CHAPTER 8

SETTLERS’ TARGET LESSONS: WORKSHEET AND
LESSON ANALYSIS

Of the fourteen lessons observed in Settlers, as outlined in the previous chapter, it was in
the first five that the everyday was recruited. For these five lessons, Mr. Smith used a
worksheet with a heading: *Using equations to solve word problems.* Unlike Bulelwa, Mr.
Smith used word problems to draw in the everyday. The use of word problems to blur the
boundary between the everyday and the mathematics is not uncommon. As Verschaffel
and De Corte (1997:67) observe, word problems “initially had an application function i.e.
they were used to train children to apply the formal mathematical knowledge and skills
learned at school to real world situations.”

It is these five lessons which constitute the target in the zoom. I will structure the
discussion of these lessons around two themes: (1) analyses of a worksheet that Mr.
Smith used throughout these lessons and (2) the way in which this worksheet was
engaged in the classroom. In discussing this second theme, I will explore the way in
which the teacher managed the everyday-mathematics boundary and the way learners
responded to this move. Learners’ take-up of these weakly classified lessons enabled an
exploration of key question number 3: How learners reason and discuss activities which
incorporate the everyday. The discussion in Chapter 5 revealed the challenges associated
with making visible either the mathematics or the everyday on the basis of a mathematics
task incorporating the everyday at Umhlanga. It will thus be of interest to observe the
resources that Settlers learners draw in order to engage weakly classified tasks.

In Umhlanga, Bulelwa frequently reminded learners about the type of behaviour that was
socially acceptable (like the value of cleanliness). It was thus possible to discuss and
reflect on the regulative discourse or “rules of social order” (Bernstein, 1996: 108) on the
basis of classroom events. In Settlers, these rules were not emphasized at a classroom
level; they were, instead, relayed at a school level. As a result my discussion of a
regulative discourse will not be part of my reflection on individual lesson but will be a specific theme on its own.

In relation to the first theme, I briefly highlighted (in Chapter 2 page 38) the possible limitation of using either the concept of weak classification or that of authentic/inauthentic and near/far concept for analyzing the type of tasks used at Settlers. I shed more light on this point by focusing on each of the aspects.

**Limitations of using weak classification:** As pointed out in the previous chapter, some of the tasks that Mr. Smith employed drew from the everyday and others drew from the mathematics. A task, for example, requiring learners to calculate the area of a rectangle whose length is \( x \) and breath is \( x+1 \) draws from mathematics and is not accessible to ‘non-native speakers’ of mathematics. Since it brackets off participation by individuals who have had no exposure to mathematics, the task may be regarded as strongly classified. A task such as John is \( x \) years old and Pule is \( x-5 \) years old, by how many years is Pule younger than John draws from the everyday. The use of real peoples’ names and setting suggests that there is an attempt to blur the boundary between mathematics and the everyday. The task may thus be considered weakly classified. However, the notion of weak classification carries with it the possibility of ‘threat to one’s identity’ (Bernstein, 2000:96). It suggests that the category to which the tasks belong is not explicit. Yet, this task, assumes familiarity with and ability to interpret letter symbols. It is a task presented in a form which has a “strong mathematical presence in terms of the mode of expression” (Dowling, 1998:135). In other words, the mathematical identity of the task is not threatened. The use of weak classification to categorize this task is problematic because it conceals the mathematical mode in which the task is presented and by which the mathematical nature of the task is defined.

**Limitations of authentic/inauthentic and near/far construct:** This construct provides a qualitative aspect about the everyday. The word problems used by Mr. Smith are characterized by an unambiguously mathematical mode of expression. Even if such tasks draw in the everyday (e.g. John is \( x \) years old), the mathematical mode of expression
already suggests the inauthentic nature of the everyday. The presence of the everyday is motivated by the extent to which it seduces learners towards the mathematics. It is used either as a bait, to capture learners’ attention or modification of reality to enable smooth entry to the mathematics. Used in this way, the everyday does not serve as an object of reflection and therefore its qualitative attributes are of no consequence. For this reason, the authentic/inauthentic and near/far notions will not be used to analyse tasks used at Settlers; instead I will use Dowling’s notions (esoteric domain, expressive domain, descriptive domain and public domain) to analyse these tasks.

Dowling (1998:135) classifies tasks whose mode of expression is ‘unambiguously’ mathematical as either esoteric or descriptive. The difference between the esoteric and descriptive tasks is in the nature of the contexts they recruit. Esoteric tasks, like the first of the two tasks highlighted so far, recruit the mathematical context whilst descriptive (like the second of the two tasks) recruit the everyday as ‘descriptive’. I will use the notions of ‘esoteric’ and ‘descriptive’, respectively, in order to distinguish between tasks in the worksheet which draw from the mathematics context and tasks which draw from the everyday context. Dowling also defines tasks which have “a weak presence in terms of the mode of expression” (Dowling, 1998:135). Some of these tasks would recruit from the everyday and some from the mathematics. Dowling classifies the former as ‘public’ and the latter as ‘expressive’. It should be apparent from a description of these four domains that the qualitative aspects of the everyday are not entertained.

In this Chapter I use Dowling’s notions to analyse tasks that were used by Mr. Smith in the five target lessons. I then provide details of how these tasks were engaged in class.

8.1 ANALYSIS OF A WORKSHEET

As pointed out above, some of the tasks (word problems) used by Mr. Smith drew from the everyday whilst others drew from the mathematics. I begin this analysis by using Dowling’s notions to distill tasks that drew in the everyday from the rest of the tasks. I will then explore the visible features of the worksheet.
8.1.1 Categorizing the tasks: The worksheet consisted of twenty four tasks, including worked examples. The following table (Table 8.1) highlights for each task, the task number as reflected in the worksheet, the context recruited and the categorization of the task. In all the tasks but one, letter symbols were used. In other words, familiarity with letter symbols was assumed. Because of this mathematical mode of expression, a task could either be esoteric or descriptive; depending on whether it drew from the mathematics or the everyday.

Table 8.1: Categorization of tasks in the worksheet

<table>
<thead>
<tr>
<th>TASK NUMBERED</th>
<th>CONTEXT RECRUITED</th>
<th>CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Children’s ages</td>
<td>Descriptive</td>
</tr>
<tr>
<td>1.2</td>
<td>Chocolate bar and Sweets</td>
<td>Descriptive</td>
</tr>
<tr>
<td>1.3</td>
<td>Size of rectangle</td>
<td>Esoteric</td>
</tr>
<tr>
<td>1.4</td>
<td>Size of rectangle</td>
<td>Esoteric</td>
</tr>
<tr>
<td>1.5</td>
<td>Basket ball team</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Worked example*</td>
<td>Price of ice-cream and cooldrinks</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Worked example</td>
<td>Children’s ages</td>
<td>Descriptive</td>
</tr>
<tr>
<td>2.1</td>
<td>Farmer’s eggs</td>
<td>Public</td>
</tr>
<tr>
<td>2.2</td>
<td>Numbers</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.3</td>
<td>Surfing and Swimming</td>
<td>Public</td>
</tr>
<tr>
<td>2.4</td>
<td>Sum of two consecutive numbers</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.5</td>
<td>Sum of three even numbers</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.6</td>
<td>Rectangular piece</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.7</td>
<td>Price of milk</td>
<td>Descriptive</td>
</tr>
<tr>
<td>2.8</td>
<td>Perimeter of a rectangle</td>
<td>Esoteric</td>
</tr>
</tbody>
</table>

* I have included tasks that were used as examples to teach learners because Mr. Smith expected learners to engage these tasks as well. They are therefore amongst the tasks that learners viewed as tasks to be solved.
<table>
<thead>
<tr>
<th>TASK NUMBERED</th>
<th>CONTEXT RECRUITED</th>
<th>CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.9</td>
<td>Rectangle</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.10</td>
<td>Numbers</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.11</td>
<td>Numbers</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.12</td>
<td>Rectangle</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.13 part 1</td>
<td>Numbers</td>
<td>Esoteric</td>
</tr>
<tr>
<td>2.13 part 2</td>
<td>Quiz show</td>
<td>Descriptive</td>
</tr>
<tr>
<td>14</td>
<td>Multiple choice test</td>
<td>Descriptive</td>
</tr>
<tr>
<td>15</td>
<td>Hockey</td>
<td>Descriptive</td>
</tr>
<tr>
<td>16</td>
<td>Tables and chairs</td>
<td>Descriptive</td>
</tr>
</tbody>
</table>

Of the 24 items in this worksheet, 10 can be categorized as descriptive and 2 as public. Thus, the total number of tasks that referenced the everyday is 12. The remaining 12 items are esoteric.

