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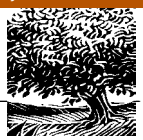

A Bernsteinian Analysis of the Integration of Natural Resource Management in the Curriculum of a Rural Disadvantaged School

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Abstract

Knowledge integration is one of the key principles that underpin curriculum reform in post-apartheid South Africa. One form of teacher support that has been adopted in South Africa is to provide schools throughout the country with samples of pedagogic texts such as curriculum documents and examination exemplars to act as guidelines to teachers as they implement this new curriculum requirement. In the isolated and under-resourced rural schools of South Africa, these texts are the main form of curriculum guidance to teachers. Hence the knowledge integration principles and messages conveyed within these texts are of crucial importance. One contributory factor to the lack of information on knowledge integration at rural under-resourced schools is the lack of simple and effective research tools by which to analyse and compare the extent of knowledge integration within pedagogic texts and classroom practices. This article reports on a Bernstein-informed analysis that was carried out on three different Grade 10 Life Sciences pedagogic texts in order to assess the extent to which they integrate natural resource management (NRM). The study involved the construction of two indicator frameworks as the research tools with which the analysis was conducted. Results from the analysis showed that although the official Grade 10 Life Sciences pedagogic texts contained very high levels of NRM integration, this was not the case for the Grade 10 Life Sciences text that was produced at the school level. The study provides useful insight into curriculum recontextualisation at a rural under-resourced school through the lens of NRM integration within the Grade 10 Life Sciences pedagogic texts. Such insight has the potential to contribute to better curriculum design and implementation strategies to service schools. This will hopefully help to narrow the gap that currently exists between the official and enacted curricula.

Introduction

Knowledge integration is one of the key principles that underpin curriculum reforms in post-apartheid South Africa. This principle has a strong tradition in the field of environmental education, where following the 1977 Tbilisi Declaration, practitioners in the field were encouraged to take an interdisciplinary approach to the field (UNESCO/UNEP, 1978). The principle of integration in environmental education was also stressed in South Africa's White Paper on education which notes that:

> Environmental education, involving an interdisciplinary, integrated and active approach to learning, must be a vital element of all levels and programmes of the education and

> training system, in order to create environmentally literate and active citizens and to ensure that all South Africans, present and future, enjoy a decent quality of life through the sustainable use of resources. (DoE, 1995:18)

As outlined in the Tbilisi Declaration, an interdisciplinary approach to environmental education involves the inclusion of content from various disciplines during the designing and implementation of environmental learning programmes, thus facilitating a holistic approach to environmental education. Ruhinda (2004) notes that in South Africa's most recent curriculum initiative, the National Curriculum Statement, educators are expected to draw on the unique contents of the various subjects under this curriculum, and to provide learners with the knowledge, skills, values and commitment necessary for making informed decisions about sustainable lifestyles. Teachers are also expected to utilise each subject's Learning Outcomes and Assessment Standards to enhance environmental learning in their classroom practices.

Unfortunately, we do not have much information on how this key feature of environmental education curriculum design is being implemented in most of the rural and disadvantaged schools in South Africa. Although some research has been done in this field, most of it has involved isolated case studies, or studies which were incidental to this research focus. However, the few cases that have focused on environmental education paint a somewhat dismal picture of environmental learning in rural schools. For example, in the Learning for Sustainability Pilot Project research, Janse van Rensburg and Lotz-Sisitka (2000) found that the lack of basic knowledge about environmental issues among teachers compromised the quality of their lesson plans. In Ruhinda factors such as lack of funds, relevant educational materials and external support are quoted by teachers as impeding their attempts to infuse environmental education in their teaching practices (Janse van Rensburg & Lotz-Sisitka, 2000). Unfortunately, studies such as these are few, and much of what is taking place with regards to integrating environmental education into the curriculum of rural schools remains under-researched and undocumented.

