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RESEARCH REPORT

The Role of Everyday Contexts in Learner-centred Teaching: The practice in Namibian secondary schools

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This paper reports on the use of out-of-school everyday contexts in Namibian science classrooms. This use is portrayed against the backdrop of an explicit educational philosophy of learner-centred teaching. Data were collected through audio-taped teacher-learner interactions and non-participant field notes in 29 junior and senior science classes taught by 12 teachers in six schools. An existing typology was applied to classify episodes of use of everyday contexts and identify teachers' pedagogic strategies for their use. The results show that more everyday contexts are used in junior secondary than in senior secondary classes, that only a limited range of types of everyday contexts are used at both levels, and that their use often follows theoretical exposition or teacher questioning. These findings are related to three interpretations of learner-centred teaching. Recommendations for a fuller implementation of learner-centred teaching are made.

Introduction

In a typology of curricula linking Science, Technology and Society, Aikenhead (1994) provides a spectrum of possible curricula grouped into:

- *context-infused curricula*—science courses that incorporate issues from society (and/or technology);
- *context-based curricula*—science courses taught through issues from society (and/or technology); and
- *context-focused curricula*—courses about issues in society (and/or technology) including the required science.

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This paper describes teachers' use of everyday contexts *infused* into their science teaching. Arguments for the inclusion of everyday contexts in science education have been put forward from two partly overlapping perspectives; that is, their effectiveness for achieving particular learning outcomes and their desirability for an appropriate curriculum. These perspectives will be discussed in turn.

The Use of Everyday Contexts for Improving Learning

For context-based science courses, a large body of literature exists about the teaching strategies used and about their learning and motivational effects (for an overview see Bennett & Holman, 2002). However, research into the learning effect of the use of everyday contexts infused in science lessons is limited and inconclusive. Rubba, McGuyer, and Wahlund (1991) reported that occasional reference to societal issues (they call it the use of "Science, Technology and Society vignettes") did not improve American high school students' understanding of the related science concepts. They speculate that it may improve students' long-term attitudes and beliefs. On the other hand, Dahncke, Behrendt, and Reiska (2001) studied two groups of secondary school students in Germany and Estonia. One group followed traditional content-based science lessons and the other followed such lessons infused with everyday contexts. Their results show that the conceptual attainment of the latter group increased significantly. The students in the experimental group also had a greater competence in science-based decision-making. Tsai (1999) concluded from a randomized controlled trial in a Taiwanese high school that the use of references to Science, Technology and Society issues improved students' understanding of the nature of science and the way scientific knowledge is constructed. However, she noted that these improved ideas are mainly held tacitly and thus seemed to have limited currency for transfer to new situations. No reports have been found on the use of context-infused science courses in developing countries.

When considering the learning effects of the use of everyday contexts in science teaching, the differences in the methods of knowledge construction in everyday and scientific domains need to be recognized. Reif and Larkin (1991) suggest that in the scientific domain models and definitions are judged on their generalizability, consistency, and precision, and their power of prediction and explanation, whereas in the everyday domain definitions require only a localized consistency for an implicitly defined audience. Concepts in the scientific domain are based on rules and follow a coherent logic. In contrast, everyday concepts are based on experiential schema and are organized through associations with only limited coherence. Sloman (1996) confirms these differences by positing that the scientific domain requires strict "rule-based" reasoning, whereas in the everyday domain this may be complemented by "associative thought".

The transition between both domains requires "border crossing" (Aikenhead, 1996). According to Costa (1995), the ease of crossing borders depends on the learner's relative match of three domains—the everyday, school, and science domains. In a study of learners' perceptions of these three domains, she finds that

potential scientists (their everyday world is congruent with both school and science worlds) and *other smart kids* (their everyday world is congruent with school but inconsistent with the science world) do well in school science and cross borders easily. However, *outsiders* (their everyday world is incompatible with both school and science worlds) and *inside outsiders* (their everyday world is irreconcilable with school but may be congruent with the science world) find border crossing almost impossible. For these learners, barriers result from their alienation from science as a “foreign country” or by the distrust of school and science teachers. Jegede and Aikenhead (1999) suggest the explicit teaching of instances of border crossing through extensive use of student discourse about their cultural everyday domain *or* the scientific domain without influences from across the border between these.