8.1.2 Visible features of the worksheet: Visible features of the text refer to that which can be seen when looking at a text material (Love and Pimm, 1996:379). Conspicuous in Mr. Smith’s worksheet are mathematical symbols, mathematical expressions and pictorial illustrations.

Mathematical symbols

Pimm (1987:141) distinguishes symbols used in mathematics into four classes: logograms, pictograms, punctuation symbols and alphabetic symbols. The specific symbols conspicuous in Mr. Smith’s worksheet are alphabetic symbols. These are alphabetical letters used in mathematics to denote or symbolize certain mathematical concepts. The first four tasks of the worksheet, under exercise 1, all incorporate and assume familiarity with alphabetic symbols. The following are four of the tasks in which the alphabetic symbols x and p are used.
The tasks above recruit a variety of contexts or different types of the everyday, however, reference to mathematical concepts such as letter symbols and equations serve as some form of reminders that the tasks are primarily mathematical. As Morgan observes:

By symbolizing an object, quantity, action or relationship by a symbol in a mathematical text, it is declared to be ‘mathematical’ and thus of significance. At the same time symbolizing is an act of abstraction which allows the writer and the reader to focus only on formal properties of the symbol itself and allowing ‘manipulation to move faster and more seamlessly by blurring the distinction between the symbol and object’ (Pimm, 1987:139). Mathematics itself thus appears as a domain in which the main activity is the manipulation of symbols rather than of concepts or ‘real world’.

(Morgan, 1998:89)

Symbolizing serves to foreground the mathematical. Thus, even though the context is used in all these tasks, its potential to derail learners’ attention from the mathematics is somewhat diluted by the use of symbols.
**Mathematical expressions**

Mathematics employs a set of words and expressions or words which may not be comprehensible to participants who are not familiar with the subject. These words and expressions, as Pimm (1987:76) asserts may “sound like jargon to the non-speaker.” Such words and expressions constitute part of what is called a mathematics register. Pimm (1987:76) regards a mathematics register as constituted by technical terms, phrases and particular modes of arguing. Acquisition of these enables one to speak like a mathematician.

Mr. Smith’s worksheet employs a number of expressions which constitute the mathematics register. These include expressions such as ‘algebraic equations’, ‘rectangles’ and ‘even numbers’. The following table provides the tasks and mathematical expressions contained in the worksheet.

Table 8.2: The tasks and mathematical expressions used

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Task Number</th>
<th>Mathematics expressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 and 6</td>
<td>Algebraic equations</td>
</tr>
<tr>
<td>1</td>
<td>2 and 5</td>
<td>Equations</td>
</tr>
<tr>
<td>1</td>
<td>3 and 4</td>
<td>Equations</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Even number</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Rectangular piece</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>Rectangle</td>
</tr>
<tr>
<td>2</td>
<td>9 and 12</td>
<td>Perimeter</td>
</tr>
<tr>
<td>2</td>
<td>11, 13 and 16</td>
<td>Algebraic equations</td>
</tr>
<tr>
<td>2</td>
<td>All tasks</td>
<td>Algebraic equations</td>
</tr>
</tbody>
</table>

These expressions have particular meanings attached to them within the mathematical discourse. Without a proper understanding of these words, learners may not be able to
meaningfully engage tasks for which familiarity with these words is assumed. In this regard, the worksheet brackets off meaningful participation by the ‘non-native speakers’ of mathematics. Thus, in Bernsteinian (1996) terms, these tasks are ‘strongly classified’ in relation to content.

**Pictorial illustration**

Conspicuous in the worksheet is the use of pictorial illustrations. Dowling (1998) provides a distinction between pictures which are icons and those which are indexes. An index is a pictorial illustration which is not meant to be a resemblance of some everyday object. An index is not a virtually realizable object but a formally defined construct (Dowling, 1998:159). An icon, on the other hand, is an object which bears some resemblance with objects one may encounter in real life. Dowling (1998:155) categorizes iconic illustrations into three: photographs, drawings (non-photographic but representational) and cartoons (non-photographic but incorporating exaggeration or humour). Mr. Smith’s worksheet consists of pictorial illustrations which may be categorized as iconic. In the following section, I argue that each of these icons is in fact a cartoon.

The worksheet incorporates iconic representations of three human beings and one animal (a sheep). The first icon is that of a small girl with a pen in her hand and a mouth wide open (see the picture below). She appears to be amazed either by a pen or her ability to hold it. She also seems to be looking through the pen and not really using it as an object for writing. Such an unusual handling and reaction towards a pen “asserts an impossibility viewpoint” (Dowling, 1998:155). This icon may thus be viewed as a cartoon. This cartoon appears at the same level with a clearly mathematical topic. Thus, the likelihood that the text may be about small girls and ballpoints is upset or diluted by this topic which is written in capital letters and mathematical language.

It therefore seem that the picture is intended to be a seductive tool in order to either make learners feel at ease with the worksheet or to provoke learners’ interest in a text about which they would not normally be enthusiastic.
The first icon: The girl with a pen in hand

The second icon is a boy jumping towards a ball in a basketball game (see the picture below). His sport shoe is about 1.1 cm long (measured from the worksheet). The main point though is that the measurement of his sport shoe is the same as the measurement one obtains between the boy’s knee and his sport shoe heel. This is an unusual size for a shoe which is supposed to facilitate jumping and running. Such an exaggeration suggests this icon is a cartoon.

The cartoon is positioned alongside a task in which reference is made to a ‘Dodgers basket ball team’. It is possibly intended to provide a pictorial illustration of the contents of a task alongside which it is positioned.

The second icon: The basketball player
The third icon is a sheep facing towards the direction of the reader. The sheep, which looks adequately woolly, stands on four limbs/legs which are proportionally small. In fact, none of the limbs/legs is longer than the sheep’s eye. The icon has exaggerated features for which it can be considered a cartoon. This cartoon appears alongside a task which makes reference to a farmer. Like the second icon above, the picture is possibly an illustration of the type of animals one may find in a farm. It is thus a pictorial reference of a task.