One major drawback to researching environmental education integration practices at schools is the lack of quality research tools with which to analyse and monitor the integration of environmental education into curriculum documents and classroom-based practices. Ensor and Hoadley (2004) are critical of many of the research tools that have been used so far to research pedagogy in South Africa's schools, describing them as under-theorised and based on preconceived and uninterrogated ideas about pedagogy. These authors call for the development of research tools which are based on strong theory rather than common-sense understanding and judgements on the part of the researcher. If such research tools are made accessible to teachers working in rural, isolated and disadvantaged schools, they can be used to generate data on their own environmental education integration practices. This will go a long way towards filling the void in our knowledge about environmental education integration practices in rural disadvantaged schools. It also has the potential to contribute towards better environmental education curriculum design for such schools, as a result of the insight gained into their environmental education implementation practices. Teachers also stand to gain from professional development gained from working with these research tools, through, for example, action research.

This article reports on a small study which was conducted at a rural school in the Peddie District of the Eastern Cape. The study had three major aims. The first aim was to construct an analytical framework that can be used to assess the integration of natural resource management (NRM) within various pedagogic documents. The second aim was to use this research tool to trace the trajectory of the NRM integration process, starting from the official Grade 10 Life Sciences curriculum policy and following it to its implementation in the Grade 10 Life Science classroom at this school. Overall, the goal of the study was to obtain insight into the environmental education curriculum interpretation and implementation processes as they occur in an isolated rural and disadvantaged Eastern Cape school. Put another way, the study researched the implementation of the environmental education curriculum policy at a rural disadvantaged school through the lens of NRM integration within the Grade 10 Life Sciences curriculum documents and other pedagogic texts. The research aimed to answer the following research questions:

- To what extent does the Grade 10 Life Sciences curriculum integrate NRM?
- To what extent does the Grade 10 examination exemplar papers (Paper 1 and 2) integrate NRM?
- To what extent does the school's end-of-year Grade 10 Life Sciences examination integrate NRM?

Theoretical Framework

This study is based on three ideas of Bernstein (1996), specifically his concept of 'classification', his model of the structure of the pedagogic device, and his theory of curriculum recontextualisation. 'Classification' is one of Bernstein's best known and better researched concepts. He uses this term to conceptualise power relations between different categories within pedagogic contexts – for example, discourses, subjects, practices and spaces. According to him, it is the degree of isolation between the different categories that constitute power relations, rather than their contents. Giving an example of subjects within a given curriculum, Bernstein explains that subjects that are powerful maintain strong boundaries between themselves and the rest of the subjects in the curriculum. As such, they are able to develop and maintain their unique identities and rules. Bernstein calls this 'strong classification'. Weak subjects, on the other hand, are surrounded by weak boundaries which allow cross-exchanges to occur amongst them, which lead to the loss of their unique identities and rules. Bernstein calls this 'week classification'. He proposes a four-point scale by which the degree of isolation between pedagogic entities could be expressed: C++ for very high level of isolation (very high classification), C+ for high level of isolation (high classification), C- for high level of integration (weak classification) and C-- for very high level of integration (very low classification). Bernstein's concept of 'classification' provides a language and lens with which to analyse and describe changes in the organisation of subjects within a given curriculum following curriculum reform, or curriculum recontextualisation processes. It can also be used to analyse power relations between recontextualising agents and agencies.

Bernstein was also interested in the structure of the system that is responsible for the formation and delivery of educational knowledge. He described it as a relay system and coined the term 'pedagogic device' to refer to it (Bernstein, 1996). According to him, the pedagogic device is constituted from three hierarchically related fields. The first field is called the production field, and forms the social space where new knowledge is produced; for example, by universities and private research institutions. From the field of production this specialist knowledge goes to the field of recontextualisation. According to Bernstein, the recontextualising field consists of two sub-fields: the official recontextualising field (ORF); and the pedagogic recontextualising field (PRF). The ORF consists of state agencies and their agents, such as the national and provincial education departments, and the system of school inspectors and subject advisers. The PRF consists of, *inter alia,* university education departments and other teacher training institutions, NGOs, teacher unions, textbook writers and publishers, and writers and readers of academic education journals. Bernstein defined recontextualisation as the process by which educational knowledge is transferred from one educational site to another. Recontextualisation also takes place in the classroom when teachers work with pedagogic texts produced in the ORF and PRF to create their own texts and pedagogic practices. Thus the classroom forms the third field of the pedagogic device, the field of reproduction.

