Exploring the recontextualisation of the discourse of geography in textbooks

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Abstract

The review of textbook studies shows that cursory attention has been given to the representation of the nature and structure of the parent discipline in textbooks. This study focuses on how the discourse of geography, is recontextualised in four grade 10 textbooks: two state approved textbooks that support the new curriculum (CAPS), an older pre-1994 textbook and a UK textbook. The analysis has been framed, at a macro-theoretical level, by Bernstein's concept of recontextualisation and Bourdieu's theory of symbolic forms. At the micro analytical level the discourse of Geography as conceptualised by Wignell, Martin and Eggins (1993) has been drawn on. A qualitative approach enabled in-depth multi-dimensional analysis that uncovered explicit and implicit similarities and differences in the texts.

This paper articulates and illustrates an analytical framework for analysing the representation of the knowledge structure of geography in textbooks. It illustrates this framework by analysing the same sub-section: *the structure and composition of the atmosphere*, in the texts. Data analysis shows that the textbooks recontextualise the discourse of Geography differently. Of the two textbooks developed to support CAPS, one recontextualises the discourse of Geography in a more coherent and differentiated way than the other. It is argued that greater divergence from the discourse of Geography increases possibility of gaps in knowledge and understanding. On the whole the paper points to paying attention in textbook studies to how the nature and structure of the parent discipline is recontextualised in textbooks.

Introduction

School textbooks are seen as fundamental for supporting curriculum enactment in schools. Textbooks, firstly, set out the parent discipline as "textbooks expound the body of accepted theory [of a discipline], . . . illustrate many or all of its successful applications, compare these applications with exemplary observations and experiments" (Kuhn, 1962, p.10) and "aim to communicate the vocabulary and syntax of a contemporary scientific language" (Kuhn, 1962, p.136). Secondly, textbooks are key resources for

directing what students learn. Apple (2004) holds that textbooks "dominate what students learn", they "set the curriculum" and present "the facts learned in most subjects" and as such "participate in no less than the organised knowledge system of society" (p.182). Thirdly, textbooks present the socially accepted body of knowledge of a discipline. Since the entire universe of knowledge of the parent discipline cannot be represented, what knowledge is selected to be included is influenced not only by national curriculum specifications but also by the ideologies of the selectors. Thus Apple holds that "textbooks signify through their content and form, particular constructions of reality" (Apple, 2004, p.182):

> Textbooks . . . signify through their content and form, particular constructions of reality…they participate in creating what a society has recognised as legitimate and truthful. They help set the canons of truthfulness. . . (Apple, 2004, p.182).

However, textbooks are not just curriculum tools nor mediums for the transfer of ideological messages but also commercial products and economic commodities that compete with other textbooks in the market. Thus, since the 70s, Apple's 'highly influential work' in books such as Teachers and Texts (1986) and Official Knowledge (1993) reveals through critical analysis "the hegemonic processes that characterise the production and consumption of textbooks both inside and outside the US" (Crawford, 2003, p.18).

Another quote cited by Apple (2004) encapsulates varied views of textbooks:

> Textbooks, for better or worse, dominate what students learn. They set the curriculum, and often the facts learned, in most subjects. For many students, textbooks are their first and sometimes only early exposure to books and to reading. The public regards textbooks as authoritative, accurate and necessary. And teachers rely on them to organise lessons and structure subject matter. But the current system of textbook adoption has filled our schools with Trojan horses – glossily covered blocks of paper whose words emerge to deaden the minds of our nation's youth, and make them enemies of learning (Apple, 2004, p.183).

While the public expects textbooks to be 'authoritative, accurate and necessary', the above quote points out that the 'quality' of textbooks have been declining, or worse textbooks are viewed as subversive. The metaphor of the Trojan horse leads one to think about textbooks as 'something that is meant to disrupt, undermine, subvert, or destroy an enemy or rival, especially somebody or something that operates while concealed within an organisation'. The quote also cautions against being fooled by the appearance of the textbook. Textbooks reduced to 'glossily covered blocks of paper'

. . .that lure selectors may 'deaden the minds of students and make them enemies of learning'.