The third icon: The sheep

The fourth icon is a picture of a person who yells ‘Yowza’ which, loosely translated means ‘come on’. The picture appears in a section wherein learners are introduced to particular steps of solving a problem. Thus, learners, it would seem, are being invited to a particular way of solving a problem. The person who yells ‘yowza’ has eyes and ears which are not aligned. His right eye protrudes out of his face, an unlikely human eye activity. This icon, like the other three, is a cartoon. This cartoon does not seem to be reflective, in any obvious way, of the contents of the task alongside which it is placed. In other words, a picture of an excited man attracting the learners’ attention can hardly be associated the contents of the task (in this case, a set of instructions on how to solve problems). However, the cartoon seems to compliment the task: It seems to be inviting the learners or drawing their attention to the text whilst the text itself gives instructions to learners on how to engage tasks. So the overall agenda of the cartoon is to seduce learners towards a set of rules.
The fourth icon: A ‘ywoza’ man

![Image of a 'ywoza' man]

The fifth picture shows a joyful and dancing character. His smile is so wide that it covers his body. This picture, like the other four, is a cartoon. It is a cartoon which seems to highlight the kind of mood learners should be in as they engage the tasks. The relationship between a joyful dancing character and the perimeter of a rectangle is not very obvious. The cartoon is possibly meant to seduce learners into engaging the task.

The fifth icon: A joyful dancing character

![Image of a joyful dancing character]

In sum, the cartoons in the worksheet seem to play two different roles. The first, fourth and fifth cartoons seem to play the role of seducing learners towards the text. In other words, their main agenda seem to be that of sugarcoating the task in order to hide the real substance of the tasks themselves. Being cartoons, these icons are also meant to elicit a happy mood or laughter and thus a happy attitude towards the tasks. The second and third cartoons can be considered extensions of the text alongside which they are placed. They provide a pictorial view of the text. That these pictures are cartoons seem to imply that they should not be taken seriously. Dowling (1998:160) asserts that, unlike other types of icons, the cartoons, owing to their exaggerated features, reduce the strength of the code of
presence. In other words, the world of cartoons is not likely to be considered realistic by the readers. As such the use of cartoons limits or discourages the readers’ digression from the mathematics.

There are some significant differences between this worksheet and the one used by Bulelwa (in Umhlanga) in terms of the type of the everyday recruited and the way in which the activities are phrased. For example, Bulelwa recruited authentic everyday aspects such as ancient societies, AIDS and flowers. Mr. Smith, in contrast, referenced inauthentic everyday aspects such as a basketball team which “lost x games during the season”. In other words, the type of the everyday he recruited was rendered inauthentic by using x to denote the number of games. With respect to the phrasing of activities, Bulelwa’s worksheet was characterized by the absence of letter symbols. Mr. Smith, however, drew in a wide range of mathematical symbols including letter symbols. Thus, the mathematical nature and therefore intention of the lessons was more announced in Mr. Smith’s activities or worksheet.

Having analysed the worksheet and observed the mathematical messages, the following section focuses on the way in which the worksheet was engaged in class.

8.2 HOW THE WORKSHEET WAS ENGAGED

In this section, I provide an account of each of the five lessons in which the everyday was recruited. Particular attention will be on the way in which the teacher presents and solves tasks and the way in which learners, particularly the focus groups, engage the tasks. I will then reflect on each of the lessons. This reflection will be premised on the teacher’s movement between the everyday and the mathematics, the moral values inculcated and the learners’ written responses to the tasks. An overall discussion of the way in which learners responded to a classroom context in which group work or collaborative learning was not privileged and the boundary between the mathematical and everyday consideration was unclear.
8.2.1 An account of Lesson 1 and 2

An account of Lesson 1

Researchers were introduced and Renuka highlighted to the learners the purpose of our visit. The focus group for this lesson comprised of three boys, Jacob, Jerry and Justice. Justice sat between Jacob (on his right) and Jerry (on his left). The teacher, Mr. Smith, then took over and started the lesson by asking learners about a puzzle which they were supposed to solve over the weekend and for which the prize was a chocolate. He then introduced the day’s lesson and highlighted that it was aimed at using mathematics in everyday settings. Mr. Smith also viewed setting up equations as, firstly, a tool to engage the everyday but secondly as a mathematical skill needed at senior mathematics classes. It was thus a skill useful for both school and out-of-school purposes.

Teacher: Okay, what we doing now we doing equations and often you want to know how you can use something in, in maths in real life. So can you remember the problems. I was giving you, things like three CDs cost you three hundred and sixty rand what does one cost? Okay that’s a real life situation you use in equations. So what we need to do is take a look at what we got here. What I’ve been finding with the Grade 8 is that in you’re very good with your problem solving, but you lousy when it comes to setting it up. Okay which makes life difficult because further up in school there are a lot of things where setting up in logic is important.

[Lesson 1, line 32, Settlers]

Before engaging the worksheet Mr. Smith started off with two self-formulated examples based on two learners, Kelly and Lucy. Having established from Kelly that her sister is fifteen years old and that she is thirteen years old, he formulated the task for learners.

Teacher: Okay, if we were to say we didn’t know you’re thirteen and she is fifteen. Okay, Kelly’s age and her sister’s age add up to twenty-eight and if Kelly is two years younger than her sister how old is Kelly? Okay something like that. Okay, out of your minds goes thirteen and fifteen jot down for me on how you would work that out. (At this stage learners take their books out and begin working the sum out).

[Lesson 1, line 38, Settlers]

Learners provided various types of responses. None of these responses was based on the use of equations.

Learner 7: I did twenty-eight divided by two and minus one.
Teacher: Okay, the whole loads of us are doing all sorts of different ways. We getting the same answer, but some of them are a bit, awkward (pointing towards another learner) …..yes.

Learner 8: I… I said uh… twenty-eight divided by two, then I said… umm (thinks) two (…) divided by two and I minused that (referring to one).

Teacher: The one.

Learner 8: The one. (in agreement)

[Lesson 1, Lines 52 – 56, Settlers]

Like some of the students’ responses, Jerry, Jacob and Justice did not use equations to solve the task as indicated by Jerry’s calculation below

Jerry’s calculation of Kelly’s age

\[
28 - 2 = 1u + 1 = \text{Sisters Age} \\
1u - 1 = \text{Children’s Age}
\]

In calculating Kelly’s age, Mr. Smith used mathematical expressions and equations. To this end, he assigned \( x \) to represent Kelley’s age and \( x + 2 \) to represent Kelly’s sister’s age, thus \( x = \) Kelly’s age and \( x + 2 = \) Kelly’s sister’s age. He thus formulated and solved the equation \( 2x + 2 = 28 \) to work out Kelly’s age as 13 and her sister’s age at 15.

The second example on Lucy stated: *Lucy is seven years older than her sister, their total age adds up to 21. Calculate Lucy’s age.*

For this task, Justice used equations. He volunteered his answer for the class, during the whole class discussion.

Justice: I went two x, … no I went how old is Lucy and I said it equals x. Then I went Lucy’s sister age as x minus seven and then combined the ages x plus x minus seven. Then I went two x minus seven.

Teacher: Okay…

Justice: Then two x minus seven equals twenty-one which was their combined age together. Then I went two x minus seven plus seven and that’s twenty-one plus seven and then I went twenty-eight divided by two divided by two and I got x equals fourteen.

[Lesson 1, lines 106 – 108, Settlers]
The teacher endorsed the answer, however, he highlighted the need to indicate that \( x = 14 \) means Lucy is fourteen years old. He then drew learners onto the first task of the worksheet: *John’s age is \( p \) years. Write down in terms of \( p \), Sue’s age if she is 16 years older than John.* As learners attempted the task, Mr. Smith walked around monitoring their progress.

In the meantime, Jerry, Justice and Jacob attempted to make sense of the task. Their discussion suggests they expected the answer to be a numerical value like 16 or 24, as evidenced in the following interaction.

\[
\begin{align*}
\text{Jacob:} & \quad \text{Each of them is sixteen.} \\
\text{Jerry:} & \quad \text{No no Sue is sixteen years older.} \\
\text{Jacob:} & \quad \text{Sixteen years older than John.} \\
\text{Justice:} & \quad \text{Oh ja ja ja.} \\
\text{Jerry:} & \quad \text{And …} \\
\text{Justice:} & \quad \text{I think eighteen and eight. [(speaking to himself)]} \\
\text{Jacob:} & \quad \text{Because then John has to be six ….} \\
\text{Justice:} & \quad \text{(shakes head in disagreement) eight.}
\end{align*}
\]

[Lesson 1, lines 187 – 194, Settlers]

Mr. Smith observed that most learners were struggling to accommodate the alphabetic symbol \( p \). He thus hinted they should treat it as an ordinary number, He showed that Sue’s age would be \( p+16 \). At this point he advised learners to underline the important information.