As knowledge is transferred from one educational site to another, it is subjected to differing ideologies, interests and contexts of the agents and agencies who occupy those sites. By the time the knowledge reaches the reproduction field, it differs markedly from what was produced in the field of production. Bernstein posits that between them, the agencies of the pedagogic device, together with their agents, compete for control of the pedagogic device. Whoever controls the pedagogic device gets to determine not only the contents of what is transferred (i.e. the curriculum content), but also the methods by which it is transferred (i.e. theory of instruction) and evaluated (i.e. the assessment systems). Hence the trajectory of curriculum recontextualisation processes, the identity of the different agents and agencies that are involved, the degree of autonomy between them, their underlying ideologies and how these affect the recontextualising process and the final product, should be of concern to curriculum designers, implementers and researchers.

Method

The research process involved the construction of two indicators frameworks as the research tools with which to analyse the extent of NRM integration within three different pedagogic documents. The first indicator framework was used to establish NRM integration within the National Curriculum Statement for Grade 10-12 (General) document, while the second framework was used to analyse both the Grade 10 Life Sciences examination exemplars (Paper 1 and 2) and the school's end-of-year Grade 10 Life Sciences examination paper. The indicators used in the construction of the frameworks were selected on the basis of what were judged to be key criteria of NRM integration within the different documents. These criteria were decided on after careful examination of the above-mentioned documents. For the analysis of the National Curriculum Statement for Grade 10-12 (General) document, the criteria under

which the integration of NRM was analysed were: definition of Life Sciences, purpose of Life Sciences, Learning Outcomes, Knowledge Areas, Assessment Standards and Glossary terms. For the analysis of the Grade 10 Life Sciences examination exemplar, and the school's end-of-year Grade 10 Life Sciences examination paper, the criteria used were: topic on which the questions were based, allocation of marks, illustrations in the paper, investigations in the paper, and the topic of the essay question in Question 4.

For each criterion, one indicator was used to further examine the status of NRM integration. Hence the analysis of the integration of NRM within the National Curriculum Statement for Grade 10-12 (General) document involved a total of six indicators, while that of the Grade 10 Life Sciences examination exemplars and the school's Grade 10 Life Sciences examination paper involved five indicators. Care was taken in the selection of indicators of NRM integration within the documents under study. For example, the indicators had to be relevant to NRM

Table 1. The indicator framework used to analyse the extent of NRM integration within the National Curriculum Statement for Grade 10–12 (General) document

Indicator	C++	C+	C-	C--
Reference to NRM in the Life Sciences (LS) definition	Refers only to LS knowledge – no reference at all to NRM or related issues	Reference to NRM and related issues are implicit	Makes explicit reference to NRM-related issues only	Makes explicit reference to both NRM and related issues
Reference to NRM in the stated purpose of LS	Refers only to living organisms and biological processes – no reference at all to NRM or related issues	Includes implicit reference to NRM and related issues	Includes explicit reference to NRM-related issues only	Includes explicit reference both to NRM and related issues
Reference to NRM in the Learning Outcomes	All refers only to LS – none refer to NRM and related issues	Make implicit reference to NRM and related issues	Make explicit reference only to NRM-related issues	Make explicit reference both to NRM and related issues
Reference to NRM in the Assessment Standards	All refer only to LS – none refer to NRM and related issues	Make implicit reference to NRM and related issues	Make explicit reference only to NRM-related issues	Make explicit reference both to NRM and related issues
Reference to NRM in the Knowledge Areas of LS	All are specific to LS – exclude NRM and related issues	Have topics that relate to NRM and related issues only in a general way	Have topics that explicitly deal only with NRM-related issues	Have topics that explicitly deal with both NRM and related issues
% of terms in the Glossary that are NRM related	All terms are specific to LS – no NRM-related terms at all in the Glossary	% of NRM-related terms is less than 5%	% of NRM-related terms is 5-10%	% of NRM related terms is more than 10%

