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Teaching Life Sciences to English second language learners: What do teachers do?

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South Africa has eleven official languages and legally learners receive tuition in their mother tongue until the end of Grade 3. From then on teachers are required to teach through the medium of English or Afrikaans. The implication is that the majority of learners in the senior secondary school phase study Life Sciences in their second language, which is English. This has a major effect on the performance of learners in Life Sciences. A review was done of possible strategies teachers could use to assist English second language learners. Focus group interviews were held with Life Science teachers in an attempt to determine what the impact of teaching Life Sciences to English second language learners is and what teachers can do to assist English second language learners master concepts and terminology. The findings and recommendations of this research are reported here.

Keywords: analogies; code switching; English second language learners; Life Sciences teaching

Introduction

Wright and Bilica (2007:1) stipulate that modern educational theory, as evidenced in the conceptual change learning model, encourages science teachers to focus less on fact-based, rote learning and more on conceptually driven teaching. This requires teachers to plan teaching by first getting information about learners' prior knowledge and then using these understandings to structure the lesson (Jaipal, 2001:3; Orgill & Bodner, 2004:15; Ren Dong, 2002:42). Jaipal (2001:3) further proposes that besides learners' prior knowledge and experiences, sign systems, especially language, and interpersonal relations between teachers and learners, also mediate learning. Consequently language plays an important role in the teaching and learning of science. It is no different for the Life Sciences. Yet to determine learners' prior knowledge it is necessary to formatively assess or probe what learners know, but in the South African context, this is a great challenge because of the diversity of its people.

South Africa has eleven official languages. Learners are initially taught in their mother tongue (from Grades 1 to 3) and most subsequent teaching takes place in English or Afrikaans. Consequently learners in the Life Sciences classroom not only have to learn the subject matter, but have to cope with language comprehension too. Setati, Adler, Reed and Bapoo (2002:129) state that the majority of South Africa's teachers, especially in secondary schools, work in classrooms where English is officially the language of learning, but is not the first language of either the teachers or the learners. Taylor and Prinsloo (2005:9) also point out that after poverty, language, and in particular proficiency in the medium of instruction, is the largest single factor that affects learner performance at school. English (second language), as a subject, has the largest number of learners, so learners are not only communicating in class in a second language, but also have to use it as medium for learning all their other subjects. Teachers are therefore faced with the double challenge of teaching a particular subject in English while

learners are still learning the language.

Many learners in rural schools are only exposed to English in the formal school context and not in their immediate environment. On the other hand the English language infrastructure of urban schools is more supportive and both teachers and learners have greater access to speakers of English as well as easier access to magazines, newspapers and television (Setati *et al*., 2002:130). Based on this, the authors argue that in urban settings it is more appropriate to describe English as an additional language because of the opportunities that learners have to acquire the language informally outside the classroom. The Department of Education distinguishes between English as home language, English as first additional language, and English as second additional language (Department of Education, 2003). However in this article all learners, whose mother tongue is a language other than English, are referred to as English second language (ESL) learners. These learners may require additional support to develop their English language skills.

One of the major difficulties experienced by learners when learning science is learning the language of science (Wellington & Osborne, 2001:1). Paying attention to language is very important to improve the quality of science education and every lesson should by implication, be a language lesson (Schaffer, 2007:5; Jaipal, 2001:2; Wellington & Osborne, 2001:3). To do well learners should be able to "extend their knowledge of concepts beyond basic vocabulary and be able to engage in, and manipulate the appropriate discourse" (Shaffer, 2007:6). There are various possible strategies that Life Sciences teachers could implement to teach ESL learners scientific discourse, concepts and terminology, though some will be more effective than others.

What could be done to teach Life Sciences to ESL learners?