Following the order of tasks in the worksheet, he advised learners to engage the following task: *(I have not used the numbering employed in the worksheet, however, the phrasing is similar): A bar of chocolate costs three times as much as a toffee sweet. Four bars of chocolate and three sweets cost R6.00 Let the price of a toffee sweet be \( x \) cents; write down in terms of \( x \), the price of a bar of chocolate, the cost of four bars of chocolate, the cost of three toffee sweets.* The question also requires learners to determine the price of a toffee sweet and the price of a chocolate bar.

Having sensed the difficulties learners were encountering with the use of symbols, he guided them as follows:
Teacher: … . You all battling a bit with trying to write things… [To a group of noisy learners]
Sshh-settle down…in an algebraic form, that question there it says a chocolate bar costs three times as much as a toffee and now we are struggling with the X’s and the Y’s to make it some thing you understand. You’ve all been at the queue at the tuckshop working out whether you’ve got enough money for whatever. Okay a toffee costs me twenty cents a chocolate bar costs me three times as much. How much was it? How much does it cost? . Okay how much is a chocolate bar?
Learner: Sixty cents.
Teacher: It’s sixty cents. How did I get from one to the other? What did you do?
Class: You times.
Teacher: I times the cost of the toffee by three. So do the exact same here. Just because it’s an x don’t worry about it. Twenty cents, a chocolate bar that costs three times as much, sixty cents. How did I get from one to the other?
Learner: Multiply by three

[Lesson 1, lines 258 – 263, Settlers]

In engaging the task, Jacob, Justice and Jerry became aware of the need to take letter symbols into consideration, though they still battled on how. Their interaction illustrates this point.

Jacob: The chocolate bars are one rand twenty each.
Justice: Ja (yes).
Jacob: And then; …forty cents. Is that right?
Justice: what?
Jacob: One rand twenty each/
Justice: I need to work that out. (…) work it out in terms of the x. You got that in terms of the x?
Jacob: [Ignores the question] So for?.(thinks aloud)
Justice : (continues) Three x

[Lesson 1, lines 281 – 288, Settlers]

Lesson ended with learners busy with this task.

8.2.1.2 An account of Lesson 2

The focus group for this lesson comprised two learners, Thoko and Nomalanga, the only two Africans in the classroom. Mr. Smith called for a volunteer to come over and write the solution on the board. One learner volunteered and copied the following responses on the board, without discussing or engaging his classmates: 2.1.1 3x 2.1.2 12x 2.1.3 3x 2.1.4 12x + 3x = R6.00. He then calculated the price of a chocolate bar and toffee sweet as follows:
4 Chocolate bars + 3 sweets = R6.00
12x + 3x = R6.00
15x/15 = R6.00/15
x = 40 c. The price of a sweet is 40 cents

Mr. Smith was satisfied with the solution. However, he advised learners of the need to convert R6 into cents “cause you have to divide it by fifteen”, he reasoned.

He then walked around in class to attend to concerns of different learners. The majority of learners, including Thoko and Nomalanga, attempted exercise 1 task number 3 of the worksheet. In particular, the two learners worked independently, hardly talking to each other during the process. As more learners called for his attention, Mr. Smith decided to conduct a whole class discussion on task number 3 (see extract below). As highlighted in following extract, he advised learners to remember the formula for the perimeter.

Teacher: No. Okay let’s go through it, the length of a rectangle is one meter longer than it is breadth and the perimeter of the rectangle is forty two meters. Okay, go back to last year. What we need a perimeter, we need the formula for that. What’s the formula? (Points to learner).
Learner: Length plus breadth times 2.
Teacher: Okay, so we going to need this equation I’m sure some of you underline. Let the breadth of the rectangle be x write down the length of the rectangle in terms of x.

[Lesson 2, lines 44 – 46, Settlers]

He then exhibited a procedure which led to the following equation 4x + 2 = 42. Task number 4 was similar to task number 3. For task number 4, the perimeter was still 42 and the breath x, however, the length was x – 1. Thoko encountered difficulties in engaging this task. She called Mr. Smith and the following conversation suggests that they did not reach the same level of viewing the task.

Thoko: I am doing number 4.
Teacher: Yes, except now you are using a different formula. The one before the breath was x okay..? And now you doing the length as x. So what will be the breath if the length is x?
Thoko: It will be x.
Teacher: No..no. In terms of …
Thoko: It will be x + 1.
Teacher: Yes it will be x – 1.

[Lesson 2, lines 68 – 73]
After a while, Mr. Smith led a general discussion on ways to solve task number 5. He advised learners to substitute x by any number. This led to him drawing the following table on the chalkboard, in which he highlighted that x should be treated as a number.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lost</strong></td>
<td>5</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>Won</strong></td>
<td>5 + 14 = 19</td>
<td><strong>X + 14</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24</td>
<td><strong>2x + 14</strong></td>
</tr>
</tbody>
</table>

However, Thoko and Nomalanga were still struggling with task number 4. At this point Mr. Smith suggested to them that they could draw a picture. He illustrated that the length of the perimeter would be 4x – 2 and thus the equation 4x – 2 = 42 would emerge and will enable the calculation of x. The siren rang soon after he had explained and was moving on to other learners.

**8.2.2 Reflections on Lessons 1 and 2**

**Instructional discourse - Movement between the mathematics and the everyday**

The main purpose of the section the class dealt with was the use of mathematics in engaging real life situations. He declared this intention at the beginning of the lessons.

Teacher:...Okay, what we doing now we doing equations and often you want to know how you can use something in …in maths in real life.

[Lesson 1, line 32, Settlers]

Mr. Smith highlighted the need for learners to relate mathematical tasks with their everyday experiences. He illustrated the relevance of mathematics to everyday settings by using Kelly and Lucy’s ages to highlight the way in which mathematics can be used in authentic settings to which learners were familiar. He also recruited realistic considerations in engaging task number 5 whose context was a basketball team. In this case, both the choice of 5 as ‘any number’ was drawn from everyday experiences. For example, any number would not include a fraction since a team cannot play, for example 2.5 games. This suggests that a certain dose of the everyday was relied on to make sense of the situation. By attending to and highlighting these realistic considerations, Mr.
Smith indirectly communicated the significance of the everyday in this mathematics lesson.

However, Mr. Smith also gave mixed messages on the legitimacy of the everyday. This mixed message was implied when he reflected on a response that one of the learners (Justice) had provided during a whole class discussion. At this point, Justice had provided a solution for the task about Lucy’s age. Justice explained, during the whole class discussion, how he had used the equation $2x - 7 = 21$ and obtained the value $x = 14$ which would be Lucy’s age. At this point Mr. Smith, intervened, asking Justice to ‘finish it off”, a comment Justice did not understand. The following is an excerpt on that interaction.

**Justice:** Pardon.

**Teacher:** You need to finish it off.

**Justice:** I underlined fourteen.

**Teacher:** OK, I am just being pedantic have you actually answered the question.

**Justice:** Err! (surprised)

**Teacher:** Good, so finish it off by writing the last statement. [writes on board Lucy’s age is 14]. Okay I’ll be very surprised if they take a mark off by not putting it down there but let’s not give them the opportunity to do. Did we all get that?