integration, easy to understand and evaluate, and based on data that are readily available in the documents that were being studied. The status of each selected indicator with regards to NRM integration was determined either qualitatively or qualitatively, depending on the nature of the indicator, and allocated a classification level according to Bernstein's scale – C++ for very strong classification (very low level of NRM integration); C+ for strong classification (low level of NRM integration), C- for weak classification (high level of NRM integration) and C-- for very weak classification (very high level of NRM integration). The indicator frameworks together with the assessment criteria that were used to analyse the extent of NRM integration within the various pedagogic documents are shown in the Table 1 and Table 2. To facilitate comparisons of the integration of NRM between different indicators in a given document, and between the different documents, the results from the analysis were graphically illustrated with the aid of radar diagrams (see Figures 1–3).

Table 2. The indicator framework used to analyse the extent of NRM integration within the Grade 10 exemplar papers, and the Grade 10 Life Sciences end-of-year school examination paper

Indicator	C++	C+	C-	C--
Proportion of questions which refer to NRM and related issues	All questions refer only to LS – no questions on NRM and related issues in the paper	A few questions refer to NRM and related issues (below 5%)	Some questions refer to NRM and related issues (5–10%)	Many questions refer to NRM and related issues (above 10%)
Proportion of marks allocated to questions on NRM and related issues	All marks were allocated to LS – no marks allocated to NRM and related issues (0%)	A few marks allocated to NRM and related issues (below 10%)	Some marks allocated to NRM and related issues (10-20%)	Many marks allocated to NRM and related issues (above 20%)
Proportion of illustrations on NRM and related issues in the paper	All illustrations were specific to LS – no illustrations on NRM and related issues in the paper	A few of the illustrations were on NRM and related issues (below 5%)	Some of the illustrations were on NRM and related issues (5-10%)	Many illustrations on NRM and related issues in the paper (above 10%)
Proportion of NRM-related investigations in the paper	All the investigations were specific to LS – no investigations on NRM and related issues in the paper (0%)	A few investigations were on NRM and related issues (below 5%)	Some investigations in the paper were on NRM and related issues (5–10%)	Many of the investigations in the paper were on NRM and related issues (above 10%)
Nature of essay topic in Question 4	Essay question is on LS only	Essay question refers generally to LS and NRM	Essay question refers implicitly to NRM	Essay question refers explicitly to NRM and related issues

Results

Integration of NRM within the National Curriculum Statement for Grade 10-12 Life Sciences (General) document

Reference to NRM in the Life Sciences definition
Although the definition of Life sciences in this document does not refer specifically to NRM, it refers to the need for learners to develop an '... understanding of the relationship between Life Sciences, technology, environment and society ...' (DoE, 2003:XXX). Using the indicator framework outlined in Table 1, the integration of NRM within this definition was identified as being high and was given the classification value of C-.

Reference to NRM in the stated purpose of Life Sciences
One of the stated purposes of Life Sciences in this document is to '... allow learners to apply knowledge and skills in a way that will lead to a sustainable management of resources and life support systems' (DoE, 2003:XXX). Using the indicator framework outlined above, the integration of NRM with the stated purposes of Life Sciences was identified as being very high and was allocated a classification value of C--.

Reference to NRM in the Learning Outcomes of Grade 10 Life Sciences
The National Curriculum Statement for Grade 10 Life Sciences has three Learning Outcomes (DoE, 2003:3). Learning Outcome 1 (Scientific inquiry and problem skills) expects learning and teaching to focus on '... exploring and investigating environmental, biological ... systems in everyday life using inquiry, problem solving and critical thinking skills.' For Learning Outcome 2 (Construction and application of Life Sciences knowledge), learners are expected to collect and share information and experiences from the world around them. For Learning Outcome 3 (Life Sciences, technology, environment and society), learners are expected to demonstrate an understanding of '... interrelationships of science, technology, indigenous knowledge the environment and society'. None of the Learning Outcomes makes direct, specific reference to NRM. However, NRM-related concepts such as indigenous knowledge, the environment and society are explicitly mentioned. Using the indicator framework outlined in Table 1 above, the overall integration of NRM within the Learning Outcomes was identified as being high and was given a classification value of C-.