Using investigations and practical work for clarification of concepts

Learning is simplified if it moves from the concrete to the abstract so it is critical that the concrete foundations, on which abstract concepts are built, are accurate (Shaffer, 2007:4). Scientific investigations can provide such foundations through the nature of the subject, by observing concrete objects and proceeding to other process skills such as classifying, hypothesising, interpreting data and extrapolation to name but a few. Ideally these skills are obtained by doing practical work and through observation concept formation can be advanced. This would imply going beyond the textbook and using the classroom situation to its full advantage with the possibility of interaction between learners, demonstrations, hands-on activities and group work (Schaffer, 2007:4).

Practical work has always been considered part and parcel of Life Sciences teaching and learning (Hofstein & Lunette, 1982:202; Killermann, 1998:4). Learning is deemed more effective if learners do experiments themselves or if they watch a demonstration performed by the teacher. An immediate hands-on involvement with subject material creates the ideal context in which to expand and develop the language skills of learners as they talk about the substance of their learning. Practical work can be used as the link between learners' experience, communication and learners' perception of the subject matter. Schaffer (2007:5) warns that the challenge for ESL learners is that they may be expected to abandon previously acquired knowledge that may be based on cultural perceptions and that may remain embedded even after formal science teaching. Making use of visuals and objects could eliminate some of the cultural barriers that impede language learning. However the findings of Jaipal (2001:11) challenge the traditional notions of language teaching where words are taught by showing and/or explaining

the meanings. The mere association of words with objects does not necessarily contribute to concept formation and consequently teaching should go beyond this proposal.

An inquiry-based teaching approach for practical work can facilitate the learning of Life Sciences while providing the opportunity for language acquisition. Worksheets and reports follow specific formats and provide some structure to practical work and documentation. There are numerous possibilities depending on the topics to be covered. As Barker, Slingsby and Tilling (2002) say: "It is in the field that science becomes alive and where acting locally becomes thinking globally". An inquiry-based approach can give learners the opportunity to work cooperatively, which would not only facilitate learning but also contribute to the development of social skills and language acquisition. However, even when using practical investigations, it may be necessary to make use of analogies to clarify concept formation.

Using analogies

Effective analogies can clarify thinking, helping learners overcome misconceptions and create ways to enable learners to visualise abstract concepts (Orgill & Bodner, 2004:15). However, confusing analogies do far more harm and can severely interfere with learning so they must be used judiciously.

What is an analogy? Basically an analogy entails a comparison between two domains of knowledge; one that is familiar and one that is not. The familiar domain is the "analogue" and the domain that needs to be learned is the "target" (Orgill & Bodner, 2004:15). According to Venville & Treagust (1996:296) analogies can be seen as a process of identifying similarities between two objects or processes for the purpose of explanation or extrapolation. For example, bricks and walls can be used as an analogue to illustrate cell and tissue structure (the target). The three-dimensionality of cells can be illustrated in this manner as it is not easy to deduce this from textbook diagrams. The idea behind using an analogy is to transfer relationships from a familiar domain to one that is less familiar (Mason & Sorzio, 1996:4). With a good analogy the analogue and target domains should have an overlap of relational structure.

Orgill & Bodner (2004:16) contrast potential positive and negative results of analogy use. On the positive side, analogies can help learners understand new information and to relate it to what they already know. Analogies can help learners organise information or to view it from a different perspective. They also give structure to the information being learned and help with the visualisation of abstract concepts providing learners with a concrete reference when working with abstract information. A further positive is that analogies fulfil a motivational role in meaningful learning (Venville & Treagust, 1997:283). Learners become more involved in the topic. In fact Lemke (1990:46) claims that learners are three to four times more likely to pay attention to the familiar language of an analogy than to unfamiliar scientific language.

Analogies may also contribute to an increase in learners' beliefs about their own problem-solving abilities when the problem is related by analogy to something they have successfully solved or comprehended. The final positive result of using analogies is that they can promote conceptual change by helping learners overcome existing misconceptions (Orgill & Bodner, 2004:16-17) as analogies help learners identify the shortcomings of any conceptions they initially hold, lead them to reject these misconceptions and adopt those in line with accepted scientific norms.