The Use of Everyday Contexts for Curriculum Appropriateness

Over the past decade, the use of everyday contexts in science classroom teaching has been promoted in Africa for purposes of curriculum relevance. The drive for political and social self-confidence has encouraged building science curricula based on learners' everyday experiences. This is expressed strongly through curricula highlighting local cultural achievements, including those in indigenous technology, for example in Ghana (Yakubu, 1994), Mozambique (Baloi, 1994) and Swaziland (Lubben, Campbell, Maphalala, & Putsoa, 1998). Secondly, the use of rural learners' everyday experiences of agricultural practices is portrayed as providing meaningful learning (Taylor & Mulhall, 2001), and a way of widening access to education (Peacock, 1995). However, Vlaardingerbroek (1998) contends that increased access to schooling in agrarian societies is, in itself, not a measure of development, and may even retard economic development if there is no balance between investment in education and (in)direct economic returns. Thirdly, everyday contexts are used to allow learners to take control over their own learning. Lubben, Campbell, and Dlamini (1996) found that learners using a context-based approach increase their participation in class and help determining what is to be learned.

Since independence in 1990, the school curriculum in Namibia, as in many other developing countries, rests on a learner-centred approach. The rhetoric surrounding the introduction of the new education system contrasts the pride of building on sociocultural achievements of diverse groups of Namibian society with the apartheid-based education system demanding learners' compliance and reinforcing their inferiority (Angula & Grant-Lewis, 1997). In Government policy documents, a learner-centred approach is described thus:

- (a) The starting point is the learner's existing knowledge, skills, interests and understandings, derived from previous experience in and outside school.
- (b) The natural curiosity and eagerness of all young people to learn to investigate and to make sense of a widening world must be nourished and encouraged by challenging and meaningful tasks.
- (c) Learners should be empowered to think and take responsibility not only for their own, but also for one another's learning and total development.

- (d) Learners should be involved as partners in rather than receivers of educational growth. (Ministry of Education and Culture, 1993, p. 60)

The earlier description of a learner-centred approach identifies all three curriculum arguments for the use of everyday contexts in science teaching; that is, building on sociocultural achievements, widening access, and promoting learners' empowerment. This study surveys the use of everyday contexts as an indicator of the ways that learner-centred approaches are implemented in class.

Although the rhetoric of learner-centred teaching seems straightforward and coherent, curriculum interpretation shows a more fractured picture. At least three interpretations of learner-centred teaching exist side by side (Swarts, Dahlstrom, & Zeichner, 2001). The first interpretation focuses on the nature of the selected curriculum content and the degree to which it matches the learners' interest and experience. It emphasizes the need to use learners' existing knowledge and skills (referring to point (a)), and to include learners' everyday experiences in topics to be taught. These everyday experiences may be used to introduce a topic, or as illustrations after presenting theoretical content. The second interpretation of learner-centred teaching focuses on involving learners in classroom activities (Dahlstrom, 1995). This strand, referring to point (b), is exemplified by teaching strategies involving learners in question-and-answer sequences. It also coincides with the tradition of active learning (for instance, see Kyriacou, Manowe, & Newson, 1999) with an emphasis on various forms of group work as desirable learning activities. The third interpretation of learner-centred teaching (referring to points (c) and (d)) focuses on allowing learners to share responsibility for their own learning. Here the keyword is empowerment, and the criterion is making meaning (Swarts et al., 2001).

This paper reports on a study of the types of everyday contexts and the strategies for which they are used in science classes. As such, the data also indicate the extent of learner-centred teaching taking place, and how teachers use this approach. The following research questions are addressed:

1. To what extent are learners' everyday experiences used in science lessons?
2. What types of everyday contexts are used?
3. How does the use of context differ for junior and senior secondary science classes?
4. What are the pedagogic strategies teachers use when contextualizing science teaching?

The study provides baseline data for an in-service programme, the Mathematics and Science Teacher Extension Project (MASTEP), aimed at improving senior secondary school science teaching by upgrading teachers' content knowledge and teaching approaches.

Methods

Data on classroom activities were collected in 11 junior secondary science lessons (Grade 10) and in 18 senior secondary science lessons (Grades 11 and 12) for 12

teachers in six schools. At both levels the data divided equally between biology and physical science lessons. The sample included urban, peri-urban, and rural schools. All teachers, nine of them female, were qualified for teaching junior secondary science. They were all enrolled in MASTEP.