Reference to NRM in the Assessment Standards of Grade 10 Life Sciences
Although the National Curriculum Statement for Grade 10 Life Sciences has nine Assessment Standards (DoE, 2003), only one (Assessment Standard 8) was NRM related. For this Assessment Standard, learners are expected to be able to compare and evaluate the uses and development of resources and products and their impact on the environment and society (DoE, 2003). The integration of NRM within this assessment standard was judged to be very high. It was decided to allocate the overall classification value for the Assessment Standards a value of C--.

Reference to NRM in the Knowledge Areas of Grade 10 Life Sciences

The environment forms one of the Knowledge Areas of Grade 10 Life Sciences. Topics under this heading include human influences on the environment, and the management and maintenance of natural resources. Another Knowledge Area 'Diversity, change and continuity' (DoE, 2003) includes topics on biodiversity, its importance, threats and conservation. Using the indicator framework outlined in Table 1, the integration of NRM within the Life Sciences Knowledge Areas was identified as being very high and was given a classification value of C--.

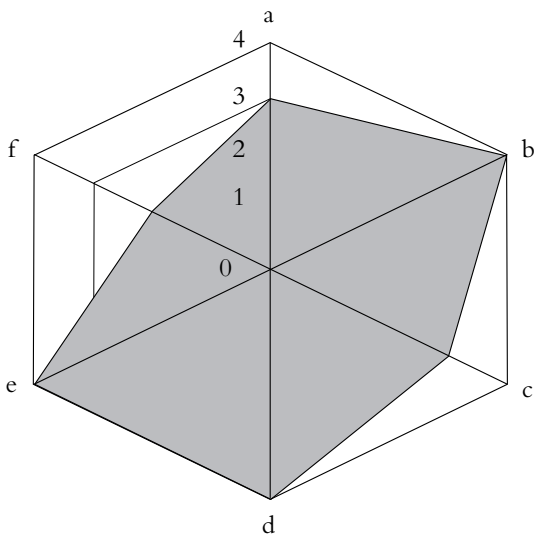
Percentage of terms in the Glossary that are NRM-related

Of the 30 terms in the Glossary, only two were NRM related (7%). The rest of the terms were mostly focused on investigation and the scientific research method. Using the indicator framework outlined in Table 1, the Glossary had a low level of NRM integration and was allocated a classification value of C+.

Synthesis of findings

As mentioned in the methodology section above, radar diagrams were used as a means of representing the findings derived from this analysis. These were used to make the results accessible and easy to interpret and follow. Figure 1 shows the synthesis results on NRM integration in the National Curriculum Statement for Grade 10 Life Sciences document.

Figure 1. A radar diagram illustrating the integration of NRM within the National Curriculum Statement for Grade 10 Life Sciences document



Key to indicators
a - Reference to NRM in the Life Sciences definition
b - Reference to NRM in the stated purpose of Life Sciences
c - Reference to NRM in the Learning Outcomes
d - Reference to NRM in the Assessment Standards
e - Reference to NRM in the Knowledge Areas of Life Sciences
f - Percentage of terms in the Glossary that are NRM related

Key to NRM integration levels
1 - Very low
2 - Low
3 - High
4 - Very high

The Grade 10 Life Sciences exemplar examination papers

The two exemplar examination papers were combined and analysed as one document since analysing them separately would have been repetitious, and analysing them as one document would not have affected the findings in any way. The results were derived from using the analytical tools outlined in Table 2.

Proportion of questions which refer to NRM and related issues

The two examination exemplars had a total of 123 questions between them, of which 19 were based on NRM (15%). Using the indicator framework in Table 2, the integration of NRM within the questions was identified as being high and was allocated a classification value of C--.

Proportion of marks allocated to questions on NRM and related issues

The total marks for the two examination exemplars were 300, out of which 56 marks (19%) were allocated to questions that were NRM related. Using the indicator framework in Table 2, the integration of NRM in the way marks were allocated was identified as being high, and was given a classification value of C-.