Textbooks have been studied from a variety of lenses. Marsden's (2001) three distinctions: of matter, refers to the content of textbooks; method, refers to the context of curriculum and pedagogy within which they are used and mission, refers to wider conceptions of schooling and society, indicates aspects that could be analysed. Nworgu (cited by Emereole, 2007) developed six indices for the evaluation of the content of science textbooks: *topical coverage index* that provides an estimate of the extent to which the textbook covers the prescribed syllabus; *learning activity index* that measures participation of learners; *study questions index* that measures the extent to which learners are required to think or to receive knowledge; the *illustration index* that measures the extent to which learners are required to engage in an activity or to view/observe the illustration; and the *chapter summary index* that measures the extent to which a more permanent understanding of the text is promoted. Stradling (2001) developed four categories of analysis, of which the first deals with the evaluation of textbook content that includes questions on coverage, sequencing of curriculum, space allocation, the incorporation of multiple perspectives, cultural and regional identity and omissions. The second deals with the textbooks pedagogic value that includes questions on students prior knowledge, on whether the textbook encourages memorisation or skills of development, on the use of charts and pictures, on the explication of historical concepts in the text and on the facilitation of comparative thinking. In Pingel's (1999) list of criteria for analysis of content, factual accuracy, completeness, errors and extent of differentiation are identified. Collada and Atxurra (2006) analysed how the objective of the curriculum of democratic citizenship within the European framework and Spanish educational reforms is represented in textbooks. From the assessment perspective, Yang (2013) compared assessments in older syllabus-based geography textbooks with new standards-based junior Geography textbooks used in Mainland China. Yang found that the new books abandoned the "overwhelming repetition drills", "the application of geographic knowledge and skills is valued", "higher order thinking assessments became more numerous" and that "the general quality of assessments in the newer standards-based books improved" (Yang, 2013, p.66). Many textbook studies focus on the social representation of marginalised groups. Emereole (2007) added the under-represented population index, to Nworgu's five indices, for measuring the extent to which women and cultural and ethnic diversity is represented in neutral or biased ways. Sleeter and Grant (1991) analysed how

America's diversity was projected to children through the school day. They examined the question: "how have the writers and publishers. . . selected knowledge of various American racial, social class, gender and disability groups?" (p.281). McKinney (2005) investigated to what extent textbooks are appropriate for diverse learners in SA and found inequity in gender representation, "significant under-representation of rural, poor, disabled and working-class social worlds, though racial diversity was better represented" (p. xi). Johnston (2006, p.286) analysed human geography in several textbooks and concluded that "their use as political tools in attempts to promote particular visions of human geographical practices". Textbooks can and have been studied from a range of lenses, and this study introduces a further category of analysis: the recontextulisation of the parent discipline in textbooks.

Bernstein's description of the recontextualisation of knowledge from its context of production to its reproduction in schools (Bernstein, 1996) provides the overarching conceptual framework for exploring how geographical knowledge is recontextualised in textbooks. Bernstein's (2000) conceptualisation of this process is analysed in his theory of the 'pedagogic device' that sees knowledge as being recontextualised from its parent discipline through to the 'official curriculum' and to its 'reproduction' in schools and in undergraduate tertiary education. The recontextulisation of biology in the South African Life Sciences curriculum has been explored by Johnson, Dempster and Hugo (2011). In line with these authors and Muller (2007) this study is based on the premise that for specialised forms of knowledge to be reproduced the school subject ought to recontextualise the generally accepted basic knowledge structure of the parent discipline as closely as possible. While the *process* of recontextualisation from the context of production of knowledge to its reproduction context in schools may be studied, this study hones in on *what knowledge* has been recontextualised in textbooks. In this regard Bernstein (1990) argues that the basic question to be asked with reference to the privileging pedagogic text is:

> Does the text focus upon the pedagogic subject's relation to this text in terms of social class, gender, race attributes or any other discriminating attribute or does the text focus on the internal constituents of the privileging text in the process of its transmission and acquisition at the level of the classroom or school (p.173–174).

The relevant point for this paper is the analytical distinction between social representation (class, gender, race attributes) and knowledge representation

('internal constituents') that could be used as lenses to categorise textbook studies. While the context in which the textbook is used has an impact on representation of content, inaccurate, incomplete, incoherent and insufficiently differentiated knowledge contents would impair understanding in contexts where both teachers and students depend on the textbook as the main resource for teaching and learning the curriculum. In this regard factual accuracy, completeness, errors and extent of differentiation of content may be analysed (Pingel, 2000).

The object of this analysis is on knowledge representation or the 'internal constituents' of textbooks that were developed to support the new curriculum (Department of Education, 2012) and to compare them with a UK textbook and an older textbook used prior to democratic change in 1994. The analysis has been framed at a macro-theoretical level by Bernstein's concept of recontextualisation and Bourdieu's theory of symbolic systems as 'structuring structures', 'structured structures' and as 'instruments of domination'. With reference to the specific nature and structure of geography, the discourse of geography as a discipline concerned with making order and meaning of the experiential world, through observing, classifying and explaining phenomena (Wignell *et.al*., 1993) was drawn on. This paper articulates an analytical framework for evaluating the knowledge structure of geography textbooks. It also proposes a fundamental general criteria to judge textbook quality – the extent to which the essential link between knowledge represented in a school subject textbook and its parent discipline is maintained.