Three data collection methods were used. Verbal classroom exchanges were recorded by audio-tape recorder placed near the front of the class. Tapes were transcribed verbatim, with only minimal identification of individual learners. Secondly, a non-participant observer used an observation sheet to record learner questions and answers as part of the verbal classroom exchanges, and teacher-group interactions during group work. The same observer recorded any notes written on the board or overhead projector, and any teaching aids used. Finally, copies of printed handouts, worksheets, or pages from books used during the teaching period were collected. The validity of the data was improved by triangulating the three data sources. These collection methods did not capture completely peer interaction within groups.

For each lesson, episodes of the use of everyday contexts were identified and compared by the authors. In this identification, any judgements were made liberally; for instance, even the mere mention of an everyday item was seen as the use of a context. Frequency counts were made for the number of episodes used in junior and secondary science lessons, and according to the initiator of the context, be it the teacher or a learner. The 12 different descriptors used in the classification scheme of Mayoh and Knutton (1997) were applied to group episodes according to the nature of the context. In addition, grounded theory (Glaser & Strauss, 1967; Strauss & Corbin, 1990) was used to construct a coding scheme to distinguish the different pedagogical strategies for the inclusion of contexts. Pedagogical strategies include any strategies used to support learning. Pairs of authors independently read and re-read a subset of 10 lesson transcripts and identified clusters of pedagogical strategies for the use of the contexts by the teacher. After comparison, the pedagogical strategies were consolidated into four clusters, each divided in two—a primary strategy if the context was used as the initial teaching approach, or a secondary strategy if the context was used as an alternative to an initial non-contextualized teaching approach.

Every lesson was analysed individually by at least two of the authors to identify the instances where everyday contexts were used, the type of these contexts, and the different pedagogical strategies for using the contexts. After pooling the results, inter-author agreement was shown to be close to 90%. Differences were reconciled through discussion.

Results

The Use of Learners' Everyday Experiences

Table 1 presents the number of times science teachers or their learners made references to everyday experiences during their lessons. The table indicates that on average 4.2 classroom episodes per lesson relate to everyday experiences. However,

Table 1. Frequency of teachers and learners referring to everyday contexts ($N = 123$, mutually exclusive)

Educational level	Number of observed lessons	Frequency of using everyday contexts			Average per lesson
		Teacher initiated	Learner initiated	Total	
Science lessons at Junior Secondary level	11	55	23	78	7.1
Science lessons at Senior Secondary level	18	37	8	45	2.5
Total	29	92	31	123	4.2

the frequency is much larger at the Junior Secondary level, with an average of just over 7 episodes per lesson, than at the Senior Secondary level, with an average of only 2.5 episodes per lesson. Closer scrutiny of the data shows that the frequency at junior level is slightly higher in the physical science than in biology lessons (9.4 against 5.2 instances per lesson), whereas at senior level they occur more frequently in the biology lessons (2.9 against 2.1 instances per lesson). Table 1 also shows that three-quarters of the contextualized episodes are introduced by the teacher. Where learners initiate episodes referring to everyday contexts, this occurs, on average, five times more frequently in Junior Secondary than in Senior Secondary lessons. This difference is statistically significant only at the 10% level (chi-square ($df = 1$): $p = 2.08$). The frequency of learner-initiated contextualized episodes hardly differs between Biology and Physical Science lessons at both levels.

Types of Everyday Contexts

The taxonomy suggested by Mayoh and Knutton (1997) has been used to identify the type of context used in Namibian science lessons. They distinguish 12 categories of contextualized lesson episodes as presented in the first column of Table 2. The remaining columns of this table show the frequencies in which the various types of everyday contexts have been used in Junior and Senior Secondary science classes, respectively. It should be noted that some episodes can be classified as using more than one type of everyday context. Thus, the total frequency of classified contexts exceeds the total number of episodes.