Proportion of illustrations on NRM and related issues in the paper

Between them, the two exemplar papers had a total of 13 illustrations, of which two (13%) were NRM related. Using the indicator framework in Table 2, the integration of NRM in the illustrations used in the exemplars was identified as being very high and was allocated a classification value of C--.

Proportion of NRM-related investigations in the paper

The two exemplars contained a total of six investigations, two of which (33%) were NRM related. Using the indicator framework in Table 2, the integration of NRM into the investigations set in the exemplars was judged to very high, and given a classification value of C--.

Nature of essay topic in Question 4

While the essay topic in Paper one was only implicitly linked to NRM, that in Paper two made explicit references to NRM. Using the indicator framework in Table 2, the integration of NRM in the essay topics for Question 4 was identified as being very high, and was allocated a classification value of C--.

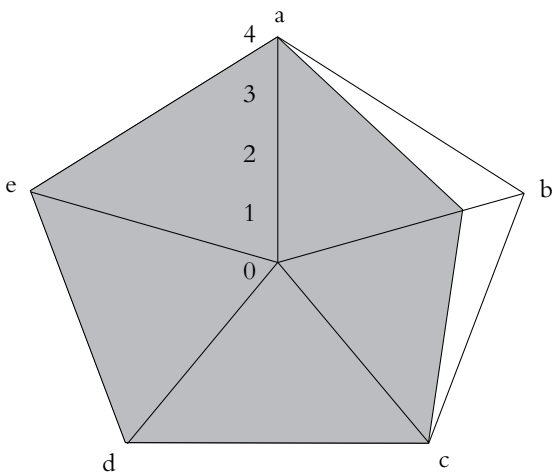
Synthesis of results

The results of this analysis are synthesised in a radar diagram, and are shown in Figure 2.

The school's end-of-year Grade 10 Life Sciences examination paper

The analysis of the examination paper set by the teacher presented a special challenge. First of all, although the National Curriculum Statement for Grade 10 Life Sciences (General) stipulates that there should be two papers set, each two-and-a-half hours long and worth 150

Figure 2. A radar diagram illustrating the integration of NRM within the Grade 10 Life Sciences examination exemplar papers



Key to indicators
a - Proportion of questions which refer to NRM and related issues
b - Proportion of marks allocated to questions on NRM and related issues
c - Proportion of illustrations on NRM and related issues in the paper
d - Proportion of illustrations on NRM and related issues in the paper
e - Proportion of NRM-related investigations in the paper
f - Nature of essay topic in Question 4

marks, the teacher set only one two-hour paper, and it was out of 100 marks. Although both exemplars contained illustrations, investigations and essay questions, the paper set by the teacher had none of these. There was no essay question in Question 4 of the paper. Hence the nature of the paper was such that only two indicators could be applied to the review.

Proportion of questions which refer to NRM and related issues
The paper contained a total of 39 separate questions, all of which were specific to Life Sciences. There was no integration of NRM at all in the questions, and based on the indicator framework in Table 2, a classification value of C++ was allocated to this indicator.

Proportion of marks allocated to questions on NRM and related issues
There being no questions set on NRM or related topics, no marks could be allocated to NRM. Based on the indicator framework in Table 2, a classification value of C++ was allocated to this indicator.

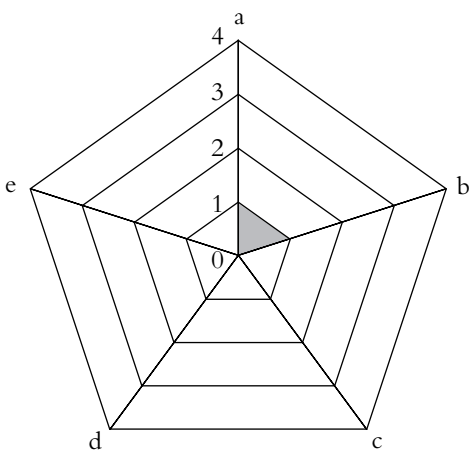
Proportion of illustrations on NRM and related issues in the paper
Since there were no questions based on illustrations in the paper, this indicator could not be used in this analysis.

