you are going to use calculators to calculate each of the tasks, predict the pattern and describe them in words.

Predict the next line in the pattern. Write a sentence describing the pattern.

**Pattern A**

1\(\times9\) - 1 = ....
21\(\times9\) - 1 = ....
321 \(\times9\) - 1 = ......
4321 \(\times9\) – 1 = ..........
Predict: 654 321 × 9 − 1 = ……………
Predict: 87 654 321 × 9−1=………………
Predict: 987 654 321 × 9 − 1 = …………

PATTERN B

1 ×99 =……
2 × 99 = ……
3× 99 =……
4 × 99 = ……
Predict: 6 × 99 = ……
Predict: 7 × 99 =……
Predict : 8 × 99 =……

1 × 999 = ……………
2 × 999 = ……………
3× 999 =….…………
4 × 999 = ……………
Predict: 6 × 999 = ……
Predict: 7 × 999 =……
Predict : 8 × 999 =……

1 × 9 999 = ……………
2 × 9 999 = ……………
3× 9 999 =……………
4 × 9 999 = ……………
Predict: 6 × 9 999 = ……
Predict: 7 × 9 999 =……
Predict : 8 × 9 999 =……
As learners engaged the task, Bulelwa moved about to check on how each group of learners was progressing. Not all learners had calculators. For the focus group in this lesson it is the scribe who uses the calculator most frequently. The teacher engaged the focus group on counting digits. Because there were many tasks, Bulelwa suggested that they complete the worksheet in the next lesson.

**Overview of Lesson 6:** As we set up the equipment, the teacher asked learners to complete the task at hand. Learners continued to discuss as requested by Bulelwa. She walked around the classroom to monitor progress of each group of learners. She then engaged learners in a whole class discussion and reflection on the worksheet. The main focus of discussion was to explore the answers that learners obtained as they engaged with the worksheet. For some of the tasks, she also tried to explore the way in which learners worded the patterns.

She then raised two questions which were not in the worksheet. First, whether calculators are important and secondly, why. The response from one group of learners was that calculators are important because they enable the rapid carrying out of calculations. Bulelwa informed learners on how time-consuming it was, when she was still a student, to carry out calculations without a calculator. In those days, she highlighted, there was much dependence on a booklet referred to as a three-figure table, particularly for looking up the square roots.

**Overview of Lesson 7 and Lesson 8**

In these two lessons, the teacher draws on the context of HIV/AIDS and world population. In Lesson 7, she introduces the worksheet and in Lesson 8 she draws the discussion on the worksheet to a close.

**Overview of Lesson 7:** The teacher started this lesson by responding to a question on what was used before calculators were invented. She held a three-figure table (booklet) for learners to see. She explained briefly how trigonometric functions were determined in the absence of calculators.
She then introduced the day’s lesson by highlighting the importance of linking mathematics with the real world. She makes reference to the spread of the HIV/AIDS epidemic. In particular, she advised learners that the epidemic is serious and therefore they should practice ‘safe sex’.

She then introduced and orientated learners to the worksheet and pointed out how each item was to be engaged. Figure 4.8 below is a worksheet providing contents of tasks learners engaged for Lesson 7.

Figure 4.8: Worksheet* used by Bulelwa in Lessons 7 and 8

PHASE ORGANISER: CULTURE & SOCIETY
PROGRAMME ORGANISER: NUMBER PATTERNS

ACTIVITY 7 (Number patterns in nature)

Mathematicians have studied number patterns for many years. It was discovered that there are links between mathematics and our natural environment and sometimes events occurring in our societies. For this reason an understanding of algebra is central to using mathematics in setting up models of real life situations.

Study the tables given and answer the questions that follow.

<table>
<thead>
<tr>
<th>Year</th>
<th>1960</th>
<th>2000</th>
<th>2040</th>
<th>2080</th>
<th>2120</th>
</tr>
</thead>
<tbody>
<tr>
<td>World population growth</td>
<td>3 000 Million</td>
<td>6 000 Million</td>
<td>12 000 million</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>World increase in the number of AIDS sufferers</td>
<td>16.7 Million</td>
<td>33.4 million</td>
<td>66.8 million</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the tables, you can see that the AIDS and population figures follow trends, which can be seen, from the number patterns. These patterns allow researchers to predict what these figures will be for the future.

(a) Describe the pattern of population increase every 40 years as shown in the first table.