However, there is a negative side to using analogies. Learners may use the analogy mechanically and not grasp the information the analogy is meant to convey (Orgill & Bodner, 2004:17; Venville & Treagust, 1997:284). It may be that the learners cannot differentiate

between the analogy and reality. This could be a problem with ESL learners who focus mainly on the analogue and not on the differentiation between the analogue and target. All analogies have limitations but because learners may not understand the target well enough, they may not be able to identify the limitations. This could also lead to misconceptions and Orgill & Bodner (2004:17) warn that these would be difficult to remedy. The "key and lock" analogy that is used to describe enzyme interaction serves as an example. Though the analogy explains enzyme specificity, it does not explain the stabilization of the transition state that enzymes achieve. Further explanations that point out the limitations are required to avoid the potential for alternative conceptions to develop (Venville & Treagust, 1997:284). Finally, analogies may limit learners' abilities to develop a deeper understanding of concepts, for example, when only one analogy is used for a particular concept, learners may consider that explanation as the only acceptable explanation. It is easier for learners to accept one analogy than to go to the trouble of mastering a new explanation of that concept.

Ideally teachers should share and discuss analogies with each other to promote concept formation amongst culturally diverse learners. The use of analogies in teacher training and professional development should also be considered. However in the classroom situation it is often easier to merely switch from the language of instruction to learners' home language. This raises the issue of code switching.

Code switching and classroom communication

Code switching is often used in ESL classroom situations and involves going from one language to another in mid-speech when both speakers know the same languages (Cook, 1991:63; Milroy & Muysken, 1995:7). Therefore learners are taught bilingually and the learners' home language is used to facilitate the learning of Life Sciences and English at the same time. This would require teachers to be fluent in the learners' first language as well as in English. The multicultural composition of classes in South Africa especially in urban areas makes this an enormous challenge.

Rollnick & Rutherford (1996:101) found the use of learners' first language to be a powerful means of getting learners to explore ideas and without code switching some learners may develop alternative conceptions that could remain unexposed. Even learners' written work may conceal misconceptions that are more likely to be revealed in group discussions in the learners' first language. Interaction between learners is important to explore ideas and concepts in a comfortable environment, which implies talking in their first language. Teaching and learning in the first language provides the support needed with concept development while learners develop their proficiency in English, the medium of instruction. It does, however, become crucial that learners practise any newly acquired terminology and be able to talk about concepts in English. This is where the dilemma of code switching arises. In fact Probyn (2001:251) is of the opinion that the language of the classroom is very often not English but a mixture of English and mother tongue. Apparently teachers deliver chunks of content in English, textbook style, and for discussion and further explanation, switch to mother tongue. Learners are often passive in the classroom and seldom engage in meaningful discussions in English. However, because the classroom is in many cases the only place where learners get exposure to English, their teachers are under pressure to use English as much as possible. Learners need feedback and input from the teacher in many areas including pronunciation and communication, the accuracy of knowledge, skills and thought processes (Schaffer, 2007:4). Teachers continuously have to verify learners' understanding and have to accommodate the unique learning styles of

individual learners. To flourish in science, learners have to extend their knowledge of concepts beyond the basic vocabulary and be able to "… engage in, and manipulate the appropriate discourse" (Schaffer, 2007:6). The question arises: How this can be done?

Studies in second language acquisition have repeatedly shown that a second language is best learned through content when learners have a purpose for learning and when language use is authentic, rich and meaningful (Ren Dong, 2002:41). Non-native English-speaking learners benefit more from learning the second language and academic content knowledge simultaneously rather than separately. This brings in an alternative to code switching especially in a multicultural setting, namely Content and Language Integrated Learning (CLIL), which has established itself in the European discourse about educational practice (Dalton-Puffer, 2007). CLIL involves teaching a particular subject such as Life Sciences through the medium of a language that is not the first language of learners. Teaching and learning does not focus primarily on language learning but on using the second language to teach the subject content. Teachers working with CLIL are specialists in their subject rather than traditional language teachers but they have to be fluent speakers of the target language. The key issue is that the learner gains new knowledge about the subject while encountering, using and learning the second language. The methodologies and approaches used are often linked to the subject area with the content leading the activities.