In this case Mr. Smith suggests he is just being ‘pedantic’ and that it would be surprising if leaving out the everyday details would warrant taking off a mark. So whilst he declared the everyday as important, he also suggests that it is not necessarily what the examiners are looking for.

In another episode, a learner had written up a solution for task number 2 on the chalkboard. Even though the solution was correct, Mr. Smith registered his concern:

**36 Teacher:** ….. Okay, let’s go through it… question two point one four (2.14); this setting up [Referring to $4(3x) + 3x = R6.00$] was right. Err… the four chocolates bars were with three sweets so I would uh… um..; instead of this six rand change it to six hundred cents cause you have to divide it by fifteen. And you had your three x times four plus three x equals…. lets change it to six hundred cents.
Conversion of R6.00 into 600 cents is probably informed by a mathematical consideration of avoiding division of 6 by 15 which would then yield a decimal 0.4 rands. It is thus convenient to treat R6.00 as 600 cents because it produces no decimals. Yet, 600 cents is hardly ever referred to in the everyday. 600 cents can thus be viewed as transformed money whose purpose is to facilitate mathematics interest. This is another instance in which the mathematical considerations seem to weigh more than the everyday.

From the two classroom episodes thus far reflected on, it would seem that in general, Mr. Smith felt that there was a need for learners to understand the value of mathematics for everyday contexts. However, when compelled to choose between the everyday and the mathematical considerations, Mr. Smith seems to privilege the mathematical. In sum, the everyday is acceptable provided it does not disadvantage the mathematics. This implies that Mr. Smith, similar to Bulelwa, had to straddle the everyday and mathematics.

In introducing the tasks, Mr. Smith made reference to real learners: Lucy and Kelly. The question was genuine; Kelly and Lucy’s ages. What is curious is that both Kelly and Lucy participated in calculating their own ages. However, in formulating the tasks, he transformed real Lucy and real Kelly into imaginary people. For example, he transformed Kelly by making a supposition, during the phrasing of the question, that: “If we were to say we didn’t know you were fifteen…” (Lesson 1, line 63) and by assigning $x$ as her age. Kelly and Lucy, whose ages are being calculated are actually transformed or ‘de-located’ (Bernstein, 1996) Kelly and Lucy. This move is similar to the one made by Bulelwa with respect to authentic AIDS and inauthentic AIDS. It required learners to be aware of the different recognition rules they were to select in order to engage the activities.

**Learners’ engagement with the task**

It was clear to learners that the tasks were mathematical. It was clear to them that they needed to illustrate some form of calculation to justify their answers. However, it was not clear what calculations were expected. For example, whilst their calculations produced a
correct answer (13), there was no use of equations. This point is evident in Jacob’s and Justice’s following written responses.

<table>
<thead>
<tr>
<th>Jacob’s response</th>
<th>Justice’s response</th>
</tr>
</thead>
<tbody>
<tr>
<td>((28 - 2) - 2 = x)</td>
<td>(28 - 2 = 14) (28 - 2 = 14)</td>
</tr>
</tbody>
</table>

In engaging tasks in the worksheet, Jacob, Justice and Jerry, as highlighted during Lesson 1 discussion, tried to guess the value of p in order to obtain a numerical value for Sue’s age.

The learners’ written responses in other tasks, often copied from the chalkboard, were mainly correct. Mr. Smith exhibited or endorsed acceptable methods of solving tasks which he advised learners to copy. This explains the following correct procedure which Thoko wrote on her worksheet.

\[\sqrt{\frac{4x^2 - 1}{x}} = 2(x + 1)\]

However, the following discussion between Thoko and Mr. Smith over the same task illustrates that she was also confused.

Thoko: I am doing number 4.
Teacher: Yes, except now you are using a different formula. The one before the breath was x okay..? And now you doing the length as x. So what will be the breath if the length is x?
Thoko: It will be x
Teacher: No..no. In terms of x
Thoko: It will be x + 1.
Teacher: Yes it will be x – 1.

[Lesson 2, lines 69 – 74, Settlers]
Either Mr. Smith did not hear Thoko properly or he simply avoided embarrassing her (line 73 -74). It is, however, apparent that Thoko had not come to terms with what the task required, namely, that the length should be considered \( x \) and the breath be \( x - 1 \).

Thoko and Nomalanga never held discussions about the mathematical tasks. However, it was clear that both of them were experiencing difficulties with this section of mathematics, a point they highlighted at the beginning of the lesson.

| Thoko:   | Question two-did you do it? |
| Teacher: | [To one of the learners] But your friend keeps doing this (motion to the learner by showing him the actions). Is there any volunteers to do the whole question still on the board. (Points to one of the learners.) |
| Nomalanga: | (speaks iXhosa) Hey ukuba ngingakuxelela ukuba (…) ngizobheka ukuba ngingaqhubeka nokwenza loku. Hey if I can tell u. I’ll see whether I can be able to do this. |
| Thoko:   | Mina angiboni lutho ngizwa kancane. I don’t see a thing. I (hear/understand) a little. |
| Nomalanga: | Awungiboleka i eraser/Lend me your eraser. |

[Lesson 2, lines 19 – 23, Settlers]

Even though Mr. Smith made the mathematics intentions explicit, access to mathematics remained difficult for some learners. These learners were aware of the ‘form’ the legitimate text ought to take. In Bernstein’s terms, they were aware that the tasks required selection of the specialized recognition rules, however, they did not possess the rules by which the text could be produced.

**Summary of Lessons 1 and 2**

Mr. Smith rationalized the lessons on the premise that learners would be able to note the relevance of mathematics for real life-practices. He paid attention to realistic considerations in engaging some of the tasks (like the basketball team task). Like Bulelwa, Mr. Smith transformed a real authentic context (Kelly’s age) into an unknown, imaginary context that learners were to engage. However, he implied that what was most important was the ability to formulate equations and solve them. It was safe to describe answers in terms of the everyday upon which they are based but an omission to do so would not warrant losing marks. Some of the learners struggled to formulate equations.
However, they understood that the tasks required them to produce either equations or some form of mathematical algorithm to justify their answers. To this end, they relied on Mr. Smith’s exhibition of a correct method which they often copied from the board.

8.2.3 Account of Lesson 3 and Lesson 4

8.2.3.1 An account of Lesson 3

The focus group for this lesson comprised three boys: Jamwell, Daniel and Bill. The three were seated in a linear fashion, with Daniel sandwiched by Jamwell on his right and Bill on his left. Bill would occasionally chat and consult other learners whilst Daniel and Jamwell worked mainly as a pair. At the beginning of the lesson, Mr. Smith reminded learners of the need to underline the important information. He began the lesson by completing the basketball task whose solution he had illustrated the previous day.

He then introduced another task: Exercise 1 task number 6. The context of the task was the construction of a fence with four strands around a yard. It stated: A sheep farmer constructs a fence with four strands of wire around a yard and has 4 metres of wire left over. He used a 120 metre roll of wire. Find, using an algebraic equation, the perimeter of the fence. He then led learners into a discussion on how an equation (4x + 4 =120) can be formulated from the task.

As illustrated in Chapter 7, all the six tasks that Mr. Smith had discussed so far were not preceded by any general method regarding their solutions. It was in this lesson that Mr. Smith illustrated the steps regarding ways of solving these tasks. These steps involved, as illustrated in the worksheet: understanding of the task, formulating an equation, solving the equation and ensuring that the answer is reasonable. He also advised learners to underline the important information. He went through a worked example with learners to illustrate these steps. He then provided learners with an opportunity to engage the second example. The context of this task was teenager’s ages. It stated: Michael is two years older than Debbie and four years older than Tylah. If their ages add up to 45 years, how old is Debbie?
As he walked around, Mr. Smith was impressed with one learner’s (Sue) approach to the task and asked her to share it with the class.