* The original worksheet provides a reasonable space between questions to accommodate learners’ written responses. It also does not have item h. I have also avoided copying down obvious minor typographical errors.
(b) Describe the pattern of increasing number of AIDS sufferers as shown in the second table.
(c) Fill in the missing numbers in each table.
(d) Researchers believe the earth cannot support a population approaching 192 000 million people. If the population continues to double every 40 years, then in which year will it be 192 000 million? Explain how you worked out your answer.
(e) The world population in the year 2000 is said to be 6 000 million. In which year will the number of AIDS sufferers be greater than 6 000 million if the trend in the second table continues? Discuss what you think this means.
(f) How is HIV virus/AIDS transmitted? Discuss.
(g) What can we do as a society to break the pattern of increasing number of AIDS sufferers? (i.e. decrease the number of AIDS sufferers).
(h) What is the percentage of people suffering from AIDS related diseases around the world in the year 2000?

She then offered learners the opportunity to engage with the worksheet on their own, advising them to work collaboratively. She requested learners to bring flowers for Lesson 8.

**An overview of Lesson 8:** Bulelwa introduced an additional item ‘h’: the percentage of people suffering from AIDS-related diseases around the world in 2000. Her motivation was that most learners did not perform during examinations on items related to percentages. She then provided learners an opportunity to discuss the worksheet and attempt the new question (item h) as well.

She observed and pointed out that most learners avoided items ‘d’ and ‘e’. She advised learners to make an effort to attempt these questions. She then engaged and led learners in an item to item discussion of the worksheet. She concluded the lesson by reminding them about the following day’s lesson for which they were to bring flowers.

**An overview of Lesson 9:** The teacher began the lesson by asking learners to take out the flowers. Though initially upset with learners who had not brought flowers, she allowed them to use those she herself had brought. The activity required learners to peel off and

---

* She thought that she would have completed the ‘AIDS –activity’ soon enough in lesson 8, whereupon she would start another activity based on flowers.
count the number of petals in each of the flowers present. The figure below (4.9) illustrates the contents of the worksheet.

**Figure 4.9 : Worksheet used by Bulelwa in lesson 9**

**PHASE ORGANISER** : CULTURE AND SOCIETY  
**PROGRAMME ORGANISER** : NUMBER PATTERNS  
**ACTIVITY 8 (MATHS IN NATURE)**

This activity aims to show that:

- There are links between mathematics and our natural environment  
- Mathematics is useful in describing patterns in nature.

1. Each member of the group is to bring a flower to the class.  
2. In groups count the number of petals on the flowers you have brought to class then fill in the following table.

<table>
<thead>
<tr>
<th>NO. OF PETALS</th>
<th>TYPE OF FLOWER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Arrange the number of petals of the flowers in an ascending order.
4. Is there a pattern in the number of petals of the flowers? If yes; describe it.
5. What is this number pattern called?

**HOMEWORK**

Discuss your own family ancestry with your family and relatives. Draw your family tree. Is there a number pattern in your family tree?

During the classroom discussion learners read out the number of petals they observed in each flower. The teacher wrote these in an increasing order: 1,3,5,6,8,13,14,16,30,45,287 on the chalkboard. She then highlighted the Fibonacci sequence as the sequence expected to emerge with respect to the number of petals in different flowers: 1,1,2,3,5,8,13,21,…
In conclusion, the teacher mentioned that Lesson 10 will focus on patterns in geometrical shapes. This never took place as all learners in the school who were in arrears with their fees were ordered to vacate the school premises.

4.3 MESSAGE IN THE LESSONS AND LEARNERS’ VOICE

The previous section has provided an overview of the nine lessons observed at Umhlanga. In this section, I use Bernstein’s construct of classification to tease out lessons that incorporate the everyday and to explore the connections between the lessons. I also use Bernstein’s notion of framing, to explore the extent to which learners were provided a platform to have a say on the extent to which answers provided by their peers and the teacher were acceptable.

*Teasing out lessons in which the everyday was visible*

The lessons’ overviews, worksheet contents and lesson topics suggest that the main mathematical focus across all the nine lessons is number patterns. This focus is clearly visible in Lesson 3 to Lesson 9. Lessons 1 and 2 are aimed at orientating learners to different representations of numbers and some aspects of number systems of Ancient Greeks, Indians, Babylonians, Chinese and Egyptians.