The nature of the everyday context used in class depends to some extent on the topic being taught. However, the types of context fall within a narrow range of the earlier taxonomy. Table 2 shows that none of the contextualized episodes refers to the media (Context 1). None are used to develop an everyday life skill (Context 11). The vast majority of the episodes can be placed into one of six categories. These categories are, in order of decreasing frequency, episodes referring to: common out-of-school experiences (Context 3), to common objects (Context 5), to personalized stories (Context 2), to uncommon out-of-school experiences (Context 4), to

Table 2. Frequencies of the episodes for different types of everyday contexts ($N = 123$, not mutually exclusive)

Type of everyday context used in science lessons	Episodes in Junior Secondary lessons ($n = 78$) (%)	Episodes in Senior Secondary lessons ($n = 45$) (%)	Total frequency of episodes ($n = 123$) (%)
Context 1. Referring to the mass media	–	–	–
Context 2. Referring to personal experiences: telling stories	16 (21)	5 (11)	21 (17)
Context 3. Referring to common out-of-school experiences	24 (31)	15 (33)	39 (32)
Context 4. Referring to uncommon out-of-school experiences	12 (15)	1 (2)	13 (11)
Context 5. Referring to common objects	17 (22)	15 (33)	32 (26)
Context 6. Referring to images from out-of-school experiences	3 (4)	–	3 (2)
Context 7. Referring to everyday knowledge	7 (9)	4 (9)	11 (9)
Context 8. Referring to everyday words	3 (4)	2 (4)	5 (4)
Context 9. Using analogies and metaphors based on everyday experiences	5 (6)	7 (16)	12 (10)
Context 10. Using everyday contexts for classroom activities	–	2 (4)	2 (2)
Context 11. Developing skills for everyday life	–	–	–
Context 12. Referring to industry	4 (5)	–	4 (3)

metaphors and analogies of everyday situations (Context 9), and to everyday knowledge (Context 7). For the first and last of these categories there is no difference in the relative frequencies in which they occur in Junior and Senior Secondary classes. Contextualized episodes referring to story-telling (Context 2) and to uncommon out-of-school experiences (Context 4) occur relatively more frequently in Junior classes. In contrast, reference to common objects (Context 5) and the use of analogies and metaphors (Context 9) feature more highly in Senior Secondary classes. Examples of each type of episode are now provided.

Episodes Referring to Common Out-of-school Experiences

About 30% of all episodes referred to common everyday experiences (Context 3). What is a common or an uncommon experience is determined by the learners' environment. In the lessons recorded, several common contexts related to the use of household apparatus, modes of travel, actions in case of sickness, or methods of communication. An example is that of the teacher asking learners to indicate the changes from one form of energy to the other. She asked learners to consider household appliances to compare the changes.

- Teacher: Okay, let's hear from your groups. Group one.
 Student: The stove.
 Teacher: The stove, yeah?
 Student: It's more compared to a television.
 Teacher: The stove compared to a television. I think it is a good example. Can you explain?
 Student: Because sometimes when you put on the stove, the unit goes fast, and once you remove the stove then it slows down.
 Teacher: Very good. She's explaining it in terms of the units, which you are all used to in your houses. Those who are having that box, where you use cards from the Telecom. Not Telecom but from?
 Chorus: Northern.
 Teacher: Northern ...? Electricity. What does it mean, James?
 [No response]
 Teacher: It will mean that the electrical stove will change the electrical energy ... faster compared to the television.

In this lesson the teacher expands on experiences of the electricity meter that a learner introduces, thus using the everyday context to support learning.

Episodes Referring to Common Objects

In more than 25% of the episodes using contextualization, reference was made to common objects (Context 5). Usually, such a reference was rather superficial. A case in point was the practical lesson aimed at developing techniques for measuring the density of irregular shapes. The teacher wanted learners to use stones, and even instructed three groups "to go outside to look for your stones". However, the teacher gave no justification for the use of this everyday object and no reference was made to

a substantive out-of-school experience. Another typical example of the use of common objects was provided in a lesson about different types of waves, based on a handout with the applications of the various waves listed.

- Teacher: Now let's look at the diagram again on the page. We'll look at some uses of these waves. What do we use radio waves for? Just look at the page. Can somebody tell me? Pendukeni, what do you use the radio waves for?
- Student: [reads] Radio and television.
- Teacher: Okay, now they are used to carry radio and television ... What? Signals. Okay, LeBenz, please, what do we use the microwaves for?

The teacher continued to call for applications of different waves without linking these firmly with the science concept under discussion.

Episodes Referring to Personalized Stories

Almost 20% of the episodes included a story (Context 2), with a specific person—the teacher, a relative or friend, one of the learners—in the main role. One example was a lesson on “speed and average speed”, where the teacher used a story of an everyday experience (i.e., learners walking long distances to school).