Geography, symbolic forms, social functions

The social function of symbolic forms of knowledge as 'structured, structuring structures' has been highlighted by Bourdieu (1991). As structuring structures the symbolic forms are instruments for making sense of objects and experiences symbolically. In Bourdieu's words they are "instruments for knowing and constructing the world of objects, as symbolic forms. . . thus recognizing . . . the active aspect of cognition" (Bourdieu, 1991, p.164). As structuring structures symbolic forms enable symbolic power, "a power of constructing reality" and one "that tends to establish a gnoseological order" or an order based on knowledge where "the immediate meaning of the world depends on what Durkheim calls logical conformism, that is, a homogenous conception of time, space, number and cause, one

which makes it possible for different intellects to reach agreement“ (Bourdieu, 1991, p.166).

Durkheim designates the social function of symbolic forms explicitly in that he “makes social solidarity dependent on the sharing of a symbolic system”. Thus Bourdieu states:

> It is an authentic political function. . .symbols are the instruments par excellence of ‘social integration’; as instruments of knowledge and communication they make it possible for there to be consensus on the meaning of the social world. . .a consensus which contributes fundamentally to the reproduction of the social order. Logical integration is the precondition of moral integration (Bourdieu, 1991, p.166).

An additional social function of symbolic forms is that “they make it possible to reach consensus on the meaning of the social world, a consensus that contributes to the reproduction of the social order” (p.166). Furthermore, that logical integration is a prerequisite for moral integration is yet another argument for symbolic forms of knowledge.

These structuring functions of all symbolic forms is echoed by Wignell *et al.* (1993), who conceptualised the discourse of geography as a discipline concerned with making order and meaning of the experiential world, through observing, classifying and explaining phenomena. The **first** procedure to uncover this order and meaning is to observe and describe the experiential world through a technical lexis. The technical lexis refers to the use of terms or expressions within a specialised field that have a field specific meaning. The technical terminology that is core to the field is the means, not only for making sense symbolically, but also for more generally accepted geographic meaning to be attributed to objects and experiences. The technical terms are either unique to the field (mesas and buttes), burrowed from other fields (condensation and transpiration) or drawn from vernacular taxonomies (weather). The vernacular terms acquire a new meaning because they are part of a geographic taxonomy. As instruments of knowledge, “symbolic structures“ can exercise a structuring power only because “they themselves are structured” (Bourdieu, 1991, p.166). This aspect aligns with Bourdieu’s symbolic forms as ‘structuring structures’ that refers to the use of the language and structure of geography to construct meaning of the experience. This first step of relating to students experience, or directing their experience, aims at rooting the symbolic description that follows in an individual perceptual experience.

The structuring power of geography as a symbolic form arises from its structure. Wignell *et al*. (1993) hold that the structure of geographical knowledge is that it is made up of many taxonomies. A taxonomy:

> Is an ordered, systematic classification of some phenomena based on the fundamental principles of superordination (where something is a type of or kind of something else) or composition (where something is a part of something else)? (Wignell *et al.,* 1993, p.137)

Taxonomies arise from two principles of classification: super-ordination where something is a kind of or type of something else and composition where something is a part of something else. This binomial classification 'tells little about the thing itself' but enables it to be placed in an ordered system of oppositions in relation to other things. An example of superordination is: there are three types of rocks – igneous, metamorphic and sedimentary rocks. This principle of classification extends a general concept into its specific types. The principle of composition refers to where something is classified as being a part of something else. It gives detailed description about something but nothing about its relationship to other similar things. Take for example the following extract from a textbook:

> Rocks are classified according to their origin. There are three categories of rock: igneous rock: rock formed when molten rock material cools and hardens. Sedimentary rock: rock formed from fragments of other rocks that have been compressed and hardened. Metamorphic rock: rocks that have been altered by heat or pressure.

In the above extract both principles of classification apply: superordination in which the three categories or types of rock are stated and the accompanying information on each type of rock illustrates the principle of composition – the properties of each type of rock is described in greater detail.

The distinction between vernacular taxonomies that are either specialised or every day and formal scientific taxonomies (Wignell *et al.,* 1993) provides a further criteria to analyse the properties of knowledge statements in textbooks. According to Wignell *et al.*, phenomena classified formally and scientifically 'already have vernacular names and vernacular definitions'. But scientific taxonomising is a process or renaming in order to reclassify the vernacular that also reorders it. For example, with reference to the section on weather and climate, everyday words and vernacular taxonomies are used to describe the weather, which are related to experience of the weather at that particular time – cold, windy, cloudy, etc. It includes a personalised and connotative dimension. However a formal definition of weather 'weather

refers to the state of the atmosphere at a local level, usually on a short time scale minutes to months', is not only general, precise, denotative and depersonalised but it also sets up its difference from the term – climate. From geomorphology, a landform could be described as a kind of hill with steep sides and a flat top. But by naming the landform a mesa, a technical name has been created for the landform and has classified it in a taxonomy that distinguishes it from other related landforms such as buttes.