The settings within which number patterns occur differ. For example, in Lessons 3 and 4 learners are expected to complete the number patterns created respectively, by their teacher and their peers. In Lessons 5 and 6, completion of these number patterns was to be achieved through the use of a calculator. In none of these four lessons is any reference made to the everyday. In other words, there is no everyday context or reality used to introduce learners to this mathematical content. In this way, the mathematics content of number patterns is insulated from non-mathematical realities and practices. In Bernstein’s terms, these lessons stand in a closed relationship with the everyday and are therefore strongly classified.
With respect to weakly classified lessons (i.e. Lessons 1 and 2 on the one hand, and Lessons 7,8 and 9 on the other) there is a clear shift of focus in the mathematics content. Lessons 7,8 and 9 are mainly focused on number patterns whilst Lessons 1 and 2 focus on number systems in ancient societies. However, in all these lessons there is a clear reference to non-mathematical everyday practices. In particular, Lessons 1 and 2 draw on the practices and numerical representations of ancient societies; Lessons 7 and 8 draw on AIDS sufferers and population size whilst Lesson 9 makes reference to flowers.

In summoning the non-mathematical everyday, the boundary between the mathematics and the everyday is blurred or weakened. In Bernstein’s terms, these lessons are regarded as weakly classified. These are lessons which form the basis on which the learners’ perspectives will be explored. Using the video-camera metaphor, these lessons represent the ‘target’ in the zoom.

*Learners’ voice*

The concept of framing provides an indication of the extent to which learners have a say in different classroom matters. Learners may have a say, for example, in whether a particular response is acceptable or not; but they may not have a say in the selection of mathematical topics they have to learn. As Bernstein (2000:13) cautions, “It is possible for framing values to vary”. My focus, in this section, refers to framing as apparent control that learners have over the correctness or acceptability of a response.

In Lessons 1 and 2, the onus was on learners to question their peers as directed by the worksheet. Thus, learners had some authority to decide on the quality of their classmates’ presentations. In Lesson 4, learners were provided an opportunity to generate sequences and to assess feedback from their peers. To the extent that in Lessons 1, 2 and 4 learners had some apparent final say or control over what was correct, the three can be regarded, in Bernstein’s terms as weakly framed. I use the qualification apparent because the control that learners have over their peers’ inputs is still, though in a subtle way, subject to the teacher’s evaluation. For example, in Lesson 4, as I will show, Bulelwa still had the authority to decide on her own which of the patterns were interesting.
In Lessons 3, 5, 6, 7, 8 and 9 learners were denied any decisive say on whether responses provided were correct or not. Instead, Bulelw a created a platform for discussion or exhibited a correct or acceptable procedure. At the same time, she was decisive on what issues to discuss and what responses could be considered correct. To this end, these lessons could be considered strongly framed, since it is the teacher who had control over what could be considered acceptable.

The variations in the strength of framing and classification for this series of nine lessons can be mapped as follows, following the framing-classification matrix in Chapter 2.

Table 4.2 A framing-classification matrix for Umhlanga lessons

<table>
<thead>
<tr>
<th></th>
<th>Strongly Framed</th>
<th>Weakly framed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly classified</td>
<td>Lessons 3, 5 and 6</td>
<td>Lesson 4</td>
</tr>
<tr>
<td>Weakly classified</td>
<td>Lessons 7, 8 and 9</td>
<td>Lessons 1 and 2</td>
</tr>
</tbody>
</table>

Even though the everyday was phased in, the table suggests that Bulelw a varied the way in which she provided space for learners to explore the correctness of their responses.

**CONCLUSION**

This chapter attempted to provide a broader context within which learners in Umhlanga encountered the everyday in their mathematics class. I informed this discussion by outlining the school setting, the lessons and the classroom events. There are two ways in which the lessons at Umhlanga may be viewed. Firstly, they may be considered a series of lessons planned around the mathematical theme of number patterns. In other words, no chasm was intended in terms of content between different lessons. In this way, the boundary between these lessons may be regarded as being characterized as blurred and connected through the number patterns theme. Alternatively, these can be considered a series of lessons which can be divided between those that draw in the everyday and those which do not.
Lessons of interest for this thesis are those which incorporate the everyday. However, the discussion in this chapter suggests that these lessons, from the teacher’s perspective, were not special. They formed part of a series of lessons for her class. With the benefit of this broader context; the next chapter, Chapter 5, zooms in on these target lessons.