Research design

A qualitative investigation was undertaken to determine the effect of teaching Life Sciences to ESL learners and to identify strategies that teachers could use in South African classrooms to teach Life Sciences, with a particular focus on specific concepts. According to Merriam (1998:5), qualitative research is "... an umbrella concept covering several forms of inquiry that help us understand and explain the meaning of social phenomena with as little disruption of the natural setting as possible". A qualitative approach makes it possible to study "things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them" (Denzin & Lincoln, 2005:3).

The investigation undertaken for this paper focused on the following questions:

- What is the influence of English as a second language on the teaching and learning of Life Sciences?
- Which strategies could be used to facilitate comprehension of particular Life Sciences concepts with ESL learners?

Sample

Selection of the sample was purposeful. Patton (1990:169) states that "the logic and power of purposeful sampling lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research". Consequently, in an attempt to find out what Life Sciences teachers do to assist ESL learners, focus group interviews were held with purposefully selected Life Sciences teachers. The participants all teach in Gauteng in co-educational public schools and were invited individually to participate in the research. In some instances Life Sciences student teachers assisted in identifying participants, who were then approached by the researcher.

Lewis (2000) suggests that focus groups should consist of between six and twelve participants. The decision about the size of the group should be guided by two considerations. It should not "... be so large as to be unwieldy or to preclude adequate participation by most

members nor should it be so small that it fails to provide substantially greater coverage than that of an interview with one individual" (Merton, Fiske & Kendall, 1990:137). The number of participants should depend on their experience and degree of expertise in the particular area of the research. Smaller groups of between four and six participants are preferable when the participants have a great deal to share about the topic or have experience in the topic under discussion (Kreuger, 1988:94). In this investigation the group size was limited to six participants per interview session.

Focus group interviews

Focus groups are structured small group interviews. According to Taylor-Powell (2002) they are "focused" in two ways. First, the persons being interviewed are similar in some way and second, the purpose of the interview is to gather information about a particular topic guided by a set of focused questions. Participants hear and interact with each other and so give different information than if they are interviewed individually.

The purpose of focus group interviews is to develop a broad and deep understanding rather than a quantitative summary. The emphasis is on insight, responses and opinions. Multiple groups are recommended since each discussion is highly influenced by the participants and consequently four sessions, with different participants, were held. These interviews spanned two years, with one interview in one year and the remaining three in the following year. Eighteen of the participants were black and English was not their mother tongue; the remaining six were white, four of whom were English first language speakers. Seven of the black participants taught in rural schools and the balance in urban schools. The participants were all considered experienced teachers as they had been teaching between 16 and 29 years. Because the participants are considered experienced teachers, the number of focus groups sessions used was deemed adequate for this study.

On commencement of the interviews all participants were thanked for their involvement. They were assured that their input was appreciated and that no reference would be made to them as individuals. They were encouraged to speak their minds and not be put off by differing opinions. The interviews then started off with a probing question: How do you feel about teaching Life Sciences in English to non-English speaking learners? Once it appeared that a saturation point had been reached and the question had been covered adequately, participants were asked how they would teach randomly selected Life Science concepts, namely, photosynthesis, energy, enzyme, tibia, and cell. The contributions were also recorded.

Data analysis

I broke down the data into basic units which were then combined to give an overall view of the findings. With analysis the unique characteristics and structure of the data were uncovered so that they could be described, interpreted, explained and interpreted to make sense of the data (Cohen, Manion & Morrison, 2000:148). The focus group interviews were transcribed providing a complete record of each encounter. The interviews were then analysed to find trends. This was done by identifying contributions that re-appeared in each of the focus group interviews. Kreuger (1988:109) suggests that content analysis begins with a comparison of the words, their emphasis and intensity in the discussions. This suggestion was used as a guideline in discussing the findings. As the interviews were semi-structured it was possible to probe participants to clarify any input they provided.