- Teacher: So let me tell you a simple story. Kalumbu is a learner in Grade 11B.
- Student: Yes.
- Teacher: So when he was at the lower primary school, so he normally gets up from his bed at 4 o'clock in the morning. And Kalumbu, at 5 o'clock in the morning he used to be on his way to school and then he used to walk 10 kilometre, which means his house is far from school 10 kilometre, and then it took him 2 hours. So why Kalumbu has to wake up so early?
- Student: Because his house is far.
- Teacher: Because of ...
- Student 1: Because of the distance.
- Student 2: [Kalumbu himself] Because of the distance from my house to school.
- Student 3: Because of the speed.
- Teacher: Oh, very good. You talk about the speed. This is very good news.
[From here the teacher starts discussing speed and average speed]

Other personalized stories emerged in a lesson on malaria transmission, which focused on a specific learner in the class being bitten by a malaria-carrying mosquito and following the development of his disease; and in a lesson on different types of waves illustrated by the teacher's personal experience when she struggled to tune in to the BBC and the local radio station.

Episodes Referring to Uncommon Out-of-school Experiences

Just over 10% of the episodes of contextualization made use of uncommon experiences (Context 4). Many in this category were brought up by learners. Two such uncommon experiences appeared in the same lesson on waves when the teacher explained the use of X-rays:

- Teacher: Yeah, the X-rays. How many of us have been to the X-rays? Any person who has been to the X-rays?
- Student: Yes.
- Teacher: Now when do you go to the X-rays?
- Student: When you have a broken arm.
- Teacher: Now, what are they seeing in the X-rays? Can somebody tell me? Find it from your paper.
- Student: [reads] To see where the bone is broken.
- Teacher: Yeah, this part of the spectrum goes through your body but not through your bones. That's why they then will identify that part of the broken ... bone, okay?
- Student 1: Like when a pregnant woman goes, when they have to check the baby, miss?
- Student 2: Is it true, madam?
- Teacher: Yes, it's true.
- Student 2: But they have no bones, do they?
- Teacher: No. Now that is why when you look in the X-ray you see the ..., the ..., the ribs, but you don't see the flesh. Because it [X-rays] does not go through the bones.

This episode illustrates the reference to two uncommon experiences, one introduced by the teacher (an X-ray test) and one by the learner (an ultrasound scan). However, the latter seemed not to be taken up by the teacher.

Episodes Referring to Analogies

About 10% of the episodes of contextualization used an analogy with an everyday situation (Context 9), such as the interaction in an overcrowded class as analogy for the influence of concentration on the rate of reaction, or the production of “boerewors” (a long sausage) to illustrate peristaltic movement in the oesophagus.

Episodes Referring to Everyday Knowledge

About 10% of the episodes referred to everyday knowledge. This category of episode referring to everyday knowledge overlaps with that referring to common out-of-school experiences. For classification purposes, the first is used for descriptions of facts and the latter for descriptions of activities. An example of the former is the teacher statement that malaria is transferred by mosquitoes and that “everyone knows that these mosquitoes move around to suck blood from several people”.

Very rarely, everyday contexts were linked with industry. In fact, a student question about the use of X-rays in diamond mining was ignored, and a lesson on copper extraction was equation-focused and made no reference to the Namibian copper mines or the extraction processes they use.

Pedagogic Strategies for Using Contexts

Classroom interactions indicated four different pedagogic strategies for the use of everyday contexts. In each case, the context may be introduced as the initial teaching

approach, here called a *primary* strategy. Alternatively, the introduction of the context may only be prompted by the failure of a non-contextualized teaching approach. In this case, the everyday context is used as an alternative strategy, here called a *secondary* strategy.

In the first pedagogic strategy, the everyday context is part of regular *exposition* (mainly by the teacher) as illustrated by the earlier quotation of the “story” about Kalumba walking a long distance to school in a lesson on (average) speed. The following episode, when the teacher explains how the rate of reaction depends on the concentration of a solution, provides an example of the use of a context in a secondary exposition:

Teacher: Concentration by definition means the amount of particles that are in the solution of a certain volume. So if you are having more particles in the solution, it means that the collision will also be high.

[Mumbling]

Teacher: I mean, just like you are in this room here, overcrowded. Then if you start moving, the collision between you will be a bit high. But if you are just two here, then the possibility of colliding with each other will be very low.

Secondly, the context may emerge as part of a *question or answer* (from either teacher or learner) as in the earlier case of the teacher asking learners to compare the energy consumption of different household apparatus. The following episode, from a lesson on the circulatory system, provides an example of the use of a context in a secondary question strategy:

Teacher: Where does the food get stored? In which part of the body is food being manufactured? Which one?