Proportion of NRM-related investigations in the paper
Since the paper contained no questions based on investigations, this indicator could not be used in this analysis.

Essay topic for Question 4
There was no easy question in the paper. Most of the questions required one word answers, or a single sentence answer. Hence this indicator could not be used in this analysis.

Synthesis of results
As in the previous two analyses, a radar diagram was used to represent the results for ease of access. Figure 3 reflects the synthesis of this analysis.

Figure 3. A radar diagram illustrating the integration of NRM within the school's end-of-year Grade 10 Life Sciences examination



Key to indicators
a - Proportion of questions which refer to NRM and related issues
b - Proportion of marks allocated to questions on NRM and related issues.
c - Proportion of illustrations on NRM and related issues in the paper
d - Proportion of illustrations on NRM and related issues in the paper.
e - Proportion of NRM-related investigations in the paper
f - Nature of essay topic in Question 4

Discussion

The indicator frameworks

The most commonly used approach to determine the extent by which a particular subject is integrated within a curriculum document, is to make the sentence the unit of analysis and compute the frequency of occurrence of sentences which refer to that subject across the entire document (see Bertram 2005; Nsubuga, 2006). This approach could not be used in this study

for the following reasons. The National Curriculum Statement for Grade 10 Life Sciences document is interspersed with material for Grade 11 and 12. In addition, large sections of this document contain information which is not of immediate relevance to the teaching and learning of Life Sciences or NRM. Including such sentences would have introduced a bias in the analysis. Secondly, some of the information in the documents is presented in bullet form, making it difficult to discern where one sentence begins and ends. For these reasons individual sentences could not be used as the units of analysis in this study.

The indicator frameworks proved very useful in providing in-depth tools for analysing integration of NRM within the documents. The key to effective analysis lay in identifying the key criteria of NRM integration within the documents (these differed across documents), and selecting suitable indicators for them. The radar diagrams used to display the results from the analysis are easy to draw and interpret, even for inexperienced researchers. Their other advantage is that they facilitate visual comparisons of NRM integration levels – not only between the different indicators in a given document, but also across the different documents. In addition, areas of NRM integration which need attention can easily be identified from the radar diagrams. However, caution needs to be exercised when drawing conclusions based on NRM integration levels determined from small sample sizes. This was the case for the analysis of NRM integration in illustrations and investigations within the exemplar examination papers which involved percentages calculated from samples of 13 and six items, respectively. However, this was counterbalanced by the larger number of indicators for which NRM integration levels were interpretively determined.

Another challenge was presented where the indicator had different NRM integration values for the same criterion. For example, in analysing the integration of NRM within the Assessment Standards, only one out of nine made a direct reference to NRM. In this case, the overall integration for the criterion was based on the indicator which reflected high or very high levels of NRM integration since this Assessment Standard. Another factor which needs to be considered is the weighting given to different indicators. In this study it was assumed that all the indicators were of equal importance and were given the same weighting. In reality, this is unlikely to be the case. For example, in the examination paper exemplars, the indicators for allocation of marks of to NRM could be seen by some as being more important than the indicator for proportion of questions based on NRM. The weighting of the indicator is one of the early decisions which have to be taken by the researcher who uses this approach. In the case of this study, I chose to weight all indicators equally to avoid an over-complex instrument which would not be accessible to teachers. I also considered that weighting all indicators equally would give a better overall view of NRM integration.

The National Curriculum Statement for Grade 10-12 Life Sciences (General)

The National Curriculum Statement for Grade 10 Life Sciences represents the intended curriculum for this subject. This document was produced by the Curriculum Innovation Directorate, which falls under the Further Education and Training branch of the National Department of Education. These entities fall under the direct control of the state, and their publications on Grade 10 Life Sciences represent the official discourse in this field. Bernstein

(1996) refers to this type of text as the official pedagogic discourse (OPD). With three of the indicators used to analyse this document reflecting a very high level of NRM integration, it can be concluded that the underlying curriculum message in this document supports the integration of NRM into the teaching and learning of Grade 10 Life Sciences.