Critical sociological perspectives have pointed out that symbolic forms are 'instruments of domination'. Often, such critiques do not give due cognisance to the logical structure and cognitive function of symbolic forms. Schmaus argues that the sociology of scientific knowledge must include cognitive goals and not always reduce knowledge to non-cognitive goals and interests (Schmaus, 1994).

The **third** geographic procedure to uncover this order and meaning is to explain how phenomena came to be the way they are through implication sequences of cause and effect. Technical terms are introduced and defined through an identifying relational clause: an x (technical term – mesas) is a y (definition). Technical terms are also defined through causal relations between phenomena. In elaborating on a technical term an additional task is explaining how it got to be that way.

> Where taxonomising tends to focus on things. . .explaining tends to focus on processes. The emphasis shifts from things in place to things in action. To explain how things are, or came to be the way they are, it is necessary to use processes, participants and circumstances. These tend to be arranged in clause complexes which will be called implication sequences (Martin, 2006, p.157).

Martin provides an example of an implication sequence that explains what cold fronts are, the processes by which frontal rainfall occurs and the clouds associated with cold fronts:

> Cold fronts. A stream of comparatively cold, dense air tends to move along close to the ground as it flows towards regions in which warmer, less dense air is rising. This rising air becomes cooler . . .if it is humid, condensation of water vapour will take place. The resulting clouds are usually of the cumulus type. The front edge of the cold air mass is known as a cold front. Much of the rain that falls in Australia occurs as a result of cold front conditions (p.41).

In explanation sequences causal resources such as logical connectors are deployed, such as, if, as a result of, resulting in. Wignell *et al*. (1993) points

out that transition networks maybe used to model implication sequences. The basic components of transition networks are states (represented by circles) and arcs (represented by arrows showing the direction of change). An example of a transition network linked by arrows shows air containing water vapour, rising, resulting in adiabatic cooling to dew point temperature, resulting in water vapour condensing and cloud formation.

The field of geography is thus made up of field specific technical terms for what is observed and experienced, a number of interrelated taxonomies that orders what is observed and experienced and sets of implication sequences that explain 'how things are' or 'came to be that way'. The major task of the geography textbook is to represent its logical structure or its technical taxonomy and enable students to make sense and explain the experiential world in geographical ways (Wignell *et al.,* 1993, p.165).

Context and methodology

In the democratic South African era, changes in curriculum policy on knowledge content and organisation set in motion a flurry of new textbooks. Against the background of three major waves of national curriculum reforms in South Africa in the post-apartheid period: Curriculum 2005 (C2005) implemented in 1998, the Revised National Curriculum Statement (NCS) implemented in 2002, and the recent National Curriculum and Assessment Policy Statement (CAPS) implemented in 2012, this paper presents an analysis of new grade 10 geography textbooks to see how the nature and structure of geography are recontextualised in these textbooks, in comparison with a UK textbook and an older textbook widely used during the apartheid political dispensation.

A qualitative approach was employed as the aim was to subject the same content to an in-depth analysis of how the discourse of geography is represented. In this study four textbooks were analysed. Two of these textbooks supporting the new curriculum (CAPS), were published in 2011 and 2012 and have been approved by the Department of Education for use in schools and cost R154. The same section in an older textbook used before C2005 and a UK textbook were also analysed. The unit of analysis is the same section *the structure and composition of the atmosphere*, an aspect of weather and climate within physical geography in all the textbooks. The knowledge

statements in the textbooks were analysed according to the extent to which the terminology, taxonomy and implication sequences of geography are evident. Nicholls (2003) advises that researchers 'must formulate a framework or criteria for the analysis. The analytical framework, see Table 1 has been derived from Wignell *et al.*'s conceptualisation of the discourse of geography. Table 1 below shows the attribute of geography, the intellectual process that accompanies it and the main questions that guided the analysis.

Table 1: Analytical framework

Attribute of geography	Intellectual process	Analytical criteria
Making meaning of experiential world	Observation, identifying, describing, naming	The extent to which each textbook requires students to observe and make sense of the experiential world?
A technical lexis	Naming	The extent to which the technical lexis is represented
Ordering the experiential world	Ordering/taxonomising/classi-fying: classification based on superordination and compositional principles	The extent to which the geographic taxonomy is represented
Explaining experiential phenomena	Implication sequences - network diagrams that represent the taxonomic relationship	The extent to which phenomena are explained

Visual images and diagrams to illustrate the section were also analysed. Each heading, subheading and sentence was analysed for the extent to which content has been differentiated in terms of classification and compositional taxonomies.