[Mumbling]

Teacher: I was talking about the idea that one organ is a factory of food for the rest of the body. Which one?

Student: The liver.

Teacher: The liver, that is true. The liver is manufacturing the food and distributes it to all parts of the body.

Thirdly, the context may form the *setting for an assessment task* such as in the following episode:

Teacher: I will quickly write here one problem on the chalkboard and then everybody should try to give the answer. So the problem is (writing on the board) “A cyclist travels 60 kilometres in 3 hours, find his average speed in kilometres per hour, and in metre per second”.

Finally, and very seldom, the everyday context is used for *practising a skill*.

Table 3 provides an overview of the frequencies of these two sets of four pedagogic strategies in which everyday contexts are utilized. The table indicates that one-half of the teaching episodes referring to everyday contexts were used in questions (Strategies 2a and 2b), the majority of these following failure to draw a response from an abstract, non-contextualized question. Including a context in an initial question was rare at senior secondary level. About 40% of the episodes referring to everyday contexts were used by the teacher as part of an exposition (Strategies 1a

Table 3. Frequencies of pedagogic strategies used for class episodes involving everyday contexts ($N = 123$, not mutually exclusive)

Pedagogic strategies	Episodes in Junior Secondary lesson ($n = 78$) (%)	Episodes in Senior Secondary lesson ($n = 45$) (%)	Total frequency of episodes ($n = 123$) (%)
Strategy 1a. Contexts as part of primary exposition	22 (28)	12 (27)	34 (28)
Strategy 1b. Contexts as part of secondary exposition	10 (13)	4 (9)	14 (11)
Strategy 2a. Context as part of primary question/answer	23 (30)	3 (7)	26 (21)
Strategy 2b. Contexts as part of secondary question/answer	21 (27)	15 (33)	36 (29)
Strategy 3a. Contexts as part of primary assessment task	1 (1)	6 (13)	7 (6)
Strategy 3b. Contexts as part of secondary assessment task	–	2 (4)	2 (2)
Strategy 4a. Contexts as part of primary skills practice	1 (1)	2 (4)	3 (2)
Strategy 4b. Contexts as part of secondary skills practice	–	1 (2)	1 (1)

and 1b). In almost three-quarters of these cases, the teacher included the context as a primary strategy. We may assume that this inclusion was planned for. Less than 10% of the contexts were introduced as part of an assessment task (Strategies 3a and 3b). This happened almost exclusively at Senior Secondary level. In the majority of cases these tasks were past examination questions or exercises from a book. Only rarely were contexts used in practicing of a skill.

Teacher Responses to the Learners' Attempts to Contextualize the Science Teaching

Few instances occurred where learners tried to contextualize the science content themselves.

Sometimes the teacher welcomed these learner contributions and integrated them seamlessly into the lesson. The example quoted earlier of the learner referring to observations of the movement of the units on the electricity meter is a case in point. However, with the majority of learner-generated contexts, the teacher seemed uncomfortable with the learners' attempts to make sense of the new science and their own previous experiences. In one situation, after learners asked about the effects of X-rays, chemotherapy, and the causes of cancer, the teacher wishes to regain control.

- Teacher: Let's say we can continue now? Yes, please?
Student: You talked about, eh, radio waves ...
Teacher: Mmm.
Student: infra rays, .. ultraviolet. I mean, what about the lasers?
Teacher: No please. What I'm trying to say is ... This here is a spectrum, an electromagnetic spectrum, and these are the parts that you want to know on this spectrum.
Student: [Protests, unclear]
Teacher: Now can we finish this spectrum? Then we can talk about ... Otherwise we will not continue. We must finish this one. What you are supposed to know, as I said, are the different parts [of the spectrum], the use of these parts and the order of this spectrum. Then this is what you have to know for the examination.

For this teacher, the learners' attempts at bringing in questions that try to explain the everyday experiences related to the content being dealt with appear to be irrelevant. Indeed her focus is on completing the topic at hand with minimal diversions. In fact, this teacher steered the class away from the contextualization of the topic on spectra. Similarly, a teacher who brought in a tickertape trolley to illustrate motion disallowed a learner's contextualization, and missed a chance of real learner-centred teaching, as shown in the following:

- [Students are buzzing when teacher enters with tickertape trolley]
Teacher: What makes you think that today we will talk about motion? What makes you guess that it will be motion today?
Student: The things you are having.
Teacher: The things I am having? What are the instruments?
Student: Toys. Like car toys.