Sue: We [Including her two friends] think that Michael’s age should be x and then we can get Tania and Debbie’s ages.

Teacher: [Rephrasing] So you are doing everything in-the question gives you everything in terms of Michael’s age. If you look there it will tell you that he is two years older than Debbie and four years older than Tylah. So its easier to work with his age (pauses) as (pause) it will be much easier to get your references from that and in the end you can still work out Debbie’s age. Good work (pause) And good timing in parents’ evening.

[Lesson 3, lines 204 – 205, Settlers]

The conversation between Bill and Daniel, though they disagreed, suggest that they understood that the tasks required the formulation and solution of equations. Their difference was on correct mathematical procedures to follow in order to solve equations. For example, the centre of the following argument was on how to deal with the equation \( x-2 + x + x – 4 = 45 \) (formulated from the question about the ages of Debbie, Tyler and Michael).

D: Did you add those?
B: Yes.
D: And why did you add those?
B: Because they are like terms.
D: You don’t add them.
B: You do.
D: You (multiply) them [Some argument ensues amongst J,D and B]
B: But then it’s forty-five minus six equals three x; which is what you want, divide it by three which gives you thirteen.
D: No, but if you add them all again they give you forty-five and not fifty-one.
J: They give you fifty-one.
D: No
J: [Throws hands in the air]

[Lesson 3, lines 214 – 225, Settlers]

Daniel worked through the other tasks with Jamwell, although Jamwell’s participation was passive. Daniel wrote and verbalized whilst Jamwell mainly listened. The second task was then attempted, and Daniel verbalized.

D: [He reads the question from the paper] ‘ A farmer has 200 eggs. He packs the eggs into four boxes each of which contains the same number of eggs. If 8 eggs are left over how many eggs are contained in each box?
J: 4x divide by 4.
D: No, but that would be x and x does not…Ok I know that x (pauses) is the number of eggs in a box.
J: I know.
D: Then I go...a full box is x times 4; so 4x...4x...200 divided by 4x [thinks aloud]. Ok 200 ÷ 8 and here we’ve got 208.

[Lesson 3, lines 228 – 232, Settlers]

For the rest of the lesson, learners engaged tasks on their own, often calling Mr. Smith in for assistance.

An account of Lesson 4

For this lesson, the focus group was three girls; Sue-Ann, Emsy and Millicent. Emsy was seated between Sue-Ann and Millicent. Millicent worked mainly on her own whilst the other pair worked closely together. The previous day Sue-Ann (Sue) had suggested a strategy towards solving the task on teenagers’ ages (example 2). At the beginning of the lesson Mr. Smith called on Sue to write on the board and explain how she solved the task. She explained:

S: Michael’s age is x. Because Michael is two years older than Debbie, I put x minus two and cos he’s four years older than Tylah x minus four and then you-the combined age is three x minus six and then the equation will be thirty-three x minus forty five cos that’s what their combined ages are. And then three x minus six plus six equals forty five plus six which is three x over three (cos) you got fifty one over three so x is seventeen and because Michael is like two years older than Debbie (...) fifteen.

Teacher: Perfect. That’s great!

[Lesson 4, lines 41-42, Settlers]

For exercise 2 tasks 1 and 2, learners were not called over to write down the solutions on the board. Instead, Mr. Smith read the questions and asked individual learners to highlight the important information. For exercise 2 task number 1, he called on Justice to tease out the important information. In other words, key information that enabled solution of tasks. For exercise 2 task 1, which stated *a farmer has two hundred eggs. He packs the eggs into four boxes each of which contain the same number of eggs. If eight eggs are left over how many eggs can each box hold?*; the key information was identified as ‘four boxes, eight eggs and two-hundred eggs’. He gave learners an opportunity to copy down the solution and then advised them to engage other tasks.
After a while, he asked learners to provide what they considered important information to solve exercise 2 number 2; *Michael spent 7 hours at the beach. If he relaxed in the shade reading for 3 hours more than he surfed, for how long did he surf?* The challenge experienced by the focus group in relation to this task was which attribute in this context was to be assigned the value of x. The focus group found this task particularly challenging.

In their solution to exercise 2 number 4, Emsy and Sue suspended the use of the variable x, as illustrated in the following written response by Emsy.

\[
\begin{align*}
\text{The number is } & \ 92 \ldots \\
2\sqrt{183} & = 5 \\
18 & = 3 \\
91, 91 + 0.5 & = 91.5 \\
91, 91 - 0.5 & = 91 \\
\text{Nos are } & \ 91 \text{ and } 92.
\end{align*}
\]

Mr. Smith observed that learners were experiencing problems with the meaning of consecutive numbers. He offered a definition and illustrated on the chalkboard how equations relating to consecutive numbers could be formulated.

A task which sparked Millicent into some discussion with Emsy was exercise 2 task 5. The task (rephrased) required learners to determine, using equations, *the sum of three even consecutive whole numbers whose value is 102*. Whatever advice Emsy offered did not seem to work because Millicent sought assistance from the teacher on a similar task. In fact, Emsy’s written account suggested she was not clear what ‘consecutive even numbers’ referred to. The written response that she and Sue-Ann ended up with was 33, 34, 35. It seemed most learners struggled on this task, as a result Mr. Smith intervened.
Teacher: [He goes to the board] Okay! (…) [cleans chalkboard]. We are having a little bit of problem here with consecutive numbers. (pause) [writes on board] Now everyone agrees with me that four and five are consecutive numbers?

Learners: Yes.

Teacher: [writes on board] to go from four to five what I do here is add this one and that will give me five. If I had to choose seven and eight to go from seven to eight you add one to the first one (number) the first one.

Learners: [Complete] ..add one

Teacher: [Continues] So if we now bring an x as my unknown [writes on board] the next number-the next consecutive number I will use the exact same process-I will add one to x [writes on board] and because they are not like terms I can’t simplify them anymore [writes on board] that is my next number. So to get the sum of those two you get x plus x plus one which is two x plus one and then you can set up your equation there. The thing is the next question is… err talks about three consecutive even numbers or is it two?

[Lesson 4, Lines 71 – 75, Settlers]

Having clarified this notion, the teacher left learners to engage the tasks by themselves. Millicent (M) was still unclear on a task which, amongst others, required understanding the notion of consecutive numbers. She thus called Mr. Smith who tried to lead her into making sense of the notion and how to formulate equations relating to consecutive numbers.

T: So what will you do to x to get the next number bigger than that?
M: Add one.
T: Hmmhm. Now you want the total so first number which is x and the second number which is one bigger than x- you agree with me?
M: [(nods head ‘yes’)]
T: Two x plus one.
M: [(nods head ‘yes’)]
T: Two x plus one equals one eight three.
M: Okay.
T: Now smile.
M: [(laughs)]

[Lesson 4, lines 125 – 134, Settlers]

The period ended just after Mr. Smith and Millicent had completed their discussion.

8.2.4 Reflections on Lesson 3 and Lesson 4

Having provided some account of Lesson 3 and Lesson 4; this section reflects back on these accounts with a focus on two aspects, firstly the relationship drawn between the everyday and the mathematics secondly the way in which learners engaged the task.
8.2.4.1 Instructional discourse - the movement between the everyday and mathematics

As was the case in the previous discussion on lesson 1 and lesson 2, Mr. Smith remained consistent with his view of the everyday playing a significant role in mathematics. He, in particular, emphasized that the everyday should be sensible to the mathematical task being engaged. In other words, a mathematical answer was supposed to make an ‘everyday’ sense. He expressed this view during Lesson 3.