The Grade 10 Life Science exemplar examination papers represent another form of OPD. The Directorate of Further Education and Training Examinations and Assessment (Schools), which also falls within the national Department of Education, is responsible for producing these exemplars. Their production involved the recontextualisation of the National Curriculum Statement for Grade 10 Life Sciences by officials in this directorate. Following the 2006 introduction of the National Curriculum Statement in Grade 10 in schools throughout South Africa, examination exemplars papers in different subjects have been distributed to schools teaching the National Curriculum Statement for Grades 10-12 throughout the country, as a form of teacher support in implementing the new curriculum requirements. The curriculum messages conveyed within the Grade 10 examination exemplars are supposed to act as guidelines to teachers in their own Grade 10 Life Sciences assessment practices and by default, to classroom practices as well. With four of the five indicators used to analyse the exemplars revealing a very high level of NRM integration, it can be concluded that, like the National Curriculum Statement for Grade 10 Life Sciences, the underlying curriculum message in the exemplars supports the integration of NRM into the Grade 10 Life Sciences curriculum.

The Curriculum Innovation Directorate and that of Further Education and Training Examinations and Assessment (Schools) are not only under direct sate control, but they also fall under the same state department. According to Bernstein (1996), the less autonomy there is between curriculum recontextualising agents or agencies, the less potential there is for changes to the curriculum during the recontextualisation process. The two directorates (who can be described as official recontextualisers working in the official recontextualising field) are under direct state control, and occur within the same department. In Bernstein language, the degree of isolation between the two departments is small: hence the similarity in their underlying messages regarding the integration NRM within the Grade 10 Life Sciences curriculum.

The school's end-of-year Grade 10 Life Sciences examination paper

End-of-year examination papers are part of the enacted curriculum and represent one of the major pedagogic texts produced by teachers in Eastern Cape's rural disadvantaged schools. The production of these texts involves recontextualisation by teachers of the curriculum documents produced in the ORF and the PRF. As noted by Bernstein (1996), the direction taken by the recontextualisation process at the reproduction level of the pedagogic device depends much on the school's context, the teachers' pedagogic practices, and the relationship between the school and the community it serves. Overall, this study revealed that although the teacher had ORF texts which advocated a high level of NRM integration in her possession, she was unable or unwilling to integrate NRM into one of her major pedagogic texts.

Using Bernsteinian language, the 'space' between the ORF texts (produced by the national department of education) and school's examination paper is marked by a very strong boundary, i.e. it is characterised by very high classification. This is due to the isolation between the ORF

and the reproduction field (represented by the Grade 10 Life Sciences lessons at the school). As a result, according to Bernstein, each field develops its own unique 'voice' internal rules and procedures. For example, while the unique 'voice' 'of the ORF emphasises the integration of NRM into the teaching, learning and assessment of Grade 10 Life Sciences curriculum, that of the reproduction field excluded NRM (at least in the end-of-year Grade 10 Life Sciences examination). It is important to realise that for rural schools this isolation is more than the physical distances between the ORF and the reproduction field. Although the physical isolation of the two fields could be playing a key role in determining the final direction of the teacher's recontextualising process (for instance, by hindering the extent by which the teacher's activities in the reproduction field can be monitored), there are other possible forms of isolation that need to be taken into consideration. For example, the isolation could be cognitive, in that the teacher failed to understand the NRM-related messages that the Grade 10 Life Sciences National Curriculum Statement and exemplars were conveying. It is also possible that isolation was resource- or knowledge-based in that the curriculum messages in the ORF texts were based on assumptions about key NRM-related educational resources, skills or knowledge which are not available at this school. The need to understand the interplay between these factors and the curriculum recontextualising process in rural disadvantaged educational contexts cannot be overemphasised. In other words, there is a need to unravel not only the trajectories of the NRM curriculum recontextualisation processes as they occur in rural and disadvantaged education settings, but also the complexities of the contexts under which these processes occur. The insight so gained will contribute to better NRM curriculum design and implementation polices for rural schools. Hopefully, this will go along way towards narrowing the gap that seems to exist between the official NRM curriculum policies and their enactment within rural disadvantaged education contexts.

Notes on the Contributor

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