Findings and discussion

Discussion of the findings is guided by the research questions that were identified, namely, what the influence of language is on the teaching and learning of Life Sciences and which strategies participants consider useful to facilitate comprehension of particular Life Sciences concepts. The discussion is in the form of a narration and on occasion includes quotations of what the participants said. No reference is made to the source of each contribution as the participants were assured of complete anonymity prior to the commencement of the research.

When the participants were asked what they thought the influence of language on the learning of Life Sciences was, it became apparent that they consider it a "*barrier in the understanding of Life Sciences*". Various reasons were given. The "*language of science*" is unfamiliar to learners and terminology encountered in the subject is difficult to master and comprehend. Many concepts are abstract and are difficult to explain to learners who are not fluent in the language of instruction. Textbooks are not in the mother tongue and "*sometimes learners miss out on the concepts because they do not understand the textbook*". Most of the participants were of the opinion that they have an important task to fulfil here because if the textbook is in the second language of learners, they have to explain the text in the mother tongue first and then revert to English (code switching). This appears to be the case especially in rural schools where learners all have the same home language. However, the participants were adamant that learners must know biological terminology irrespective of the language of instruction. Code switching is used most often to explain concepts to learners in previously disadvantaged schools, but according to the participants, the "*key is to stick to learning outcomes and terminology*". Most of the participants argued against the use of code switching because it is against policy, yet a number of the participants admitted that "*we have no choice and use it (code switching) because the learners do not understand and just sit and look at you*". The participants who taught in culturally mixed schools accepted that it may be easier to explain concepts to learners in their mother tongue, but were in agreement that code switching will limit learning rather than enhance it. Those who do use code switching pointed out that it is easier for those who teach Life Sciences to English first language learners because they "*only have to work with the subject and not struggle with the language as well. When you teach learners about population dynamics and they don't know what mortality means, you have to explain it to them in their home language and this sometimes happens automatically*". Code switching may therefore be used almost inadvertently in these classrooms.

Learners should be able to "*speak about aspects in Life Sciences through the medium of English as that is the language in which learners are examined*". To help especially shy learners become more fluent in English, it would be useful to make use of group work or to get two learners to work together so that they can learn from each other. It is necessary to look at the composition of the groups and ideally there should always be a learner in each group who is an English first language learner. By grouping learners with different language competences, learners who may have the ability to complete activities, but have difficulty understanding what is expected, can be helped. This was immediately met with the challenge that "*it is not always possible because in some classes English is the second language of all the learners*". The teacher should then move between groups and provide the necessary support for each group. This suggestion was also challenged as there are teachers who themselves required assistance with their English language skills. These teachers may not be able to help learners and are comfortable just using the learners' first language.

An idea was offered that teachers should change their teaching so that the subject becomes

more understandable for those learners whose English is not on the expected level of competence. When prompted on how this should be done, the response was that "*teachers should use teaching resources such as charts, transparencies and any visual aids they can get hold of. It is extremely useful to be able to help learners make a connection between the content that is being covered and its relevance to everyday life. That is why Life Sciences is such a great subject to teach*". The participants pointed out that even the textbook may be difficult for a learner from a different culture to understand and where possible the teacher should give the necessary guidance to learners from different backgrounds. The participants pointed out that "*teachers should be sensitive to all learners when they teach, and when they talk to learners they should show consideration for everyone's language and culture*".