Data analysis and discussion

Overview of the four textbooks

Table 2: Headings, sub-headings and alternate semiotic modes (numbered as in the texts)

The four textbooks	Textbook A	Textbook B	Textbook C	Textbook D
Heads and sub-headings	Topic 2 The atmosphere	Module 1 The atmosphere – weather, climate	Weather and climate	2 Climatology
	Chpt 1 Composition and structure of the atmosphere	Unit 1 Composition and structure of the atmosphere	Structure and composition of the atmosphere 1. Troposphere 2. Stratosphere 3. Meosphere 4. Thermosphere	2.1 The atmosphere 2.1.1 What is the atmosphere? 2.1.2 The composition of the atmosphere 2.1.3 The structure of the atmosphere 1. Troposphere 2. Stratosphere 3. Mesosphere 4. Thermosphere 2.1.4 The physical properties of the atmosphere – mass mobility compressibility
	Unit 1 Importance of the atmosphere	The importance of the atmosphere		
	1. What is the atmosphere?	Composition and structure of the atmosphere Troposphere Stratosphere Mesosphere Thermosphere		
	2. Why is the atmosphere important for life on earth?			
	3. The composition of the atmosphere. Gasses, liquids, solid particles			
	4. The structure of the atmosphere Troposphere Stratosphere Mesosphere Thermosphere		Atmospheric gasses	
Total headings	11	7	7	10

Number of tables	1 (the gasses and their impor-tance)	0	1 (the composition of the atmosphere)	0
Number of diagrams	3 (the composition of gasses in the atmosphere, the structure of the atmosphere, a simple line graph)	3 (the composition of the atmosphere, the vertical structure of the atmosphere, temperature changes in the atmosphere, the ozone in. . .)	1 (the vertical structure of the atmosphere)	4 (the structure of the atmosphere, gravitational pull, mobility, compressibility)
Images, photographs	2 (the Arctic icecap; polar temperatures are colder than equatorial temperatures, volcanic ash from an eruption in Iceland in April 2010)	1 (polar stratospheric clouds)	0	3 (meteosat image, baragraph and barometer, anemometer)
Total alternate semiotic modes	6	4	2	7

The number of headings and subheadings in the texts range from seven to eleven. Text A differentiates the sections into four main sections that are numbered from one to four and seven subsections (gasses, liquids, solid particles, troposphere, stratosphere, mesosphere and thermosphere) that are written in bold print. The headings indicate progressive focussing on the more specific concepts. Text A differentiates the section into seven headings and sub-headings. A higher level heading 'Composition and structure of the atmosphere' is repeated verbatim later.

Although not part of the object of analysis the multisemiotic modes of representation are indeed striking and impressive. The use of alternate semiotic modes ranges from two to seven across the textbooks. The three SA texts use alternate semiotic modes to a larger extent than the UK textbook. The new CAPS geography textbooks and the older text book used before C2005 (text D) show a greater multitude of figures and narrative images consisting of photographs, satellite images, graphs, diagrams that illustrate

and explain textual meanings. The use of different colours in the new CAPS texts are not only appealing aesthetically but also illustrate factual details better. Diagrams in a variety of colours support linguistic explanations. For example, the use of differing spacing between drawings of air molecules to show gravitational force and compressibility of the atmosphere provide an additional semiotic mode to convey meaning. The photographs and images provide a strong link to the empirical and perceptual/experiential. For example, the photograph of clouds and the barometer provide learners with a direct link to the perceptual and empirical. This is consistent with Marsden's (2001) observation of the "move away from the dominance of text to the use of visual material as complementary" to text (p.317). The common sections are the composition and structure of the atmosphere, the importance of the atmosphere. All four books provide a diagram that illustrates the vertical structure of the atmosphere.

Observing and making sense of the experiential world

Of the four textbooks analysed, just one, (textbook A) required students to engage in empirical observation and to make sense of such observations geographically. This has been done by setting exercises or activities requiring students to observe their environment and to respond to questions on the basis of their observations. Two examples will be used to illustrate this aspect. Firstly, students need to do fieldwork to understand that the atmosphere is composed of solid particles:

1. Find a shelf in your classroom that can be left untouched for a few days.

    1.1 After three or four days, examine the shelf – wipe your fingers across it. What do you notice?

    1.2 In your geography workbook, write a brief report. . .

The aim of the activity is to enable students to link the dust particles that settle on surfaces to the concept of microscopic solid particles being part of the atmosphere.

Secondly, to enable understanding of the concept of reflection of solar insolation, students were required to observe and name objects that cause glare:

1.1 When you walk around at school (or at home) what objects cause so much glare that they hurt your eyes? List them

1.2 Why do these objects cause glare?

The second task requires students to identify objects that reflect light and to draw on what they learned on depletion of insolation to explain absorption, scattering or reflection of light. With reference to observation and explaining the experiential world, this textbook includes everyday experiences that are subjected to scientific observation and inquiry. Both examples link common experiences to geographic terms, concepts and processes. It thus enables a key function of symbolic forms, 'structuring structures' (Bourdieu, 1991) that enable scaffolding of students' cognition towards more objective geographical sense-making. It also establishes the link between phenomena and experiences to their symbolic representation. A possible explanation for lack of such activities in the three other textbooks could be that authors see this type of activity as a pedagogic responsibility of the teacher (Young, 2010), thus making assumptions about the specialised capabilities of the teacher that might disadvantage students taught by less qualified and competent teachers. In this regard Bernstein (2003) noted the social class assumptions that underpin invisible pedagogies in which knowledge criteria are implicit.