Teacher: These are not toys. This is called a trolley. It's called a trolley, so you are right: today we are going to talk about motion.

In other cases, teachers were uncomfortable because they clearly did not know how to answer learners' questions. The issue about the nature of the waves used for screening of pregnant women in one of the quotations earlier was an example. When a learner suggests that "babies (foetus) have no bones, do they?", the teacher seems to agree, skirts the question, and rapidly returns to the science topic of the lesson.

Discussion

When interpreting the data in this study, we have to exercise caution in making any generalizations as the number of lessons at each level of education is small. However, several points emerge that have relevance for science education in Namibia and elsewhere.

The Extent to which Science Teachers Make Use of Learners' Everyday Experiences

In science lessons, an average of just above four classroom episodes per lesson refer to learners' everyday experiences. This is almost double the frequency reported by Mayoh and Knutton (1997) for the situation in UK science lessons. Using this as a comparison, the data seem to indicate that the Namibian emphasis on a learner-centred approach has been successful in bringing learners' experiences into the classroom. However, the data also show that almost one-half of the everyday contexts are introduced as a secondary strategy, that is after a more conventional use of abstract theoretical terms and images has been unsuccessful in helping pupils to provide meaning to their learning. This seems to indicate that contexts are used as a remedial strategy, not as a teaching approach. Therefore, considerable numbers of lessons are still subject-centred rather than learner-centred. It would thus seem to be important that programmes preparing and supporting teachers for learner-centred science education give stress to the approach as a main strategy for the classroom, rather than a fall back approach when a more teacher-centred or content-driven approach fails to engage the learners.

It is striking that teacher-initiated references to everyday contexts are on average four times as high as learners' references to everyday contexts. This clearly indicates that the "empowerment" interpretation of a learner-centred approach, where learners determine the direction of the learning experience, is not implemented. In addition, this finding implies that the teacher decides on the everyday experiences the learners are supposed to be familiar with or interested in. Tabulawa (1997) and Shumba (1999) have shown that a large number of learners in Southern Africa have a poor match between their everyday world and their school world in terms of the characteristics of learning, the criteria for trustworthy knowledge, and the role of initiative in learning. The fact that the large majority of everyday contexts is introduced by teachers will risk increasing the number of *outsiders* (Costa, 1995); that is,

those whose everyday world is incompatible with both school and science worlds. As a result, border-crossing will be problematic for more learners, and the use of everyday contexts may be counter-productive in enhancing science learning. Avoiding this situation presents a huge challenge to teachers. In contexts where adults are respected as the keepers of knowledge and the young are expected to learn from their elders, teachers trying to implement learner-centred education have to break down traditional societal barriers and schooling traditions and encourage learners to contribute their ideas and experiences. Furthermore, they have to develop new skills that move away from evaluating and announcing learners' contributions as right or wrong science, towards systems of recognizing all contributions as of worth and selecting those that are most helpful to learning the science ideas being considered.

The Types of Contexts used in Science Lessons

The fact that, compared with classroom episodes in industrialized nations (Mayoh & Knutton, 1997), several types of contexts do not, or rarely, feature in the reality of science teaching in developing countries suggests specific characteristics of classroom management, rather than a weakness of the Mayoh-Knutton taxonomy used. For instance, it is not surprising that few episodes are based on contexts from the media or imagery. Learners' access to television and newspapers are limited, and few schools in Namibia have films, videos, or slides. This situation is not unique to Namibia. In such situations teaching could be arranged around newspaper cuttings or publicly available posters, provided by the teacher. Equally, the fact that references to industry are rare and seemingly avoided shows a need for generally available materials about the highly developed mining, tourism, fishing, and beef industries of Namibia clearly linked to the formal curriculum, as has been done for instance in Ghana (Yakubu, 1994) and Swaziland (Krueger, 1992). Such strategies will, however, only support the most basic interpretation of learner-centred teaching; that is, the use of relevant learning materials. Using a more advanced interpretation of learner-centred teaching (i.e., learner involvement), learners could be asked to collect, interpret, and share such materials. Several learners may have relevant industrial experience (as indicated by several of the episodes in this study) that can be capitalized on for teaching by their recognition and integration in to classroom practice, thus enacting the "empowerment" interpretation of learner-centred teaching. In both developed and developing countries these strategies are important to the implementation of learner-centred education and need be highlighted in teaching training programmes (see Zeichner & Dahlstrom, 2001).