The teaching style is also important and "*the teacher's body language can be very useful if he or she uses their hands in gestures, body movement or facial expressions to explain things. If learners feel comfortable to ask questions and there are active discussions, learners could pick up vocabulary and language-related skills*". The way in which various concepts fit together can be explained in any language, but learners need practice in responding to questions in English. If they are not given an adequate opportunity to do so, code switching will be pointless, because "*even if learners understand concepts and they cannot describe them in English, they will not be successful in examinations*". To overcome this problem it is important to use simple English especially in assessment. The Education Department should also keep this in mind when setting final examinations. This does not imply that the standard should be lowered but that learners be given the opportunity to give effective feedback. What often happens now is that learners resort to memorisation, which should be avoided. Learners should be able to explain content in English even if the language and grammar is poor. To help learners understand the meaning of words, it would be helpful to compile a glossary of concepts in English and when a particular concept is discussed to refer to the glossary and explain the English definitions in simple English and if this fails, to do so in the mother tongue where necessary.

Further suggestions include the use of ideas that are culturally familiar. When, for example, the concept "*ecosystem*" is explained, teachers should refer to a system "*with which learners are familiar and not necessarily the traditional explanation involving a pond*". According to the participants, learners living in dry rural areas do not grasp the terminology because they do not necessarily know what pond life entails. A response to this statement suggested that "*this should be a given and that all teachers should do this in any case*". However, the participant who made the initial statement pointed out that "*some teachers themselves are unsure of what concepts mean*" and they are consequently not comfortable with using examples or explanations not included in textbooks. The consensus was that in-service teacher training definitely needs attention and that there are many teachers who are expected to teach senior certificate learners yet do not have the necessary qualifications to do so. The inadequate training that many teachers received in the pre-democracy era is still a major problem. Suggestions were made that not only should teacher training programmes focus on assisting prospective teachers to teach learners in a multi-cultural setting, but in-service programmes should be developed to provide guidance to those who are in practice. Teachers do not always know the cultures of all the learners in their class and when working with a multi-cultural class, they should be attentive to the different backgrounds of learners and "*different ways of looking at things*".

The participants also mentioned that the problem increases as one moves to the higher

grades. Terminology remains a problem and because "*some of the words are strange and difficult*". The degree of difficulty of the content as well as the volume of work covered in, for example, Grade 10 is much greater than that in Grade 9. All participants agreed that "*life would have been much easier if there was one universal language*" and that teaching would be "*much easier under those circumstances*". The insight that one of the participants gained during a focus group session resulted in the expression of appreciation for raising an awareness of ESL learners. She mentioned that "*one tends to focus so much on teaching that you forget that your learners may have difficulty in understanding what you are going on about*".

During the interviews, the participants were asked how they would teach the concepts photosynthesis, energy, enzyme, tibia, and cell. These terms were selected because on occasion they can be compounded by the fact that the concepts may have a different meaning to that encountered in daily life, for example '*cell*' could refer to a small room as in a prison, or in biological terms, refer to the functional basic unit of life; '*energy*' refers to the ability to do work or, in biological terms, it refers to an attribute in living organisms that is required for metabolism. Other terms are new words that can be introduced in familiar contexts. The '*tibia*' or shinbone in humans clearly visible on a model of the skeleton is also the fourth segment of the insect leg. In unfamiliar contexts words such as '*enzyme*' are difficult to grasp as these cannot be seen with the naked eye.

Suggestions that were proposed to teach the concept '*photosynthesis*' varied. Some suggestions are "*old school*", starting with the definition in the second language and breaking the word down into "*photo*" and "*synthesis*" and explaining what these meant. A suggestion was also made that one can use learners' prior knowledge by asking them to work in groups and draw charts listing what plants need to survive. The connection between the various requirements can serve as a point of departure for the lesson. An alternative is to teach the topic inductively using a practical example with a variegated leaf. Learners should first know that iodine discolours when it comes into contact with starch, using bread, maize meal and potatoes. Once learners know this, a practical can be done using a variegated leaf that is boiled in ethanol and then gives a positive test with iodine showing that starch is present in the green part and absent in the non-green part. According to the participants the use of practical work with work-sheets and process skills such as observation and communication will be the ideal choice in this situation. However the difficult part is teaching biochemistry, which learners end up memorising because "*it does not really make sense to them*". The four English first language participants concurred and pointed out that even English first language learners find the content difficult to understand as it is very abstract.