Defining key technical terms

All four texts provide definitions of key terms. For example a key term in this section – atmosphere – is defined as:

> The atmosphere is an envelope of transparent, odourless gasses held to the earth by gravitational attraction (text C)
> The atmosphere is the gaseous layer which envelops the earth and is essential for the maintenance of life on earth (textbook D)
> The atmosphere is the layer of gasses that surround earth. The main gasses include nitrogen, oxygen, argon, water vapour and carbon dioxide (textbook A)

However, text B differed in four ways. The meaning of key terms such as 'composition' and 'structure' in the heading are taken for granted as self evident. Then, statements that contain a number of technical terms are not further explained. For example, 'the separation into layers based on thermal characteristics, chemical composition, movement and density' is not defined or elaborated on further in terms of how chemical composition, movement and density differ in the four layers. In an accompanying keyword box the term thermal characteristics is defined as 'temperature changes – how hot or cold something is', which is a definition of temperature. In this definition 'thermal characteristics' is conflated with temperature. Key words (insolation, terrestrial radiation, radiation, latent heat) defined in keyword boxes in the margin of the page actually belong to the section heating of the atmosphere or energy in the atmosphere. These disconnections point to incoherence between the specific section and the keywords being defined. Lastly, unlike the other three books, text B includes in its representation vernacular terms (Wignell *et al.*, 1993) more frequently than technical terms, such as 'sun block' in the sentence 'If all the sun's rays were to strike down on earth, there would be no life, so the atmosphere acts as a 'sun block'.' In this example the use of the vernacular term 'sun block' is not co-extended to its scientific term. Further, it's the ozone layer and not the entire atmosphere that performs this function. The excessive amount of 'greenhouse' gasses in the atmosphere in large cities results in the 'greenhouse' effect and to global warming. These aspects point to factual inaccuracy and incompleteness (Pingel, 1999).

Representing the technical taxonomy

Contextualisation in disciplinary area

The texts analysed differ in positioning the section within the parent discipline. Textbook C links the section of 'structure and composition of the atmosphere' to weather and climate and to meteorology which is defined as the study of atmospheric phenomena. It then proceeds to define 'weather' and 'climate'. The definitions maintain the link with the atmosphere: 'Weather refers to the state of the atmosphere; it emphasizes aspects of the atmosphere that affect human activity…' It then goes on to emphasise that both weather and climate refer to states of the atmosphere or the 'behaviour' of the atmosphere at local and short time scales, whereas climate explains the long-term behaviour of the atmosphere.

In Text B the section *composition and structure of the atmosphere* is not contextualised within the section weather and climate and within meteorology. This leads to lack of focus and cohesion. It does state: 'in order to understand weather and climate we need to know about the atmosphere'. This sentence indicates the reason for studying the atmosphere, however, the taxonomic relation across weather and climate and atmosphere, that we study the atmosphere in order to understand weather and climate that are experienced on a daily basis, are not established. The section thus appears disconnected to the experiential and to the broader section weather and climate and to the science of meteorology. The content present under the heading *importance of the atmosphere* is general and not related to importance of the various components of the atmosphere for weather and climate. The disjointedness and lack of connection compromises the knowledge structure being represented.

Textbook C contextualises the section *moisture in the atmosphere* within *weather and climate* and the further within *meteorology* whereas textbook D contextualises the section within *climatology*. In text C, the 'structure and composition of the atmosphere' is orthographically marked by bold and larger font and a different colour. The first line defines the atmosphere as 'an envelope of transparent, odourless gasses held to the earth by gravitational attraction'. The next sentence gives its dimensions and that since 'most' of the atmosphere is concentrated within 16 km of the earth's surface at the equator and 8 km of the poles, weather and climate is also concentrated in this zone. It goes on to then indicate that while atmospheric pressure decreases with height, temperature changes within the atmosphere are complex and based on such changes the atmosphere is divided into four layers from the earth's surface upwards. A graph is used to illustrate the vertical structure of the atmosphere – its temperature and its pressure. A table shows the composition of the atmosphere and the importance of each for weather and climate. It distinguishes permanent, variable and inert gasses. Its relevance is established as 'importance for weather and climate'. These multi-semiotic modes of representation provide a range of resources for students to grasp the symbolic meaning and structure of the content more accurately.