The data show that personalized stories are used in about one-quarter of the contextualized episodes. Several of these stories centre on actual or imaginary learners, often inviting learners to participate in the story development. This seems an example of an "empowerment" interpretation of a learner-centred approach. However, in a society with strong oral traditions for communication, this powerful tool for raising learners' motivation and classroom participation (Lubben et al., 1996) seems under-utilized. In Namibia and other countries with strong oral

traditions, teacher training needs to focus on ways of further harnessing learners' oral skills from outside the classroom for use within (see Cleghorn & Rollnick, 2002). This could explicitly involve the encouragement of "code switching" (Rollnick & Rutherford, 1996) (i.e. the temporal use of a local language) in order to strengthen the authenticity of the everyday context.

Several of the everyday episodes point towards a risk in using a learner-centred teaching approach as a vehicle of learner empowerment. The data suggest that there is a danger of the teacher providing misinformation in explaining everyday contexts, particularly those brought up unexpectedly by learners, such as the example of the embryo scan. In countries with a strong teaching profession, teachers' knowledge can also be challenged. What is different is that such teachers can more readily admit to a lack of knowledge and usually have the ability and resources to acquire the knowledge or to direct learners to appropriate information sources. It is a greater challenge for teachers in Namibia and in other developing countries, where the teaching force is less mature. Even if such teachers are willing to admit ignorance but to try to obtain information, few have access to resources such as libraries or the internet. High-quality, learner-centred science teaching through learner empowerment needs to be supported by strong knowledge acquisition infrastructures based around, for example, decentralized science resource centres and libraries or a flexible science advisory service.

The Differences in the Use of Everyday Contexts at Junior and Secondary Levels

Out-of-school experiences were introduced considerably more frequently in Junior Secondary than in Senior Secondary classes. The difference may be related to the differences in the textbooks prescribed for the different levels. As Lubben et al. (2003) point out, the Senior Secondary texts are imported and therefore do not specifically include references to Namibian situations. Textbooks for the Junior Secondary level have been written after independence, and incorporate local contexts. This is an important outcome of the study and has implications for others seeking to encourage learner-centred approaches to science education. It would appear that, at least in the Junior sector, the availability of locally relevant texts incorporating contexts to which teacher and learners can relate could have a significant impact on the adoption of learner-centred approaches. However, further research needs to explore whether teachers hold epistemological views (Tsai, 1999) that it is more appropriate to contextualize science for Junior than for Senior Secondary students, who must be prepared for advanced science, which is often viewed as being non-contextual.

Pedagogical Strategies for Contextualized Teaching

In terms of strategies, contexts are frequently used as part of ERF interactions [teacher's Elicitation; learners' Response; and teacher's Feedback (Lemke, 1990)]. Most often, contexts are used as part of a question or given as an answer. The

ERF interactions only allow for the most basic learner-centred teaching, namely the introduction of learners' experiences in the class. The data show little evidence of small group work, or project work that would support the more advanced types of learner-centred teaching. This finding is perhaps unsurprising because in Namibia, as with many other countries in Southern Africa, the history of teaching is characterized by the transmission of knowledge from teacher to learner. To break from this requires established teachers to re-skill and new teachers to reject practices they experienced and found successful for their own learning. Both groups need careful and sensitive support and coaching in new methodologies. Furthermore, learners have expectations of being told things, and they too need to adjust to new ways of teaching and learning. Teachers who organize group discussion work or discovery learning through project activities run the risk of being accused of not teaching. Learners need educated in learner-centred education as well as teachers.

The data show that some contexts were used, especially at senior level, in assessment. Usually, the stem of an externally constructed problem contained such a context. Both teacher and learners engage with the context only to the extent that the numerical information needed for substitution in a selected formula is extracted. From there on, no reference was made to the context and even the solution was usually stated in abstract terms. This observation also relates to the availability of resources as discussed. For Namibia, as elsewhere, the inclusion of contexts in assessment tasks in standard textbooks would provide opportunities for teachers to cement the links between everyday experiences and science content. Of course, this approach would be more readily adopted if examinations were to use local contexts.

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