Mr. Smith: ……[reads from worksheet] ‘read the problem once more to ensure that the answer is reasonable and in the correct form’. Okay I just want to add one little thing there-underline all the important information-make it so that it sticks out and you can see it-now getting back to step six there (pause) you need to be able to estimate roughly when what the answer is going to be. Okay if you end up with a telephone bill of fourteen million you know that the chance’s are you made a mistake. (pause) okay. You have made a mistake. A couple of years ago we had a question about these two cyclist hmm who err how much could one peddle than the other and the answers some one gave us would have got to the other side of the Milky Way and back-you need to be able to realise that is not going to happen.

[Lesson 3, Line 131, Settlers]

The sensibility of a mathematical answer towards a context was reinforced by a worked example, in the worksheet, whose answer suggested that the price of one ice-cream is R3.60. In relation to this answer Mr. Smith enquired from learners:

Teacher: Okay, is the answer we get reasonable?
Learner: Yes sir.
Teacher: It’s not going to come out to two thousand rands?
Learner: No.

[Lesson 3, Lines 174 – 177, Settlers]

Even though Mr. Smith was encouraged learners to draw in realistic considerations, he also wanted to accommodate mathematical considerations as well. These two interests often led to conflicts over which of the considerations were to be prioritized and under which conditions. The following exchange, between a teacher and one learner during a whole class discussion, illustrates this point. During this instance, there was confusion on whether the price of ice-cream should be regarded as R2.00 (two rands) or 200 cents.
Two- thousand cents, which Mr. Smith is insisting on, makes calculation manageable for learners; however, it does not makes ‘everyday’ sense like two-hundred rands which learners are suggesting.

In Chapter 2 reference was made to pedagogic discourse as a principle which delocates a discourse from its context and relocates it to another (Bernstein, 1990:184). Mr. Smith tried to set up the everyday both as a discourse to be delocated and as a discourse in which mathematics was to be relocated. As a discourse to be delocated, the everyday had to be appropriated for mathematics, as exemplified by the conversion of R2.60 into 260 cents. As a discourse upon which mathematics relocates, mathematical answers had to make everyday sense. This had the potential to confuse learners over the preferred legitimate text.

**Learners’ responses in Lesson 3 and 4**

A number of learners, including Daniel, made sense of what the substance of the tasks were, following the teacher’s explanation at the beginning of the lesson. For example with reference to the second worked example: *Michael is two years older than Debbie and four years older than Tylah; if their ages add up to 45 years, how old is Debbie.* Bill used the following equation $3x + 6 = 45$ (instead of $3x – 6 = 45$), on the assumption that $x$ will be assigned to Michael’s age. He thus shows some understanding that the ‘known’ part of the equation is 45 (the total number of years). However, he formulates this expression incorrectly as $3x +6$. Daniel was able to engage and cast doubt on this equation. The following exchange between Bill and Daniel ensued:
But then it’s forty-five minus six equals three \(x\); which is what you want, divide it by three which gives you thirteen.

No, but if you add them all again they give you forty-five and not 51.

Ultimately, Daniel was able to obtain a correct answer which he tested by adding 15, 17 (value of \(x\)) and 13.

However, there were instances when other learners could not figure out the value of using letter symbols like \(x\). For example, even after Mr. Smith had clarified what the meaning of consecutive even numbers, Emsy and Sue provided 33, 34 and 35 three consecutive even numbers adding up to 102. The following explanation, which Emsy shared with Millicent about solving this task illustrates that the use of a variable \(x\) (as Mr. Smithy expected) was not considered.

E: Yes...three consecutive even numbers and you ...you got three consecutive numbers
Okay.
M: Okay.
E: [continues] And they equal 102; you got to find the numbers so what are you going to do
to try and find the numbers?
M: Divide it.
E: Divide it by what?
M: Three.
E: Ja...so do it.
M: The ...the..err the sum of three consecutive numbers is \(x\)?

[Lesson 4, Lines 67 – 75, Settlers]

It is apparent from the above exchange that Millicent is unclear on how \(x\) can be factored in. Emsy’s explanation and written response also suggests that she was not able use \(x\) towards solving this task.

In spite of mixed messages communicated by the teacher over whether the everyday or the mathematics was to be privileged, learners viewed mathematics as a discourse in whose form answers were to be expressed. Thus, there was an awareness of the specialized nature of the context. The selection of specialized recognition rules, however, does not guarantee the production of a legitimate text (as was the case with Bill’s use of \(3x - 6 = 45\) instead of \(3x + 6 = 45\) to represent Debbie, Tyler and Michael’s age).
Summing up Lessons 3 and 4

In these two lessons, Mr. Smith continues to highlight the significance of the everyday. However, in solving some tasks, he prioritized the mathematical interests over the everyday considerations, as was the case in his insistence that R20.00 should be presented in cents. He also gave general hints for learners on formulation of equations from the given contexts. In this regard, he outlined the importance of physically underlining important information from what could be considered ‘noise’. Some learners, like Daniel and Bill, were able to formulate equations and talk about them, however for others, the value of using equations remained unclear.

8.2.5 An account of Lesson 5

The focus group for this lesson was two girls, Lucy and Nirmala. Nirmala was the only person in the class of ‘Indian’ or Asian origin. After some casual chat with the learners, Mr. Smith asked Nirmala to solve Exercise 2 task 7 on the board. It was, however, still apparent that the mastery of employing variables was not general. For example Lucy was not able to identify, in exercise 2 task 7 which aspect she should assign the value of x; as shown in her written account below.

In writing out and explaining her solution, Nirmala (N) used x to denote 1 litre of milk and 5x to denote 5 litres of milk. At this point Mr. Smith (T) intervened:

Teacher: I am happy-I know what you’ve done but you but you made one mistake-you said x equals a litre of milk. Is that what you meant to say?
N: Ja.
T: No. you meant to say x is the cost of a litre of milk?
N:… Yes and then err I went two x plus seven rands equals five five x plus two equals to fifty x plus seven rand and then I went.
T: [(nods head ‘yes’)][writes on board] right good and then you solved it.
N: Yes.

[Lesson 5, lines 27 – 32, Settlers]

Nirmala’s written solution, similar to the one she had on the board is as follows.
The teacher repeated the solution and discussed exercise 2 task 5. *The sum of three consecutive even numbers is 102. What are the numbers?* He led learners into a discussion during which he showed that the following equation $3x+6 = 102$ would yield the three even numbers 32, 34, and 36. As he cleaned the board for the next task, Lucy suggested to Nirmala that she had not followed what was happening. She made reference to the solution of the tasks as confusing.

The next task solved was task 6, which stated that *the perimeter of a rectangular piece of land is 74m. The width is 7m less than the length. Find the dimensions of the piece of land.* He led the discussion towards solving the task. It was clear that some learners were still uncertain on how $x$ could be factored in as illustrated in the following exchange between Mr. Smith and learners (Sue and Nomalanga) during a whole class discussion.

Teacher: In terms of the length? Okay the width is seven metres less than the length-if the length is $x$ what is the width?
S: The width is err $x$ minus…
Teacher: …Yes.  {[encouraging her]}
S: I mean…seven {[doubtfully]}
Teacher: Seven. Yes. $x$ minus seven. Good. [writes on board] What's the perimeters formulae? Yes?
N: Uhm perimeter equals two $x$ umm…
Teacher: Okay, before before we substitute.
N: Before we substitute (…) its uhm minus seven.
Teacher: You’re right but I want it-the general one.
Ultimately, though, he was able to probe learners towards the correct answer.