The two new textbooks (A and B) locate the section in 'the atmosphere' and not in weather and climate or meteorology or climatology. This indicates disconnection with the disciplinary context in the two new CAPS textbooks as well as possible disconnection with more specialised meanings to follow in grades 11 and 12 and tertiary education.

Coherence and differentiation of headings and sub-headings

Textbooks A, C and D show productive coherence and differentiation between headings and subheadings. Text A references the technical lexis of geography. It effects adequate differentiation by listing the significance of the atmosphere separately and by distinguishing between composition and structure and between permanent and variable gasses. It defines key terms such as atmosphere and structure that are connected to the section. Text B, however, shows lack of differentiation of main and sub-headings that also lead to lack of differentiation of the taxonomic structure of geography. This book opens in unit one with the heading composition and structure of the atmosphere and repeats this same heading as the second sub-heading. Further, two excerpts from text B are illustrative of incoherence between the heading and the content presented:

> **The importance of the atmosphere**
> Heat energy and the way in which it is transported in the atmosphere forms the basis of our weather. The atmosphere is vital for the transport of energy around our planet. Since the earth is neither warming up nor cooling down, there must be a balance between the amount of incoming insolation and the amount of outgoing terrestrial radiation.

The content under the heading describes heating of the atmosphere or energy in the atmosphere. Due to the mismatch, the ordering of key content is again compromised – there is lack of statement of the prime source of energy, of short wave radiation and of its link to weather and climate.

Secondly, under the heading 'composition and structure of the atmosphere' the following appears:

> **Composition and structure of the atmosphere**
> You need to study the atmosphere to see how energy is transported in the atmosphere. If all the sun's rays were to strike down on earth, there would be no life, so the atmosphere acts as a 'sun block'. It allows just the right amount of heat energy needed to maintain life on the planet (p. 2).

The correct heading for the content presented would be 'the importance of the atmosphere'.

Classificational principles

Of all four texts analysed text B does not represent the core taxonomy of the section analysed. While all three books represent gasses as permanent and variable, text B does not classify gasses into permanent and variable gasses, nor does it define these types of gasses and give examples of each. With regard to the discourse of geography, in Wignell *et al.*'s terms, the classificational and compositional taxonomy are not represented. Further, there is insufficient differentiation between different aspects – composition and structure – as both are represented under one heading.

An example of a piece of text that illustrates the taxonomic structure of concepts according to both principles of classification and composition from text A is provided below:

> **Gasses**
> The atmosphere consists of two main categories of gasses: permanent gasses and variable gasses. Permanent gasses do not change significantly in proportion while variable gasses vary from time to time and place to place. . .

The first statement is an example of the superordination principle where gasses – a general concept – is classified into two categories and the composition principle where there is further elaboration of the properties of each type of gas. In the above example the coherence across the analytical distinctions of 'two main types of gasses' and then what 'permanent gasses' and 'variable gasses' are is robust and explicit. In Wignell *et al.*'s terms, the taxonomic structure of geography as indicated by classificational and compositional taxonomies has been maintained. Text A, C and the older textbook used during the apartheid era reflect the taxonomic structure of geography in similar ways.

Explaining the experiential world

The texts include explanations of processes throughout it. Technical terms are introduced and defined through an identifying relational clause. For example, **weather** refers to the state of the atmosphere at a local level and short time scale. Processes are explained through the use of causal relations through the

use of logical connectors such as *because, caused by* and *is due to*. For example, 'temperatures in the troposphere decrease by 6.4 degrees C with every 1000m increase in altitude. This *is because* the earth's surface is warmed by incoming solar radiation…'

The incoherence in text B that arises from insufficient differentiation of its structure impacts negatively on explanations of processes. The text is characterised by more narrative descriptions (Bernstein, 2003) rather than the analytical code (Bernstein, 2003, Taylor, 2009) that characterises scientific knowledge. Consistent with Wignell *et al.*'s point, all four textbooks also do not represent explanations through transition network diagrams.

Table 3: Summary of findings

Attribute of geography	Intellectual process	Textbook A	Textbook B	Textbook C	Textbook D
A structuring structure: make meaning of experiential world	Observation, processing, collating and presenting fieldwork findings	Activity set based on empirical observation	Not investigative – more content based. Very little reference to the experiential	Not investigative – graded content based. Very little reference to the experiential	Not investigative – more content based Very little reference to the experiential
A technical lexis	Naming	Defines key terms, atmosphere and structure. Key concept definition connected to section	Key terms not defined. Less connected to section (compromises the composi-tional principle)	Defines key terms, atmosphere, structure. No definitions alongside text.	Evident

A structured structure	Taxonomising: classification based on super-ordination and compositional principles.	Distin-guishes between composition and structure. Distin-guishes between permanent and variable gasses.	Lack of contextuali-sation in meteorology – represents both under one heading. Gasses are not distinguished into permanent and variable gasses.	Main and substructure evident – meteorology, weather and climate, atmosphere, composition and structure. Distinguishes between permanent and variable gasses.	Main and substructure evident – climatology. weather and climate, atmosphere, composition and structure. Distinguishes between permanent and variable gasses.
Implication sequences – explaining processes	Use of causal resources. Transition network diagrams.	Evident Not used	Weakly evident Not used	Most evident Not used	Evident Not used