When discussing the concept '*energy*', the participants indicated that as the electrical supply in South Africa has come under pressure, learners are more aware of energy and wise utilisation of energy. However it is more of a challenge to explain that energy is the capacity to do work and that it is required at cellular level for normal functioning of organisms. Some participants proposed comparing the functioning of the body to driving a motorcar. "*If you do not fill the fuel tank when it approaches empty, the car will stop. To get it going, it needs fuel. In the same way the body needs fuel to get it to work and this is where energy features*". This serves as an example of the use of an analogy. A further suggestion made use of flow diagrams with pictures illustrating the transfer of energy at each trophic level in a food chain stressing that energy is used in the metabolism of the organism. Learners could be asked what they had for breakfast and why they ate, followed by questions about what would happen if they did not eat. Here the use of visuals could also assist concept formation.

'*Enzymes*' were linked with what is encountered in daily life like the use of a particular brand of washing powder that "*contains enzymes to remove fatty stains by breaking down complex molecules into simpler ones*", or using "*meat tenderizer to make meat less chewy*". The explanation would involve the function of enzymes in the digestive system to break down food molecules into simpler substances that the body can use for its own functioning. As the analogy of a key and lock is often used to explain enzyme activity in cellular reactions, it was not surprising that this was discussed again. Most of the participants indicated that they use this analogy in their lessons and are not aware of any misconceptions that learners may have formed with its use.

Though '*tibia*' may be a strange word to remember, the participants were unanimous in their discussions that it is not difficult to teach it. With either the use of a model of a skeleton or pictures of a skeleton, the tibia can be pointed out and the word written and stated. Some participants admitted that even though it is not encouraged they would resort to learners' mother tongue to explain that the word is the correct name for the shinbone and like a lot of terms, just has to be memorised. There should be no difficulty in concept formation and further use of the term.

The discussion on how to teach cells produced the greatest variety of possible strategies. What seemed to be used the most where facilities were available, were microscope slides of onion membranes and cheek cells. By observing these structures under a microscope, learners formed an idea of what they look like. If microscopes were not available the participants tried to make a model. Some participants made models of cells to try and convey the three-dimensionality of cells. Others got learners to make cells with plastic bags, gelatine, and various structures suspended in the gelatine to represent the organelles. One said that she "*let the learners make more functional models and let learners represent a particular organelle's structure with its function; so for example, a model of the brain would be used as the nucleus, small batteries would be used to represent mitochondria, and railway tracks would be used to represent the endoplasmic reticulum*". This led to a discussion on possible confusion that could be created between the representation and the actual structure of organelles. Most participants agreed that learners have difficulty in forming a concept of microscopic structures and unless they actually see how these are enlarged with the aid of a microscope, they will not be comfortable with the concept.

The members of the focus groups indicated that they used a variety of strategies in their teaching. The black participants who teach in rural schools admitted that they mainly use code switching, whereas some of the participants in the urban schools use code switching occasionally and analogies and experimental work most of the time. Content and language integrated learning was not mentioned. The fact that teachers were not exposed to CLIL in their training could be a reason for this.

Concluding remarks

Even though it may be simpler to use familiar words or learners' first language when teaching Life Sciences, learning to use terminology correctly is fundamental to learning any science (Wellington & Osborne, 2001:6). Teachers should be able to integrate language and Life Sciences content, creating authentic contexts for language learning. Although code switching can help with exploratory talk, teachers have to help learners communicate in English and learners need to practise their language skills orally and in writing. Setati *et al.* (2002:147) point out that learning *from* talk is significantly limited if it is not supported or complemented

by strategies for learning *to* talk, in other words, learning subject-specific formal discourses. CLIL could be an alternative and it is my contention that its use in the South African context should be investigated further. The fact remains that there is a need to train teachers to assist learners with second language acquisition; all teachers should be able to use methods and strategies to assist ESL learners in their classrooms and they therefore need more exposure and guidance in their training to do so.

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