**Teacher:** That’s fine? Okay. but still someone tell me what do I do here? - I’ve got this perimeter equals four x minus fourteen - what else does it equal?

**Class:** Seventy-four

**Teacher:** Yes?

**N:** It equals seventy-four.

**Teacher:** It equals seventy-four. That’s what they gave us. Yes. So [writes on board] four x minus fourteen equals seventy-four. [writes on board] Okay, let’s see and check if this is right so we don’t get forty point five and what’s it thirty six.

[Lesson 5, lines 113 – 117, Settlers]

Task 8 was solved by one of the students. It stated: the length of a rectangle is 3 m longer than the breadth. If the perimeter is 45m, what is the length of the rectangle?. The learner highlighted the solution as follows:

**Learner:** Err…. Length is 3 meters longer than the breadth so I said that my breadth is x and my length is x plus three.

**Teacher:** Ok.

**Learner:** And I then I got four x plus six and the I divided it by-uh then I minused the six on both sides and then I got four x so I divided that by four and because x was my breathe and I got breath equals 9.75 and I now add three meters and I get 12.75 for my length.

**Teacher:** Any questions anyone wants to ask him?

**Class:** No.

**Teacher:** Okay. ‘ The length of a rectangle is twice its breadth. If the perimeter is 45m, what is the length’ [reads from worksheet] yes. I am not going to do nine and ten because not everyone’s finished it. By Monday I want to see nine and ten eleven and twelve. Okay try and answer these questions [cleans chalkboard] okay. Settle down. I got the exact response of you that I expected when I said you was going on to geometry there was groaning, wailing (…) teeth.

[Lesson 5, lines 151 – 156, Settlers]

The teacher had indicated before that he was going introduce geometry and in the process he sensed that learners did not like the subject. He thus asked them to mentioned anything they knew about geometry from their previous experiences. Learners mentioned geometric figures including angles, triangles and some geometrical conventions like the acute angles and isosceles or equilateral triangle. The teacher closed the discussion by observing that learners had mentioned up to twenty-one things they knew about geometry. He then put a challenge to Justice, a student and a cricketer. He asked him to name twenty-one things about cricket, a task Justice could not manage. He mentioned a
few aspects he knew about South African cricket but numerically, these never reached ten. At this point Mr. Smith explicitly outlined the purpose of the exercise.

Teacher: Okay. what I was trying to do was show ...(pauses)... you quite easily you came up with twenty one things about something that you are saying you don’t like and its difficult for Justice here…. he is a sportsman and I asked him to give me twenty one facts about cricket okay. He plays Pinetown district cricket so he’s a good cricketer and he knows what's happening but he’s been struggling to do that on something that he knows [referring to cricket]. So I am saying that you do have a knowledge about geometry compared to cricket.

[Lesson 5, line 335, Settlers]

Mr. Smith was thus trying to entice learners to geometry. He indicated that there would be a question on geometry during exams. The lesson ended on this note.

8.2.6 Reflections on Lesson 5

Instructional discourse - Movement between the everyday and the mathematics

In this lesson Mr. Smith introduced the cricket context towards the end of the lesson, a context with which most learners were familiar. However, he kept the boundary between this context and mathematics solid. In other words, cricket and geometry were put in a close relationship. So, even when he recruited an authentic and close context, unlike Bulelwa, Mr. Smith did not attempt to use this context as a platform to engage mathematics. Instead, he used it as a way to entice learners into engaging geometry with a positive attitude or confidence, derived from a sense of knowing that they understood more of its aspects than they did about cricket.

Learners’ engagement with the task

Lucy and Nirmala were among learners who were able to draw in and use letter symbols to formulate equations. For example, in solving exercise 2 task 5, they employed two variables, x and y, as illustrated in Lucy’s written response below.
It was, however, still apparent that the mastery of employing variables was not general. For example Lucy was not able to identify, in exercise 2 task 7, which aspect she should assign the value of $x$. As illustrated before (in page 202), both Lucy and Nirmala equated $x$ with 1 litre of milk instead of equating it with the cost of 1 litre of milk.

**Summing up Lesson 5**

It was during Lesson 5 that a chapter on using equations to solve word problems was drawn to a close. Mr. Smith continued to exhibit, by discussing with learners, ways of solving tasks which incorporate both the mathematical and the everyday. Some learners, like Lucy, were not always able to formulate acceptable equations whilst others, like Nirmala, seemed to have a better understanding of ways to draw in variables in order to solve equations.

**8.2.7 Regulative discourse**

At school level, through uniforms and grade-specific tuckshops, Settlers promoted ethos and practices which promoted particular “rules of social order” (Bernstein, 1996:108). Grade 12 learners wore jerseys on which the words ‘Grade 12’ were printed and which thus distinguished them from other learners. Tuckshops were also designated for different grade-levels. This arrangement differentiated learners with respect to the grades. It
subconsciously reminded learners about their positions and ranks in relation to other learners.

At classroom level, as pointed out in Chapter 7, learners were expected to stand up when the teacher walked into a room and all desks faced the front. Meighan (1986:78) observes that “a teacher’s room tells us who he is and a great deal about what he is doing” and that a room represents in “physical form the spirit of places and institutions”. Therefore, no matter how routine and familiar the classroom learners’ actions and the classroom arrangement may look, they communicate certain values. Standing up may be regarded as a symbolic action of acknowledging and showing respect for authority. The learning message in a classroom with desks arranged in rows facing the front suggests, as Meighan (1986:86) asserts, that learners should “look ahead, look and listen”. The asymmetric relationship between learners and teachers was thus communicated.

Except for his occasional calls for learners’ attention when he needed to stress a particular aspect, Mr. Smith hardly addressed aspects relating to moral or acceptable societal behaviours as Bulelwa did during mathematics lessons. This difference resonates with the different ways in which Mr. Smith and Bulelwa highlighted the role of the everyday during the lessons. For example, Bulelwa used the everyday as a platform to address both the mathematics content (number patterns) and the social issues (transmission of AIDS through the use of razors that had been used to cut people). Mr. Smith used the everyday mainly as a means to access the mathematics and less as a basis for discussing social issues.

**CONCLUSION**

This chapter focused on two aspects with respect to the target lessons: The worksheet used and the classroom events. Mr. Smith used a worksheet which made mathematics conspicuous through the use of letter symbols and the use of cartoons. In this way, even though he summoned the everyday, the nature of the worksheet used by Mr. Smith ensured that the mathematical intentions were not obscured.
A major difference between Mr. Smith and Bulelwa was with regard to the framing values. Bulelwa used the everyday to address a range of aspects, in addition to mathematics. Mr. Smith’s teaching, on the other hand, remained very close to a worksheet he used. In this way he kept the framing values strong. Thus, he was very explicit about how learning ought to take place in a mathematics class. Mr. Smith also had a task of managing the everyday and the mathematics. Possibly on a subconscious level, he moved between the two discourses. For example, he insisted that learners write R6.00 in cents, a practice which is unlikely in real world settings. What emerges from this discussion is that both on the basis of the worksheet and how it was handled in class, the everyday was phased in judiciously.

Throughout these five lessons, learners illustrated an awareness of the form a legitimate text ought to take, even though they could not always produce this text. Bernstein (1996) has argued that selection of non-specialized recognition rules prohibits learners from recognizing the special nature of a context. Selection of a specialized recognition rule, on the other hand, tends to assist an awareness of the special nature of the context. The argument presented in relation to learners at Settlers suggests that the movement from specialized recognition rule to production of a legitimate text is challenging to a number of learners.

Given the way in which the everyday is phased in, what observations do learners make about the everyday and what are their perspectives regarding the incorporation of the everyday in mathematics? I attend to this question in the next chapter.