Conclusion

This paper articulates and illustrates an analytical framework for analysing the representation of the knowledge structure of geography in textbooks. It has deployed Wignell *et al.*'s analysis of the discourse of geography in the analysis of a section in four geography textbooks. While it is specific to the discipline of geography it proposes that studies of textbook content also pay attention to the rigour of recontextualisation of the knowledge structure of the parent discipline in the school subject textbook. As Muller says: "if recontextualisation totally severs any relation (between the parent knowledge structure and the recontextualised school subject), then how are specialised knowledges ever reproduced?" (2007, p.80). With reference to recontextualisation of knowledge, it suggests that drawing on theories of the nature and structure of the specific subject enhances the general sociological views of knowledge as put forward by Bourdieu and Bernstein. In other words, the use of macro theoretical formulations that provide the framework for studying the functions of symbolic forms and the processes by which they are recontextulised, together with micro analytical frameworks enable more specific analyses of the knowledge structure of symbolic forms thereby enabling establishing the relationship between the macro and the micro and the social implications of micro representations.

The textbooks analysed indicate different recontextualisations of the nature and structure of geography without a single text representing all three aspects of geography. Of the four texts analysed, three recontextualise the subject adequately, whereas text B falls short on representing the terminology, taxonomy and implication sequences of geography. It fails to represent basic, general, universally accepted classifications of the core knowledge structure of geography, is incoherent and factually inaccurate. In this regard Johnson, Dempster and Hugo (2011) note that "curricula need to reflect their parent discipline to a reasonable degree, if the reproduction of specialised knowledges is not to be undermined" (p.27).

Given Apple's (2004) view that textbooks 'dominate what students learn', 'set the curriculum' and present 'the facts learned in most subjects' the variations in the textbooks would lead to inequalities in students understanding of the subject and in performance in national examinations. It would disadvantage students who come from lower income backgrounds who might depend more heavily on textbooks for the 'facts' about the subject. For these children the school is most often the only site of acquisition of the 'analytical code' (Bernstein, 2003) and well-structured textbooks a necessary resource. As such, the use of text B to support curriculum delivery may impair the cognitive interest (Schmauss, 1994) and effect symbolic domination (Bourdieu, 1991). Uncovering the social class positioning of students using this text has been beyond the scope of this study. Given that both text A and B cost the same, the injustice is even greater. Just one of the four texts directs students to observe phenomena as starting points for learning its conceptual explanations. The absence of this in the remaining three texts may hinder students from linking their own experiences and observations to geographic terms, definitions and explanations in order to progress to learning how to make sense of objects and experiences geographically. Text C represents the technical and taxonomic structure most cohesively and it explains by the use of implication sequences. Its weakness lays in not representing geography as a symbolic form that takes its starting point from empirical or experiential objects and in limited multisemiotic modes of representation.

The weaker differentiation of concepts in text B when representing the taxonomy of geography is not only factually inaccurate but also incomplete. This would undoubtedly place students using this textbook at a disadvantage in understanding and concomitantly in performance in national examinations. Muller (2000) notes that "divisions and distinctions of ideas become knowledge only once they have become systematized or connected to each

other i.e. once they become formed into *schemes of classification. . .*" (p.1). Given Bourdieu's theory that the learning of symbolic forms enable social reproduction of symbolic forms of knowledge, then the lack of activation of the active cognitive construction of common experiences into general symbolic representations, may impair coherence across experience and symbolic form, thus impairing the 'structuring structure' role of symbolic forms.

Finally the implications of the findings point to the need for high quality textbooks to be developed that represent the knowledge structure of the parent discipline well. This analysis shows, firstly, that a high quality text would: contextualise the section within its overarching discipline; number the main and sub-headings that correspond to the accepted core structure of subject; represent the facts accurately, represent the classificational and compositional taxonomic structure fully, provide full descriptions of the properties of each category, require students to reflect on their perceptual experiences; use multisemiotic modes of representations such as diagrams to illustrate concepts, tables that summarise the text and include images and photographs that make linguistic descriptions real. Secondly, that choice of texts to support public education be based on an objective evaluation of the extent to which the nature and structure of the discipline is represented. Thirdly, that textbooks be developed by writers adequately qualified in the discipline who would be able to represent the structure of the subject better. Given that the majority of South African schools are ineffective (Taylor, 2009) high quality textbooks create the possibility of disruption, even if at the level of individual exceptions, of the "correspondence between social structures and mental structures" (Wacquant, 2007, p. 7) that is evident in the social universe.

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